Florida Department of Education

Curriculum Frameworks

Manufacturing

Rule 6A-6.0571, F.A.C.
Effective April 2024

Florida Department of Education
Curriculum Framework

Program Title: **Industrial Biotechnology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Secondary – Career Preparatory	
Program Number	8736000
CIP Number	0626061601
Grade Level	9-12
Program Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA, FL-TSA
SOC Codes (all applicable)	19-4021 – Biological Technicians
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

Industrial Biotechnology is a program offering students science credit through an applied science education, to prepare them for entry level positions in the cutting edge industry of Biotechnology. While meeting the state standards for science, the coursework will focus on developing science and bio-technical skills that are current and in demand for this rapidly growing occupation.

Upon completion of the integrated program, students will be able to explain and perform bio-technical skills used by Industrial, Medical, Agricultural, and Research facilities that develop and produce marketable products and processes.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of three credits.

It is **strongly recommended** that the following scope, sequence, and course recommendations be followed.

To teach the course(s) listed below, instructors must hold the teacher certification(s) indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
3027010	Biotechnology 1	BIOLOGY & BIOTECH 7G **or** CHEMISTRY & BIOTECH 7G	1 credit	19-4021	3	EQ
3027020	Biotechnology 2	BIOLOGY & BIOTECH 7G **or** CHEMISTRY & BIOTECH 7G	1 credit	19-4021	3	EQ
8736030	Biotechnology 3	BIOLOGY **or** CHEMISTRY **or** BIOTECH 7G	1 credit	19-4021	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

Academic Knowledge Standards

01.0 Apply knowledge of the nature of science and scientific habits of mind to solve problems, and employ safe and effective use of laboratory technologies.
02.0 Demonstrate understanding of the roles of matter, energy, in the chemical processes of cells, organisms.
03.0 Demonstrate an understanding of the structure and processes of the cell, with emphasis on reproduction and communication.
04.0 Demonstrate an understanding of the fundamentals of biochemistry including protein synthesis and reproduction.
05.0 Demonstrate an understanding of genetics, including the principles of, molecular basis, diversity, and applications to biotechnology.
06.0 Demonstrate an understanding of the levels of organization, from atoms to molecular DNA to organisms, classification, taxonomy.
07.0 Demonstrate an understanding of genetic diversity, selection, adaptations, and changes through time.
08.0 Demonstrate an understanding of the legal and ethical responsibilities associated with working with biological specimens for research or industry, bioethics.
09.0 Demonstrate an understanding of the connection between the various industry sectors of biotechnology (agricultural, food, and medical technologies) and careers.

CTE Performance Standards

11.0 Demonstrate knowledge of the history, career fields, and benefits of biotechnology.
12.0 Recognize and practice safety procedures.
13.0 Recognize and follows quality control procedures and regulatory guidelines.
14.0 Demonstrate the ability to communicate and use interpersonal skills effectively.
15.0 Apply basic skills in scientific inquiry, calculations, and analysis.
16.0 Demonstrate knowledge of organism structure and function.
17.0 Utilize materials processing and standard laboratory operating procedures for biotechnology.
18.0 Apply biotechnical materials analysis skills.
19.0 Demonstrates knowledge of basic chemistry as applied to biotechnology procedures.
20.0 Utilizes basic knowledge of microbiology and blood-borne diseases, including AIDS.
21.0 Demonstrate knowledge of legal and ethical responsibilities.
22.0 Demonstrate literacy and computer skills applicable to the biotechnology industry.
23.0 Demonstrate employability skills.

Academic Knowledge Standards

24.0 Apply knowledge of the nature of science and scientific habits of mind to solve problems, and employ safe and effective use of laboratory technologies.
25.0 Demonstrate understanding of the chemical processes in biotechnology, pH, solutions, dilutions, molarity.
26.0 Demonstrate an understanding of cell propagation, growth and cultures for biotechnology.
27.0 Demonstrate an understanding of the fundamentals of biochemistry including protein synthesis, recombinants, and reproduction, analysis, western blot.

28.0 Demonstrate an understanding of genetics and biotechnology, gene selection, transformation, analysis, PCR, Northern and Southern blot.
29.0 Demonstrate knowledge of the structure and function and reproduction of various organisms used as genetic models.
30.0 Demonstrate an understanding of the interdependence of organisms, humans, and the environment.
31.0 Demonstrate an understanding of genetic diversity, natural and genetic selection.
32.0 Demonstrate an understanding of bioethics.
33.0 Demonstrate an understanding of the connection between the various industry sectors of biotechnology (agricultural, food, and medical technologies) and careers.

CTE Performance Standards

34.0 Demonstrate knowledge of the history, career fields, and benefits of biotechnology.
35.0 Recognize and practice safety procedures.
36.0 Recognize and follows quality control procedures and regulatory guidelines.
37.0 Demonstrate the ability to communicate and use interpersonal skills effectively.
38.0 Apply basic skills in scientific inquiry, calculations, and analysis.
39.0 Demonstrate knowledge of organism structure and function.
40.0 Utilize materials processing and standard laboratory operating procedures for biotechnology.
41.0 Apply biotechnical materials analysis skills.
42.0 Demonstrates knowledge of basic chemistry as applied to biotechnology procedures.
43.0 Utilizes basic knowledge of microbiology and blood-borne diseases, including AIDS.
44.0 Demonstrate knowledge of legal and ethical responsibilities.
45.0 Demonstrate literacy and computer skills applicable to the biotechnology industry.
46.0 Demonstrate employability skills.

CTE Performance Standards

47.0 History, career fields, and benefits of biotechnology.
48.0 Safety procedures.
49.0 Quality control procedures and regulatory guidelines.
50.0 Communicate and use interpersonal skills effectively.
51.0 Basic skills in scientific inquiry, calculations, and analysis.
52.0 Organism structure and function.
53.0 Materials processing and standard laboratory operating procedures for biotechnology.
54.0 Biotechnical materials analysis skills.
55.0 Basic chemistry as applied to biotechnology procedures.
56.0 Microbiology and blood-borne diseases, including AIDS.
57.0 Legal and ethical responsibilities.
58.0 Literacy and computer skills applicable to the biotechnology industry.
59.0 Employability skills.

Florida Department of Education
Student Performance Standards

Course Title: **Biotechnology 1**
Course Number: **3027010**
Course Credit: **1 Science**

It is **strongly recommended** that the following scope, sequence, and course recommendations be followed.

Recommended Prerequisite: **None**
Recommended Grade Level: **9th/10th**

Course Description:

This course provides exploratory experience combining laboratory and real-life applications in the field of biotechnology. The content includes, but is not limited to, the following:

- The nature of science
- Matter, energy, chemical processes of cells, organisms
- Cell molecular structure and function, membranes, DNA, plasmids, reproduction, communication
- Fundamentals of biochemistry, protein synthesis, germ theory,
- Molecular genetics and biotechnology, restriction digest, DNA analysis, PCR
- Levels of organization, molecular to organismal, classification, and taxonomy
- Interdependence of organisms, humans, and the environment,
- Genetic diversity, selection, adaptations, and changes through time
- Bioethics
- Connection between Biotechnology, agricultural, food, and medicine and careers

This course shall integrate the Goal 3 Student Performance Standards of the Florida System of School Improvement and Accountability as appropriate to the content and processes of the subject matter.

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error, and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences.

CTE Standards and Benchmarks	
Academic Knowledge Standards	
01.0	Apply knowledge of the nature of science and scientific habits of mind to solve problems, and employ safe and effective use of laboratory technologies. The student will be able to:
01.01	Describe general reasons for scientific investigations, which advance a process or improve scientific understanding.
01.02	Understand that from time to time, major shifts occur in the scientific view of how the world works, but that more often, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge.
01.03	Understand that the potential for bias exists within individuals and scientific teams, and therefore scientists are expected to seek out possible sources of bias in the design of their investigations and in their data analysis.
01.04	Understand that new ideas in science are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and usually grow slowly from many contributors.
01.05	Understand how new theories are evaluated by the range of observations they explain and their effectiveness in predicting new findings when compared to existing scientific thought.
01.06	Understand that scientists assume that the universe is a vast system in which basic rules exist that may range from very simple to extremely complex but that scientists operate on the belief that the rules can be discovered by careful, systemic study.
01.07	Understand the difference between laws, theories, and facts.
02.0	Demonstrate understanding of the roles of matter, energy, in the chemical processes of cells, organisms. The student will be able to:
02.01	Understand that the electron configuration in atoms determines how a substance reacts and how much energy is involved in its reactions.
02.02	Understand that the vast diversity of the properties of materials is primarily due to variations in the forces that hold molecules together.
02.03	Understands that a change from one phase of matter to another involves a gain or loss of energy.
02.04	Understand that connections (bonds) form between substances when outer-shell electrons are either transferred or shared between their atoms, changing the properties of substances.
02.05	Understand that the number and configuration of electrons will equal the number of protons in an electrically neutral atom and when an atom gains or loses electrons the charge is unbalanced.
02.06	Understand the difference between an element, a molecule, ion, and a compound
02.07	Identify the usefulness of the periodic table and identify properties of specific groups.
02.08	Understand that biological systems obey the same laws of conservation as physical systems.
02.09	Understand that organisms respond to internal and external stimuli.
03.0	Demonstrate an understanding of the structure and processes of the cell, with emphasis on reproduction and communication. The student will be able to:

CTE Standards and Benchmarks	
	03.01 Understand that body structures are uniquely designed and adapted for their function.
	03.02 Understand that living systems are complex and that interactions between internal (metabolism etc.) and external sources can influence cell behavior.
04.0	Demonstrate an understanding of the fundamentals of biochemistry including protein synthesis and reproduction. The student will be able to:
	04.01 Understand that body processes involve specific biochemical reactions governed by biochemical principles, and that pathways have been identified through advances in molecular analyses, which have led to better understanding, diagnosis, and treatment of disease.
	04.02 Understand that membranes are sites for chemical synthesis and essential energy conversions.
	04.03 Understand the complex interactions among the different kinds of molecules in the cell cause distinct cycles of activity governed by proteins.
05.0	Demonstrate an understanding of genetics, including the principles of, molecular basis, diversity, and applications to biotechnology. The student will be able to:
	05.01 Understand the mechanism of asexual and sexual reproduction and know the different genetic advantages and disadvantages of sexual and asexual reproduction.
	05.02 Understand that every cell contains a “blueprint” coded in DNA molecules which follow the central dogma of biology from DNA to RNA, to protein assembly; from transcription to translation.
06.0	Demonstrate an understanding of the levels of organization, from atoms to molecular DNA to organisms, classification, taxonomy. The student will be able to:
	06.01 Understand that chemical elements that make up the molecules of living things are combined and recombined in different ways.
07.0	Demonstrate an understanding of genetic diversity, selection, adaptations, and changes through time. The student will be able to:
	07.01 Understand the mechanisms of change (e.g., mutation and natural selection) that lead to adaptations in a species and their ability to survive naturally in changing conditions and to increase species diversity.
	07.02 Understand the great diversity and interdependence of living things.
	07.03 Understands how genetic variation of offspring contributes to natural selection.
08.0	Demonstrate an understanding of the legal and ethical responsibilities associated with working with biological specimens for research or industry, bioethics. The student will be able to:
	08.01 Understand the importance of a sense of responsibility, a commitment to peer review, truthful reporting of the methods and outcomes of investigations, and making the public aware of the findings.
	08.02 Understand that scientists first define then control conditions in order to obtain evidence, but when that is not possible for practical or ethical reasons, they try to observe a wide range of natural occurrences to discern patterns.
	08.03 Understand that performance testing is often conducted using small-scale models, computer simulations, or analogous systems to reduce the chance of system failure.

CTE Standards and Benchmarks	
08.04	Understand that scientific knowledge is used by those who engage in design and technology to solve practical problems, taking human values and limitations into account.
08.05	Discuss the extended impact of involving animal and human subjects in research with respect to humane treatment, providing full disclosure to clinical trial participants, ensuring patient confidentiality, and participants, ensuring patient.
08.06	Understand the purpose of clinical trials.
08.07	Understand the purpose of Good Laboratory Practices (GLP) as related to product testing and approval.
09.0	Demonstrate an understanding of the legal and ethical responsibilities associated with working with biological specimens for research or industry, bioethics. The student will be able to:
09.01	Understand that scientists can bring information, insights, and analytical skills to matters of public concern and help people understand the possible causes and effects of events.
09.02	Understand that funds for science research come from federal government agencies, industry, private investors, and private foundations and that this funding often influences the areas of discovery.
09.03	Provide examples of industry trends related to Biotechnology.
CTE Performance Standards	
10.0	Demonstrate knowledge of the history, career fields, and benefits of biotechnology. The student will be able to:
10.01	Describe major historic developments in biotechnology fields such as pharmaceuticals, biopharmaceuticals, agriculture, diagnostics, industrial products, devices, instrumentation, and research and development.
10.02	Identify several products obtained through recombinant DNA technology and other biotechnology advances.
10.03	Describe the major steps in a product's move through a company's product pipeline.
10.04	Explain how companies decide on the research and development targets and potential products.
10.05	Give examples of how the biotechnology revolution has had an impact on current science and manufacturing practices, as well as how new discoveries in science have in turn impacted biotechnology.
10.06	Illustrate examples of how biotechnology has led to benefits and risks to society and how biotechnical advances affect human lives on a personal level.
11.0	Recognize and practice safety procedures. The student will be able to:
11.01	Identify safety symbols and signs.
11.02	Identify appropriate safety procedures and guidelines.

CTE Standards and Benchmarks	
	11.03 Demonstrate an understanding of the emergency procedures in case of fire, burn, chemical spill or other hazardous situations.
	11.04 Recognize laboratory safety hazards and avoid them.
	11.05 Locate and identify emergency equipment, including first aid.
	11.06 Use laboratory apparatus, materials, and technology in an appropriate and safe manner.
	11.07 Locate a Safety Data Sheet (SDS) and use the information to operate in a safe manner.
	11.08 Demonstrate knowledge of universal precautions for blood-borne pathogens.
12.0	Recognize and follows quality control procedures and regulatory guidelines. The student will be able to:
	12.01 Identify the need for and function of regulatory agencies such as those in government, industry, and society.
	12.02 Describe appropriate attire for different biotechnology workplaces including the office, laboratory and cleanroom environments.
	12.03 Monitor, use, store and dispose of hazardous materials properly.
	12.04 Clean, organize, and sterilize materials and equipment.
	12.05 Understand the role of the employer to provide a safe and healthful workplace. (OSHA regulations)
13.0	Demonstrate the ability to communicate and use interpersonal skills effectively. The student will be able to:
	13.01 Follow all oral and written instructions.
	13.02 Demonstrate good listening, writing, and verbal communication skills and procedures.
	13.03 Appropriately use and respond to verbal and non-verbal cues.
	13.04 Use correct spelling, grammar, and format in all written communication.
	13.05 Use appropriate scientific terminology and abbreviations.
	13.06 Recognize the importance of courtesy and respect and maintain good interpersonal relationships.
	13.07 Read and discuss technical material.
	13.08 Read and present a scientific paper for discussion, including an overview of the objective, experimental methods, results, and conclusions.
14.0	Apply basic skills in scientific inquiry, calculations, and analysis.--The student will be able to:

CTE Standards and Benchmarks	
14.01	Demonstrate knowledge of the scientific method.
14.02	Use a variety of methods including literature searches in libraries, computer databases, or on-line, for gathering background information, making observations, and collecting and organizing data.
14.03	Use the scientific method to conduct a valid experiment, including hypothesis formation, data collection, data analysis including results and discussion, and conclusion.
14.04	Maintain a scientific notebook per industry best practices (objectives, procedures, data, materials, sources of error, and conclusions).
14.05	Properly and safely operate scientific equipment including graduates, hoods, microscopes, pipets, micropipets, electronic balance, pH meters, incubators, centrifuges, water baths, power supplies and electrophoresis chambers.
14.06	Make and use measurements in both traditional and metric units.
14.07	Measure time, temperature, distance, capacity and mass/weight.
14.08	Make estimates and approximations to test the reasonableness of the result.
14.09	Evaluate the validity of results obtained during experimentation and product development.
14.10	Interpret and use graphs, charts and tables used to collect and analyze data.
14.11	Interpret quantitative and qualitative data.
14.12	Demonstrate ability to evaluate and draw conclusions.
14.13	Follow guidelines to prepare a scientific report.
15.0	Demonstrate knowledge of organism structure and function. The student will be able to:
15.01	Recognize and distinguish between the following based upon the hierarchy of organization of organisms: atom, molecule, cells, tissue, organs, organ system, and organism.
15.02	Outline the life cycle and characteristics of certain model organisms used in the biotechnology industry, including bacterial, yeast, and mammalian cells, and viruses.
15.03	Differentiate between prokaryotic and eukaryotic cells.
15.04	Describe the cell (both prokaryotes and eukaryotes) as the basic unit of life.
15.05	Analyze the difference between plant and animal cells.
15.06	Describe cell structure and function.
15.07	Differentiate between mitosis and meiosis.

CTE Standards and Benchmarks
15.08 Describe the role of DNA, RNA, and ribosomes in protein synthesis.
16.0 Utilize materials processing and standard laboratory operating procedures for biotechnology. The student will be able to:
16.01 Maintain a clean and organized work area.
16.02 Follow written protocols and oral directions to perform a variety of laboratory and technical tasks.
16.03 Determine appropriate equipment and units of measurement for a given task.
16.04 Discuss and perform disinfection and sterilization techniques.
17.0 Apply biotechnical materials analysis skills. The student will be able to:
17.01 Isolate DNA from a variety of cells.
17.02 Explain the principles involved in agarose gel electrophoresis.
17.03 Prepare, load, run, visualize, and analyze DNA samples on an agarose gel.
17.04 Describe the meaning in differences in DNA and peptide bands seen on agarose gels.
17.05 Explain the difference between analyzing PCR products on conventional gels vs. using a realtime PCR system.
17.06 Discuss sources of environmental contamination and methods of detection in controlled environments.
18.0 Demonstrates knowledge of basic chemistry as applied to biotechnology procedures. The student will be able to:
18.01 Demonstrate that the rate of chemical reactions depend on reactant concentration or temperature, or the presence of a catalyst.
19.0 Utilizes basic knowledge of microbiology and blood-borne diseases, including AIDS. The student will be able to:
19.01 Differentiate between aerobic vs. anaerobic bacteria, viruses, bacteriophage, and mycoplasma.
19.02 Discuss microbial taxonomy and classification.
19.03 Practice aseptic techniques as required.
19.04 Discuss sterilization and isolation techniques.
19.05 Discuss techniques of inoculation and transfer of cultures.
19.06 Describe conditions that promote cell growth under aseptic conditions in the laboratory and workplace.

CTE Standards and Benchmarks	
	19.07 Identify "at risk" behaviors which promote the spread of diseases caused by blood borne pathogens.
	19.08 Discuss differences between sterilization, decontamination, and disinfection.
	19.09 Demonstrate proper protocol for the disposal of biohazardous waste and microorganisms.
20.0	Demonstrate knowledge of legal and ethical responsibilities. The student will be able to:
	20.01 Discuss ethical, legal and social issues raised by biotechnology.
21.0	Demonstrate literacy and computer skills applicable to the biotechnology industry. The student will be able to:
	21.01 Define terms and demonstrate basic computer skills.
	21.02 Describe the uses of computers in the biotechnology industry.
	21.03 Use the Internet to gather and share scientific and regulatory information.
22.0	Demonstrate employability skills. The student will be able to:
	22.01 Demonstrate appropriate responses to criticism and coaching from employer, supervisor, or other persons.
	22.02 Demonstrate appropriate methods for asking questions and providing constructive criticism and feedback.
	22.03 Use several resources including the internet to gather information about job opportunities in the biotechnology field.
	22.04 Outline the opportunities for careers in biotechnology in health, industry, medicine, genetics, agriculture, etc.
	22.05 Identify and demonstrate acceptable work habits and health habits.
	22.06 Follow acceptable work habits, personal characteristics, and hygiene habits for the biotechnology workplace.

Florida Department of Education
Student Performance Standards

Course Title: **Biotechnology 2**
Course Number: **3027020**
Course Credit: **1 Science**

It is **strongly recommended** that the following scope, sequence, and course recommendations be followed.

Recommended Prerequisite: **Biotechnology 1, Biology 1, Honors Biology, or Biology Technology**
Recommended Grade Level: **10th/11th**

Course Description:

This course provides exploratory experience combining laboratory and real-life applications in the field of biotechnology. The content includes, but is not limited to, the following:

- The nature of science
- Chemical processes in biotechnology, pH, solutions, molarity
- Cell propagation, growth and cultures for biotechnology
- Biochemistry, proteins, enzymes, plasmids, recombinants, blood borne pathogens
- Genetics and biotechnology, gene selection, transformation, analysis
- Structure and function of various organisms used as genetic models
- Interdependence of organisms, humans, and the environment,
- Genetic diversity and selection
- Connection between biotechnology, agricultural, food, and medicine and careers
- Bioethics

This course shall integrate the Goal 3 Student Performance Standards of the Florida System of School Improvement and Accountability as appropriate to the content and processes of the subject matter.

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error, and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences.

CTE Standards and Benchmarks	
Academic Knowledge Standards	
23.0	Apply knowledge of the nature of science and scientific habits of mind to solve problems, and employ safe and effective use of laboratory technologies. The student will be able to:
23.01	Understand that investigations are conducted to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare different theories.
23.02	Understand that from time to time, major shifts occur in the scientific view of how the world works, but that more often, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge.
23.03	Understand that no matter how well one theory fits observations, a new theory might fit them as well or better, or might fit a wider range of observations, because in science, the testing, revising, and occasional discarding of theories, new and old, never ends and leads to an increasingly better understanding of how things work in the world, but not to absolute truth.
23.04	Understand that the potential for bias exists within individuals and scientific teams, and therefore scientists are expected to seek out possible sources of bias in the design of their investigations and in their data analysis.
23.05	Understand that new ideas in science are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and usually grow slowly from many contributors.
23.06	Understand that in the short run, new ideas that do not mesh well with mainstream ideas in science often encounter vigorous criticism and that in the long run, theories are judged by how they fit with other theories, the range of observations they explain, how well they explain observations, and how effective they are in predicting new findings.
23.07	Understand that scientists assume that the universe is a vast system in which basic rules exist that may range from very simple to extremely complex but that scientists operate on the belief that the rules can be discovered by careful, systemic study.
24.0	Demonstrate understanding of the chemical processes in biotechnology, pH, solutions, dilutions, molarity. The student will be able to:
24.01	Experiments and determines that the rates of reaction among atoms and molecules depend on the concentration, pressure, and temperature of the reactants and the presence of absence of catalysts.
24.02	Understand how knowledge of energy is fundamental to all the scientific disciplines (e.g., the energy required for biological processes in living organisms and the energy required for the building, erosion, and rebuilding of the Earth).
24.03	Understand that there is conservation of mass and energy when matter is transformed.
24.04	Understands that membranes are sites for chemical synthesis and essential energy conversions.
24.05	Understands that biological systems obey the same laws of conservation as physical systems.
25.0	Demonstrate an understanding of cell propagation, growth and cultures for biotechnology. The student will be able to:
25.01	Understand the mechanisms of asexual and sexual reproduction and know the different genetic advantages and disadvantages of asexual and sexual reproduction.
26.0	Demonstrate an understanding of the fundamentals of biochemistry including protein synthesis, recombinants, and reproduction, analysis, western blot. The student will be able to:
26.01	Define monoclonal antibodies and hybridoma technology.

CTE Standards and Benchmarks	
	26.02 Understand the complex interactions among the different kinds of molecules in the cell cause distinct cycles of activity governed by proteins.
	26.03 Understand that cell behavior can be affected by molecules from other parts of the organism or even from other organisms.
27.0	Demonstrate an understanding of genetics and biotechnology, gene selection, transformation, analysis, PCR, northern and southern blot. The student will be able to:
	27.01 Understand that the chemical elements that make up the molecules of living things are combined and recombined in different ways.
	27.02 Understand that every cell contains a “blueprint” coded in DNA molecules which follow the central dogma of biology from DNA to RNA, to protein assembly; from transcription to translation.
28.0	Demonstrate a knowledge of the structure and function and reproduction of various organisms used as genetic models. The student will be able to:
	28.01 Understand that body structures are uniquely designed and adapted for their function.
	28.02 Describe animal models used in research, and the types of studies they are optimally used for.
29.0	Demonstrate an understanding of the interdependence of organisms, humans, and the environment. The student will be able to:
	29.01 Understand the interdependence between both the biotic and abiotic components of any system.
30.0	Demonstrate an understanding of genetic diversity, natural and genetic selection. The student will be able to:
	30.01 Understand the mechanisms of change (e.g., mutation and natural selection) that lead to adaptations in a species and their ability to survive naturally in changing conditions and to increase species diversity.
	30.02 Understand the great diversity and interdependence of living things, and the value of biodiversity.
	30.03 Understands how genetic variation of offspring contributes to natural selection.
31.0	Demonstrate an understanding of bioethics. The student will be able to:
	31.01 Understand the importance of a sense of responsibility, a commitment to peer review, truthful reporting of the methods and outcomes of investigations, and making the public aware of the findings.
	31.02 Understand that scientists first define then control conditions in order to obtain evidence, but when that is not possible for practical or ethical reasons, they try to observe a wide range of natural occurrences to discern patterns.
	31.03 Understand that performance testing is often conducted using small-scale models, computer simulations, or analogous systems to reduce the chance of system failure.
	31.04 Understand that scientific knowledge is used by those who engage in design and technology to solve practical problems, taking human values and limitations into account.
32.0	Demonstrate an understanding of the connection between the various industry sectors of biotechnology (agricultural, food, and medical technologies) and careers. The student will be able to:

CTE Standards and Benchmarks	
32.01	Understand that funds for science research come from federal government agencies, industry, and private foundations and that this funding often influences the areas of discovery.
32.02	Understand that scientists can bring information, insights, and analytical skills to matters of public concern and help people understand the possible causes and effects of events.
32.03	Discuss how scientists contribute to and promote science-based policy in US government.
32.04	Discuss the correlation between scientific discovery and product development, based on societal benefit vs. financial benefit to a company.
CTE Performance Standards	
33.0	Demonstrate knowledge of the history, career fields, and benefits of biotechnology. The student will be able to:
33.01	Understand that technologies used in biotechnology continue to be developed and improved, with respect to advances in discoveries, applications, and demand for increased efficiency.
33.02	Compare the developments in two biotechnology fields and make predictions for future developments in those areas.
33.03	Identify several local biotechnology companies specializing in the production of pharmaceuticals, agricultural products, industrial products, and research instruments and reagents.
33.04	Compare the benefits of products derived from biotechnological advances (including DNA technology) to an environment devoid of biotechnological products or applications.
33.05	Demonstrate knowledge of various career fields in the biotechnology industry, including but not limited to research and development, pre-clinical and clinical trials, manufacturing, facilities and equipment, quality control, quality assurance, regulatory affairs, marketing, and sales.
34.0	Recognize and practice safety procedures. The student will be able to:
34.01	Define Biological Safety Levels 1 through 4 and their differences.
34.02	Describe appropriate attire for Biological Safety Levels 1 through 4.
34.03	Identify potential biohazards and relate how to deal with a variety of biohazards.
34.04	Use appropriate safety procedures and guidelines and demonstrate knowledge of emergency procedures.
34.05	Maintain equipment and material logs for all apparatus, materials, and technology.
34.06	Maintain a Safety Data Sheet (SDS) notebook and appropriately reference for each activity.
34.07	Follow approved protocols for all activities which may cause exposure to blood-borne pathogens.
34.08	Describe strategies used in a cleanroom to minimize the introduction of contaminating microorganisms or particulates.

CTE Standards and Benchmarks	
35.0	Recognize and follows quality control procedures and regulatory guidelines. The student will be able to:
35.01	Describe the need for and function of regulatory agencies such as those in government, industry, and society.
35.02	Discuss quality control and assurance with respect to documentation.
35.03	Discuss quality control in relation to inspection results and specifications, procedures, testing methods, process control, regulatory specifications and documentation, and internal audits.
35.04	Utilize quality control methods in relation to hazardous and non-hazardous materials.
36.0	Demonstrate the ability to communicate and use interpersonal skills effectively. The student will be able to:
36.01	Demonstrate ability to give and follow oral and written directions.
36.02	Recognize potential errors in protocol and address them with colleagues and the appropriate supervisor.
36.03	Maintain thorough documentation of tasks and procedures.
36.04	Work effectively in a research, manufacturing, quality control, or quality assurance team with a defined responsibility.
36.05	Incorporate appropriate scientific terminology and abbreviations into all technical documents.
36.06	Prepare, analyze, and discuss technical material.
37.0	Apply basic skills in scientific inquiry, calculations, and analysis. The student will be able to:
37.01	Develop scientific questions, hypotheses, and experimental plans.
37.02	Properly and safely operate scientific equipment including mixers, analytical balances, stirrers, shakers, conductivity meters, and a hemocytometer.
37.03	Calculate ratios used for making chemical dilutions or plate counting.
37.04	Compose a thorough concluding statement outlining the results of an experiment with evidence, explanations, error analysis, and practical applications.
37.05	Evaluate scientific reports with well-supported, clearly presented opinions.
37.06	Consistently analyze and properly use a variety of valid literature resources.
37.07	Set-up and maintain a legal scientific notebook that includes an account of all laboratory procedures, data, conclusions, and appropriate signatures.
37.08	Measure time, temperature, distance, capacity, mass/weight, flow rates and growth rates.

CTE Standards and Benchmarks	
	37.09 Create graphs, charts and tables used to record, analyze, and convey scientific data.
	37.10 Critically analyze quantitative and qualitative data.
	37.11 Organize and communicate clear, concise written and oral reports of scientific findings.
38.0	Demonstrate knowledge of organism structure and function. The student will be able to:
	38.01 Discuss the makeup of chromosomes.
	38.02 Describe the processes of nucleic acid transfer.
	38.03 Describe the relationship of cellular science and biotechnology.
	38.04 Describe how enzymes regulate all aspects of protein synthesis.
	38.05 Explain how the structure of nucleic acid affects its isolation from cells and solutions.
	38.06 Describe how cells are engineered to express recombinant proteins.
	38.07 Identify groups of proteins based on their functions, citing specific examples of proteins in each group.
	38.08 Use the Internet to find information about the structure and function of specific proteins.
39.0	Utilize materials processing and standard laboratory operating procedures for biotechnology. The student will be able to:
	39.01 Maintain a professional laboratory space following standard operating procedures.
	39.02 Perform a variety of biological tests and chemical assays, collect data, perform calculations, and statistical analysis.
	39.03 Discuss classification, composition and preparation of culture media.
	39.04 Discuss collection and handling of specimens for fungal, bacterial, mammalian cells and viral specimens, and parasites.
40.0	Apply biotechnical materials analysis skills. The student will be able to:
	40.01 Outline the steps in cell culture, aseptic technique, and media preparation.
	40.02 Isolate DNA from cells and analyze its purity and concentration.
	40.03 Outline the steps in production, product testing, and delivery of a product made through recombinant DNA technology.
	40.04 Explain the principles' involved in polyacrylamide and agarose gel electrophoresis.

CTE Standards and Benchmarks	
40.05	Prepare, load, run, visualize, and analyze protein samples on a polyacrylamide or agarose gel.
40.06	Prepare protein solutions and dilutions at specific concentrations and pH.
40.07	Use protein indicator solutions to identify the presence and concentration of protein in a solution.
40.08	Describe the meaning in differences in DNA and peptide bands seen on polyacrylamide or agarose gels.
40.09	Prepare and maintain plate and broth cultures of bacteria. Explain how polyacrylamide gel electrophoresis (PAGE) is used with column chromatography to monitor protein product.
40.10	Describe the steps in harvesting protein product from fermentation cell culture.
40.11	Outline the steps of using a visible light spectrophotometer.
40.12	Prepare a serial dilution of protein and measure absorbance at a given wavelength.
40.13	Use a standard curve to determine the concentration of an unknown protein solution.
40.14	Explain the protocol and application for isolating plasmids.
40.15	Explain the process and application of inserting genes that code for antibiotic resistance into a plasmid.
40.16	Demonstrate the ability to culture, propagate, and harvest bacteria.
40.17	Understand the bacterial growth stages in culture.
40.18	Understand components of growth media such as energy source, and antibiotics, and incubation parameters: time, temp, atmospheric concentration.
40.19	Explain the process of utilizing restriction enzymes and DNA ligase to insert a new gene into a plasmid.
40.20	Explain the process of replicating plasmids.
40.21	Practice environmental monitoring using agar plates.
41.0	Demonstrates knowledge of basic chemistry as applied to biotechnology procedures. The student will be able to:
41.01	Use the periodic table to calculate molarity.
41.02	Balance equations to show that there is a conservation of matter. Explain hydrogen and polar bonding.
41.03	Discuss and use techniques that identify and separate components of a homogenous mixture.

CTE Standards and Benchmarks	
41.04	Explain and use the function of pH in the preservation, purification, and functioning of proteins.
41.05	Use pH paper or pH meter to measure and adjust pH.
41.06	Calculate how to prepare solutions based on % mass/volume.
41.07	Calculate how to prepare solutions based on molar concentrations.
41.08	Use stoichiometry and molarity to prepare solutions of any volume and concentration.
41.09	Prepare dilutions of concentrated solutions.
42.0	Utilizes basic knowledge of microbiology and blood-borne diseases, including AIDS. The student will be able to:
42.01	Discuss bacterial metabolism, reproduction, cell structures and their functions.
42.02	Perform microbiology techniques in controlled environments.
42.03	Demonstrate techniques of microscope use related to oil immersion and slide preparation.
42.04	Discuss uses for different microscopy methods, including light, fluorescent, phase-contrast, and electron.
42.05	Demonstrate the preparation and interpretation of Gram stains.
42.06	Perform various preparation and staining techniques.
42.07	Perform disinfection and aseptic techniques.
42.08	Perform sterilization and isolation techniques.
42.09	Prepare artificial culture media.
42.10	Perform techniques of inoculation and transfer of cultures.
42.11	Use various methods to monitor the growth of cell cultures.
42.12	Discuss the immune system and the normal immune response.
42.13	Perform antigen and antibody testing.
42.14	Discuss methods that utilize the antigen/antibody complex as tools for research, diagnosis, and testing.
42.15	Discuss the ABO, Rh and other blood group systems.

CTE Standards and Benchmarks	
42.16	Distinguish between fact and fallacy about the transmission and treatment of diseases caused by blood borne pathogens including Hepatitis B.
42.17	Identify community resources and services available to individuals with diseases caused by blood borne pathogens.
42.18	Demonstrate knowledge of the legal aspects of AIDS, including testing.
42.19	Describe how blood-borne pathogens are avoided in manufacturing.
43.0	Demonstrate knowledge of legal and ethical responsibilities. The student will be able to:
43.01	Recognize ethical issues of the biotechnology workplace such as employee privacy, employee safety, animal testing, etc.
43.02	List the local, regional, state, and federal agencies who oversee safety, ethics, and manufacturing.
43.03	Provide examples of the appropriate professional traits of a worker in biotechnology.
43.04	Outline the proper protocol for reporting unsafe or unethical behavior.
44.0	Demonstrate literacy and computer skills applicable to the biotechnology industry. The student will be able to:
44.01	Use the Internet to gather and share scientific and regulatory information.
44.02	Use a variety of methods including literature searches in libraries, in computer databases, and on-line for gathering background information, making observations, and collecting and organizing data.
44.03	Use a computer spreadsheet, word processing, and presentation programs to collect, analyze and report information or data.
45.0	Demonstrate employability skills. The student will be able to:
45.01	Conduct a job search.
45.02	Develop a portfolio that demonstrates proficiency in specific biotechnology workplace tasks including writing samples and performance-based lab and computer skills.
45.03	Describe the opportunities for careers in biotechnology in health, industry, medicine, genetics, agriculture, etc.
45.04	Identify or demonstrate appropriate responses to criticism from employer, supervisor, or other persons.
45.05	Analyze the impact that work and health habits have in the biotechnology industry.
45.06	Recognize appropriate professional behavior.
45.07	Explain the roles of different departments and the employees within each department at an industry site.

CTE Standards and Benchmarks
45.08 Describe the departmental functions in a typical biotechnology company.

Florida Department of Education
Student Performance Standards

Course Title: **Biotechnology 3**
Course Number: **8736030**
Course Credit: **1**

It is **strongly recommended** that the following scope, sequence, and course recommendations be followed.

Recommended Prerequisite: **Biotechnology 1 and Biotechnology 2**
Recommended Grade Level: **11th/12th**

Course Description:

Biotechnology 3 is a course designed to provide students with intense laboratory and research skills in preparation for continued education and/or entry into the biotechnology industry. Students will build upon the skills attained in Biotechnology 1 and Biotechnology 2 as they design and conduct experiments relevant to current biotechnology. A close association with local industry and postsecondary institutions will provide additional opportunities for development and application of biotechnology practices.

CTE Standards and Benchmarks	
CTE Performance Standards	
47.0	History, career fields, and benefits of biotechnology. The student will be able to:
47.01	Identify a recent advancement in a biotechnological tool or method and compare it to its predecessor.
47.02	Select and evaluate the potential of a product based on industry criteria.
47.03	Explain how biotechnology practices, procedures, and philosophies have evolved to current high technology and integrated disciplines.
47.04	Illustrate examples of how biotechnology has led to benefits and risks to society and how biotechnical advances affect human lives on a personal level.
47.05	Graph a history timeline with medical advances due to technological advances.
47.06	Research and analyze career opportunities available in biotechnology and select the career pathway best suited to your interests, abilities, and objectives.
47.07	Discuss medical, agricultural, forensic, and environmental applications of biotechnology.
48.0	Safety procedures. The student will be able to:

CTE Standards and Benchmarks	
48.01	Identify safety symbols and signs.
48.02	Use appropriate safety procedures and guidelines.
48.03	Demonstrate an understanding of the emergency procedures in case of fire, burn, chemical spill or other hazardous situations.
48.04	Recognize laboratory safety hazards and avoid them.
48.05	Locate and be able to use emergency equipment, including first aid.
48.06	Identify potential biohazards and relate how to deal with a variety of biohazards.
48.07	Use laboratory apparatus, materials, and technology in an appropriate and safe manner.
48.08	Locate a Safety Data Sheet (SDS) and use the information to operate in a safe manner.
48.09	Follow universal precautions for blood-borne pathogens.
49.0	Quality control procedures and regulatory guidelines. The student will be able to:
49.01	Evaluate the need for and function of regulatory agencies such as those in government, industry, and society.
49.02	Understand that all products intended to be used for the diagnosis, cure, mitigation, treatment, or prevention of disease must go through a regulatory approval process that is based on documented research and testing to ensure the product is safe and efficacious (works).
49.03	Describe the purpose of current Good Manufacturing Practices, and how they are supported by guidance from the International Organization for Standardization.
49.04	Analyze experimental data and/or manufacturing processing documentation from the perspective of quality assurance.
49.05	Discuss quality control in relation to inspection results and specifications, procedures, testing methods, process control, regulatory specifications and documentation, and internal audits.
49.06	Monitor, use, store and dispose of hazardous materials properly.
49.07	Check and maintain equipment and logs.
49.08	Clean, organize, and sterilize materials.
49.09	Manage material and supply inventories.
49.10	Define/chart the process of receiving an unqualified (or qualified) raw material and follow it through the manufacturing process into the finished product.
50.0	Communicate and use interpersonal skills effectively. The student will be able to:

CTE Standards and Benchmarks	
50.01	Follow all oral and written instructions.
50.02	Demonstrate ability to give oral and written directions.
50.03	Demonstrate good listening, writing, and verbal communication skills and procedures.
50.04	Recognize potential errors in protocol and address them with colleagues and the appropriate supervisor.
50.05	Maintain thorough documentation of tasks and procedures.
50.06	Work effectively in a research, manufacturing, quality control, or quality assurance team with a defined responsibility.
50.07	Develop basic observational skills and related documentation strategies in written and oral form.
50.08	Identify characteristics of successful and unsuccessful communication.
50.09	Appropriately use and respond to verbal and non-verbal cues.
50.10	Use correct spelling, grammar, and format in all written communication.
50.11	Use appropriate scientific terminology and abbreviations.
50.12	Recognize the importance of courtesy and respect and maintain good interpersonal relationships.
50.13	Interpret technical material and prepare a journal article related to the development of a process or product on which the student has worked.
51.0	Basic skills in scientific inquiry, calculations, and analysis. The student will be able to:
51.01	Demonstrate knowledge of the scientific method in general and biotechnology research in manufacturing and quality control.
51.02	Understand the applicability of Koch’s postulates.
51.03	Consistently analyze and properly uses valid literature resources.
51.04	Set-up and maintain a legal scientific notebook that includes an account of all laboratory procedures, data, conclusions, and appropriate signatures.
51.05	Properly and safely operate scientific equipment including graduates, hoods, microscopes, pipets, micropipets, electronic balance, pH meters, incubators, centrifuges, water baths, power supplies and electrophoresis chambers.
51.06	Properly and safely operate scientific equipment including mixers, analytical balances, stirrers, shakers, conductivity meters, and a hemocytometer.
51.07	Describe how to properly and safely use scientific equipment including spectrophotometer, autoclave, thermocycler, plate reader/fluorometer, and sterile hood/ biosafety cabinet.

CTE Standards and Benchmarks	
51.08	Understand why sometimes equipment is dedicated to one specific room, assay, or process.
51.09	Describe how to properly and safely use scientific equipment including polarimeter, chart recorder, particle counter, and hybridization oven.
51.10	Make and use measurements in both traditional and metric units.
51.11	Calculate ratios used for making chemical dilutions or plate counting.
51.12	Measure time, temperature, distance, capacity, mass/weight, flow rates and growth rates.
51.13	Describe the relationship between 12- and 24-hour time and be able to convert between the two.
51.14	Make estimates and approximations to test the reasonableness of the result.
51.15	Evaluate the validity of results obtained during experimentation and product development.
51.16	Interpret and create graphs, charts and tables used to collect and analyze data.
51.17	Interpret and critically analyze quantitative and qualitative data.
51.18	Demonstrate ability to evaluate and draw conclusions.
51.19	Organize and communicate clear, concise written and oral reports of scientific findings.
51.20	Evaluate scientific reports with well-supported, clearly presented opinions. Monitor scientific equipment by conducting and documenting preventative maintenance and calibration.
51.21	Correctly identify positive and negative controls in an experiment and evaluate the validity of the result in the light of controls.
52.0	Organism structure and function. The student will be able to:
52.01	Discuss the makeup of chromosomes.
52.02	Discuss the process of nucleic acid transfer.
52.03	Describe the relationship of cellular science and biotechnology.
52.04	Explain how the structure of nucleic acid affects its isolation from cells and solutions.
52.05	Describe how cells are engineered to express recombinant proteins.
53.0	Materials processing and standard laboratory operating procedures for biotechnology.--The student will be able to:

CTE Standards and Benchmarks	
53.01	Maintain a clean and organized work area.
53.02	Follow written protocols and oral directions to perform a variety of laboratory and technical tasks.
53.03	Determine appropriate equipment and units of measurement for a given task.
53.04	Discuss the various sections of a Standard Operating Procedure (SOP), with respect to safety, equipment, reagents, procedural steps, result analysis, reporting, and troubleshooting.
53.05	Perform a variety of biological tests and chemical assays, collect data, perform calculations and statistical analysis.
53.06	Discuss and perform disinfection and sterilization techniques.
53.07	Outline the steps in cell culture, aseptic technique and media preparation.
53.08	Discuss classification, composition and preparation of culture media.
53.09	Discuss collection and handling of specimens for fungal, bacterial, mammalian cells and viral specimens.
53.10	Prepare and examine specimens, and identify ova and parasites as indicated.
54.0	Biotechnical materials analysis skills. The student will be able to:
54.01	Describe the characteristics of proteins that allow for their purification after cloning transformed cells.
54.02	Explain how polyacrylamide gel electrophoresis (PAGE) is used with column chromatography to monitor protein product.
54.03	Describe the steps in harvesting protein product from fermentation cell culture.
54.04	Summarize the steps in manufacturing and product testing and FDA approval for new drugs produced through genetic engineering.
54.05	Outline the steps of using a visible light spectrophotometer.
54.06	Prepare a serial dilution of protein and measure absorbance at a given wavelength.
54.07	Use a standard curve to determine the concentration of an unknown protein solution.
54.08	Do a linear regression to calculate protein concentration using a computer spreadsheet.
54.09	Discuss techniques of chemistry related to standardization of procedure and use of standards, blanks and controls.
54.10	Explain the protocol and application for isolating plasmids.
54.11	Explain the process and application of inserting genes that code for antibiotic resistance into a plasmid.

CTE Standards and Benchmarks
54.12 Demonstrate the ability to culture, propagate, and harvest bacteria.
54.13 Explain the process of utilizing restriction enzymes and DNA ligase to insert a new gene into a plasmid.
54.14 Explain the process of replicating plasmids.
54.15 Practice environmental monitoring using agar plates.
54.16 Discuss sources of environmental contamination and methods of detection in controlled environments.
54.17 Demonstrate knowledge of and perform enzyme assays.
55.0 Basic chemistry as applied to biotechnology procedures. The student will be able to:
55.01 Use the periodic table to predict valence electron configuration, and physical and chemical characteristics of elements.
55.02 Use the periodic table to calculate molarity.
55.03 Balance equations to show that there is a conservation of matter.
55.04 Explain hydrogen and polar bonding.
55.05 Discuss and use techniques that identify and separate components of a homogenous mixture.
55.06 Explain and use the function of pH in the preservation, purification, and functioning of proteins.
55.07 Use pH paper or pH meter to measure and adjust pHSC.
55.08 Calculate how to prepare solutions based on % mass/volume.
55.09 Calculate how to prepare solutions based on molar concentrations.
55.10 Use stoichiometry and molarity to prepare solutions of any volume and concentration.
55.11 Prepare dilutions of concentrated solutions.
56.0 Microbiology and blood-borne diseases, including AIDS. The student will be able to:
56.01 Discuss microbial taxonomy and classification.
56.02 Perform microbiology techniques in controlled environments.
56.03 Perform disinfection techniques.

CTE Standards and Benchmarks
56.04 Practice aseptic techniques as required.
56.05 Perform sterilization techniques.
56.06 Discuss isolation techniques.
56.07 Prepare artificial culture media.
56.08 Discuss techniques of inoculation and transfer of cultures
56.09 Use various methods to monitor the growth of cell cultures.
56.10 Describe conditions that promote cell growth under aseptic conditions in the laboratory and workplace.
56.11 Discuss methods for the isolation, purification, and quantification of DNA and plasmid DNA.
56.12 Perform antigen and antibody testing.
56.13 Identify community resources and services available to the individuals with diseases caused by blood borne pathogens.
56.14 Demonstrate knowledge of the legal aspects of AIDS, including testing.
56.15 Describe how blood-borne pathogens are avoided in manufacturing.
56.16 Discuss methods of microbial detection, isolation, quantification (enumeration), and identification.
57.0 Legal and ethical responsibilities. The student will be able to:
57.01 Investigate an ethical, social, or legal issue facing biotechnology today and suggest an approach to solving it.
57.02 Provide examples of the appropriate professional traits of a worker in biotechnology.
57.03 Outline the proper protocol for reporting unsafe or unethical behavior.
57.04 Describe a Code of Ethics consistent with the biotechnology industry
57.05 Discuss the importance of maintaining confidentiality of information, including computer information.
57.06 Recognize and report illegal and unethical practices of health care workers.
58.0 Literacy and computer skills applicable to the biotechnology industry. The student will be able to:
58.01 Use the Internet to gather and share scientific and regulatory information.

CTE Standards and Benchmarks	
58.02	Use a computer spreadsheet, word processing, and presentation programs to collect, analyze and report information or data.
58.03	Use a variety of methods including literature searches in libraries, in computer databases, and on-line for gathering background information, making observations, and collecting and organizing data.
59.0	Employability skills. The student will be able to:
59.01	Conduct a job search.
59.02	Use several resources including the Internet to gather information about job opportunities in the biotechnology field.
59.03	Create an appropriate resume for use in applying for job opportunities in a biotechnology company.
59.04	Use ‘keywords’ in a resume to match job description and rank higher when analyzed by resume scanning software.
59.05	Complete a job application form correctly.
59.06	Identify documents that may be required when applying for a job.
59.07	Develop a portfolio that demonstrates proficiency in specific biotechnology workplace tasks including writing samples and performance-based lab and computer skills.
59.08	Identify or demonstrate appropriate responses to criticism from employer, supervisor, or other persons.
59.09	Evaluate the overall condition of personal work habits and health habits and the effect, (if any) these habits might have in the biotechnology workplace.
59.10	Recognize appropriate professional behavior.
59.11	Explain the roles of different departments and the employees within each department at an industry site.
59.12	Describe the departmental functions in a typical biotechnology company.
59.13	Respond to potential interview questions.

Additional Information

Laboratory Activities

This program is designed to provide students with intense laboratory and research skills in preparation for continued education and/or entry into the biotechnology industry. Students will build upon the skills attained as they design and conduct experiments relevant to current biotechnology. A close association with local industry and postsecondary institutions will provide additional opportunities for development and application of biotechnology practices.

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the co-curricular career and technical student organizations for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology, and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Advanced Manufacturing Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Secondary – Career Preparatory	
Program Number	9200200
CIP Number	0615040605
Grade Level	9 –12
Program Length	5 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA, FL-TSA
SOC Codes (all applicable)	51-1011 – First-line Supervisors of Production and Operating Workers
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in Advanced Manufacturing and Production positions.

The content includes but is not limited to providing students with a foundation of knowledge and technically oriented experiences in the study of automation technology, its application in manufacturing, engineering and robotics, and its effect upon our lives and the choosing of an occupation. The content and activities will also include the study of enterprise systems, safety, quality, and leadership skills. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of five credits.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
9200210	Advanced Manufacturing Technology 1	AUTO PROD 7G ELECTRONIC @7 7G ENG 7G TECH ED 1 @ 2 ENG&TEC ED1@2	1 credit	51-1011	2	CT
9200220	Advanced Manufacturing Technology 2		1 credit	51-1011	3	CT
9200230	Advanced Manufacturing Technology 3		1 credit	51-1011	3	CT
9200240	Advanced Manufacturing Technology 4		1 credit	51-1011	3	CT
9200250	Advanced Manufacturing Technology Capstone		1 credit	51-1011	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

National Standards

Industry or National Standards corresponding to the standards and/or benchmarks for the Advanced Manufacturing Technology program can be found using the following link: http://www.msscusa.org

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of technology.
02.0 Demonstrate an understanding of Design for Manufacturing (DFM).
03.0 Demonstrate an understanding of workplace safety and workplace organization.
04.0 Demonstrate an understanding of workplace communication skills and teamwork.
05.0 Demonstrate an understanding of basic machine tools.
06.0 Demonstrate the ability to read and interpret blueprints and schematics.
07.0 Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings.
08.0 Demonstrate proficiently in the use of quality assurance methods and quality control concepts.
09.0 Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods.
10.0 Demonstrate an understanding of modern business practices and enterprise systems.
11.0 Demonstrate an understanding of and be able to select production processes.
12.0 Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control.
13.0 Demonstrate the ability to properly identify, organize, plan, allocate resources, document and produce a mass-produced product via a master project.
14.0 Demonstrate an understanding of industrial tools and processes inclusive of: Manual Milling (Optional), CNC machines, and Welding (Optional).
15.0 Demonstrate proficiency in computer control, robotics, and programmable logic.
16.0 Demonstrate an understanding of mechanisms.
17.0 Demonstrate a fundamental understanding of AC/DC electrical and electrical control.
18.0 Demonstrate an understanding of fluid power.
19.0 Demonstrate the abilities to use and maintain technological products and systems.
20.0 Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies.
21.0 Conceive, design, and present a project(s) that encompass all the skills learned in the Advanced Manufacturing Technology program.
22.0 Plan, organize, and carry out a project plan.
23.0 Formulate strategies to properly manage resources.
24.0 Use tools, materials, and processes in an appropriate and safe manner.
25.0 Create a project portfolio describing the project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology 1**
Course Number: **9200210**
Course Credit: **1**

Course Description:

The Advanced Manufacturing Technology 1 course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students gain an understanding of technology and the concept of Design for Manufacturing, study workplace safety and workplace organization, workplace communication skills, and basic machine operation.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of technology. The student will be able to:
01.01	Define and understand the concept of “Technology”.
01.02	Explain “Technological Literacy” and what it means to be “Technologically Literate”.
01.03	Classify the resources of technology.
01.04	Illustrate the nature and development of technological knowledge and processes.
01.05	Identify and describe technological systems. (e.g., open-loop, closed-loop, system, subsystem)
01.06	Compare and contrast current and past technological systems.
01.07	Identify and give examples of criteria and constraints applied to a product or system.
01.08	Identify and give examples of optimization and trade-offs.
01.09	Apply systems thinking logic and creativity with appropriate compromises.
01.10	Define management systems applicable to process planning, organizing, and controlling work.
01.11	Assess and evaluate technological systems embedded within larger technological, social, and environmental systems.
01.12	Explain technological innovation results when ideas, knowledge, or skills are shared within a technology, among technologies, and across other industries.
01.13	Identify and discuss ethical considerations important in the development, selection, and use of technologies.

CTE Standards and Benchmarks	
01.14	Assess how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
01.15	Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
02.0	Demonstrate an understanding of Design for Manufacturing (DFM). The student will be able to:
02.01	Describe and apply the engineering and design process.
02.02	Identify design principles to include, but not limited to, Design for Manufacturing (DFM) used to evaluate existing designs, to collect data, and to guide the design process.
02.03	Describe the influence of personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly on the Engineering Design process.
02.04	Create and populate a graph or table identifying how the fields of science, technology, engineering, and mathematics apply to a manufactured product.
02.05	Utilize a multidisciplinary approach to solving technological problems.
03.0	Demonstrate an understanding of workplace safety and workplace organization. The student will be able to:
03.01	Follow appropriate safety procedures.
03.02	Follow applicable safety and environmental laws and regulations.
03.03	Maintain a clean and safe work environment.
03.04	Maintain personal protection equipment.
03.05	Report unsafe conditions and practices.
03.06	Locate emergency equipment, exits, and alarms.
03.07	Comply with established safety practices.
03.08	Explain appropriate fire extinguishing procedures.
03.09	Explain when a machine or a process should be stopped to investigate an unsafe condition.
03.10	Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
03.11	Demonstrate knowledge of government and company procedures, rules and regulations concerning incident investigations.
03.12	Use and evaluate information resources such as SDS (Safety Data Sheets).

CTE Standards and Benchmarks
03.13 Describe safe identification, handling, monitoring, and measurement of hazardous materials.
03.14 Use appropriate electrical and mechanical safety procedures.
03.15 Selecting and use personal protective equipment (PPE).
03.16 Explain Lock Out/Tag Out requirements and procedures.
03.17 Explain the safety benefits of a 6S work environment.
03.18 Demonstrate knowledge of ergonomic impact of work techniques.
03.19 Describe Federal Law as recorded in (29 CFR-1910.1200).
04.0 Demonstrate an understanding of workplace communication skills and teamwork. The student will be able to:
04.01 Write logical and understandable statements, or phrases, to accurately complete forms commonly used in business and industry.
04.02 Read and follow written instructions.
04.03 Demonstrate knowledge of technical language and technical acronyms.
04.04 Demonstrate an understanding of; and ability to follow oral instructions.
04.05 Answer and ask questions coherently and concisely.
04.06 Read critically to identify oversights and assumptions.
04.07 Interact with co-workers using communication tools appropriately.
04.08 Create and deliver a short presentation using a presentation application.
04.09 Explain the benefits of teamwork.
04.10 Define member roles of a high-performance team.
04.11 Compare and contrast various types of teams.
04.12 Select and analyze the stages of teambuilding.
04.13 Develop and participate in teambuilding exercises.
04.14 Explain the importance of setting goals both personally and as a team.

CTE Standards and Benchmarks
04.15 Understand the importance of building consensus.
04.16 Formulate a process for building consensus.
04.17 Understand how to use technology to find tools for resolving conflict and the value associated with it.
04.18 Develop a plan for resolving conflict within a team.
05.0 Demonstrate an understanding of basic machine tools. The student will be able to:
Simple Machines
05.01 Define simple machine.
05.02 Understand and construct a wheel and axle.
05.03 Understand and construct a pulley system.
05.04 Understand and construct the three classes of levers.
05.05 Understand and construct an inclined plane.
05.06 Understand and construct a wedge.
05.07 Understand and construct a screw.
Hand Tools
05.08 Use a bench vise to hold material for a bench-work operation.
05.09 Change a blade on a hacksaw.
05.10 Cut a piece of stock to length using a hacksaw.
05.11 Stamp letters in a part using a letter/number stamp set.
05.12 Deburr a part using a file.
05.13 Clean and store a file.
05.14 Chamfer a part using a file.
05.15 Square the ends of a part using a file.

CTE Standards and Benchmarks
05.16 Identify three common metal stock shapes: sheet, flat, round.
Band Saw Operation
05.17 Select stock size and type (sheet, flat, round) given a part drawing and prepare for cutting.
05.18 Use a horizontal band saw to cut stock to a specified length.
05.19 Use a vertical band saw to cut stock to a specified length.
Drill Press Operation
05.20 Create layout lines on stock. (sheet, flat, round)
05.21 Use the prick punch, center punch, and ball-peen hammer to prepare holes for drilling.
05.22 Determine the size of a drill.
05.23 Select and change the spindle speeds of a floor drill press.
05.24 Install a twist drill into a drill chuck.
05.25 Mount a workpiece in a drill press vise.
05.26 Drill holes using cutting fluid.
05.27 Select a drill and drill a hole for reaming.
05.28 Select a reamer and ream a hole.
05.29 Drill a pilot hole to prepare a hole for countersinking.
05.30 Select a countersink and countersink a hole.
05.31 Drill the pilot hole for the counter-boring operation.
05.32 Select a counter-bore and counter-bore a hole.
05.33 Select drill size and drill the holes for the tapping operation.
05.34 Use a countersink to chamfer a hole.

CTE Standards and Benchmarks
05.35 Select a tap and thread a hole using a tap and a tap wrench.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology 2**
Course Number: **9200220**
Course Credit: **1**

Course Description:

The Advanced Manufacturing Technology 2 course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students study how to accurately read and interpret blueprints and schematics; graphic design and computer-aided drawing; quality assurance methods and quality control concepts; use of precision measurement tools and instruments; and understanding modern business practices.

CTE Standards and Benchmarks	
06.0	Demonstrate the ability to read and accurately interpret blueprints and schematics. The student will be able to:
06.01	Define basic blueprint terminology used in manufacturing.
06.02	Differentiate between dimensions of location and size.
06.03	Interpret Linear, Circular, and Angular dimension features on a print.
06.04	Identify general note symbols and their applications within a manufacturing environment.
06.05	Locate notes on a print using industry standards.
06.06	Interpret commonly used abbreviations and terminology used on prints in the manufacturing environment.
06.07	Determine tolerances associated with dimensions on a drawing.
06.08	Determine if a part dimension is within tolerance using conventional tolerancing.
06.09	Calculate the limits of a dimension given its tolerance.
06.10	Determine a dimension of an object given an undimensioned scaled drawing.
06.11	Identify types of lines within a drawing.
06.12	Interpret and understand information from a blueprint title block.
06.13	Check for revisions.

CTE Standards and Benchmarks	
06.14	Recognize the changes through which the design has progressed from the original design.
06.15	Interpret the meaning of the revision block symbols and notations.
06.16	Identify orthographic views.
06.17	Recognize the three basic orthographic views which may be represented on a drawing; front, top, right side.
06.18	Construct an orthographic view.
06.19	Identify isometric views.
06.20	Interpret the isometric view on a drawing containing both orthographic and isometric views.
06.21	Identify positions of views: top, front, side, auxiliary, and section of an orthographic drawing.
06.22	Draw an actual part using orthographic principles.
06.23	Determine the scale of the view or section.
06.24	Calculate appropriate scale of view or section based on the title block information, physical scaling of view, and standard drawing scale
06.25	Identify the size and type of fasteners used in an assembly drawing.
07.0	Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings. The student will be able to:
07.01	Apply current industrial design software computer aided-drawing practices.
07.02	Apply standard dimensioning and tolerance rules.
07.03	Import and export various file types.
07.04	Use industrial design software to open and change the views of CAD drawings.
07.05	Use standard industrial design software commands in the editing of a drawing.
07.06	Use industrial design software to create a single view drawing.
07.07	Use industrial design software to create a multi-view drawing.
07.08	Use industrial design software to dimension a drawing.
07.09	Use industrial design software to create a full sectional view for an object.

CTE Standards and Benchmarks	
	07.10 Use industrial design software to create a bent sectional view for an object.
	07.11 Use industrial design software to create an offset sectional view for an object.
	07.12 Use industrial design software to draw a thread representation.
	07.13 Create a custom 3D coordinate system orientation.
	07.14 Create a 3D object using 3D drawing commands.
	07.15 Open and change the view of a solid model.
08.0	Demonstrate proficiency in the use of quality assurance methods and quality control concepts. The student will be able to:
	08.01 Demonstrate knowledge of quality systems. (e.g., Statistical Process Control (SPC), Six Sigma, Total Quality Management (TQM), and International Standards Organization (ISO) 9000)
	08.02 Select and use quality systems to identify problems and record quality issues.
	08.03 Demonstrate knowledge of statistics for making accurate decisions about quality data.
	08.04 Demonstrate knowledge of various statistical quality tools. (e.g., histograms, Cpk, X bar and R charts, and range)
	08.05 Create control charts (e.g., variables and attributes) using linear relationships and properties of parallel lines.
	08.06 Record and analyze quality issues in the production process using tools such as Root Cause Failure Analyses (RCFA).
	08.07 Use Pareto analysis to identify priorities for solving multiple sub–standard product problems.
	08.08 Demonstrate knowledge of performance indicators that can be readily understood by operators.
	08.09 Develop records on quality process which are maintained to appropriate standards.
	08.10 Chart outcomes of quality processes according to appropriate methods and standards.
	08.11 Demonstrate knowledge of the importance of accurate and precise data for quality process performance.
	08.12 Analyze quality process performance data to identify trends.
	08.13 Examine previous documentation on similar process issues to identify possible solutions.
	08.14 Recommend actions that are clear, concise and supported by data.
	08.15 Identify the circumstances for prompt corrective actions related to product quality.

CTE Standards and Benchmarks	
08.16	Implement closed-loop corrective action follow-up activities which include spot checks, quality documentation, and an audit to optimize the outcomes of the corrective steps.
08.17	Document product quality following corrective action and identify documentation and records transmittal required for customers.
08.18	Determine disposition of sub-standard product.
08.19	Identify follow-up activities that indicate that corrective action was taken.
08.20	Describe and explain the concepts of Lean Manufacturing.
08.21	Identify value stream mapping, just-in-time procedures, and techniques of continual improvement.
08.22	Describe the changes necessary in implementing waste-free manufacturing (WFM) in a lean environment.
08.23	Describe and explain supply chain management.
08.24	Describe and explain the use of the 6S's, (sort, set in order, shine, standardize, sustain, safety).
09.0	Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods. The student will be able to:
09.01	Use measurement tools appropriately (e.g., torque wrenches, calipers, micrometers, etc.).
09.02	Maintain and store inspection tools appropriately.
09.03	Determine accuracy and precision when using inspection tools, measuring equipment, and procedures.
09.04	Use and convert both U.S. measurement and Standard International (S.I.) metric systems.
09.05	Demonstrate knowledge of inspection equipment, calibration standards, and requirements.
09.06	Verify calibration of inspection equipment.
09.07	Demonstrate knowledge of appropriate automated inspection systems.
09.08	Use appropriate safety monitoring and testing equipment.
09.09	Discuss various testing regimens.
09.10	Use multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.
09.11	Research measurement tools for non-mechanical systems and products. (e.g., pH, °Brix)

CTE Standards and Benchmarks	
10.0	Demonstrate an understanding of modern business practices and enterprise systems. The student will be able to:
10.01	Understand basic economic concepts (e.g., supply & demand, scarcity, cost & benefits, etc.).
10.02	Research commodity price data.
10.03	Use a spreadsheet application to analyze economic data.
10.04	Select materials and process for a product using cost as a factor.
10.05	Interpret a Bill of Materials.
10.06	Create a Bill of Materials for a product.
10.07	Demonstrate knowledge of the alignment of a company's business objectives with production goals.
10.08	Compare and contrast various business structures. (e.g., sole-proprietor, S-Corporation, Limited-Liability Corporation, C-Corporation, etc.)
10.09	Identify the necessary personal characteristics of a successful entrepreneur.
10.10	Identify the business leadership skills needed to operate a business efficiently and effectively.
10.11	Identify the key elements of a business plan and apply them in the creation of a business plan.
10.12	Identify and explain personal and organizational consequences of unethical or illegal behaviors in the workplace.
10.13	Interpret and explain written organizational policies and procedures.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology 3**
Course Number: **9200230**
Course Credit: **1**

Course Description:

The Advanced Manufacturing Technology 3 course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students study how to select production processes; computer-aided manufacturing and flexible manufacturing planning; produce a product via a master project; manual milling machines, computer-numeric-control machines, and welding systems; and robotic systems used in manufacturing.

CTE Standards and Benchmarks	
11.0	Demonstrate an understanding of and be able to select production processes. The student will be able to:
11.01	Identify customer needs.
11.02	Determine available and needed resources for the production process.
11.03	Make job assignments and coordinate workflow.
11.04	Communicate production and material requirements to meet product specifications.
11.05	Establish set-up and operation procedures are available and up to date.
11.06	Read and interpret a production schedule and manufacturing work order.
11.07	Demonstrate knowledge of production processes, including flow and bottlenecks.
11.08	Document product and process compliance with customer requirements.
11.09	Compare and contrast various production processes. (e.g., push, pull, just-in-time, workcell, batch, etc.)
12.0	Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control. The student will be able to demonstrate:
12.01	Identify manufacturing process variables that must be controlled for quality and reliability.
12.02	Identify the process for making job assignments and coordinating workflow.
12.03	Identify and explain Enterprise Resource Planning (ERP) and Material Resource Planning (MRP).

CTE Standards and Benchmarks	
	12.04 Understand and predict lead-time required for a production plan.
	12.05 Read and interpret bills of materials and routing sheets.
	12.06 Identify methods of productivity measurement and improvement.
	12.07 Apply principles and practice of various production processes such as just-in-time (JIT) inventory control in performing a physical inventory.
13.0	Demonstrate the ability to properly identify, organize, plan, allocate resources, document and produce a mass-produced product via a master project. The student will be able to:
	13.01 Work in a team and use a multi-step design process to design a prototype.
	13.02 Create a Design Portfolio documenting research and student development.
	13.03 Create a Technology Sector Research Report.
	13.04 Create an Industry Market Report.
	13.05 Create a Bill of Material (BOM) for your solution.
	13.06 Create and build a prototype using specified design constraints (time, expenses, materials, safety considerations, etc.).
	13.07 Create and deliver a presentation to communicate project results.
14.0	Demonstrate an understanding of industrial tools and processes inclusive of: Manual Milling (Optional), CNC machines, and Welding (Optional). The student will be able to:
Manual Milling Processes (Optional when manual mill is NOT available to students)	
	14.01 Operate manual controls on a milling machine.
	14.02 Use a milling machine micrometer collar to measure table movement.
	14.03 Face a piece of stock to length.
	14.04 Mill a step using the micrometer collars on the milling machine.
	14.05 Mill a step on a part using layout lines.
	14.06 Mill a slot to a specific depth.
	14.07 Mill a part.

CTE Standards and Benchmarks
CNC Mill Programming and Operation
14.08 Write and edit a CNC program that uses common industry accepted tasks.
14.09 Enter and edit a CNC mill program using a text editor.
14.10 Simulate and edit a CNC mill program.
14.11 Determine the size and cutting direction of an end mill.
14.12 Mount a tool in a CNC mill.
14.13 Operate a CNC Mill.
14.14 Determine CNC program coordinates based on a dimensioned part drawing.
14.15 Select tooling for a CNC operation.
14.16 Determine the spindle speed for various machining operations.
14.17 Determine the feed rate for a machining operation.
14.18 Locate the PRZ (Program Reference Zero) of a part in a CNC mill using an edge-finder.
14.19 Determine the tool offsets in a CNC mill.
14.20 Create a precision part using PRZ (Program Reference Zero) and tool offset measurements.
14.21 Convert coordinates between absolute and incremental positioning methods.
14.22 Interpret a CNC mill program that uses basic G- and M-Codes.
Welding (Optional when welding equipment is NOT available to students)
14.23 Identify a specified weld using a welding symbol.
14.24 Draw welding symbols.
14.25 Demonstrate an understanding of the steps necessary to create a project from a welding drawing.
14.26 Prepare metal for welding.
14.27 Demonstrate an understanding of weld quality analysis using various testing procedures. (i.e., dye penetrant, guided bend)

CTE Standards and Benchmarks
14.28 Design a welded project.
15.0 Demonstrate proficiency in computer control, robotics, and programmable logic. The student will be able to:
Programmable Logic Controllers (PLC)
15.01 Read and interpret the operation of a circuit given a ladder diagram.
15.02 Connect and operate a logic circuit given a ladder diagram.
15.03 Design a ladder diagram using one or more logic elements.
15.04 Review, connect, and operate a control circuit to operate a solenoid valve.
15.05 Read and interpret a basic ladder diagram with detached symbology.
15.06 Review, connect, and operate a relay to energize a fluid power solenoid.
15.07 Connect and operate a relay to perform a seal-in function.
15.08 Connect and operate an event sequencing circuit given a ladder diagram.
15.09 Review a logic circuit that uses a limit switch to sequence an event.
15.10 Connect and operate a single-cycle cylinder reciprocation circuit.
15.11 Connect and operate a continuous-cycle cylinder reciprocation circuit.
15.12 Review a continuous-cycle cylinder reciprocation circuit with a safety interlock.
15.13 Connect and operate a control circuit with a timer relay.
15.14 Connect and operate a control circuit to perform an unloaded start of a motor.
15.15 Review a control circuit to perform time-driven sequencing.
15.16 Connect and operate a dual-cylinder control circuit using two limit switches.
15.17 Review a continuous-cycle multiple-cylinder circuit.
15.18 Connect and operate a circuit having both automatic and manual modes of operation.
15.19 Connect and operate a control circuit to simulate a two-pushbutton jog circuit.

CTE Standards and Benchmarks
15.20 Demonstrate proficiently an understanding of Binary concepts.
15.21 Wire input and output devices to a PLC.
15.22 Open, download, monitor, run and stop a PLC processor file using PLC programming software.
15.23 View the status of Input and Output Data Tables.
15.24 Create, enter, save, and edit a PLC program using PLC programming software.
15.25 Generate and print out a ladder logic report using PLC software.
15.26 Design PLC programs to jog two motors, control the start/stop of two motors, and a program to interlock two motors.
15.27 Understand a PLC program that uses a safety interlock to control the operation of a machine.
15.28 Understand a reciprocating actuator sequence PLC program.
15.29 Understand a continuous cycle clamp and drill sequence PLC program.
Basic Robot Operation
15.30 Power up and shut down servo robot.
15.31 Jog a servo robot and adjust the fast and slow jog speed settings.
15.32 Move parts using the manual jog function.
15.33 Home a servo robot.
15.34 Manually operate the gripper using the teach pendant.
15.35 Use a teach pendant to: teach robot position points, test teach points, and edit teach points.
15.36 Use a teach pendant to delete a program file.
15.37 Use a teach pendant to enter a servo robot program that uses standard commands.
15.38 Run a servo robot program using a teach pendant.
15.39 Stop a servo robot program using functions on a teach pendant.
15.40 Design a program to perform a basic material handling task.

CTE Standards and Benchmarks
15.41 Store and retrieve multiple programs in a robot controller.
15.42 Use PC software to enter and edit a robot program offline and online.
15.43 Use PC software to delete a program.
15.44 Use PC software to power up, jog, home, and power down a servo robot
15.45 Use PC software to run a servo robot program.
15.46 Connect digital input and output devices to a robot controller.
15.47 Use PC software to enter program commands that uses a manual operator station, and will unload an automatic machine.
15.48 Design a robot program that performs a basic assembly task using linear motion.
15.49 Enter a robot program that uses the World Coordinate motion commands.
15.50 Design and enter a robot program that uses Tool Coordinate motion commands.
15.51 Discuss the difference between a motor and a servo and how to encoders work to control movement.
Application Development and Flexible Manufacturing Cells
15.52 Construct a flow chart given a general sequence of operations.
15.53 Connect a solenoid-operated pneumatic valve to the output of a robot and operate.
15.54 Design a robot program that will load and unload an automatic machine.
15.55 Teach points with a double-jointed robot arm using the full range of its work envelope.
15.56 Design a robot program that uses a robot's double-jointed design.
15.57 Design a robot program given a general description of the application.
15.58 Connect and configure a servo conveyor to a servo robot (optional when conveyor is available to students).
15.59 Design and run a robot program that uses a non-servo DC motor attached to a robot controller axis.
15.60 Design a robot program that uses a servo conveyor.
15.61 Design a robot program that uses a conveyor (optional when conveyor is available to students).

CTE Standards and Benchmarks
15.62 Design and enter a robot program that uses conditional commands.
15.63 Design a robot program that sorts parts.
15.64 Program a robot that uses a servo traverse axis.
15.65 Design and enter a robot program that uses a servo gripper.
15.66 Interface a robot discrete I/O using a relay.
Production Control
15.67 Enter a robot program that uses an input command.
15.68 Enter a robot program that uses arithmetic and relational operators.
15.69 Enter a robot program that has loop commands.
Quality Control
15.70 Design and run a robot program that uses points stored in Cartesian coordinates.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology 4**
Course Number: **9200240**
Course Credit: **1**

Course Description:

The Advanced Manufacturing Technology 4 course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students study mechanisms; AC/DC electrical control; programmable logic control; fluid power; maintenance of technological systems; and exploration of employability and career opportunities.

CTE Standards and Benchmarks
16.0 Demonstrate an understanding of mechanisms. The student will be able to:
Levers and Linkages
16.01 For the relation (m, w) calculate the weights (range) of objects given mass (domain) of objects.
16.02 Calculate the compression rate of a spring using Hooke's Law.
16.03 Use a spring scale to measure the weight of an object and the force on an object.
16.04 Calculate torque.
16.05 Calculate the moment caused by a force.
16.06 Calculate and measure the mechanical advantage of a first-class, second-class, and third-class lever.
16.07 Calculate the coefficient of friction given application data.
16.08 Measure the force required to overcome friction in different applications.
16.09 Calculate and measure the mechanical advantage of an inclined plane
16.10 Understand the operation of a slider crank linkage.
16.11 Understand the operation of a double rocker linkage.
16.12 Understand the operation of a crank rocker linkage.

CTE Standards and Benchmarks
16.13 Understand the operation of a cam and cam follower.
16.14 Connect and operate a turnbuckle.
Power Transmission Systems
16.15 Use a spirit level to determine orientation of a surface.
16.16 Select a fastener size and type for a motor mount and correct for a soft foot condition.
16.17 Level an electric motor.
16.18 Select a key size.
16.19 Measure the actual size of a key and keyseat.
16.20 Assemble a hub to a shaft using a key fastener.
16.21 Use a digital tachometer to measure motor speed.
16.22 Calculate rotary mechanical power.
16.23 Identify shaft size given a sample.
16.24 Install and adjust a pillow block antifriction bearing and shaft.
16.25 Install a flexible jaw coupling.
16.26 Align two shafts using a straight edge and feeler gage.
Pulley Systems and Gear Drives
16.27 Measure the mechanical advantage of a fixed pulley.
16.28 Measure the mechanical advantage of a movable pulley.
16.29 Calculate and measure the mechanical advantage of a pulley combination.
16.30 Connect and operate a gear drive system.
16.31 Calculate and measure the mechanical advantage of a gear drive.
V-belt Drives

CTE Standards and Benchmarks
16.32 Calculate pulley ratio.
16.33 Calculate the shaft speed and torque of a belt drive system.
16.34 Install and align a fractional HP V-belt drive with a finished bore.
16.35 Determine the belt deflection force for a given application.
16.36 Adjust belt tension using an adjustable mounting base.
16.37 Use a belt tension tester to measure belt tension.
Chain Drives
16.38 Calculate sprocket ratio.
16.39 Calculate the shaft speed and torque of a chain drive system.
16.40 Install and align a roller chain drive system with adjustable centers.
16.41 Determine allowable chain sag for a given application.
16.42 Use a rule and a straight edge to measure chain sag.
16.43 Adjust chain sag to a specified amount using adjustable centers.
16.44 Install and remove a chain with a master link.
17.0 Demonstrate a fundamental understanding of AC/DC electrical and electrical control. The student will be able to:
17.01 Demonstrate knowledge of AC/DC theory.
17.02 Check electrical components for UL and CSA approval.
17.03 Understand how to use an AC tester to check for electricity.
17.04 Use appropriate grounding techniques.
17.05 Connect and operate a circuit with a load.
17.06 Use a Digital Multi-Meter (DMM) to properly measure voltage, current, resistance, and continuity.
17.07 Solve circuit problems using appropriate units and notation.

CTE Standards and Benchmarks
17.08 Solve problems using Ohm's Law.
17.09 Solve problems using Watt's Law.
17.10 Solve problems involving series and parallel impedance in circuits.
17.11 Discuss problems involving capacitance in circuits.
17.12 Test a capacitor with a DMM.
17.13 Measure the voltage across a charged capacitor.
17.14 Calculate the time to charge and discharge a capacitor.
17.15 Following specific safety instructions safely discharge a capacitor.
17.16 Solve problems involving inductance in circuits.
17.17 Operate a circuit using a fuse, test and replace a fuse.
17.18 Operate a circuit using a circuit breaker, test and reset a circuit breaker.
17.19 Connect and operate a relay in a circuit.
17.20 Solve problems involving combination circuits.
17.21 Connect and operate a basic rheostat.
17.22 Understand the operation of a voltage divider network.
17.23 Solve problems involving a transformer
17.24 Size, connect, and operate a transformer.
17.25 Troubleshoot a transformer.
17.26 Design a control transformer circuit to provide a given output voltage.
18.0 Demonstrate an understanding of fluid power. The student will be able to:
Pneumatic Circuits and Power Systems
18.01 Identify pneumatic symbols.

CTE Standards and Benchmarks
18.02 Read a pneumatic pressure gage and flow meter.
18.03 Calculate the extension force of a cylinder given its size and pressure.
18.04 Determine the pressure needed to create a known output force on an extending cylinder.
18.05 Measure the force output of an extending cylinder.
18.06 Calculate the retraction force of a cylinder given its size and pressure.
18.07 Convert between gage and absolute pressures.
18.08 Solve problems using Boyle's Law.
18.09 Convert air volumes at pressures to free air volumes.
18.10 Measure pressure drop (Delta P) across pneumatic components.
18.11 Connect equipment and perform basic pneumatic operations.
18.12 Connect a pneumatic circuit given a schematic.
18.13 Draw a pneumatic schematic from the actual circuit connections on a machine.
18.14 Design a multiple actuator pneumatic circuit.
18.15 Connect pneumatic speed control circuits.
18.16 Design speed control circuits.
18.17 Connect and operate pneumatic Directional Control Valve (DCV) applications.
18.18 Design a rapid traverse-slow feed pneumatic circuit.
18.19 Design a pneumatic circuit to sequence two cylinders.
18.20 Design a pneumatic circuit that uses an externally air piloted DCV.
Vacuum Systems
18.21 Convert between units of mercury and units of air pressure.
18.22 Connect and operate a vacuum generator.

CTE Standards and Benchmarks
18.23 Calculate vacuum cup lift force.
18.24 Connect and operate a vacuum cup.
Hydraulic Circuits and Power Systems
18.25 Read a hydraulic pressure gage, flow meter and the liquid level and temperature in the reservoir.
18.26 Calculate the extension force of a cylinder given its size and pressure.
18.27 Measure the force output of an extending cylinder.
18.28 Calculate the retraction force of a cylinder given its size and pressure.
18.29 Measure the force output of a retracting cylinder.
18.30 Measure the pressure drop (Delta P) across a hydraulic component.
18.31 Convert between absolute pressure and gage hydraulic pressure.
18.32 Calculate the extend speed, retract speed, and cylinder stroke time of a hydraulic cylinder given its size and a flow rate.
18.33 Draw a hydraulic schematic from the actual circuit connections on a pictorial.
18.34 Draw a hydraulic circuit given a schematic.
18.35 Operate a hydraulic power unit.
18.36 Connect equipment and perform basic hydraulic operations.
18.37 Connect and operate hydraulic Directional Control Valve (DCV) applications.
18.38 Design and connect hydraulic speed control circuits.
18.39 Design and connect a multiple actuator hydraulic circuit, an independent speed control circuit, and a two-speed actuator circuit.
19.0 Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
Overall Maintenance Process
19.01 Discuss preventive and predictive maintenance methods for manufacturing environments.
19.02 Demonstrate knowledge of principles of Total Productive Maintenance (TPM).

CTE Standards and Benchmarks	
19.03	Recognize potential maintenance issues with basic production systems and determine when to inform maintenance personnel about issues.
19.04	Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.
19.05	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
19.06	Operate systems so that they function in the way they were designed.
19.07	Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
19.08	Develop and follow maintenance schedules.
19.09	Identify the most common causes of failure of equipment to diagnosis problem quickly.
19.10	Demonstrate knowledge of what different equipment alarms indicate.
19.11	Understand the procedure for making on-process adjustments during production.
19.12	Examine the concept of troubleshooting within basic manufacturing maintenance areas.
19.13	Identify equipment failures in manufacturing maintenance areas.
19.14	Describe root cause analysis methods.
19.15	Use materials management to know what is recyclable and what is not.
19.16	Use monitoring or diagnostic devices to find out when equipment is operating correctly.
19.17	Use appropriate maintenance tools to maintain machines.
Documentation of Maintenance	
19.18	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
19.19	Demonstrate knowledge of the procedures for logging repairs and work order requests.
19.20	Demonstrate knowledge of statistical method charts to ensure that equipment is producing a quality product.
19.21	Demonstrate knowledge of forms and procedures for correctly documenting processes (e.g., preventative maintenance forms and workorders).
19.22	Read diagrams, schematics, manuals, and specifications to understand how to repair equipment.

CTE Standards and Benchmarks	
19.23	Document repairs, replacement parts, problems and corrective actions to maintain log to determine patterns of operation.
19.24	Review maintenance log/checklist to ensure that recommended preventative procedures are followed.
Specific Maintenance Operations	
19.25	Demonstrate knowledge of proper and safe functioning of mechanical power transmission equipment.
19.26	Demonstrate knowledge of lubrication procedures and requirements.
19.27	Demonstrate knowledge of the selection, design, and safe functioning of belt, chain, and roller chain drive equipment.
19.28	Demonstrate knowledge of fluid transport.
19.29	Identify standard types of industrial pumps and determine the causes and maintenance procedures for shaft seal failure, shaft misalignment, and pump cavitations.
20.0	Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies. The student will be able to:
20.01	Demonstrate proper interview skills (e.g., dress, body language, eye contact, etc.).
20.02	Understand and demonstrate effective resume writing skills.
20.03	Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
20.04	Discuss motivation and human behavior.
20.05	Develop a personal stress management plan.
20.06	Demonstrate knowledge of ways to improve reading, listening, and writing skills.
20.07	Demonstrate knowledge of techniques for making effective presentations to internal and external customers.
20.08	Provide effective feedback and make suggestions.
20.09	Demonstrate appropriate customer service skills and techniques.
20.10	Explain the characteristics of a high-performance team and how to assess team member personality types.
20.11	Engage in team activities such as a team icebreaker exercise, developing a team constitution, brainstorming session, and reaching a decision by consensus.
20.12	Demonstrate knowledge of roles and responsibilities of production team members.

CTE Standards and Benchmarks
20.13 Align team goals (that are specific, documented, measurable and achievable) to customer and business production needs.
20.14 Communicate production and process information to team members.
20.15 Organize or participate on a high-performance team to construct and analyze a project.

Florida Department of Education
Student Performance Standards

Course Title: **Advanced Manufacturing Technology Capstone**
Course Number: **9200250**
Course Credit: **1**

Course Description:

The Advanced Manufacturing Technology Capstone course provides students with extended content and skills essential to the planning, design, creation, and presentation of an advanced manufacturing capstone project.

CTE Standards and Benchmarks	
21.0	Conceive, design, and present a project(s) that encompass all the skills learned in the Advanced Manufacturing Technology program. The student will be able to:
21.01	Create and produce an original working drawing using CAD/CAM software.
21.02	Create and produce a 3-D drawing using appropriate industry recognized software.
21.03	Create and produce a toolpath.
21.04	Create and produce a 3-D model of the project. (if applicable)
21.05	Compose a well written design proposal and present to instructor for approval.
21.06	Incorporate principles and practices of manufacturing processes into the design.
22.0	Plan, organize, and carry out a project plan. The student will be able to:
22.01	Determine the scope of a project.
22.02	Organize tasks.
22.03	Determine project priorities.
22.04	Identify required resources.
22.05	Record project progress in a process journal.
22.06	Record and account for budget expenses during the life of the project.
22.07	Carry out the project plan to successful completion and delivery.

CTE Standards and Benchmarks	
23.0	Formulate strategies to properly manage resources. The student will be able to:
23.01	Identify required resources and associated costs for each stage of the project plan.
23.02	Create a project budget based on the identified resources.
23.03	Determine the methods needed to acquire needed resources.
23.04	Demonstrate good judgment in the use of resources.
23.05	Recycle and reuse resources where appropriate.
23.06	Demonstrate an understanding of proper legal and ethical waste disposal.
24.0	Use tools, materials, and processes in an appropriate and safe manner. The student will be able to:
24.01	Identify the proper tool for a given job.
24.02	Use tools and machines in a safe manner.
24.03	Adhere to laboratory safety rules and procedures.
24.04	Identify the application of processes appropriate to the task at hand.
24.05	Identify materials appropriate to their application.
25.0	Create a project portfolio describing the project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results. The student will be able to:
25.01	Create a Design Portfolio documenting drawings and specifications.
25.02	Create a Bill of Material (BOM) for your project.
25.03	Create and deliver a presentation to communicate project results.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the co-curricular career and technical student organizations for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology, and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Course Title: **Manufacturing Cooperative Education - OJT**
Course Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Secondary – Cooperative Education - OJT	
Course Number	9200420
CIP Number	06149999CP
Grade Level	9-12
Course Length	Multiple credits
Teacher Certification	Refer to the **Course Structure** section
CTSO	SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing cluster(s); provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing cluster.

Each student job placement must be related to the job preparatory program in which the student is enrolled or has completed.

The purpose of this course is to provide the on-the-job training component when the **cooperative method of instruction** is appropriate. Whenever the cooperative method is offered, the following is required for each student: a training agreement; a training plan signed by the student, teacher and employer, including instructional objectives; a list of on-the-job and in-school learning experiences; a workstation which reflects equipment, skills and tasks which are relevant to the occupation which the student has chosen as a career goal; and a site supervisor with a working knowledge of the selected occupation. The workstation may be in an industry setting or in a virtual learning environment. The student **must be compensated** for work performed.

The teacher/coordinator must meet with the site supervisor a minimum of once during each grading period for the purpose of evaluating the student's progress in attaining the competencies listed in the training plan.

Manufacturing Cooperative Education OJT may be taken by a student for one or more semesters. A student may earn multiple credits in this course. The specific student performance standards which the student must achieve to earn credit are specified in the Cooperative Education - OJT Training Plan.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Course Structure

To teach the course listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary course structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
9200420	Manufacturing Cooperative Education-OJT	Any District Certification appropriate to the students' chosen career field	Multiple Credits	2	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Perform designated job skills.
02.0 Demonstrate work ethics.

Florida Department of Education
Student Performance Standards

Program Title: **Manufacturing Cooperative Education OJT**
Secondary Number: **9200420**

Standards and Benchmarks	
01.0	Perform designated job skills. The student will be able to:
01.01	Perform tasks as outlined in the training plan.
01.02	Demonstrate job performance skills.
01.03	Demonstrate safety procedures on the job.
01.04	Maintain appropriate records.
01.05	Attain an acceptable level of productivity.
01.06	Demonstrate appropriate dress and grooming habits.
02.0	Demonstrate work ethics. The student will be able to:
02.01	Follow directions.
02.02	Demonstrate good human relations skills on the job.
02.03	Demonstrate good work habits.
02.04	Demonstrate acceptable business ethics.

Additional Information

Special Notes

The **Cooperative Education Manual** is available on-line and has guidelines for students, teachers, employers, parents and other administrators and sample training agreements. It can be accessed on the DOE Website at http://fldoe.org/academics/career-adult-edu/career-tech-edu/additional-cte-programs-courses/diversified-edu.stml

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology, and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Course Title: **Manufacturing Directed Study**
Career Cluster: **Manufacturing**

Secondary – Career Preparatory	
Course Number	9201000
CIP Number	0614999901
Grade Level	11-12
Course Length	1 credit - Multiple credits
Teacher Certification	Refer to the **Course Structure** section
CTSO	SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this course is to provide students with learning opportunities in a prescribed program of study within the manufacturing cluster that will enhance opportunities for employment in the career field chosen by the student.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Course Structure

The content is prescribed by the instructor based upon the individual student's assessed needs for directed study.

This course may be taken only by a student who has completed or is currently completing a specific secondary job preparatory program for additional study in this career cluster. A student may earn multiple credits in this course.

The selected standards and benchmarks, which the student must master to earn credit, must be outlined in an instructional plan developed by the instructor.

To teach the course listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary course structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
9201000	Manufacturing Directed Study	Any District Certification appropriate to the students' chosen career field	1 credit – Multiple Credits	2	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate expertise in a specific occupation contained within the career cluster.
02.0 Conduct investigative research on a selected topic related to the career cluster using approved research methodology, interpret findings, and prepare presentation to defend results.
03.0 Apply enhanced leadership and professional career skills.
04.0 Demonstrate higher order critical thinking and reasoning skills appropriate for the selected program of study.

Florida Department of Education
Student Performance Standards

Course Title: **Manufacturing Directed Study**
Course Number: **9201000**
Course Credit: **1**

CTE Standards and Benchmarks	
01.0	Demonstrate expertise in a specific occupation within the career cluster. The student will be able to:
01.01	The benchmarks will be selected from the appropriate curriculum frameworks and determined by the instructor based upon the individual students assessed needs.
02.0	Conduct investigative research on a selected topic related to the career cluster using approved research methodology, interpret findings, and prepare presentation to defend results. The student will be able to:
02.01	Select investigative study referencing prior research and knowledge.
02.02	Collect, organize and analyze data accurately and precisely.
02.03	Design procedures to test the research.
02.04	Report, display and defend the results of investigations to audiences that may include professionals and technical experts.
03.0	Apply enhanced leadership and professional career skills. The student will be able to:
03.01	Develop and present a professional presentation offering potential solutions to a current issue.
03.02	Enhance leadership and career skills through work-based learning including job placement, job shadowing, entrepreneurship, internship, or a virtual experience.
03.03	Participate in leadership development opportunities available through the appropriate student organization and/or other professional organizations.
03.04	Enhance written and oral communications through the development of presentations, public speaking, and live and/or virtual interviews.
04.0	Demonstrate higher order critical thinking and reasoning skills appropriate for the selected program of study. The student will be able to:
04.01	Use mathematical and/or scientific skills to solve problems encountered in the chosen occupation.
04.02	Read and interpret information relative to the chosen occupation.
04.03	Locate and evaluate key elements of oral and written information.
04.04	Analyze and apply data and/or measurements to solve problems and interpret documents.
04.05	Construct charts/tables/graphs using functions and data.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Machining Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Secondary – Career Preparatory	
Program Number	9202100
CIP Number	0648050306
Grade Level	9-12
Program Length	5 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA, FL-TSA
SOC Codes (all applicable)	51-4035 – Milling and Planning Machine Setters, Operators, and Tenders, Metal and Plastic
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in machining positions.

The content includes but is not limited to broad, transferable skills, stresses the understanding of all aspects of the machining industry, and demonstrates such elements of the industry as planning, management, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of five credits.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
9202110 9202120	Machining Technology 1 Machining Technology 2	MACH SHOP @7 7G METAL WORK 7G TOOL DIE %7G	1 credit 1 credit	51-4035	3 3	CT
9202130 9202140	Machining Technology 3 Machining Technology 4		1 credit 1 credit	51-4035	3 3	CT
9202150	Machining Technology Capstone		1 credit	51-4035	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of workplace safety and workplace organization.
02.0 Solve basic job-related math problems**.**
03.0 Interpret basic blueprint information.
04.0 Perform basic measuring operations.
05.0 Perform benchwork skills.
06.0 Demonstrate basic knowledge of manufacturing history and primary manufacturing processes.
07.0 Demonstrate basic knowledge of secondary manufacturing processes and manufacturing systems.
08.0 Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings.
09.0 Perform basic precision measuring operations.
10.0 Sharpen machining tools.
11.0 Set up and operate power saws.
12.0 Set up and operate pedestal grinders.
13.0 Set up and operate drill presses.
14.0 Explain the importance of employability and entrepreneurship skills.
15.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
16.0 Solve problems using critical thinking skills, creativity and innovation.
17.0 Solve advanced job-related math problems.
18.0 Demonstrate inspection methods.
19.0 Plan lathe machining operations.
20.0 Interpret and apply blueprint for lathe machine operations.
21.0 Operate lathes.
22.0 Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for lathe operations.
23.0 Set up and operate a computerized-numerical-control (CNC) machine for lathe operations.
24.0 Plan milling machining operations.
25.0 Interpret and apply blueprint for milling machine operations.
26.0 Operate milling machines.
27.0 Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for milling operations.
28.0 Set up and operate a computerized-numerical-control (CNC) machine for milling operations.
29.0 Conceive, design, and present a machining project(s) that encompass all the skills learned in the Machining Technology program.
30.0 Plan, organize, and carry out a project plan.
31.0 Formulate strategies to properly manage resources.
32.0 Use tools, materials, and processes in an appropriate and safe manner.
33.0 Create a project portfolio describing the machining project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results.

Florida Department of Education
Student Performance Standards

Course Title: **Machining Technology 1**
Course Number: **9202110**
Course Credit: **1**

Course Description:

The Machining Technology 1 course prepares students for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes beginning skills key to the success of working in the machining industry. Students study workplace safety and organization, job-related mathematics, basic blueprint information, basic measuring operations, benchwork skills, and the history of manufacturing.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding of workplace safety and workplace organization. The student will be able to:
01.01	Identify safety requirements for manual, electrical-powered, and pneumatic tools.
01.02	Demonstrate, apply, and provide evidence of safely using manual, electrical-powered, and pneumatic tools.
01.03	Identify safety requirements for operation of automated machines and equipment.
01.04	Demonstrate, apply, and provide evidence of safely operating automated machines and equipment.
01.05	Demonstrate, apply, and provide evidence of properly storing equipment and tools.
01.06	Demonstrate, apply, and provide evidence of properly storing precision measuring tools.
01.07	Identify, demonstrate, apply, and provide evidence of understanding of shop safety rules on an ongoing basis.
01.08	Research and characterize class A, B, and C type fires.
01.09	Demonstrate and apply the proper procedures for extinguishing class A, B, and C type fires.
01.10	Identify various workplace injuries related to the machining industry.
01.11	Demonstrate and practice knowledge of first aid and first response procedures appropriate for this course.
01.12	Identify and apply safety procedures in case of smoke or chemical inhalation.
01.13	Demonstrate and apply material handling techniques to safely move materials.

CTE Standards and Benchmarks
01.14 Demonstrate and apply proper techniques for lifting loads.
01.15 Research Occupational Safety Health Administration (OSHA) safety standards.
01.16 Demonstrate, apply, and provide evidence of understanding Occupational Safety Health Administration (OSHA) safety standards.
01.17 Locate Safety Data Sheets (SDS).
01.18 Demonstrate understanding and knowledge of using and applying the information located on Safety Data Sheets (SDS).
01.19 Proactively respond to a safety concern and then document occurrences.
01.20 Demonstrate knowledge of emergency exits and signage.
01.21 Develop safety checklists.
01.22 Identify and report unsafe conditions.
01.23 Determine the appropriate corrective action after an unsafe condition is identified.
01.24 Demonstrate knowledge of various emergency alarms and procedures.
01.25 Perform emergency drills and participate in emergency teams.
01.26 Demonstrate knowledge and apply clean-up procedures for spills.
01.27 Explain Lock Out/Tag Out requirements and procedures.
01.28 Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.
01.29 Identify and apply procedures for handling hazardous material.
01.30 Perform safety and environmental inspections.
01.31 Perform leak checks to determine if toxic or hazardous material is escaping from a piece of equipment.
01.32 Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists, and regulations.
01.33 Demonstrate and apply proper equipment shutdown procedures.
01.34 Identify safety related maintenance procedures.
01.35 Select lubricants for machining operations.

CTE Standards and Benchmarks
01.36 Lubricate equipment parts.
01.37 Inspect and maintain machine cutting fluids.
01.38 Inspect drive pulleys and belts; perform necessary action.
01.39 Properly dispose of scrap-metal chips, shavings, trash, and waste.
01.40 Identify, select, and use personal protective equipment (PPE).
01.41 Explain the safety benefits of 6S work environment.
01.42 Identify, demonstrate, and apply ergonomic work techniques.
01.43 Train other students to use and apply safety skills outlined in this standard.
02.0 Solve basic job-related math problems. The student will be able to:
02.01 Solve job-related problems by adding, subtracting, multiplying, and dividing whole numbers, decimals, and common fractions.
02.02 Calculate the amount of material that should be removed to obtain correct limits for secondary operations.
02.03 Solve job-related problems using mathematical handbooks, charts, and tables.
02.04 Calculate machine speed and feed by using appropriate formulas.
02.05 Calculate chip load per tooth on milling operations.
03.0 Interpret basic blueprint information. The student will be able to:
03.01 Interpret view concepts.
03.02 Interpret lines.
03.03 Read and interpret title blocks.
03.04 Read and interpret change orders on working and assembly prints.
03.05 Read and interpret abbreviations.
03.06 Identify basic geometrical dimensioning & tolerancing (GD&T) terminology.
04.0 Perform basic measuring operations. The student will be able to:

CTE Standards and Benchmarks	
	04.01 Comply with safe and efficient work practices.
	04.02 Measure a workpiece and compare measurements with blueprint specifications, including tolerances.
	04.03 Read and measure with rules and calipers.
	04.04 Read and measure with micrometers.
	04.05 Read and measure with vernier tools.
	04.06 Use surface-plate techniques.
05.0	Perform benchwork skills. The student will be able to:
	05.01 Comply with safe and efficient work practices.
	05.02 Cut materials by using appropriate hand saws.
	05.03 Cut threads by using hand taps.
	05.04 Cut threads by using dies.
	05.05 Deburr workpiece.
	05.06 Demonstrate or identify filing techniques.
06.0	Demonstrate basic knowledge of manufacturing history and primary manufacturing processes. The student will be able to:
	06.01 Demonstrate knowledge of how manufacturing processes have evolved throughout history.
	06.02 Demonstrate knowledge of obtaining raw materials through harvesting and extracting.
	06.03 Explain the difference between primary and secondary manufacturing processes.
	06.04 Demonstrate knowledge of primary processes (e.g., thermal, chemical, mechanical, etc.)

Florida Department of Education
Student Performance Standards

Course Title: **Machining Technology 2**
Course Number: **9202120**
Course Credit: **1**

Course Description:

The Machining Technology 2 course is designed to build on the skills and knowledge students learned in Machining Technology 1for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes knowledge of manufacturing processes and systems, generating and interpreting computer-aided design drawings, basic precision measurement, sharpening tools, operating power saws, pedestal grinders, drill presses, and understanding the importance of employability and entrepreneurship skills.

CTE Standards and Benchmarks	
07.0	Demonstrate basic knowledge of secondary manufacturing processes and manufacturing systems. The student will be able to:
07.01	Demonstrate knowledge of secondary processes. (e.g., casting and molding, separating, forming, conditioning, assembling, and finishing)
07.02	Demonstrate knowledge of the various materials used in manufacturing. (e.g., metallic, polymeric, ceramic, composite)
07.03	Demonstrate knowledge of the various material properties. (e.g., physical, mechanical, chemical, thermal, acoustic, optical, electrical, and magnetic)
07.04	Demonstrate knowledge of the technological or universal systems model (inputs, process, outputs, feedback).
07.05	Demonstrate knowledge of the various manufacturing/production systems. (e.g., custom, intermittent, continuous, flexible, automated)
07.06	Demonstrate knowledge of the use of current manufacturing processes.
07.07	Demonstrate knowledge of quality assurance.
08.0	Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings. The student will be able to:
08.01	Create a sketch of an object.
08.02	Sketch a multi-view drawing with dimensions given an isometric drawing.
08.03	Select the front view of an object.
08.04	Use a CAD System to open and change the views of CAD drawings.

CTE Standards and Benchmarks
08.05 Use a CAD system to identify points in Absolute, Relative, and Polar coordinates.
08.06 Use standard CAD commands (such as Grid, Snap, Array, Erase, Trim Break, Hatch) in the editing of a drawing.
08.07 Create a drawing with a title block using CAD drawing commands.
08.08 Plot (Print) a CAD System drawing to a specific scale.
08.09 Use CAD software to create a single view drawing.
08.10 Use CAD software to create a multi-view drawing.
08.11 Use CAD software to dimension a drawing.
08.12 Print a CAD drawing to a specific scale.
08.13 Use a CAD system to create an electrical schematic of a process.
08.14 Use a CAD system to create a piping schematic of a process.
08.15 Use a CAD system to create a schematic symbol library.
08.16 Use CAD to create a full sectional view for an object.
08.17 Use CAD to create a bent sectional view for an object.
08.18 Use CAD to create an offset sectional view for an object.
08.19 Sketch an internal thread using the simplified method of thread representation.
08.20 Sketch an external thread using the simplified method of thread representation.
08.21 Use a CAD system to draw a thread representation.
08.22 Use the UCS command to create a custom 3D coordinate system orientation.
08.23 Create a 3D object using 3D drawing commands.
08.24 Open and change the view of a solid model.
08.25 Add features (such as: extruded cut, fillet, chamfer, revolved boss/base, revolved cut) to a solid model.
09.0 Perform basic precision measuring operations.--The student will be able to:

CTE Standards and Benchmarks
09.01 Use appropriate measurement tools. (e.g., machinist's rule, tape measure, calipers, micrometers, vernier and dial indicator.
09.02 Convert between common fraction inches and decimal inches.
09.03 Calibrate a dial caliper.
09.04 Master a dial indicator.
09.05 Read and interpret gage blocks and adjustable gages.
09.06 Implement appropriate testing regimes.
09.07 Use appropriate safety monitoring and testing equipment.
09.08 Use multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.
09.09 Research measurement tools for non-mechanical systems and products. (i.e., pH, °Brix)
10.0 Sharpen machining tools. The student will be able to:
10.01 Comply with safe and efficient work practices.
10.02 Hand sharpens cutting tools by using abrasive stones.
10.03 Grind lathe tools to required angles.
10.04 Sharpen drills.
11.0 Set up and operate power saws. The student will be able to:
11.01 Comply with safe and efficient work practices.
11.02 Remove and replace saw blades.
11.03 Select appropriate blades to perform given sawing operations.
11.04 Select and set speeds and feeds for given sawing operations.
11.05 Measure and cut material using a power saw.
11.06 Saw to scribed lines by using a metal band saw.
11.07 Cut and weld band-saw blades for contour sawing.

CTE Standards and Benchmarks
11.08 Set up and operate saws for angular cutting.
12.0 Set up and operate pedestal grinders. The student will be able to:
12.01 Comply with safe and efficient work practices.
12.02 Identify the parts of the machine and explain their uses.
12.03 Set up support rests.
12.04 Dress grinding wheels.
13.0 Set up and operate drill presses. The student will be able to:
13.01 Identify the parts of a drill press and explain their uses.
13.02 Identify and set the machine controls.
13.03 Comply with safe and efficient work practices.
13.04 Select the proper tooling.
13.05 Set up and operate drill press for hole work, center drill, drill, ream, countersink, and counterbore.
13.06 Set drill presses for proper feed and speed for specified operations.
14.0 Explain the importance of employability and entrepreneurship skills. The students will be able to:
14.01 Identify and demonstrate positive work behaviors needed to be employable.
14.02 Develop personal career plan that includes goals, objectives, and strategies.
14.03 Examine licensing, certification, and industry credentialing requirements.
14.04 Maintain a career portfolio to document knowledge, skills, and experience.
14.05 Evaluate and compare employment opportunities that match career goals.
14.06 Identify and exhibit traits for retaining employment.
14.07 Identify opportunities and research requirements for career advancement.
14.08 Research the benefits of ongoing professional development.

CTE Standards and Benchmarks
14.09 Examine and describe entrepreneurship opportunities as a career planning option.

Florida Department of Education
Student Performance Standards

Course Title: **Machining Technology 3**
Course Number: **9202130**
Course Credit: **1**

Course Description:

The Machining Technology 3 course is designed to build on the skills and knowledge students learned in Machining Technology 1 & 2 for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes knowledge of working in the machining industry. Students study the skills necessary to work in teams, using critical thinking skill to solve complex problems, advance mathematics, quality control and inspection methods, plan machining operations using a lathe, use CAD/CAM processes for lathe operations, and set-up and program a CNC machine for lathe operations.

CTE Standards and Benchmarks
15.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The students will be able to:
15.01 Employ leadership skills to accomplish organizational goals and objectives.
15.02 Establish and maintain effective working relationships with others to accomplish objectives and tasks.
15.03 Conduct and participate in meetings to accomplish work tasks.
15.04 Employ mentoring skills to inspire and teach others.
16.0 Solve problems using critical thinking skills, creativity and innovation. The students will be able to:
16.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
16.02 Employ critical thinking and interpersonal skills to resolve conflicts.
16.03 Identify and document workplace performance goals and monitor progress toward those goal.
16.04 Conduct technical research to gather information necessary for decision-making.
17.0 Solve advanced job-related math problems. The student will be able to:
17.01 Solve job-related problems using basic formulas, geometry, and trigonometry.
17.02 Convert measurements from English to metric and from metric to English units.

CTE Standards and Benchmarks
18.0 Demonstrate inspection methods. The student will be able to:
18.01 Comply with safe and efficient work practices.
18.02 Measure with sine bars.
18.03 Take readings with hardness testers.
18.04 Explain the purpose of statistical process control (SPC).
19.0 Plan lathe machining operations. The student will be able to:
19.01 Comply with safe and efficient work practices.
19.02 Perform layout for precision machine work by using layout instruments.
19.03 Describe the importance of quality assurance.
20.0 Interpret and apply blueprint for lathe machine operations. The student will be able to:
20.01 Create shop sketches.
20.02 Read and interpret blueprints that include geometric tolerances.
20.03 Determine and interpret reference information used in performing machine work.
20.04 Comply with safe and efficient work practices.
20.05 Inspect, remove, and replace manufactured parts that need repair or machine work.
20.06 Select the most productive tool and tooling for a given operation.
20.07 Identify the costs involved in product production.
21.0 Operate lathes. The student will be able to:
21.01 Identify the parts of a lathe and explain their uses.
21.02 Comply with safe and efficient work practices.
21.03 Inspect tooling prior to operations.
21.04 Set up an engine lathe.

CTE Standards and Benchmarks
21.05 Secure tools, tool holders, and fixtures or attachments.
21.06 Select and set feeds and speeds.
21.07 Set up lathes and face workpieces held in chucks.
21.08 Rough cut and finish cut with lathes.
21.09 Perform lathe filing to deburr parts.
21.10 Drill holes with lathes.
21.11 Countersink holes with lathes.
21.12 Ream holes with lathes.
21.13 Tap threads with lathes.
21.14 Die cut threads with lathes.
21.15 Counterbore holes with lathes.
21.16 Align lathe centers using accurate methods.
21.17 Bore holes with lathes.
21.18 Knurl parts with lathes.
21.19 Cut external threads with lathes.
21.20 Perform contour, angular, or radii cuts with lathes.
21.21 Set up the faceplate and dog.
22.0 Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for lathe operations. The student will be able to:
22.01 Identify parts of the machine and explain their uses.
22.02 Identify CAD/CAM processes.
22.03 Comply with safe and efficient work practices.
22.04 Create a multidimensional geometry of parts.

CTE Standards and Benchmarks
22.05 Create a CNC code from parts geometry.
22.06 Identify the basic classification of CNC tooling.
22.07 Set up and manufacture parts.
23.0 Set up and operate a computerized-numerical-control (CNC) machine for lathe operations. The student will be able to:
23.01 Comply with safe and efficient work practices.
23.02 Set up work holding devices.
23.03 Select proper cutting tools.
23.04 Write a basic program and apply basic programming skills.
23.05 Adjust appropriate cutting tools and tool offsets.
23.06 Machine and create parts to blueprint tolerances.

Florida Department of Education
Student Performance Standards

Course Title: **Machining Technology 4**
Course Number: **9212040**
Course Credit: **1**

Course Description:

The Machining Technology 4 course is designed to build on the skills and knowledge students learned in Machining Technology 1, 2, & 3 for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes knowledge of working in the machining industry. Students study the skills necessary to work in teams, using critical thinking skill to solve complex problems, advance mathematics, quality control and inspection methods, plan machining operations using a mill, use CAD/CAM processes for milling operations, and set-up and program a CNC machine for milling operations.

CTE Standards and Benchmarks
15.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The students will be able to:
15.01 Employ leadership skills to accomplish organizational goals and objectives.
15.02 Establish and maintain effective working relationships with others to accomplish objectives and tasks.
15.03 Conduct and participate in meetings to accomplish work tasks.
15.04 Employ mentoring skills to inspire and teach others.
16.0 Solve problems using critical thinking skills, creativity and innovation. The students will be able to:
16.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
16.02 Employ critical thinking and interpersonal skills to resolve conflicts.
16.03 Identify and document workplace performance goals and monitor progress toward those goal.
16.04 Conduct technical research to gather information necessary for decision-making.
17.0 Solve advanced job-related math problems. The student will be able to:
17.01 Solve job-related problems using basic formulas, geometry, and trigonometry.
17.02 Convert measurements from English to metric and from metric to English units.

CTE Standards and Benchmarks
18.0 Demonstrate inspection methods. The student will be able to:
18.01 Comply with safe and efficient work practices.
18.02 Measure with sine bars.
18.03 Take readings with hardness testers.
18.04 Explain the purpose of statistical process control (SPC).
24.0 Plan milling machining operations. The student will be able to:
24.01 Comply with safe and efficient work practices.
24.02 Perform layout for precision machine work by using layout instruments.
24.03 Describe the importance of quality assurance.
25.0 Interpret blueprints and milling machine operations. The student will be able to:
25.01 Create shop sketches.
25.02 Read and interpret blueprints that include geometric tolerances.
25.03 Determine and interpret reference information used in performing machine work.
25.04 Comply with safe and efficient work practices.
25.05 Lay out radial and bolt hole circles.
25.06 Inspect, remove, and replace manufactured parts that need repair or machine work.
25.07 Select the most productive tool and tooling for a given operation.
25.08 Identify the costs involved in product production.
26.0 Operate milling machines. The student will be able to:
26.01 Identify the parts of a vertical milling machine and explain their uses.
26.02 Comply with safe and efficient work practices.
26.03 Inspect tooling prior to operations.

CTE Standards and Benchmarks
26.04 True up the head and align milling fixtures.
26.05 Select and set feeds and speeds for milling work.
26.06 Square up workpieces with a table vise.
26.07 Perform end milling.
26.08 Perform fly-cutting operations.
26.09 Drill holes with milling machines.
26.10 Perform reaming operations.
26.11 Perform form milling.
26.12 Mill an external radius.
26.13 Mill an angle.
26.14 Use an edge finder and wiggler.
26.15 Identify the parts of vertical and horizontal milling machines and explain their uses.
26.16 Select the correct set up and operation for different milling machines.
26.17 Cut external keyways.
26.18 Bore holes with boring head.
26.19 Mill cylindrical work.
26.20 Set up and perform slab mill operations.
26.21 Use digital readouts.
26.22 Set up and operate power tapping head.
27.0 Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for mill operations. The student will be able to:
27.01 Identify parts of the machine and explain their uses.
27.02 Identify CAD/CAM processes.

CTE Standards and Benchmarks	
	27.03 Comply with safe and efficient work practices.
	27.04 Create a multidimensional geometry of parts.
	27.05 Create a CNC code from parts geometry.
	27.06 Identify the basic classification of CNC tooling.
	27.07 Set up and manufacture parts.
28.0	Set up and operate a computerized-numerical-control (CNC) machine for mill operations. The student will be able to:
	28.01 Comply with safe and efficient work practices.
	28.02 Set up work holding devices.
	28.03 Select proper cutting tools.
	28.04 Write a basic program and apply basic programming skills.
	28.05 Adjust appropriate cutting tools and tool offsets.
	28.06 Machine and create parts to blueprint tolerances.

Florida Department of Education
Student Performance Standards

Course Title: **Machining Technology Capstone**
Course Number: **9202150**
Course Credit: **1**

Course Description:

This course provides students with extended content and skills essential to the planning, design, creation, and presentation of a machining capstone project.

CTE Standards and Benchmarks	
29.0	Conceive, design, and present a machining project(s) that encompass all the skills learned in the Machining Technology program. The student will be able to:
29.01	Create and produce an original working drawing using CAD/CAM software.
29.02	Create and produce a 3-D drawing using appropriate industry recognized software.
29.03	Create and produce a toolpath.
29.04	Create and produce a 3-D model of the project (if applicable).
29.05	Compose a well written design proposal and present to instructor for approval.
29.06	Incorporate principles and practices of manufacturing processes into the design.
30.0	Plan, organize, and carry out a project plan. The student will be able to:
30.01	Determine the scope of a project.
30.02	Organize tasks.
30.03	Determine project priorities.
30.04	Identify required resources.
30.05	Record project progress in a process journal.
30.06	Record and account for budget expenses during the life of the project.
30.07	Carry out the project plan to successful completion and delivery.

CTE Standards and Benchmarks	
31.0	Formulate strategies to properly manage resources. The student will be able to:
31.01	Identify required resources and associated costs for each stage of the project plan.
31.02	Create a project budget based on the identified resources.
31.03	Determine the methods needed to acquire needed resources.
31.04	Demonstrate good judgment in the use of resources.
31.05	Recycle and reuse resources where appropriate.
31.06	Demonstrate an understanding of proper legal and ethical waste disposal.
32.0	Use tools, materials, and processes in an appropriate and safe manner. The student will be able to:
32.01	Identify the proper tool for a given job.
32.02	Use tools and machines in a safe manner.
32.03	Adhere to laboratory safety rules and procedures.
32.04	Identify the application of processes appropriate to the task at hand.
32.05	Identify materials appropriate to their application.
33.0	Create a project portfolio describing the machining project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results. The student will be able to:
33.01	Create a Design Portfolio documenting drawings and specifications.
33.02	Create a Bill of Material (BOM) for your project.
33.03	Create and deliver a presentation to communicate project results.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the co-curricular career and technical student organizations for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Electronic Systems Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Secondary – Career Preparatory	
Program Number	9202300
CIP Number	0615030331
Grade Level	9-12
Program Length	6 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA, FL-TSA
SOC Codes (all applicable)	17-3023 – Electrical and Electronic Engineering Technicians 49-2094 – Electrical and Electronics Repairers, Commercial and Industrial Equipment 51-2022 – Electrical and Electronic Equipment Assemblers
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in electronic support services positions.

The content includes but is not limited to direct current (DC) circuits, alternating current (AC) circuits and analog circuits; solid state and digital devices; microprocessors; use of circuit diagrams and schematics; soldering and chassis assembly techniques; laboratory practices; and technical recording and reporting.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of six credits.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
9202310	Electronic Systems Technology 1	AVIONICS @7 7G ELECTRONIC @7 7G RADIO TV %7 %G TEC ELEC @7 7G TV PROD TEC @7 7G	1 credit	51-2022	3	CT
9202320	Electronic Systems Technology 2		1 credit	49-2094	3	CT
9202330	Electronic Systems Technology 3		1 credit	49-2094	3	CT
9202340	Electronic Systems Technology 4		1 credit	49-2094	3	CT
9202350	Electronic Systems Technology 5		1 credit	17-3023	3	CT
9202360	Electronic Systems Technology 6		1 credit	17-3023	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in electronics assembly, soldering, and basic laboratory practices.
02.0 Demonstrate proficiency in basic DC circuits.
03.0 Demonstrate proficiency in advanced DC circuits.
04.0 Demonstrate proficiency in digital circuits.
05.0 Demonstrate proficiency in fundamental micro-processors.
06.0 Demonstrate skills in technical recording utilizing industry recognized computer application software.
07.0 Demonstrate proficiency in AC circuits.
08.0 Demonstrate proficiency in solid state devices.
09.0 Demonstrate proficiency in analog circuits.
10.0 Demonstrate proficiency in basic systems troubleshooting.
11.0 Demonstrate proficiency in fiber optic circuits.
12.0 Explain the importance of employability and entrepreneurship skills.
13.0 Demonstrate an understanding of emerging electronic technologies.

Florida Department of Education
Student Performance Standards

Course Title: **Electronic Systems Technology 1**
Course Number: **9202310**
Course Credit: **1**

Course Description:

The Electronic Systems Technology 1 course prepares students for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Students study basic soldering lab practices, Basic DC and Advanced DC circuitry.

CTE Standards and Benchmarks	
01.0	Demonstrate proficiency in electronics assembly, soldering, and basic laboratory practices. The student will be able to:
01.01	Apply proper Occupational Safety Health Administration (OSHA) safety standards.
01.02	Identify and use hand tools and power tools properly.
01.03	Draw and interpret electronic schematics.
01.04	Apply recognized industry accepted standard electrostatic discharge (ESD) safety procedures.
01.05	Make electrical connections.
01.06	Specify and request simple electronic components.
01.07	Properly place and solder components on a basic printed circuit board (PCB) to industry accepted standards.
01.08	Apply recognized industry standard soldering and De soldering techniques to include surface mount and thru-hole techniques.
01.09	Apply recognized industry accepted standard techniques for rework and repair.
01.10	Understand the purpose for writing reports and properly communicating results.
01.11	Understand the purpose for recording data.
01.12	Understand the purpose for designing curves and graphs.
01.13	Understand the purpose for writing formal laboratory experience reports.

CTE Standards and Benchmarks
01.14 Understand the process for generating equipment failure reports.
01.15 Understand the process for maintaining test logs.
01.16 Understand preventive maintenance and calibration procedures and related documentation.
02.0 Demonstrate proficiency in basic DC circuits. The student will be able to:
02.01 Solve problems in electronic units utilizing metric prefixes.
02.02 Describe the relationship of DC electricity to the nature of matter.
02.03 Identify sources of electricity.
02.04 Define voltage, current, resistance, power, and energy.
02.05 Apply Ohm's law and power formulas to series circuits.
02.06 Read and interpret color codes, surface mount codes, and symbols to identify electrical components and values.
02.07 Measure properties of a circuit using appropriate test equipment.
02.08 Compute conductance and compute and measure resistance of conductors and insulators.
02.09 Verify, analyze, and troubleshoot the operation of series circuits.
02.10 Apply Ohm's law to parallel circuits.
02.11 Verify, analyze, and troubleshoot the operation of parallel circuits.
03.0 Demonstrate proficiency in advanced DC circuits. The student will be able to:
03.01 Solve algebraic problems to include exponentials to DC.
03.02 Apply Ohm’s law to series-parallel and parallel-series circuits.
03.03 Verify, analyze, and troubleshoot the operation of series-parallel, parallel-series, and bridge circuits.
03.04 Verify, analyze, and troubleshoot and the operation of voltage divider circuits (loaded and unloaded).
03.05 Apply and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
03.06 Describe magnetic properties of circuits and devices.

CTE Standards and Benchmarks
03.07 Determine the physical and electrical characteristics of capacitors and inductors.
03.08 Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
03.09 Verify the operation of power supplies for DC circuits.
03.10 Identify and explain the theory of DC motors and their practical applications.

Florida Department of Education
Student Performance Standards

Course Title: **Electronic Systems Technology 2**
Course Number: **9202320**
Course Credit: **1**

Course Description:

The Electronic Systems Technology 2 course is designed to build on the skills and knowledge students learned in the Electronic Systems Technology 1 course for entry into the electronics technology industry. Students study digital circuitry, fundamental micro-processor theory, and technical recording.

CTE Standards and Benchmarks
04.0 Demonstrate proficiency in digital circuits. The student will be able to:
04.01 Define and apply numbering systems to codes and arithmetic operations.
04.02 Analyze and minimize logic circuits using Boolean operations.
04.03 Verify the operation of digital devices and circuits using appropriate test equipment.
04.04 Verify, analyze and troubleshoot the operation of combinational logic circuits and sequential logic gates.
04.05 Verify, analyze, and troubleshoot the operation of flip-flops using integrated circuits and their truth tables.
04.06 Identify, define and measure characteristics of integrated circuit (IC) logic families.
04.07 Verify, analyze, and troubleshoot the operation of registers and counters.
04.08 Verify, analyze, and troubleshoot the operation of timing circuits.
04.09 Verify, analyze, and troubleshoot the operation of arithmetic-logic circuits.
04.10 Verify, analyze and troubleshoot the operation of encoding and decoding devices.
04.11 Verify, analyze and troubleshoot the operation of multiplexer and demultiplexer circuits.
04.12 Identify types of memory circuits.
04.13 Verify, analyze and troubleshoot the operation of digital-to-analog and analog-to-digital circuits.

CTE Standards and Benchmarks
04.14 Verify, analyze and troubleshoot the operation of digital display circuits.
05.0 Demonstrate proficiency in fundamental micro-processors. The student will be able to:
05.01 Identify central processing unit (CPU) building blocks and their uses (architecture).
05.02 Safely install and remove a CPU without damaging.
05.03 Analyze bus concepts.
05.04 Analyze various memory schemes.
05.05 Define and identify the types of memory devices and circuits.
05.06 Define and identify the functions of a microprocessor
05.07 Analyze and troubleshoot a microprocessor system
05.08 Define and identify microprocessor peripheral devices.
05.09 Demonstrate the proper handling of a microprocessor.
05.10 Compare and contrast micro types and programming language types.
06.0 Demonstrate skills in technical recording utilizing industry recognized computer application software. The student will be able to:
06.01 Draw and interpret electronic schematics.
06.02 Record data and design curves and graphs.
06.03 Write reports and make oral presentations.
06.04 Maintain test logs.
06.05 Make equipment failure reports.
06.06 Specify and requisition simple electronic components.
06.07 Compose technical letters and memoranda with issue and solutions.
06.08 Write formal reports of laboratory experiences.
06.09 Understand preventive maintenance and calibration procedures and related documentation.

Florida Department of Education
Student Performance Standards

Course Title: **Electronic Systems Technology 3**
Course Number: **9202330**
Course Credit: **1**

Course Description:

The Electronic Systems Technology 3 course is designed to build on the skills and knowledge students learned in the Electronic Systems Technology 2 course for entry into the electronics technology industry. Students study AC circuitry, and technical recording.

CTE Standards and Benchmarks	
07.0	Demonstrate proficiency in AC circuits. The student will be able to:
07.01	Solve basic trigonometric problem as applicable to electronics.
07.02	Verify, analyze, and troubleshoot the operation of AC capacitive circuits and their characteristics.
07.03	Verify, analyze, and troubleshoot the operation of AC inductive circuits and their characteristics.
07.04	Verify, analyze, and troubleshoot the operation of AC circuits utilizing transformers and their principles of transformers to AC circuits.
07.05	Verify, analyze, and troubleshoot the operation of differentiators and integrators to determine R-C and R-L time constraints.
07.06	Define, analyze, and troubleshoot the characteristics of Resistive, Inductive, and Capacitive (RLC) circuits, R-C & R-L circuits.
07.07	Verify, analyze, and troubleshoot the operation of series and parallel resonant circuits and their characteristics
07.08	Verify, analyze, and troubleshoot operations of frequency selective filter circuits and their characteristics
07.09	Define the characteristics of polyphase circuits.
07.10	Define basic AC motor theory, operation, and practical applications.
07.11	Define basic generator theory, operation, and practical applications.
07.12	Operate power supplies for AC circuits.
07.13	Set up and operate oscilloscopes for AC circuits.
07.14	Set up and operate function generators for AC circuits.

CTE Standards and Benchmarks	
06.0	Demonstrate skills in technical recording utilizing industry recognized computer application software. The student will be able to:
06.01	Draw and interpret electronic schematics.
06.02	Record data and design curves and graphs.
06.03	Write reports and make oral presentations.
06.04	Maintain test logs.
06.05	Make equipment failure reports.
06.06	Specify and requisition simple electronic components.
06.07	Compose technical letters and memoranda with issue and solutions.
06.08	Write formal reports of laboratory experiences.
06.09	Understand preventive maintenance and calibration procedures and related documentation.

Florida Department of Education
Student Performance Standards

Course Title: **Electronic Systems Technology 4**
Course Number: **9202340**
Course Credit: **1**

Course Description:

The Electronic Systems Technology 4 course is designed to build on the skills and knowledge students learned in the Electronic Systems Technology 3 course. Students study solid state devices, analog circuitry, and technical recording.

CTE Standards and Benchmarks	
08.0	Demonstrate proficiency in solid state devices. The student will be able to:
08.01	Identify and define properties of semiconductor materials.
08.02	Identify and define operating characteristics and applications of junction diodes.
08.03	Identify and define operating characteristics and applications of special diodes, for example Zener diodes.
08.04	Verify, analyze and troubleshoot the proper operation of diode circuits.
08.05	Identify and define operating characteristics and applications of bipolar transistors,
08.06	Identify and define operating characteristics and applications of field effect transistors.
08.07	Identify and define operating characteristics and applications of single-stage amplifiers.
08.08	Verify, analyze and troubleshoot the operation of single-stage amplifiers.
08.09	Understand the principles and application of thyristor circuity.
08.10	Set up and operate power supplies, oscilloscopes and function generators for solid-state devices.
08.11	Verify the proper operation of transistors.
08.12	Analyze and troubleshoot transistor circuits.
09.0	Demonstrate proficiency in analog circuits. The student will be able to:
09.01	Verify, analyze, and troubleshoot the operational characteristics and applications of multistage amplifiers.

CTE Standards and Benchmarks	
09.02	Identify and define operating characteristics and applications of linear integrated circuits.
09.03	Verify, analyze, and troubleshoot the operating characteristics and applications of basic power supplies and filters.
09.04	Verify, analyze, and troubleshoot the operating characteristics and applications of differential and operational amplifiers.
09.05	Verify, analyze, and troubleshoot the operating characteristics and applications of audio power amplifiers.
09.06	Verify, analyze, and troubleshoot the operating characteristics and applications of power supply regulator circuits.
09.07	Verify, analyze, and troubleshoot the operating characteristics and applications of active filter circuits.
09.08	Verify, analyze, and troubleshoot the operating characteristics and applications of sinusoidal and non-sinusoidal oscillator circuits.
09.09	Verify, analyze, and troubleshoot the operating characteristics and applications of Optoelectronic Devices including: Liquid Crystal Display (LCD), Light Emitting Diode (LED), and Three Dimensional (3D) technologies.
06.0	Demonstrate skills in technical recording utilizing industry recognized computer application software. The student will be able to:
06.01	Draw and interpret electronic schematics.
06.02	Record data and design curves and graphs.
06.03	Write reports and make oral presentations.
06.04	Maintain test logs.
06.05	Make equipment failure reports.
06.06	Specify and requisition simple electronic components.
06.07	Compose technical letters and memoranda with issue and solutions.
06.08	Write formal reports of laboratory experiences.
06.09	Understand preventive maintenance and calibration procedures and related documentation.

Florida Department of Education
Student Performance Standards

Course Title: **Electronic Systems Technology 5**
Course Number: **9202350**
Course Credit: **1**

Course Description:

The Electronic Systems Technology 5 course is designed to build on the skills and knowledge students learned in the Electronic Systems Technology 4 course. Students study basic systems troubleshooting, and fiber optic circuitry.

CTE Standards and Benchmarks	
10.0	Demonstrate proficiency in basic systems troubleshooting. The student will be able to:
10.01	Identify basic components of systems.
10.02	Interpret basic flow charts, block diagrams, schematics, and technical documentation.
10.03	Isolate a system malfunction to a specific subsystem or field replaceable unit.
11.0	Demonstrate proficiency in fiber optic circuits. The student will be able to:
11.01	Describe the nature of light propagation.
11.02	Identify and define optical transmitters, receivers, and fibers.
11.03	Recognize a fiber optic cable connection that complies too industry standards.
11.04	Determine reflectivity, refractivity, and losses within a fiber optic system.

Florida Department of Education
Student Performance Standards

Course Title: **Electronic Systems Technology 6**
Course Number: **9202360**
Course Credit: **1**

Course Description:

The Electronic Systems Technology 6 course is designed to build on the skills and knowledge students learned in the Electronic Systems Technology 6 course. Students study employability and entrepreneurship skills, and emerging electronic technologies.

CTE Standards and Benchmarks	
12.0	Explain the importance of employability and entrepreneurship skills. The students will be able to:
12.01	Identify and demonstrate positive work behaviors needed to be employable.
12.02	Develop personal career plan that includes goals, objectives, and strategies.
12.03	Research licensing, certification, and industry credentialing requirements.
12.04	Maintain a career portfolio to document knowledge, skills, and experience.
12.05	Evaluate and compare employment opportunities that match career goals.
12.06	Identify and exhibit traits for retaining employment.
12.07	Identify opportunities and research requirements for career advancement.
12.08	Research the benefits of ongoing professional development.
12.09	Examine and describe entrepreneurship opportunities as a career planning option.
13.0	Demonstrate an understanding of emerging electronic technologies. The student will be able to:
13.01	Research and identify careers and workforce needs that employ emerging electronic technologies.
13.02	Identify the skills required to work within careers that use emerging electronic technologies.
13.03	Apply learned skills and competencies related to various electronic technology industry sectors. (e.g., communications, telecommunications, computer networking, consumer electronics, medical electronics, avionics, mechatronics, etc.)

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the co-curricular career and technical student organizations for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Industrial Machinery Maintenance Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Secondary – Career Preparatory	
Program Number	9204300
CIP Number	0647030307
Grade Level	9-12
Program Length	5 Credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9041 – Industrial Machinery Mechanics
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in industrial-machinery maintenance positions.

The content includes but is not limited to understanding all aspects of the industrial-machinery maintenance-technology industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of five credits.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
9204310	Machinery Maintenance 1	BLDG CONST @7 7G IND ENGR 7G MACH SHOP @7 7G MILLWRIGHT 7G TECH CONST @7 7G	1 credit	49-9041	3	CT
9204320	Machinery Maintenance 2		1 credit	49-9041	3	CT
9204330	Machinery Maintenance 3		1 credit	49-9041	3	CT
8743240	Machinery Maintenance 4		1 credit	49-9041	3	CT
9204350	Industrial Machinery Mechanic Technology Capstone		1 credit	49-9041	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply safety rules and procedures.
02.0 Explain basic electricity and electronics.
03.0 Perform mathematical calculations.
04.0 Use and maintain hand tools.
05.0 Use and maintain portable power tools.
06.0 Read plans and drawings.
07.0 Perform measuring and layout operations.
08.0 Demonstrate basic knowledge of industrial and manufacturing processes.
09.0 Perform benchwork skills.
10.0 Troubleshoot electrical circuits.
11.0 Identify common troubles and basic troubleshooting techniques.
12.0 Handle and apply lubricants.
13.0 Perform rigging functions.
14.0 Explain the basic elements of physics as related to industrial machinery maintenance and repair.
15.0 Install and maintain drive components.
16.0 Maintain and troubleshoot pneumatic systems.
17.0 Maintain and troubleshoot fluid-drive systems.
18.0 Maintain reciprocating, positive-displacement, and rotary air compressors.
19.0 Plan an elementary predictive-preventive-maintenance (PPM) schedule.
20.0 Maintain and repair hydraulic-system components.
21.0 Troubleshoot hydraulic systems.
22.0 Maintain and troubleshoot robotic systems.
23.0 Demonstrate an understanding of employability skills and career opportunities.
24.0 Conceive, design, and present a project(s) that encompass all the skills learned.
25.0 Plan, organize, and carry out a project plan.
26.0 Formulate strategies to properly manage resources.
27.0 Use tools, materials, and processes in an appropriate and safe manner.
28.0 Create a portfolio describing the project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results.

Florida Department of Education
Student Performance Standards

Course Title: **Machinery Maintenance 1**
Course Number: **9204310**
Course Credit: **1**

Course Description:

The Machinery Maintenance 1 course prepares students for entry into the Industrial Machinery Mechanics industry. Content emphasizes beginning skills and concepts as a recommended requisite for entry into Machinery Maintenance 2. Students study workplace safety and organization, basics of electricity and electronics, mathematical calculations, proper use of hand and power tools, read and interpret plans and drawings, and perform measuring and layout operations.

CTE Standards and Benchmarks	
01.0	Apply safety rules and procedures. The student will be able to:
01.01	Practice shop safety rules and procedures.
01.02	Practice personal safety rules and procedures, including the use of personal protective equipment (PPE).
01.03	Practice fire safety rules and procedures.
01.04	Practice electrical safety rules and procedures.
01.05	Practice tool safety rules and procedures.
01.06	Practice ladder and scaffolding safety rules and procedures.
01.07	Maintain a clean work and shop area.
01.08	Perform tag lockout procedures.
01.09	Identify Occupational Safety and Health Administration (OSHA) requirements and procedures.
01.10	Use Safety Data Sheets (SDS).
02.0	Explain basic electricity and electronics. The student will be able to:
02.01	Define electrical/electronic terms.
02.02	Describe direct current (DC) and alternating current (AC) circuits.

CTE Standards and Benchmarks
02.03 Identify the advantages and disadvantages of alternating current (AC) and direct current (DC) motors for various applications.
03.0 Perform mathematical calculations. The student will be able to:
03.01 Make job-related decimal and fraction calculations.
03.02 Solve job-related problems by adding, subtracting, multiplying, and dividing numbers.
03.03 Solve job-related problems using a hand-held calculator.
03.04 Solve job-related problems using basic formulas.
03.05 Solve job-related problems using basic geometry.
03.06 Measure a work piece and compare the measurements with blueprint specifications.
03.07 Solve job-related problems using mathematical handbooks, charts, and tables.
03.08 Convert measurements from English to metric and from metric to English units.
03.09 Solve job-related problems using proportions.
03.10 Solve job-related problems using statistics.
04.0 Use and maintain hand tools. The student will be able to:
04.01 Demonstrate the safe use of hand tools such as screwdrivers, hammers, wrenches, pliers, hacksaws, punches, chisels, drills, files, tin snips, taps, and dies.
04.02 Use measuring devices.
04.03 Use wrenches and screwdrivers.
04.04 Use pipefitting tools.
04.05 Use sheet-metal tools.
04.06 Safely use ropes, slings, pulleys, and block and tackle.
04.07 Select the proper tool for each job application.
04.08 Select correct tools for metric and standard fasteners.
04.09 Identify state-of-the-art innovations and explore their uses.

CTE Standards and Benchmarks	
04.10	Identify and select fasteners for various applications, taking into account the effects of corrosion on each, including threaded fasteners, nuts, washers, rivets, locking pins, keys, self-tapping screws, locking-nut fasteners, and self-retaining nuts.
04.11	Describe the techniques and liability issues regarding retrofitting fasteners for ease of removal.
05.0	Use and maintain portable power tools. The student will be able to:
05.01	Demonstrate the safe use of portable power tools, drills, belt and disc sanders, grinders, circular saws, saber saws, metal shears, electric and pneumatic impact wrenches, rotary and pneumatic chipping hammers, drill presses, and bench grinders.
05.02	Use and maintain light- and heavy-duty drills.
05.03	Use and maintain electric hammers.
05.04	Use and maintain pneumatic drills and hammers.
05.05	Use and maintain power screwdrivers and nut runners.
05.06	Use and maintain linear motion saws.
05.07	Use and maintain circular saws.
05.08	Use and maintain belt, pad, and disc sanders.
05.09	Use and maintain grinders and shears.
06.0	Read plans and drawings. The student will be able to:
06.01	Identify various types of plans and drawings (e.g., architectural, mechanical, electrical, etc.).
06.02	Identify dimensions.
06.03	Identify lists of materials and specifications.
06.04	Identify section and detail views.
06.05	Sketch and dimension a part.
06.06	Disassemble and assemble parts using an exploded-view drawing.
06.07	Interpret blueprint abbreviations.
06.08	Identify dimensioning of radii, round holes, fillets, and chamfers.

CTE Standards and Benchmarks	
	06.09 Identify screw threads and bolt types.
	06.10 Apply dimensional tolerances.
	06.11 Identify the metal-fabrication symbols used in blueprints.
07.0	Perform measuring and layout operations. The student will be able to:
	07.01 Perform basic geometric-construction operations.
	07.02 Safely use marking gauges, center punches, scribes, surface gauges, squares, dividers, dial indicators, protractors, surface plates, depth gauges, and circumference rules.
	07.03 Develop patterns using parallel lines, radial lines, and triangulation.
	07.04 Make metal-fabrication sketches.
	07.05 Read and measure with steel rules.
	07.06 Read and measure with micrometers.
	07.07 Read and measure with vernier tools.
	07.08 Read and measure with dial and digital calipers.
	07.09 Read and measure with dial and digital indicators.

Florida Department of Education
Student Performance Standards

Course Title: **Machinery Maintenance 2**
Course Number: **9204320**
Course Credit: **1**

Course Description:

The Machinery Maintenance 2 course is designed to build on the skills and knowledge students learned in Machinery Maintenance 1 for entry into the Industrial Machinery Mechanics industry. Content emphasizes beginning skills and concepts as a recommended requisite for entry into Machinery Maintenance 3. Students study industrial and manufacturing processes, benchwork skills, troubleshooting skills and techniques, lubrication processes, and rigging.

CTE Standards and Benchmarks	
08.0	Demonstrate basic knowledge of industrial and manufacturing processes. The student will be able to:
08.01	Demonstrate knowledge of the use of current manufacturing processes.
08.02	Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment.
08.03	Understand the processes of separating, forming, conditioning, fabricating, and finishing of materials.
09.0	Perform benchwork skills. The student will be able to:
09.01	Identify safety and shop rules.
09.02	Cut materials by using hand hacksaws.
09.03	Cut threads by using hand taps.
09.04	Cut threads by using dies.
09.05	Repair threads by chasing and thread inserts.
09.06	Install dowel pins using tapered and straight reamers.
09.07	Ream holes by using tapered and straight reamers.
09.08	Hand-sharpen cutting tools by using abrasive stones.
09.09	Hone and lap surfaces.

CTE Standards and Benchmarks
09.10 Remove damaged screws and other hardware.
09.11 Deburr workpieces.
09.12 Demonstrate accurate dis-assembly and re-assembly of machinery components.
10.0 Troubleshoot electrical circuits. The student will be able to:
10.01 Describe the safety requirements and precautions for troubleshooting electrical circuits.
10.02 Disconnect and reconnect electric motors.
10.03 Identify the parts and function of an electrical system.
10.04 Explain how to troubleshoot a sequence of events.
10.05 Properly use electrical test equipment for troubleshooting.
11.0 Identify common troubles and basic troubleshooting techniques. The student will be able to:
11.01 Analyze the possible causes of common troubles in industrial machinery performance.
11.02 Identify basic troubleshooting techniques for bearings.
11.03 Identify basic troubleshooting techniques for pumps.
11.04 Identify basic troubleshooting techniques for drive systems.
11.05 Identify basic troubleshooting techniques for hydraulics.
11.06 Identify basic troubleshooting techniques for pneumatics.
12.0 Handle and apply lubricants. The student will be able to:
12.01 Explain the functions of lubrication.
12.02 Explain the properties of oil lubricants.
12.03 Identify the types, advantages, and functions of lubricant additives.
12.04 Explain the types of circulating oils and their purposes.
12.05 Identify grease application.

CTE Standards and Benchmarks
12.06 Identify lubricating systems and methods.
12.07 Explain lubricant storage and handling methods.
12.08 Explain the types of oil filters and their uses.
12.09 Lubricate a piece of industrial equipment.
12.10 Define the role of preventive maintenance in total equipment maintenance.
12.11 Describe the major tasks of preventive maintenance: cleaning, inspection, lubrication, minor repair, and information feedback.
12.12 Review a typical maintenance program.
13.0 Perform rigging functions. The student will be able to:
13.01 Demonstrate the safety procedures for performing rigging and lifting operations.
13.02 Identify and inspect fiber and wire rope.
13.03 Tie knots and hitches.
13.04 Identify and use the components of rigging hardware.
13.05 Perform rigging and lifting operations.

Florida Department of Education
Student Performance Standards

Course Title: **Machinery Maintenance 3**
Course Number: **9204330**
Course Credit: **1**

Course Description:

The Machinery Maintenance 3 course is designed to build on the skills and knowledge students learned in Machinery Maintenance 1 & 2 for entry into the Industrial Machinery Mechanics industry. Content emphasizes beginning skills and concepts as a recommended requisite for entry into Machinery Maintenance 4. Students study basic elements of physics, installation of drive components, troubleshoot pneumatic and fluid-drive systems, and maintaining air compressors.

CTE Standards and Benchmarks	
14.0	Explain the basic elements of physics as related to industrial machinery maintenance and repair. The student will be able to:
14.01	Explain the standards of measurement and the impact of action and working forces, including tension, compression, torque, and shear.
14.02	Identify the principles and laws of motion and explain how they affect acceleration and deceleration.
14.03	Explain the relationship of work, power, and energy to the types of collisions and conservation of momentum.
14.04	Explain the operation of simple machines, including the lever, inclined plane, screw, wedge, wheel and axle, pulley, and jacking screws.
14.05	Identify the ways of producing power for mechanical efficiency, in terms of gear ratios, work forces, and the types of work done by a crane hook, forklift truck, and screw or bolt.
14.06	Use linear, liquid, and weight units of measurement to measure areas, areas within areas, and volume.
14.07	Describe the mechanical and chemical properties of materials commonly used in industry.
14.08	Explain the laws and conditions governing static and kinetic friction, the problems caused by friction, and the effects of the angle of repose.
14.09	Explain molecular action as a result of temperature extremes, chemical reaction, and moisture content.
14.10	Draw conclusions or make inferences from data.
14.11	Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
15.0	Install and maintain drive components. The student will be able to:

CTE Standards and Benchmarks
15.01 Demonstrate safety procedures for installing and maintaining drive components.
15.02 Identify the types of bearings, their cross-referencing, and their uses.
15.03 Remove, inspect, and/or replace bearings.
15.04 Remove and replace seals.
15.05 Perform shaft alignment.
15.06 Identify the types of belts.
15.07 Identify the types of chains.
15.08 Perform tension adjustments and alignment on belt and chain drives.
15.09 Troubleshoot belt and chain drives.
15.10 Identify the types of gears.
15.11 Remove, replace, and align gears, sprockets, and couplings.
15.12 Remove, replace, or repair V-joints and jack shafts.
15.13 Adjust gear backlash.
15.14 Troubleshoot gear drives.
15.15 Disassemble, inspect, reassemble, and adjust clutches.
15.16 Identify the types of variable-speed drives.
15.17 Troubleshoot variable-speed drives.
15.18 Identify the types of cams and link mechanisms.
15.19 Troubleshoot cam-and-link mechanism problems.
16.0 Maintain and troubleshoot pneumatic systems. The student will be able to:
16.01 Explain the safety procedures for troubleshooting pneumatic systems.
16.02 Diagram an air supply system.

CTE Standards and Benchmarks
16.03 Install system components.
16.04 Demonstrate system-maintenance techniques.
16.05 Explain proper troubleshooting procedures.
16.06 Troubleshoot air compressors.
16.07 Troubleshoot, repair, and install control valves.
16.08 Troubleshoot air motors.
17.0 Maintain and troubleshoot fluid-drive systems. The student will be able to:
17.01 Explain the safety procedures for maintaining and troubleshooting fluid-drive systems.
17.02 Install adjustable-speed drives.
17.03 Troubleshoot adjustable-speed drives.
17.04 Explain the operation of fluid couplings.
17.05 Install fluid couplings.
17.06 Install torque converters.
17.07 Perform preventive maintenance.
17.08 Apply a "dynamic" magnetic/mechanical braking device to a motor.
17.09 Mount the equipment.
18.0 Maintain reciprocating, positive-displacement, and rotary air compressors. The student will be able to:
18.01 Relate scientific principles to a pneumatic system.
18.02 Demonstrate the safety procedures for maintaining and operating reciprocating, positive-displacement, and rotary air compressors.
18.03 Identify the systems of reciprocating, positive-displacement, and rotary air compressors.
18.04 Check oil level.
18.05 Change oil.

CTE Standards and Benchmarks
18.06 Drain water from tank.
18.07 Test for efficiency of compressor.
18.08 Inspect storage tank for quality.
18.09 Test pressure control switch.

Florida Department of Education
Student Performance Standards

Course Title: **Machinery Maintenance 4**
Course Number: **8743240**
Course Credit: **1**

Course Description:

The Machinery Maintenance 4 course is designed to build on the skills and knowledge students learned in Machinery Maintenance 1, 2, and 3 for entry into the Industrial Machinery Mechanics industry. Students explore career opportunities and requirements of a professional industrial machinery mechanic. Students study elementary predictive-preventive-maintenance planning, maintain and troubleshoot hydraulic and robotic systems, and understanding employability skills.

CTE Standards and Benchmarks	
19.0	Plan an elementary predictive-preventive-maintenance (PPM) schedule. The student will be able to:
19.01	List the types of predictive-preventive maintenance.
19.02	Describe the purpose of preventive-maintenance schedules.
19.03	Create a preventive-maintenance schedule form using a machine manual or the manufacturer recommendations.
19.04	Identify troubles caused by the lack of preventive maintenance.
19.05	Create a maintenance log and make entries for a machine or equipment.
19.06	Create a preventive-maintenance schedule from a maintenance-failures log.
20.0	Maintain and repair hydraulic-system components. The student will be able to:
20.01	Explain the safety procedures for installing hydraulic lines.
20.02	Explain how heat and pressure relate to power and transmission.
20.03	Describe the physical and chemical properties of a fluid.
20.04	Install and maintain a contaminant-removal system.
20.05	Determine reservoir requirements.
20.06	Classify and select pumps for specific applications.

CTE Standards and Benchmarks
20.07 Compute hose requirements.
20.08 Select and install control valves.
21.0 Troubleshoot hydraulic systems. The student will be able to:
21.01 Explain the safety procedures for troubleshooting hydraulic systems.
21.02 Read a hydraulic schematic.
21.03 Install hydraulic components.
21.04 Explain hydraulic-system troubleshooting techniques.
21.05 Repair and replace valves.
21.06 Repair and replace cylinders.
21.07 Repair and replace pumps and motors.
22.0 Maintain and troubleshoot robotic systems. The student will be able to:
22.01 Identify uses of robotics in industry.
22.02 Identify safety procedures related to robotic systems.
22.03 Identify mechanical, hydraulic, pneumatic, and electric/electronic components of robotic systems.
23.0 Demonstrate an understanding of employability skills and career opportunities. The student will be able to:
23.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
23.02 Discuss motivation and human behavior.
23.03 Demonstrate knowledge of ways to improve reading, listening and writing skills.
23.04 Provide effective feedback and make suggestions.
23.05 Demonstrate knowledge of roles and responsibilities of team members.
23.06 Effectively communicate production and process information to internal and external customers.
23.07 Develop personal career plan that includes goals, objectives, and strategies.

CTE Standards and Benchmarks
23.08 Examine licensing, certification, and industry credentialing requirements.
23.09 Evaluate and compare employment opportunities that match career goals.
23.10 Identify and exhibit traits for retaining employment.
23.11 Identify opportunities and research requirements for career advancement.
23.12 Research the benefits of ongoing professional development.

Florida Department of Education
Student Performance Standards

Course Title: **Industrial Machinery Mechanic Capstone**
Course Number: **9204350**
Course Credit: **1**

Course Description:

This optional course provides students with extended content and skills essential to the planning, design, creation, and presentation of an industrial machinery maintenance capstone project.

CTE Standards and Benchmarks	
24.0	Conceive, design, and present a project(s) that encompass all the skills learned. The student will be able to:
24.01	Create and produce an original working drawing.
24.02	Compose a well written design proposal and present to instructor for approval.
25.0	Plan, organize, and carry out a project plan. The student will be able to:
25.01	Determine the scope of a project.
25.02	Organize tasks.
25.03	Determine project priorities.
25.04	Identify required resources.
25.05	Record project progress in a process journal.
25.06	Record and account for budget expenses during the life of the project.
25.07	Carry out the project plan to successful completion and delivery.
26.0	Formulate strategies to properly manage resources. The student will be able to:
26.01	Identify required resources and associated costs for each stage of the project plan.
26.02	Create a project budget based on the identified resources.
26.03	Determine the methods needed to acquire needed resources.

CTE Standards and Benchmarks	
	26.04 Demonstrate good judgment in the use of resources.
	26.05 Recycle and reuse resources where appropriate.
	26.06 Demonstrate an understanding of proper legal and ethical waste disposal.
27.0	Use tools, materials, and processes in an appropriate and safe manner. The student will be able to:
	27.01 Identify the proper tool for a given job.
	27.02 Use tools and machines in a safe manner.
	27.03 Adhere to laboratory safety rules and procedures.
	27.04 Identify the application of processes appropriate to the task at hand.
	27.05 Identify materials appropriate to their application.
28.0	Create a portfolio describing the project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results. The student will be able to:
	28.01 Create a Design Portfolio documenting drawings and specifications.
	28.02 Create a Bill of Material (BOM) for your project.
	28.03 Create and deliver a presentation to communicate project results.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Welding Technology Fundamentals**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Secondary – Career Preparatory	
Program Number	9204400
CIP Number	0648050807
Grade Level	9-12
Program Length	5 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA
SOC Codes (all applicable)	51-9198 – Helpers-Production Workers 51-4121 – Welders, Cutters, Solderers, and Brazers
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in the welding industry

The content includes but is not limited to planning, management, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of five credits.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
9204410	Welding Technology Fundamentals 1	METAL WORK 7G WELDING @7 7G	1 credit		3	CT
9204420	Welding Technology Fundamentals 2		1 credit	51-9198	3	CT
9204430	Welding Technology Fundamentals 3		1 credit		3	CT
9204440	Welding Technology Fundamentals 4		1 credit	51-4121	3	CT
9204450	Welding Technology Fundamentals Capstone		1 credit	51-4121	3	CT

(Graduation Requirement Codes: CT=Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA=Mathematics, PL=Personal Financial Literacy)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding and apply workplace safety and workplace organization skills.
02.0 Demonstrate basic knowledge of industrial and manufacturing processes.
03.0 Describe and identify metals and their properties accurately.
04.0 Demonstrate and apply basic knowledge of drawing and interpreting AWS welding symbols.
05.0 Apply basic oxyfuel gas cutting principles and practices.
06.0 Demonstrate a basic understanding of shielded metal arc welding (SMAW).
07.0 Apply intermediate oxyfuel gas cutting principles and practices.
08.0 Demonstrate plasma arc cutting principles and practices.
09.0 Create a product using basic shielded metal arc welding (SMAW) principles and practices.
10.0 Apply basic shielded metal arc welding (SMAW) skills.
11.0 Demonstrate and apply Carbon Arc Gouging (GAC) principles and practices.
12.0 Apply visual examination skills.
13.0 Create a product using Carbon Arc Gouging and basic shielded metal arc welding (SMAW) principles and practices.
14.0 Demonstrate an understanding of employability skills and career opportunities related to the welding industry.
15.0 Apply intermediate shielded metal arc welding (SMAW) skills.
16.0 Create a product using intermediate shielded metal arc welding (SMAW) principles and practices.
17.0 Conceive, design, and present a welding project(s) that encompasses all the skills learned in the Welding Technology program.
18.0 Plan, organize, and carry out a project plan.
19.0 Formulate strategies to properly manage resources.
20.0 Use tools, materials, and processes in an appropriate and safe manner.
21.0 Create a project portfolio describing the welding project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results.

Florida Department of Education
Student Performance Standards

Course Title: **Welding Technology Fundamentals 1**
Course Number: **9204410**
Course Credit: **1**

Course Description:

The Welding Technology Fundamentals 1 course prepares students for entry into the welding industry. Students explore career opportunities and requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study workplace safety and organization, basic manufacturing processes, metals identification, basic interpretation of welding symbols, and oxyfuel gas cutting practices. Students demonstrate learned skills by creating and producing a finished product.

CTE Standards and Benchmarks	
01.0	Demonstrate an understanding and apply workplace safety and workplace organization. The student will be able to:
01.01	Locate and use Safety Data Sheets (SDS).
01.02	Demonstrate knowledge of material handling techniques to safely move materials.
01.03	Demonstrate the proper techniques for lifting.
01.04	Explain Lock Out/Tag Out requirements procedures, including confined space awareness.
01.05	Proactively respond to a safety concern and notify the instructor.
01.06	Demonstrate knowledge of emergency exits and signage.
01.07	Demonstrate knowledge of various emergency alarms and procedures
01.08	Demonstrate knowledge of clean-up procedures.
01.09	Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.
01.10	Demonstrate knowledge of safety requirements for manual, electrical-powered, and pneumatic tools.
01.11	Perform safety and environmental inspections.
01.12	Demonstrate skill in performing leak checks to determine if toxic or hazardous material is escaping from a piece of equipment.

CTE Standards and Benchmarks	
	01.13 Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists, and regulations.
	01.14 Demonstrate knowledge of equipment shutdown procedures.
	01.15 Identify-safety related maintenance procedures.
	01.16 Selecting and use personal protective equipment (PPE).
	01.17 Demonstrate knowledge of ergonomic impact of work techniques.
	01.18 Apply Occupational Safety Health Administration (OSHA) safety standards properly.
	01.19 Research and identify class A, B, and C type fires.
	01.20 Demonstrate and apply the proper procedures for extinguishing class A, B, and C type fires.
02.0	Demonstrate basic knowledge of industrial and manufacturing processes. The student will be able to:
	02.01 Demonstrate knowledge of the use of current manufacturing processes as related to the welding industry.
	02.02 Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment.
03.0	Describe and identify metals and their properties accurately. The student will be able to:
	03.01 Describe and understand the steelmaking process.
	03.02 Describe and understand the differences between ferrous and nonferrous metals.
	03.03 Describe and understand casting, alloys, and forging.
	03.04 Identify and understand metallurgical processes related to metals such as galvanized iron and steel, aluminum stainless steel, sheet metal, copper, and brass.
04.0	Demonstrate and apply basic knowledge of drawing and interpreting AWS welding symbols. The student will be able to:
	04.01 Interpret, understand, and apply elements of a drawing or sketch.
	04.02 Interpret, understand, and apply welding symbol information.
	04.03 Design and create a drawing using welding symbology.
	04.04 Identify a specified weld using a welding symbol.

CTE Standards and Benchmarks	
	04.05 Draw welding symbols using given variables.
	04.06 Use and apply appropriate mathematical practices to the design and creation of drawings using welding symbols.
05.0	Apply basic oxyfuel gas cutting principles and practices. The student will be able to:
	05.01 Perform external inspections of equipment and accessories.
	05.02 Make minor repairs to equipment and accessories.
	05.03 Set up manual OFC operations for plain carbon steel.
	05.04 Operate manual oxyfuel cutting equipment.
	05.05 Perform straight cutting operations using manual oxyfuel cutting process on plain carbon steel.
06.0	Demonstrate a basic understanding of shielded metal arc welding (SMAW). The student will be able to:
	06.01 Perform external inspections of SMAW equipment and accessories.
	06.02 Make minor repairs to SMAW equipment and accessories.
	06.03 Set up shielded metal arc welding operations on plain carbon steel.
	06.04 Operate shielded metal arc welding equipment.
	06.05 Make pad welds, all positions, on plain carbon steel.

Florida Department of Education
Student Performance Standards

Course Title: **Welding Technology Fundamentals 2**
Course Number: **9204420**
Course Credit: **1**

Course Description:

The Welding Technology Fundamentals 2 course is designed to build on the skills and knowledge students learned in Welding Technology Fundamentals 1 for entry into the welding industry. Students explore career opportunities and the requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study drawings and welding symbols, intermediate oxyfuel gas cutting practices, plasma arc cutting principles, and basic shielded metal arc welding (SMAW). Students demonstrate learned skills by creating and producing a finished product.

CTE Standards and Benchmarks	
07.0	Apply intermediate oxyfuel gas cutting principles and practices. The student will be able to:
07.01	Apply intermediate manual oxyfuel gas cutting skills.
07.02	Perform shape cutting operations on plain carbon steel.
07.03	Perform bevel cutting operations on plain carbon steel.
07.04	Remove weld metal on plain carbon steel using weld washing techniques.
07.05	Apply machine oxyfuel gas cutting (track burner) skills.
07.06	Perform safety inspections of equipment and accessories.
07.07	Make minor external repairs to equipment and accessories.
07.08	Set up for plain carbon steel machine OFC (track burner) operations.
07.09	Operate machine oxyfuel gas cutting (track burner) equipment.
07.10	Perform straight cutting operations on plain carbon steel.
07.11	Perform bevel cutting operations on plain carbon steel.
08.0	Demonstrate plasma arc cutting principles and practices. The student will be able to:

CTE Standards and Benchmarks	
	08.01 Identify and describe common gages, shapes, and dimensions of metals.
	08.02 Apply Manual Air (Plasma Arc Gouging) and Cutting (CAC-A) skills.
	08.03 Perform safety inspections of equipment and accessories.
	08.04 Make minor external repairs to equipment and accessories.
	08.05 Set up manual air carbon arc gouging and cutting operations.
	08.06 Operate manual air carbon arc cutting equipment.
	08.07 Perform metal removal operations.
	08.08 Apply manual Arc Gouging and Arc Cutting (AC) skills.
	08.09 Make minor repairs to equipment and accessories.
	08.10 Set up for using plasma arc cutting operations.
	08.11 Operate manual plasma arc cutting equipment.
	08.12 Perform shape cutting operations using plasma arc cutting process.
09.0	Create a product using oxyfuel gas cutting and introductory shielded metal arc welding (SMAW) principles and practices. The student will be able to:
	09.01 Design and create a work of art or project utilizing material and skills learned.
	09.02 Create a working drawing or blueprint using welding symbols.
	09.03 Design a product from a working drawing or blueprint created.
	09.04 Fabricate a product using the skills learned related to oxyfuel gas cutting and introductory shielded metal arc welding (SMAW).
	09.05 Create and deliver a presentation to communicate project results.

Florida Department of Education
Student Performance Standards

Course Title: **Welding Technology Fundamentals 3**
Course Number: **9204430**
Course Credit: **1**

Course Description:

The Welding Technology Fundamentals 3 course is designed to build on the skills and knowledge students learned in Welding Technology Fundamentals 1 and 2 for entry into the welding industry. Students explore career opportunities and requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study basic shielded metal arc welding (SMAW), Carbon Arc Gouging (GAC) principles, and visual examination skills. Students demonstrate learned skills by creating and producing a finished product.

CTE Standards and Benchmarks
11.0 Apply basic shielded metal arc welding (SMAW) skills. The student will be able to:
11.01 Perform external inspections of SMAW equipment and accessories.
11.02 Make minor repairs to SMAW equipment and accessories.
11.03 Set up shielded metal arc welding operations on plain carbon steel.
11.04 Operate shielded metal arc welding equipment.
11.05 Make pad welds, all positions, on plain carbon steel.
11.06 Make fillet welds, all positions, on plain carbon steel.
11.07 Make groove welds, all positions, on plain carbon steel.
11.08 Understand the processes of separating, forming, conditioning, fabricating, and finishing of materials.
11.09 Explain the difference between primary and secondary manufacturing processes.
12.0 Demonstrate and apply Carbon Arc Gouging (GAC) principles and practices. The student will be able to:
12.01 Perform safety inspections of equipment and accessories.
12.02 Repair unacceptable weld profiles.

CTE Standards and Benchmarks	
	12.03 Properly set up equipment, accessories, and machine for Carbon Arc Gouging (GAC)
13.0	Apply visual examination skills. The student will be able to:
	13.01 Examine cut surfaces and edges of prepared base metal parts.
	13.02 Examine tack, intermediate pass and cover pass.
14.0	Create a product using Carbon Arc Gouging and basic shielded metal arc welding (SMAW) principles and practices. The student will be able to:
	14.01 Design and create a work of art or project utilizing material and skills learned.
	14.02 Create a working drawing or blueprint using welding symbols.
	14.03 Design a product from a working drawing or blueprint created.
	14.04 Fabricate a product using the skills learned related to Carbon Arc Gouging and basic shielded metal arc welding (SMAW).
	14.05 Create and deliver a presentation to communicate project results.

Florida Department of Education
Student Performance Standards

Course Title: **Welding Technology Fundamentals 4**
Course Number: **9204440**
Course Credit: **1**

Course Description:

The Welding Technology Fundamentals 4 course is designed to build on the skills and knowledge students learned in Welding Technology Fundamentals 1, 2, and 3 for entry into the welding industry. Students explore career opportunities and requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study employability and welding careers, and intermediate shielded metal arc welding (SMAW). Students demonstrate learned skills by creating and producing a finished product.

CTE Standards and Benchmarks
15.0 Demonstrate an understanding of employability skills and career opportunities related to the welding industry. The student will be able to:
15.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
15.02 Discuss motivation and human behavior.
15.03 Develop a personal stress management plan.
15.04 Demonstrate knowledge of ways to improve reading, listening and writing skills.
15.05 Demonstrate knowledge of techniques for making effective presentations.
15.06 Use different forms of technology communication.
15.07 Provide effective feedback and make suggestions.
15.08 Demonstrate appropriate customer service skills and techniques.
15.09 Demonstrate knowledge of roles and responsibilities of team members.
15.10 Align team goals (that are specific, documented, measurable and achievable) to customer and business production needs.
15.11 Effectively communicate production and process information.
15.12 Develop personal career plan that includes goals, objectives, and strategies.
15.13 Examine licensing, certification, and industry credentialing requirements.

CTE Standards and Benchmarks	
	15.14 Evaluate and compare employment opportunities that match career goals.
	15.15 Identify and exhibit traits for retaining employment.
	15.16 Identify opportunities and research requirements for career advancement.
	15.17 Research the benefits of ongoing professional development.
	15.18 Examine and describe entrepreneurship opportunities as a career planning option.
	15.19 Describe "Right-to-Know" Law as recorded in (29 CFR-1910.1200).
16.0	Apply intermediate shielded metal arc welding (SMAW) skills. The student will be able to:
	16.01 Make single “V” groove welds, all positions (visual inspection criteria, using current and applicable welding industry codes) on plain carbon steel with backing.
	16.02 Perform 1G - 4G limited thickness qualification (bend) tests on plain carbon steel plate (using current and applicable welding industry codes).
	16.03 Perform destructive root and face bend specimens (using current and applicable welding industry codes).
	16.04 Understand WPS and PQR.
17.0	Create a product using intermediate shielded metal arc welding (SMAW) principles and practices. The student will be able to:
	17.01 Identify, understand, and describe thermal properties of metals.
	17.02 Design and create a work of art or project utilizing material and skills learned.
	17.03 Create a working drawing or blueprint using welding symbols learned.
	17.04 Design a product from a working drawing or blueprint created.
	17.05 Fabricate a product using the skills learned related to intermediate shielded metal arc welding (SMAW).
	17.06 Repair products of ferrous and non-ferrous metals.
	17.07 Create and deliver a presentation to communicate project results.

Florida Department of Education
Student Performance Standards

Course Title: **Welding Technology Fundamentals Capstone**
Course Number: **9204450**
Course Credit: **1**

Course Description:

This course provides students with extended content and skills essential to the planning, design, creation, and presentation of a welding capstone project.

CTE Standards and Benchmarks	
18.0	Conceive, design, and present a welding project(s) that encompass all the skills learned in the Welding Technology Fundamentals program. The student will be able to:
18.01	Create and produce an original working drawing using welding symbology.
18.02	Compose a well written design proposal and present to instructor for approval.
18.03	Incorporate principles and practices of oxyfuel gas cutting into the design.
18.04	Incorporate principles and practices of shielded metal arc welding (SMAW) into the design.
19.0	Plan, organize, and carry out a project plan. The student will be able to:
19.01	Determine the scope of a project.
19.02	Organize tasks.
19.03	Determine project priorities.
19.04	Identify required resources.
19.05	Record project progress in a process journal.
19.06	Record and account for budget expenses during the life of the project.
19.07	Carry out the project plan to successful completion and delivery.
20.0	Formulate strategies to properly manage resources. The student will be able to:
20.01	Identify required resources and associated costs for each stage of the project plan.

CTE Standards and Benchmarks	
	20.02 Create a project budget based on the identified resources.
	20.03 Determine the methods needed to acquire needed resources.
	20.04 Demonstrate good judgment in the use of resources.
	20.05 Recycle and reuse resources where appropriate.
	20.06 Demonstrate an understanding of proper legal and ethical waste disposal.
21.0	Use tools, materials, and processes in an appropriate and safe manner. The student will be able to:
	21.01 Identify the proper tool for a given job.
	21.02 Use tools and machines in a safe manner.
	21.03 Adhere to laboratory safety rules and procedures.
	21.04 Identify the application of processes appropriate to the task at hand.
	21.05 Identify materials appropriate to their application.
22.0	Create a project portfolio describing the welding project, including drawings and specifications, the tasks and rationale, process journal, budget report, and the results. The student will be able to:
	22.01 Create a Design Portfolio documenting drawings and specifications.
	22.02 Create a Bill of Material (BOM) for your project.
	22.03 Create and deliver a presentation to communicate project results to other teams.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading, and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences, and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Florida Department of Education
Curriculum Framework

Program Title: **Engineering Technology Support Specialist**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615000007
Program Type	College Credit Certificate (CCC)
Program Length	18 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001). **This certificate program is the core of the Engineering Technology degree program.**

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, technical competency, safe and efficient work practices and a combination of theory and laboratory activities to gain the necessary cognitive and manipulative skills to perform preventive and corrective maintenance and support for engineering design, processes, production, testing, and/or maintaining product quality.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Engineering Technology and Industrial Applications: production materials and processes, quality, computer-aided drafting, electronics, mechanics, instrumentation and safety.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of industrial processes and material properties.
02.0 Generate and interpret computer-aided drawings.
03.0 Demonstrate a fundamental understanding of electricity and electronics.
04.0 Demonstrate an understanding of industrial safety, health, and environmental requirements.
05.0 Demonstrate proficiently in the use of quality assurance methods and quality control concepts.
06.0 Demonstrate proficiency in using tools, instruments and testing devices.
07.0 Demonstrate basic troubleshooting skills.
08.0 Demonstrate appropriate communication skills.
09.0 Demonstrate appropriate math skills.
10.0 Demonstrate an understanding of modern business practices and strategies.
11.0 Demonstrate employability skills.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology Support Specialist**
CIP Number: **0615000007**
Program Length: **18 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate knowledge of industrial processes and materials properties. The student will be able to:
01.01	Explain current manufacturing processes to include modern trends (3-D printing, etc.).
01.02	Determine available and needed resources for the production process.
01.03	Describe the factors considered for design, maintenance, procurement and handling.
01.04	Analyze process changes for impact on product.
01.05	Identify principles and practices of production timing.
01.06	Identify effect of time, motion, and procedural changes on productivity.
01.07	Demonstrate knowledge of raw materials properties and requirements.
01.08	Follow engineering specifications and documentation in equipment setup.
01.09	Explain the importance of routine maintenance.
01.10	Identify customer needs. Document product and process compliance with customer requirements.
02.0	Generate and interpret computer-aided drawings. The student will be able to:
02.01	Apply current industrial computer aided design and drafting practices.
02.02	Import and export various file types and formats.
02.03	Create and interpret technical drawings.
03.0	Demonstrate a fundamental understanding of electricity and electronics. The student will be able to:
03.01	Use appropriate electrical circuit grounding techniques.
03.02	Solve circuit problems using appropriate units and notation.
03.03	Operate appropriate test equipment.
04.0	Demonstrate an understanding of safety, health, and environmental requirements. The student will be able to:
04.01	Identify and select appropriate Personal Protective Equipment (PPE).
04.02	Follow appropriate safety procedures.
04.03	Follow applicable environmental laws and regulations.

	04.04 Identify and report unsafe conditions and practices.
	04.05 Explain when a machine or a process should be stopped to investigate an unsafe condition.
	04.06 Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
	04.07 Use and evaluate information resources such as SDS (Safety Data Sheets).
05.0	Demonstrate proficiency in use of quality assurance methods and quality control concepts. The student will be able to:
	05.01 Apply quality methods to industrial processes.
	05.02 Apply quality principles to manufactured products.
	05.03 Document quality measurements and observations.
06.0	Demonstrate proficiency in using tools, instruments and testing devices. The student will be able to:
	06.01 Identify and use hand tools properly.
	06.02 Use inspection equipment appropriately.
	06.03 Implement appropriate testing techniques and procedures.
	06.04 Use appropriate measurement tools.
	06.05 Use appropriate safety monitoring and testing equipment.
	06.06 Communicate issues with visual tools.
07.0	Demonstrate basic troubleshooting skills. The student will be able to:
	07.01 Apply critical thinking skills to identify problems.
	07.02 Identify symptoms and changes in a system.
	07.03 Apply root cause analysis techniques to identify problem causes.
	07.04 Evaluate corrective action options.
	07.05 Properly document all corrective actions.
08.0	Demonstrate appropriate communication skills. The student will be able to:
	08.01 Write logical and understandable statements, or phrases, to accurately complete forms commonly used in business and industry.
	08.02 Read and understand graphs, charts, diagrams, and common table formats.
	08.03 Read and follow written instructions.
	08.04 Demonstrate an understanding of; and ability to follow oral instructions.
	08.05 Demonstrate knowledge of technical language and technical acronyms.
	08.06 Explain the benefits of teamwork.
09.0	Demonstrate appropriate math skills. The student will be able to:
	09.01 Solve problems for appropriate scalars.

	09.02 Calculate tolerance(s).
	09.03 Use different unit systems appropriately.
	09.04 Accurately convert between unit systems.
	09.05 Use appropriate notation.
	09.06 Solve simple algebraic equations.
10.0	Demonstrate an understanding of modern business practices and strategies. The student will be able to:
	10.01 Demonstrate knowledge of production process to meet business requirements.
	10.02 Demonstrate knowledge of the alignment of a company's business objectives with production goals.
11.0	Demonstrate employability skills. The student will be able to:
	11.01 Describe the appropriate steps to acquire employment.
	11.02 Respond appropriately to professional criticism.
	11.03 Identify and practice professional work habits.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Mechatronics**
Specialization Tract: **Advanced Manufacturing**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615000013
Program Type	College Credit Certificate (CCC)
Program Length	30 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Advanced Manufacturing specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Manufacturing career cluster.

The content includes but is not limited to instruction in maintenance techniques, computer aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of industrial processes and material properties.
02.0 Generate and interpret computer-aided drawings.
03.0 Demonstrate a fundamental understanding of electricity and electronics.
04.0 Demonstrate an understanding of industrial safety, health, and environmental requirements.
05.0 Demonstrate proficiency in using tools, instruments, and testing devices.
06.0 Demonstrate basic troubleshooting skills.
07.0 Demonstrate appropriate communication skills.
08.0 Demonstrate appropriate math skills.
09.0 Understand, operate, troubleshoot, and maintain pneumatic, hydraulic, and electromechanical components and/or systems.
10.0 Understand, operate, and maintain industrial automation systems.
11.0 Troubleshoot industrial automation systems.
12.0 Apply the principles of robotics to automated systems.
13.0 Create and operate human machine interfaces to control automated systems.

Florida Department of Education
Student Performance Standards

Program Title: **Mechatronics**
CIP Number: **0615000013**
Program Length: **30 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate knowledge of industrial processes and materials properties. The student will be able to:
01.01	Explain current manufacturing processes to include modern trends (3-D printing, etc.).
01.02	Determine available and needed resources for the production process.
01.03	Describe the factors considered for design, maintenance, procurement and handling.
01.04	Analyze process changes for impact on product.
01.05	Identify principles and practices of production timing.
01.06	Identify effect of time, motion, and procedural changes on productivity.
01.07	Demonstrate knowledge of raw materials properties and requirements.
01.08	Follow engineering specifications and documentation in equipment setup.
01.09	Explain the importance of routine maintenance.
01.10	Identify customer needs. Document product and process compliance with customer requirements.
02.0	Generate and interpret computer-aided drawings. The student will be able to:
02.01	Apply current industrial computer aided-drawing practices.
02.02	Import and export various file types.
02.03	Interpret technical drawings.
03.0	Demonstrate a fundamental understanding of electricity and electronics. The student will be able to:
03.01	Use appropriate electrical circuit grounding techniques.
03.02	Solve circuit problems using appropriate units and notation.
03.03	Operate appropriate test equipment.
04.0	Demonstrate an understanding of industrial safety, health, and environmental requirements. The student will be able to:
04.01	Identify and select appropriate Personal Protective Equipment (PPE).

	04.02 Follow appropriate safety procedures.
	04.03 Follow applicable environmental laws and regulations.
	04.04 Identify and report unsafe conditions and practices.
	04.05 Explain when a machine or a process should be stopped to investigate an unsafe condition.
	04.06 Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
	04.07 Use and evaluate information resources such as SDS (Safety Data Sheets).
05.0	Demonstrate proficiency in using tools, instruments and testing devices. The student will be able to:
	05.01 Identify and use hand tools properly.
	05.02 Use inspection equipment appropriately.
	05.03 Implement appropriate testing techniques and procedures.
	05.04 Use appropriate measurement tools.
	05.05 Use appropriate safety monitoring and testing equipment.
	05.06 Communicate issues with visual tools.
06.0	Demonstrate basic troubleshooting skills. The student will be able to:
	06.01 Apply critical thinking skills to identify problems.
	06.02 Identify symptoms and changes in a system.
	06.03 Apply root cause analysis techniques to identify problem causes.
	06.04 Evaluate corrective action options.
	06.05 Properly document all corrective actions.
07.0	Demonstrate appropriate communication skills. The student will be able to:
	07.01 Write logical and understandable statements, or phrases, to accurately complete forms commonly used in business and industry.
	07.02 Read and understand graphs, charts, diagrams, and common table formats.
	07.03 Read and follow written instructions.
	07.04 Demonstrate an understanding of; and ability to follow oral instructions.
	07.05 Demonstrate knowledge of technical language and technical acronyms.
	07.06 Explain the benefits of teamwork.
08.0	Demonstrate appropriate math skills. The student will be able to:

	08.01 Solve problems for appropriate scalars.
	08.02 Calculate tolerance(s).
	08.03 Use different unit systems appropriately.
	08.04 Accurately convert between unit systems.
	08.05 Use appropriate notation.
	08.06 Solve simple algebraic equations.
09.0	Understand, operate, troubleshoot, and maintain pneumatic, hydraulic and electromechanical components and/or systems. The student will be able to:
	09.01 Identify, classify, and describe the function of pneumatic, hydraulic, and electrical machines and components.
	09.02 Construct and interpret flow diagrams of pneumatic, hydraulic, and electromechanical systems.
	09.03 Configure, install, operate, and maintain pneumatic, hydraulic, and electromechanical components, devices and/or machines.
	09.04 Troubleshoot errors, faults, and inconsistencies in pneumatic, hydraulic, and electromechanical components, machines and/or systems.
	09.05 Define special applications of electromechanical, hydraulic, and pneumatic machines and devices used in manufacturing and process equipment.
	09.06 Describe limitations of electromechanical, pneumatic, and hydraulic machinery.
	09.07 Use safe practices while operating, troubleshooting, and maintaining industrial equipment.
10.0	Understand, operate and maintain industrial automation systems. The student will be able to:
	10.01 Create and interpret schematic diagrams.
	10.02 Explain, operate, maintain, and program industrial control systems.
	10.03 Integrate control systems and equipment with production and production support mechanisms.
11.0	Troubleshoot industrial automation systems. The student will be able to:
	11.01 Demonstrate troubleshooting techniques to identify root cause, errors and faults of a problem.
	11.02 Use troubleshooting data to make systems improvement.
	11.03 Identify issues requiring additional expertise.
	11.04 Participate in troubleshooting and resolution teams effectively.
	11.05 Troubleshoot problems and perform minor repairs to industrial automation systems.
12.0	Apply the principles of robotics to automated systems. The student will be able to:
	12.01 Identify and describe the essential components and characteristics of a robotic system.

	12.02 Analyze industrial tasks for the selection of robotic equipment.
	12.03 Understand, choose, and implement appropriate sensors and actuators for robotic applications.
	12.04 Program a robotic device for a specific industrial application.
13.0	Create and operate human machine interfaces to control automated systems. The student will be able to:
	13.01 Apply appropriate industrial standards in the development of HMI.
	13.02 Establish communication for data flow between interface and controlled equipment.
	13.03 Perform interface testing and troubleshooting.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **CNC Machinist Operator / Programmer**
Specialization Tract: **Mechanical Design and Fabrication**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615000015
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Mechanical Design and Fabrication specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to maintenance techniques, computer aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Generate and interpret computer-aided drawings.
02.0 Demonstrate proficiency in the set-up and operation of manual and CNC machining centers.
03.0 Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software.

Florida Department of Education
Student Performance Standards

Program Title: **CNC Machinist Operator/Programmer**
CIP Number: **0615000015**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Generate and interpret computer-aided drawings. The student will be able to:
01.01	Apply current industrial computer aided-drawing practices.
01.02	Import and export various file types.
01.03	Create and interpret technical drawings.
02.0	Demonstrate proficiency in the set-up and operation of manual and CNC machining centers. The student will be able to:
02.01	Explain operation and maintenance procedures used for machine tools.
02.02	Identify cutting tool geometry and cutting tool materials used in CNC machining.
02.03	Demonstrate efficient toolpath processes used in 2D and 3D High Speed CNC machining operations.
02.04	Identify and perform CNC Code 4 used in toolpath operations.
02.05	Identify and implement appropriate CAM toolpath operations used in CNC machining.
02.06	Identify metal alloys and their properties in machining.
02.07	Demonstrate job planning procedures in machining.
02.08	Demonstrate and apply acceptable procedures in CNC job planning, tooling, selection, and programming.
03.0	Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software. The student will be able to:
03.01	Create geometry for post-processing used in CAD/CAM software.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Electronics Technician**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615030309
Program Type	College Credit Certificate (CCC)
Program Length	31 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to DC circuits, AC circuits, solid-state devices, analog circuits, and digital circuits. Integrated into this content will be communications skills, leadership skills, human relations skills, employability skills, safe and efficient work practices, use of circuit diagrams and schematics, soldering, laboratory practices and technical recording and reporting. This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Electronics Engineering industry, planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in direct current (DC) circuits.
03.0 Demonstrate proficiency in alternating current (AC) circuits.
04.0 Demonstrate proficiency in solid-state devices.
05.0 Demonstrate proficiency in analog and linear integrated circuits.
06.0 Demonstrate proficiency in digital circuits.
07.0 Demonstrate proficiency in technical recording and reporting.
08.0 Demonstrate proficiency in advanced direct current (DC) circuit network analysis.
09.0 Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis.
10.0 Demonstrate proficiency in design and analysis of discrete solid-state circuits.

Florida Department of Education
Student Performance Standards

Program Title: **Electronics Technician**
CIP Number: **0615030309**
Program Length: **31 credit hours**

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in laboratory practices. The student will be able to:
01.01	Apply Occupational Safety Health Administration (OSHA) safety standards in an electronics laboratory environment when required.
01.02	Analyze drawings and electronic schematics to make proper electrical and component connections and to also identify obvious faulty connections.
01.03	Identify and use electrical/electronic hand and power tools (wire stripper, wire needle-nose clipper, solder and desolder station, etc.).
01.04	Explain the theoretical and practical concepts of soldering including soldering paste and conductive glue.
01.05	Identify non-functional solder connections.
01.06	Practice acceptable soldering, de-soldering, rework, and repair techniques.
01.07	Practice electrostatic discharge (ESD) safety procedures.
01.08	Describe the construction of printed circuit boards (PCBs).
01.09	Use circuit simulation programs to solve problems, verify circuit functionality and design circuits.
01.10	Demonstrate the use of instrumentation and module analytical software.
01.11	Read and interpret data sheet specifications for electronic components.
01.12	Identify basic limitations of multi-meters, oscilloscopes, function generators, and power supplies.
01.13	Use digital multi-meters (DMM), oscilloscopes, function generators, and power supplies to build, analyze and trouble shoot electrical/electronic circuits.
02.0	Demonstrate proficiency in direct current (DC) circuits. The student will be able to:
02.01	Describe the physical laws that govern electricity and magnetism.
02.02	Identify sources of electricity.
02.03	Define voltage, current, resistance, power and energy.
02.04	Apply Ohm's law and power formulas to electrical/electronic circuits.
02.05	Read and interpret color codes and symbols to identify electrical components and values.

02.06	Measure properties of a circuit and electronic components using Digital Multimeters (DMM), LCR meters and oscilloscopes.
02.07	Calculate and measure the conductance and resistance of conductors and insulators.
02.08	Solve problems in electronics utilizing metric prefixes.
02.09	Apply Ohm's law and Kirchoff's voltage and current laws to solve series, parallel, and series-parallel circuits.
02.10	Construct and verify operation of series, parallel, and series-parallel circuits.
02.11	Analyze and troubleshoot series, parallel, and series-parallel circuits.
02.12	Apply Ohm's law and Kirchoff's voltage and current laws to bridge circuits.
02.13	Construct and verify the operation of bridge circuits.
02.14	Analyze and troubleshoot bridge circuits.
02.15	Identify and define voltage divider circuits (loaded and unloaded).
02.16	Construct and verify the operation of voltage divider circuits (loaded and unloaded).
02.17	Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
02.18	Apply maximum power transfer theory to determine the conditions under which maximum power transfer occurs in a circuit.
02.19	Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
02.20	Describe magnetic properties of circuits and devices.
02.21	Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
02.22	Setup and operate power supplies for DC circuits.
03.0	Demonstrate proficiency in alternating current (AC) circuit. The student will be able to:
03.01	Use Trigonometry to solve AC circuits.
03.02	Identify properties of an AC signal.
03.03	Identify AC sources.
03.04	Analyze and measure AC signals utilizing DMM's, oscilloscope, frequency counter and function generator.
03.05	Define the characteristics of AC capacitive and inductive circuits.
03.06	Construct and verify the operation of AC capacitive and inductive circuits.
03.07	Analyze and troubleshoot AC capacitive and inductive circuits.
03.08	Define and apply the principles of transformers to AC circuits.
03.09	Construct and verify the operation of AC circuits utilizing transformers.

03.10	Analyze and troubleshoot AC circuits utilizing transformers.
03.11	Construct and verify the operation of passive differentiators and integrators to determine R-C and R-L time constants.
03.12	Compute the impedance of passive RC, RL, and RLC circuits.
03.13	Analyze and troubleshoot passive differentiator and integrator circuits.
03.14	Define the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel and complex).
03.15	Construct and verify the operation of R-C, R-L and RLC circuits (series, parallel and complex).
03.16	Define the characteristics of series and parallel resonant circuits.
03.17	Construct and verify the operation of series and parallel resonant circuits.
03.18	Analyze and troubleshoot R-C, R-L and RLC circuits.
03.19	Define the characteristics of frequency selective filter circuits.
03.20	Construct and verify the operation of frequency selective filter circuits.
03.21	Analyze and troubleshoot frequency selective filter circuits.
03.22	Define the characteristics of three-phase circuits.
03.23	Define basic motor theory and operation.
03.24	Define basic generator theory and operation.
03.25	Setup and operate power supplies for AC circuits.
03.26	Analyze and measure power in AC circuits.
03.27	Define power factor and power factor correction in AC circuits.
04.0	Demonstrate proficiency in solid-state device. The student will be able to:
04.01	Identify and define properties of semiconductor materials.
04.02	Identify and define operating characteristics and applications of junction diodes.
04.03	Identify and define operating characteristics and applications of special diodes, such as varactor diodes, LED, Zener diodes, etc.
04.04	Construct diode circuits.
04.05	Analyze and troubleshoot diode circuits.
04.06	Identify and define operating characteristics and applications of bipolar junction transistors (BJT).
04.07	Identify and define operating characteristics and applications of Metal Oxide Semiconductor Field Effect Transistors (MOSFETs).
04.08	Identify and define operating characteristics and applications of single-stage amplifiers.

04.09	Construct single-stage amplifiers.
04.10	Analyze and troubleshoot single-stage amplifiers.
04.11	Identify and define operating characteristics and applications of thyristor circuits.
04.12	Construct thyristor circuitry.
04.13	Analyze and troubleshoot thyristor circuitry.
04.14	Demonstrate proficiency in the use of curve tracers and/or transistor testers.
05.0	Demonstrate proficiency in analog and linear integrated circuits. The student will be able to:
05.01	Identify and define operating characteristics and applications of unregulated, linear, or switch-mode power supplies and basic passive filters.
05.02	Construct, analyze, and troubleshoot unregulated power supplies and basic passive filters.
05.03	Identify and define operating characteristics and applications of differential amplifiers including operational amplifiers.
05.04	Construct, analyze, and troubleshoot differential and operational amplifier circuits.
05.05	Identify and analyze different amplifier classes and their applications.
05.06	Construct, analyze, and troubleshoot different amplifier classes.
05.07	Identify and define characteristics of power amplifiers including audio power amplifiers.
05.08	Solve problems in heat sinking and power limitations for audio frequency power amplifiers.
05.09	Construct, analyze and troubleshoot power amplifier circuits including audio power amplifiers.
05.10	Identify and define operating characteristics of power supply regulator circuits.
05.11	Construct, analyze and troubleshoot power supply regulator circuits.
05.12	Identify and define operating characteristics of linear integrated circuits especially operational amplifiers, including time and frequency responses.
05.13	Construct, analyze and troubleshoot operational amplifier circuits including active filters, sinusoidal and non-sinusoidal oscillators, negative and positive feedback circuits, phase shift circuits, phase-locked loop circuits, integrator, and differentiator circuits.
05.14	Select the integrated circuit (IC) appropriate to the defined parameters of a circuit.
05.15	Identify and define operating characteristics and applications of optoelectronic devices i.e. opto-isolators, IR receivers, etc.
05.16	Construct, analyze and troubleshoot optoelectronic circuits.
05.17	Describe fundamental concepts of modulation and demodulation.
05.18	Identify, define, construct, analyze and troubleshoot operating characteristics and applications of linear /non-linear integrated circuits/amplifier circuits.
06.0	Demonstrate proficiency in digital circuits. The student will be able to:

06.01	Define and apply numbering systems to codes and arithmetic operations.
06.02	Analyze and minimize logic circuits using Boolean and Karnaugh Map (K-Map) operations.
06.03	Demonstrate proficiency in the use of logic probes for digital circuits.
06.04	Describe the various logic families and their electrical characteristics, i.e., transistor-transistor logic (TTL), Complimentary Metal-Oxide Semiconductor (CMOS), etc.
06.05	Use pulsers/pulse generators/clock signals to drive the inputs of digital circuits.
06.06	Use oscilloscopes and function generators to analyze and troubleshoot digital circuits.
06.07	Use logic analyzers to analyze and troubleshoot digital circuits.
06.08	Determine the fan-out of digital circuits based on IC limitations.
06.09	List the various types of logic gates and their truth tables.
06.10	Construct combinational logic circuits using integrated circuits.
06.11	Troubleshoot combinational and sequential logic circuits.
06.12	Identify and analyze types of flip-flops and their truth tables.
06.13	Construct flip-flops using integrated circuits.
06.14	Troubleshoot flip-flop circuits.
06.15	Identify types of registers and counters.
06.16	Construct registers and counters using flip-flops and logic gates.
06.17	Troubleshoot registers and counters.
06.18	Analyze, construct, and troubleshoot clock and timing circuits.
06.19	Identify, construct, and troubleshoot adder/subtractor logic circuits.
06.20	Identify, construct, and troubleshoot encoders and decoders.
06.21	Identify, construct, and troubleshoot multiplexer and demultiplexer circuits.
06.22	Identify types of memory circuits.
06.23	Describe and examine the uses of digital-to-analog and analog-to-digital conversions.
06.24	Construct and troubleshoot digital-to-analog and analog-to-digital circuits.
06.25	Identify, construct, and troubleshoot digital display circuits.
06.26	Program Programmable Logic Devices (PLD).
07.0	Demonstrate proficiency in technical recording and reporting. The student will be able to:

	07.01 Use computer application programs (e.g., word processor, database, spreadsheet) to create reports and record and analyze data.
	07.02 Use schematic capture and simulation programs to create figures and gather data for technical reporting.
	07.03 Write reports and make oral presentations.
	07.04 Maintain a lab notebook documenting procedures, activities, observations, calculations, and results of conducted experiments.
08.0	Demonstrate proficiency in advanced direct current (DC) circuit network analysis. The student will be able to:
	08.01 Analyze multi source circuits using superposition theorem.
	08.02 Analyze circuits using Thevenin's theorem.
	08.03 Analyze circuits using Norton's theorem.
	08.04 Use or understand branch current, Nodal, source transformation and/or mesh current methods to analyze DC circuits.
	08.05 Analyze circuits using maximum power transfer theorem.
09.0	Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis. The student will be able to:
	09.01 Explain the principles of electromagnetism.
	09.02 Apply Faraday's law of induced voltages to simple solenoids.
	09.03 Solve for mutual inductance in a coupled circuit.
	09.04 Use or understand branch current, nodal, source transformation and/or mesh current methods to analyze AC circuits.
	09.05 Identify the effects of transient spikes in RC, RL, and RLC circuits.
	09.06 Identify the effects of loading on transformers.
	09.07 Analyze multi source circuits using superposition theorem.
	09.08 Analyze circuits using Thevenin's theorem.
	09.09 Analyze circuits using Norton's theorem.
	09.10 Analyze circuits using maximum power transfer theorem.
	09.11 Design and Simulate AC Circuits using engineering software.
10.0	Demonstrate proficiency in design and analysis of discrete solid-state circuits. The student will be able to:
	10.01 Construct, analyze, and troubleshoot regulator circuits using zener diodes.
	10.02 Construct, analyze, and troubleshoot bipolar junction transistor biased circuits.
	10.03 Construct, analyze, and troubleshoot field effect transistor biased circuits.
	10.04 Construct, analyze small signal amplifier circuits using bipolar junction or field effect transistors.

10.05	Identify, define, construct, analyze, and troubleshoot multistage amplifiers.
10.06	Identify, define, construct, analyze, and troubleshoot power amplifiers.
10.07	Analyze low and high frequency amplifier responses.
10.08	Discuss troubleshooting techniques applied to discrete solid-state circuits.
10.09	Discuss performance and applications for discrete solid-state circuits.
10.10	Analyze discrete solid-state circuits using computer programs.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Basic Electronics Technician**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615030310
Program Type	College Credit Certificate (CCC)
Program Length	14 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to DC circuits, AC circuits, and digital circuits. Integrated into this content will be communications skills, leadership skills, human relations skills, employability skills, safe and efficient work practices, use of circuit diagrams and schematics, soldering, laboratory practices and technical recording and reporting.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in direct current (DC) circuits.
03.0 Demonstrate proficiency in advanced direct current (DC) circuit network analysis.
04.0 Demonstrate proficiency in alternating current (AC) circuits.
05.0 Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis.
06.0 Demonstrate proficiency in digital circuits.
07.0 Demonstrate proficiency in technical recording and reporting.

Florida Department of Education
Student Performance Standards

Program Title: **Basic Electronics Technician**
CIP Number: **0615030310**
Program Length: **14 credit hours**

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in laboratory practices. The student will be able to:
01.01	Apply Occupational Safety Health Administration (OSHA) safety standards in an electronics laboratory environment when required.
01.02	Analyze drawings and electronic schematics to make proper electrical and component connections and to also identify obvious faulty connections.
01.03	Identify and use electrical/electronic hand and power tools (wire stripper, wire needle-nose clipper, solder and desolder station, etc.).
01.04	Explain the theoretical and practical concepts of soldering including soldering paste and conductive glue.
01.05	Identify non-functional solder connections.
01.06	Practice acceptable soldering, de-soldering, rework, and repair techniques.
01.07	Practice electrostatic discharge (ESD) safety procedures.
01.08	Describe the construction of printed circuit boards (PCBs).
01.09	Use circuit simulation programs to solve problems, verify circuit functionality and design circuits.
01.10	Demonstrate the use of instrumentation and module analytical software.
01.11	Read and interpret data sheet specifications for electronic components.
01.12	Identify basic limitations of multimeters, oscilloscopes, function generators, and power supplies.
01.13	Use digital multi-meters (DMM), oscilloscopes, function generators, and power supplies to build, analyze and trouble shoot electrical/electronic circuits.
02.0	Demonstrate proficiency in direct current (DC) circuits. The student will be able to:
02.01	Describe the physical laws that govern electricity and magnetism.
02.02	Identify sources of electricity.
02.03	Define voltage, current, resistance, power and energy.
02.04	Apply Ohm's law and power formulas to electrical/electronic circuits.
02.05	Read and interpret color codes and symbols to identify electrical components and values.

	02.06 Measure properties of a circuit and electronic components using Digital Multimeters (DMM), LCR meters and oscilloscopes
	02.07 Calculate and measure the conductance and resistance of conductors and insulators.
	02.08 Solve problems in electronics utilizing metric prefixes.
	02.09 Apply Ohm's law and Kirchoff's voltage and current laws to solve series, parallel, and series-parallel circuits.
	02.10 Construct and verify operation of series, parallel, and series-parallel circuits.
	02.11 Analyze and troubleshoot series, parallel, and series-parallel circuits.
	02.12 Apply Ohm's law and Kirchoff's voltage and current laws to bridge circuits.
	02.13 Construct and verify the operation of bridge circuits.
	02.14 Analyze and troubleshoot bridge circuits.
	02.15 Identify and define voltage divider circuits (loaded and unloaded).
	02.16 Construct and verify the operation of voltage divider circuits (loaded and unloaded).
	02.17 Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
	02.18 Apply maximum power transfer theory to determine the conditions under which maximum power transfer occurs in a circuit.
	02.19 Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
	02.20 Describe magnetic properties of circuits and devices.
	02.21 Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
	02.22 Setup and operate power supplies for DC circuits.
03.0	Demonstrate proficiency in advanced direct current (DC) circuit network analysis. The student will be able to:
	03.01 Analyze multi source circuits using superposition theorem.
	03.02 Analyze circuits using Thevenin's theorem.
	03.03 Analyze circuits using Norton's theorem.
	03.04 Use or understand branch current, Nodal, source transformation and/or mesh current methods to analyze DC circuits.
	03.05 Analyze circuits using maximum power transfer theorem.
04.0	Demonstrate proficiency in alternating current (AC) circuits. The student will be able to:
	04.01 Use Trigonometry to solve AC circuits.
	04.02 Identify properties of an AC signal.
	04.03 Identify AC sources.

04.04	Analyze and measure AC signals utilizing DMM's, oscilloscope, frequency counter and function generator.
04.05	Define the characteristics of AC capacitive and inductive circuits.
04.06	Construct and verify the operation of AC capacitive and inductive circuits.
04.07	Analyze and troubleshoot AC capacitive and inductive circuits.
04.08	Define and apply the principles of transformers to AC circuits.
04.09	Construct and verify the operation of AC circuits utilizing transformers.
04.10	Analyze and troubleshoot AC circuits utilizing transformers.
04.11	Construct and verify the operation of passive differentiators and integrators to determine R-C and R-L time constants.
04.12	Compute the impedance of passive RC, RL, and RLC circuits.
04.13	Analyze and troubleshoot passive differentiator and integrator circuits.
04.14	Define the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel and complex).
04.15	Construct and verify the operation of RLC circuits (series, parallel and complex).
04.16	Define the characteristics of series and parallel resonant circuits.
04.17	Construct and verify the operation of series and parallel resonant circuits.
04.18	Analyze and troubleshoot R-C, R-L and RLC circuits.
04.19	Define the characteristics of frequency selective filter circuits.
04.20	Construct and verify the operation of frequency selective filter circuits.
04.21	Analyze and troubleshoot frequency selective filter circuits.
04.22	Define the characteristics of three-phase circuits.
04.23	Define basic motor theory and operation.
04.24	Define basic generator theory and operation.
04.25	Setup and operate power supplies for AC circuits.
04.26	Analyze and measure power in AC circuits.
04.27	Define power factor and power factor correction in AC circuits.
05.0	Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis. The student will be able to:
05.01	Explain the principles of electromagnetism.
05.02	Apply Faraday's law of induced voltages to simple solenoids.

05.03	Solve for mutual inductance in a coupled circuit.
05.04	Use or understand branch current, nodal, source transformation and/or mesh current methods to analyze AC circuits.
05.05	Identify the effects of transient spikes in RC, RL, and RLC circuits.
05.06	Identify the effects of loading on transformers.
05.07	Analyze multi source circuits using superposition theorem.
05.08	Analyze circuits using Thevenin's theorem.
05.09	Analyze circuits using Norton's theorem.
05.10	Analyze circuits using maximum power transfer theorem.
05.11	Design and Simulate AC Circuits using engineering software.
06.0	Demonstrate proficiency in digital circuits. The student will be able to:
06.01	Define and apply numbering systems to codes and arithmetic operations.
06.02	Analyze and minimize logic circuits using Boolean and Karnaugh Map (K-Map) operations.
06.03	Demonstrate proficiency in the use of logic probes for digital circuits.
06.04	Describe the various logic families and their electrical characteristics, i.e., transistor-transistor logic (TTL), Complimentary Metal-Oxide Semiconductor (CMOS), etc.
06.05	Use pulsers/pulse generators/clock signals to drive the inputs of digital circuits.
06.06	Use oscilloscopes and function generators to analyze and troubleshoot digital circuits.
06.07	Use logic analyzers to analyze and troubleshoot digital circuits.
06.08	Determine the fan-out of digital circuits based on IC limitations.
06.09	List the various types of logic gates and their truth tables.
06.10	Construct combinational logic circuits using integrated circuits.
06.11	Troubleshoot combinational and sequential logic circuits.
06.12	Identify and analyze types of flip-flops and their truth tables.
06.13	Construct flip-flops using integrated circuits.
06.14	Troubleshoot flip-flop circuits.
06.15	Identify types of registers and counters.
06.16	Construct registers and counters using flip-flops and logic gates.
06.17	Troubleshoot registers and counters.

06.18	Analyze, construct, and troubleshoot clock and timing circuits.
06.19	Identify, construct, and troubleshoot adder/subtractor logic circuits.
06.20	Identify, construct, and troubleshoot encoders and decoders.
06.21	Identify, construct, and troubleshoot multiplexer and demultiplexer circuits.
06.22	Identify types of memory circuits.
06.23	Describe and examine the uses of digital-to-analog and analog-to-digital conversions.
06.24	Construct and troubleshoot digital-to-analog and analog-to-digital circuits.
06.25	Identify, construct, and troubleshoot digital display circuits.
06.26	Program Programmable Logic Devices (PLD).
07.0	Demonstrate proficiency in technical recording and reporting. The student will be able to:
07.01	Use computer application programs (e.g., word processor, database, spreadsheet) to create reports and record and analyze data.
07.02	Use schematic capture and simulation programs to create figures and gather data for technical reporting.
07.03	Write reports and make oral presentations.
07.04	Maintain a lab notebook documenting procedures, activities, observations, calculations, and results of conducted experiments.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Electronics Aide**
Specialization Tract: **Electronics**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615030313
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Electronics specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to maintenance techniques, computer aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in basic direct current (DC) circuits.
02.0 Demonstrate proficiency in alternating current (AC) circuits.
03.0 Demonstrate proficiency in solid state devices.
04.0 Demonstrate proficiency in digital circuits.

Florida Department of Education
Student Performance Standards

Program Title: **Electronics Aide**
CIP Number: **0615030313**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in basic direct current (DC) circuits. The student will be able to:
01.01	Define the characteristics of basic DC circuits.
01.02	Solve problems in electronic units utilizing metric prefixes.
01.03	Identify sources of electricity.
01.04	Define and describe voltage, current, resistance, power and energy.
01.05	Apply Ohm's law and power formulas.
01.06	Read and interpret codes and symbols to identify electrical components and values.
01.07	Measure properties of circuits using a digital multi-meter meter (DMM) and oscilloscopes.
01.08	Set up and operate power supplies for DC circuits.
01.09	Compute conductance and measure resistance of conductors and insulators.
01.10	Apply Ohm's law to series circuits.
01.11	Construct and verify the operation of series circuits.
01.12	Analyze and troubleshoot series circuits.
01.13	Apply Ohm's law to parallel circuits.
01.14	Construct and verify the operation of parallel circuits.
01.15	Analyze and troubleshoot parallel circuits.
01.16	Measure values of resistors, capacitors, and inductors to include 4 wire measurement techniques.
01.17	Analyze and troubleshoot circuits containing capacitors and inductors.
01.18	Apply various network theorems to DC circuits.
01.19	Select substitute components in troubleshooting.
02.0	Demonstrate proficiency in alternating current (AC) circuits. The student will be able to:

02.01	Solve basic trigonometric problems as applicable to AC circuits.
02.02	Define the characteristics of AC capacitive circuits.
02.03	Construct and troubleshoot AC inductive and capacitive circuits.
02.04	Define and apply the principles of transformers to AC circuits.
02.05	Analyze and troubleshoot AC circuits utilizing transformers.
02.06	Construct and verify the operation of differentiators and integrators to determine R-C and R-L time constraints.
02.07	Analyze and troubleshoot differentiator and integrator circuits.
02.08	Define the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel and complex).
02.09	Define the characteristics of series and parallel resonant circuits.
02.10	Define the characteristics of frequency selective filter circuits.
02.11	Define the characteristics of polyphase circuits.
02.12	Define basic motor and generator theory and operation.
02.13	Define basic generator theory and operation.
02.14	Set up and operate power supplies for AC circuits.
02.15	Apply lumped analysis to circuits and components.
02.16	Apply various network theorems to AC circuits.
02.17	Select substitute components in troubleshooting.
03.0	Demonstrate proficiency in solid state devices. The student will be able to:
03.01	Identify and define properties of semiconductor materials.
03.02	Identify and define operating characteristics and applications of junction diodes.
03.03	Identify and define operating characteristics and applications of special purpose diodes.
03.04	Construct and verify the operation of single and multi-stage devices.
03.05	Identify and define operating characteristics and applications of bipolar transistors.
03.06	Identify and define operating characteristics and applications of field effect transistors.
03.07	Identify and define operating characteristics and applications of single-stage amplifiers.
03.08	Construct and verify the operation of single-stage amplifiers.
03.09	Construct and verify thyristor circuitry.

03.10	Analyze and troubleshoot thyristor circuitry.
03.11	Set up and operate appropriate bench equipment for solid-state devices.
03.12	Set up and operate power supplies for solid-state devices.
03.13	Examine appropriate solid state circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.
03.14	Identify and operate temperature measurement devices, including thermocouples and resistance temperature devices (RTDs).
04.0	Demonstrate proficiency in digital circuits. The student will be able to:
04.01	Define and apply numbering systems to codes and arithmetic operations.
04.02	Analyze and minimize logic circuits using Boolean operations.
04.03	Set up and operate logic probes for digital circuits.
04.04	Set up and operate power supplies for digital circuits.
04.05	Identify types of logic gates and their truth tables.
04.06	Construct combinational logic circuits using integrated circuits.
04.07	Troubleshoot logic circuits.
04.08	Analyze types of flip-flops and their truth tables.
04.09	Identify, define and measure characteristics of integrated circuit (IC) logic families.
04.10	Identify types of registers and counters.
04.11	Analyze clock and timing circuits.
04.12	Construct clock and timing circuits.
04.13	Identify types of arithmetic-logic circuits.
04.14	Identify types of encoding and decoding devices.
04.15	Construct encoders and decoders.
04.16	Identify types of multiplexer and demultiplexer circuits.
04.17	Identify types of memory circuits.
04.18	Identify types of digital displays.
04.19	Apply appropriate digital circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Laser and Photonics Technician**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615030411
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communications skills, leadership skills, human relations skills, employability skills, safe and efficient work practices, use of circuit diagrams and schematics, soldering, laboratory practices and technical recording and reporting.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in direct current (DC) circuits.
03.0 Demonstrate proficiency in alternating current (AC) circuits.
04.0 Demonstrate proficiency in advanced direct current (DC) circuit network analysis.
05.0 Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis.
06.0 Demonstrate proficiency in photonics, optics, and lasers.
07.0 Demonstrate proficiency in electro-optical devices.
08.0 Demonstrate proficiency in technical recording and reporting.

Florida Department of Education
Student Performance Standards

Program Title: **Laser and Photonics Technician**
CIP Number: **0615030411**
Program Length: **12 credit hours**

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in laboratory practices. The student will be able to:
01.01	Apply Occupational Safety Health Administration (OSHA) safety standards in an electronics laboratory environment when required.
01.02	Analyze drawings and electronic schematics to make proper electrical and component connections and to also identify obvious faulty connections.
01.03	Identify and use electrical/electronic hand and power tools (wire stripper, wire needle-nose clipper, solder and desolder station, etc.).
01.04	Explain the theoretical and practical concepts of soldering including soldering paste and conductive glue.
01.05	Identify non-functional solder connections.
01.06	Practice acceptable soldering, de-soldering, rework, and repair techniques.
01.07	Practice electrostatic discharge (ESD) safety procedures.
01.08	Describe the construction of printed circuit boards (PCBs).
01.09	Use circuit simulation programs to solve problems, verify circuit functionality and design circuits.
01.10	Demonstrate the use of instrumentation and module analytical software.
01.11	Read and interpret data sheet specifications for electronic components.
01.12	Identify basic limitations of multi-meters, oscilloscopes, function generators, and power supplies.
01.13	Use digital multi-meters (DMM), oscilloscopes, function generators, and power supplies to build, analyze and trouble shoot electrical/electronic circuits.
02.0	Demonstrate proficiency in direct current (DC) circuits. The student will be able to:
02.01	Describe the physical laws that govern electricity and magnetism.
02.02	Identify sources of electricity.
02.03	Define voltage, current, resistance, power and energy.
02.04	Apply Ohm's law and power formulas to electrical/electronic circuits.
02.05	Read and interpret color codes and symbols to identify electrical components and values.

02.06	Measure properties of a circuit and electronic components using Digital Multimeters (DMM), LCR meters and oscilloscopes.
02.07	Calculate and measure the conductance and resistance of conductors and insulators.
02.08	Solve problems in electronics utilizing metric prefixes.
02.09	Apply Ohm's law and Kirchoff's voltage and current laws to solve series, parallel, and series-parallel circuits.
02.10	Construct and verify operation of series, parallel, and series-parallel circuits.
02.11	Analyze and troubleshoot series, parallel, and series-parallel circuits.
02.12	Apply Ohm's law and Kirchoff's voltage and current laws to bridge circuits.
02.13	Construct and verify the operation of bridge circuits.
02.14	Analyze and troubleshoot bridge circuits.
02.15	Identify and define voltage divider circuits (loaded and unloaded).
02.16	Construct and verify the operation of voltage divider circuits (loaded and unloaded).
02.17	Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
02.18	Apply maximum power transfer theory to determine the conditions under which maximum power transfer occurs in a circuit.
02.19	Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
02.20	Describe magnetic properties of circuits and devices.
02.21	Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
02.22	Setup and operate power supplies for DC circuits.
03.0	Demonstrate proficiency in alternating current (AC) circuits. The student will be able to:
03.01	Use Trigonometry to solve AC circuits.
03.02	Identify properties of an AC signal.
03.03	Identify AC sources.
03.04	Analyze and measure AC signals utilizing DMM's, oscilloscope, frequency counter and function generator.
03.05	Define the characteristics of AC capacitive and inductive circuits.
03.06	Construct and verify the operation of AC capacitive and inductive circuits.
03.07	Analyze and troubleshoot AC capacitive and inductive circuits.
03.08	Define and apply the principles of transformers to AC circuits.
03.09	Construct and verify the operation of AC circuits utilizing transformers.

	03.10 Analyze and troubleshoot AC circuits utilizing transformers.
	03.11 Construct and verify the operation of passive differentiators and integrators to determine R-C and R-L time constants.
	03.12 Compute the impedance of passive RC, RL, and RLC circuits.
	03.13 Analyze and troubleshoot passive differentiator and integrator circuits.
	03.14 Define the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel and complex).
	03.15 Construct and verify the operation of RLC circuits (series, parallel and complex).
	03.16 Define the characteristics of series and parallel resonant circuits.
	03.17 Construct and verify the operation of series and parallel resonant circuits.
	03.18 Analyze and troubleshoot R-C, R-L and RLC circuits.
	03.19 Define the characteristics of frequency selective filter circuits.
	03.20 Construct and verify the operation of frequency selective filter circuits.
	03.21 Analyze and troubleshoot frequency selective filter circuits.
	03.22 Define the characteristics of three-phase circuits.
	03.23 Define basic motor theory and operation.
	03.24 Define basic generator theory and operation.
	03.25 Setup and operate power supplies for AC circuits.
	03.26 Analyze and measure power in AC circuits.
	03.27 Define power factor and power factor correction in AC circuits.
04.0	Demonstrate proficiency in advanced direct current (DC) circuit network analysis. The student will be able to:
	04.01 Analyze multi source circuits using superposition theorem.
	04.02 Analyze circuits using Thevenin's theorem.
	04.03 Analyze circuits using Norton's theorem.
	04.04 Use or understand branch current, Nodal, source transformation and/or mesh current methods to analyze DC circuits.
	04.05 Analyze circuits using maximum power transfer theorem.
05.0	Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis. The student will be able to:
	05.01 Explain the principles of electromagnetism.
	05.02 Apply Faraday's law of induced voltages to simple solenoids.

	05.03 Solve for mutual inductance in a coupled circuit.
	05.04 Use or understand branch current, nodal, source transformation and/or mesh current methods to analyze AC circuits.
	05.05 Identify the effects of transient spikes in RC, RL, and RLC circuits.
	05.06 Identify the effects of loading on transformers.
	05.07 Analyze multi source circuits using superposition theorem.
	05.08 Analyze circuits using Thevenin's theorem.
	05.09 Analyze circuits using Norton's theorem.
	05.10 Analyze circuits using maximum power transfer theorem.
	05.11 Design and Simulate AC Circuits using engineering software.
06.0	Demonstrate proficiency in photonics, optics, and lasers. The student will be able to:
	06.01 Describe the nature and properties of light.
	06.02 Demonstrate the proper handling of optical components and positioning equipment.
	06.03 Describe the different light sources used in the photonics industry.
	06.04 Demonstrate understanding of laser safety for both beam and non-beam hazards.
	06.05 Setup and operate basic optical systems.
	06.06 Demonstrate understanding of geometrical and physical optics.
	06.07 Demonstrate understanding of the principles of lasers.
	06.08 List and describe the operational characteristics of lasers.
	06.09 Categorize and explain the operation of lasers.
	06.10 Explain the construction, operation, and applications of optical detectors.
	06.11 Explain the principles of human vision and related laser safety issues.
	06.12 List and explain the characteristics of photonic devices used for imaging, display and storage.
	06.13 Explain a fiber optic datalink.
	06.14 Demonstrate understanding of attenuation in fiber optics links (including the loss of all fiber, splices and connectors).
	06.15 Demonstrate how to terminate single and multi-mode connectors.
	06.16 Perform fusion splicing of fiber.
	06.17 Conduct optical power source measurements.

	06.18 Conduct and interpret OTDR measurements.
	06.19 Properly arrange fibers in splice cassettes.
07.0	Demonstrate proficiency in electro-optical devices. The student will be able to:
	07.01 Demonstrate proficiency in fundamentals of light.
	07.02 Demonstrate proficiency in reflection, refraction, and mirrors.
	07.03 Demonstrate proficiency in measurement of maximum power and pulse energy.
	07.04 Define radiation sources, their types, properties, and applications.
	07.05 Demonstrate proficiency in measurement of detector rise time.
	07.06 Demonstrate proficiency in prisms, optical filters, resonator, and beam splitters.
	07.07 Demonstrate proficiency in characteristics of a helium-neon laser.
	07.08 Demonstrate proficiency in the use of photo detectors, and LEDs.
	07.09 Demonstrate proficiency in bandwidth in optical power measurements.
	07.10 Demonstrate proficiency in different applications of solid-state lasers.
	07.11 Demonstrate proficiency in explaining and describing different types of gases used as active media or lasers.
	07.12 Demonstrate proficiency in calculating the power, irradiance and area of a laser beam.
	07.13 Demonstrate proficiency in energy-transfer processes that increase the lower lasing level in gas lasers and solid-state lasers.
	07.14 Explain the processes that account for all the light energy striking a surface.
	07.15 Demonstrate proficiency in safety precautions when operating a laser.
	07.16 Demonstrate proficiency in four elements of a laser.
08.0	Demonstrate proficiency in technical recording and reporting. The student will be able to:
	08.01 Use computer application programs (e.g., word processor, database, spreadsheet) to create reports and record and analyze data.
	08.02 Use schematic capture and simulation programs to create figures and gather data for technical reporting.
	08.03 Write reports and make oral presentations.
	08.04 Maintain a lab notebook documenting procedures, activities, observations, calculations, and results of conducted experiments.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Medical Equipment Repair**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615040107
Program Type	College Credit Certificate (CCC)
Program Length	23 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Biomedical Equipment Technician AS degree program (1615040102).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to designing, manufacturing, evaluating, troubleshooting, repairing, and testing various types of biomedical equipment. Additionally, students will learn to function in a hospital or industry environment through an internship at a local biomedical department. During the internship, students will be assigned routine duties as biomedical equipment technicians.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply written and verbal skills.
02.0 Apply mathematical skills.
03.0 Apply basic software skills related to biomedical engineering technology.
04.0 Understand basic pneumatics, hydraulics, and mechanical principles.
05.0 Understand basic biomedical principles.
06.0 Understand basic electronics/computer principles.

Florida Department of Education
Student Performance Standards

Program Title: **Medical Equipment Repair**
CIP Number: **0615040107**
Program Length: **23 credit hours**

This certificate program is part of the Biomedical Equipment Technician AS degree program (1615040102). At the completion of this program, the student will be able to:	
01.0	Apply written and verbal skills. The student will be able to:
01.01	Apply written composition principles.
01.02	Demonstrate verbal presentation approaches.
01.03	Demonstrate proficiency in verbal and written communication.
01.04	Demonstrate reasoning and creative thinking ability.
01.05	Apply word processing skills for technical report writing.
01.06	Work effectively in a team environment.
02.0	Apply mathematical skills. The student will be able to:
02.01	Understand mathematical functions, algebra, and complex numbers.
02.02	Demonstrate proficiency in solving basic algebraic expressions and systems of equations.
02.03	Analyze technical applications with computer and calculator-based tools.
03.0	Apply basic software skills related to biomedical engineering technology. The student will be able to:
03.01	Understand word processing software functions.
03.02	Understand database software functions.
03.03	Understand spreadsheet software functions.
03.04	Understand Internet browser functions.
03.05	Demonstrate proficiency in using word processors for written reports and communication.
03.06	Demonstrate proficiency in utilizing Internet resources.
04.0	Understand basic pneumatics, fluidic, and mechanical principles. The student will be able to:
04.01	Use biomedical instrumentation.
04.02	Demonstrate proficiency in troubleshooting basic mechanical, fluidic, and pneumatic systems.

05.0	Understand basic biomedical principles. The student will be able to:
05.01	Understand basic medical terminology.
05.02	Understand principles of selected biomedical instrumentation.
05.03	Identify biomedical sensors and transducers.
05.04	Identify selected biomedical instruments.
05.05	Use biomedical instrumentation.
05.06	Demonstrate proficiency in analyzing selected biomedical instrumentation.
05.07	Demonstrate proficiency in testing selected biomedical instrumentation.
05.08	Demonstrate proficiency in calibrating selected biomedical instrumentation.
05.09	Demonstrate proficiency in troubleshooting and repairing selected biomedical instrumentation.
05.10	Demonstrate proficiency in maintenance of selected biomedical instrumentation.
06.0	Understand basic electronics/computer principles. The student will be able to:
06.01	Understand and apply basic electrical signals.
06.02	Understand computer interface concepts.
06.03	Demonstrate proficiency in reading electrical diagrams.
06.04	Demonstrate proficiency in analyzing, troubleshooting, and repairing basic electrical systems.
06.05	Demonstrate proficiency in electrical measurements.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Medical Device Design and Manufacturing**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615040108
Program Type	College Credit Certificate (CCC)
Program Length	28 Credit Hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Biomedical Equipment Repair AS degree program (1615040102).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to designing, manufacturing, evaluating, troubleshooting, repairing and testing various types of biomedical equipment.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of twenty eight credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply written and verbal skills.
02.0 Apply mathematical skills.
03.0 Apply basic software skills related to biomedical engineering technology.
04.0 Understand basic biomedical principles.

Florida Department of Education
Student Performance Standards

Program Title: **Medical Device Design and Manufacturing**
CIP Number: **0615040108**
Program Length: **28 credit hours**

This certificate program is part of the Biomedical Equipment Repair AS degree program (1615040102). At the completion of this program, the student will be able to:	
01.0	Apply written and verbal skills. The student will be able to:
	01.01 Apply written composition principles.
	01.02 Demonstrate verbal presentation approaches.
	01.03 Demonstrate proficiency in verbal and written communication.
	01.04 Demonstrate reasoning and creative thinking ability.
	01.05 Apply word processing skills for technical report writing.
	01.06 Work effectively in a team environment.
02.0	Apply mathematical skills. The student will be able to:
	02.01 Understand mathematical functions, algebra, and complex numbers.
	02.02 Demonstrate proficiency in solving basic algebraic expressions and systems of equations.
	02.03 Analyze technical applications with computer and calculator-based tools.
03.0	Apply basic software skills related to biomedical engineering technology. The student will be able to:
	03.01 Understand word processing software functions.
	03.02 Understand database software functions.
	03.03 Understand spreadsheet software functions.
	03.04 Understand Internet browser functions.
	03.05 Demonstrate proficiency in using word processors for written reports and communication.
	03.06 Demonstrate proficiency in utilizing Internet resources.
04.0	Understand basic pneumatics, hydraulics, and mechanical principles. The student will be able to:
	04.01 Demonstrate proficiency in troubleshooting basic mechanical, hydraulic, and pneumatic systems.
05.0	Understand basic biomedical principles. The student will be able to:

	05.01 Understand basic medical terminology.
	05.02 Understand principles of selected biomedical instrumentation.
	05.03 Identify biomedical sensors and transducers.
	05.04 Identify and demonstrate the use of selected biomedical instrumentation.
	05.05 Demonstrate proficiency in analyzing, testing, troubleshooting, repairing, and calibrating selected biomedical instrumentation.
06.0	Understand basic electronics/computer principles. The student will be able to:
	06.01 Understand and apply basic electrical signals.
	06.02 Understand computer interface concepts.
	06.03 Demonstrate proficiency in reading electrical diagrams.
	06.04 Demonstrate proficiency in analyzing, troubleshooting, and repairing basic electrical systems.
	06.05 Demonstrate proficiency in electrical measurements.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Skills USA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Medical Device Networking and Cybersecurity**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615040109
Program Type	College Credit
Program Length	23 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Biomedical Equipment Technician AS degree program (1615040102).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to designing, manufacturing, evaluating, troubleshooting, repairing and testing various types of biomedical equipment. Additionally, students will learn to function in a hospital or industry environment through an internship at a local biomedical department. During the internship, students will be assigned routine duties as biomedical equipment technicians.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 23 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply written and verbal skills.
02.0 Apply mathematical skills.
03.0 Apply basic software skills related to biomedical engineering technology.
04.0 Understand basic biomedical principles.
05.0 Understand basic electronics/computer principles.
06.0 Understand basic networking principles.

Florida Department of Education
Student Performance Standards

Program Title: **Medical Device Networking and Cybersecurity**
CIP Numbers: **0615040109**
Program Length: **23 credit hours**

This certificate program is part of the Biomedical Equipment Technician AS degree program (1615040102). At the completion of this program, the student will be able to:	
01.0	Apply written and verbal skills. The student will be able to:
	01.01 Apply written composition principles.
	01.02 Demonstrate verbal presentation approaches.
	01.03 Demonstrate proficiency in verbal and written communication.
	01.04 Demonstrate reasoning and creative thinking ability.
	01.05 Apply word processing skills for technical report writing.
	01.06 Work effectively in a team environment.
02.0	Apply mathematical skills. The student will be able to:
	02.01 Understand mathematical functions, algebra, and complex numbers.
	02.02 Demonstrate proficiency in solving basic algebraic expressions and systems of equations.
	02.03 Analyze technical applications with computer and calculator-based tools.
03.0	Apply basic software skills related to biomedical engineering technology. The student will be able to:
	03.01 Understand word processing software functions.
	03.02 Understand database software functions.
	03.03 Understand spreadsheet software functions.
	03.04 Understand Internet browser functions.
	03.05 Demonstrate proficiency in using word processors for written reports and communication.
	03.06 Demonstrate proficiency in using software to analyze and troubleshoot basic biomedical systems.
	03.07 Demonstrate proficiency in utilizing Internet resources.
04.0	Understand basic biomedical principles. The student will be able to:
	04.01 Understand basic medical terminology.

04.02	Understand principles of selected biomedical instrumentation.
04.03	Identify biomedical sensors and transducers.
04.04	Identify and demonstrate the use of selected biomedical instrumentation.
04.05	Demonstrate proficiency in analyzing, testing, troubleshooting, repairing, and calibrating selected biomedical instrumentation.
05.0	Understand basic electronics/computer principles. The student will be able to:
05.01	Understand and apply basic electrical signals
05.02	Understand microprocessors and microcontrollers.
05.03	Demonstrate proficiency in analyzing, troubleshooting, and repairing basic electrical systems.
05.04	Understand computer interface concepts.
05.05	Demonstrate proficiency in reading electrical diagrams.
05.06	Demonstrate proficiency in electrical measurements.
05.07	Demonstrate proficiency in computer interfacing.
05.08	Demonstrate proficiency in loading system software in computer-based equipment.
05.09	Demonstrate proficiency in hardware replacement in computer equipment.
06.0	Understand basic networking principles. The student will be able to:
06.01	Understand basic network software and hardware technologies
06.02	Demonstrate proficiency in understanding broad-based vendor independent network hardware technologies such as Local Area Networks (LAN) which include wired and wireless technologies.
06.03	Demonstrate proficiency in understanding basics in principle software protocols such as TCP/IP functions.
06.04	Demonstrate proficiency in relating network technology to real world applications in the biomedical field such as:
	• Laboratory Information Systems (LIS)
	• Hospital Information Systems (HIS)
	• Medical Instrumentation Interfacing
	• Cyber Security (to include network security)

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Robotics and Simulation Technician**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615040514
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to the basic electronics competencies as identified by the electronics industry, which is prerequisite for all technical programs. This program is designed to prepare individuals in the areas of Robotic Applications, Modeling and Simulation, and Virtual Reality Environment. Upon completion of this technical program, the student will be able to install, maintain and troubleshoot general robot systems and simulators. Graduates of this technical program will be prepared to enter advanced training and education in specialized Robotics and Simulation related fields.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in direct current (DC) circuits.
03.0 Demonstrate proficiency in alternating current (AC) circuits.
04.0 Demonstrate proficiency in technical recording and reporting.
05.0 Demonstrate proficiency in advanced direct current (DC) circuit network analysis.
06.0 Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis.
07.0 Demonstrate proficiency in robotics and automation.
08.0 Demonstrate proficiency in modeling and simulation.

Florida Department of Education
Student Performance Standards

Program Title: **Robotics and Simulation Technology**
CIP Number: **0615040514**
Program Length: **12 credit hours**

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in laboratory practices. The student will be able to:
01.01	Apply Occupational Safety Health Administration (OSHA) safety standards in an electronics laboratory environment when required.
01.02	Analyze drawings and electronic schematics to make proper electrical and component connections and to also identify obvious faulty connections.
01.03	Identify and use electrical/electronic hand and power tools (wire stripper, wire needle-nose clipper, solder and desolder station, etc.).
01.04	Explain the theoretical and practical concepts of soldering including soldering paste and conductive glue.
01.05	Identify non-functional solder connections.
01.06	Practice acceptable soldering, de-soldering, rework, and repair techniques.
01.07	Practice electrostatic discharge (ESD) safety procedures.
01.08	Describe the construction of printed circuit boards (PCBs).
01.09	Use circuit simulation programs to solve problems, verify circuit functionality and design circuits.
01.10	Demonstrate the use of instrumentation and module analytical software.
01.11	Read and interpret data sheet specifications for electronic components.
01.12	Identify basic limitations of multi-meters, oscilloscopes, function generators, and power supplies.
01.13	Use digital multi-meters (DMM), oscilloscopes, function generators, and power supplies to build, analyze and trouble shoot electrical/electronic circuits.
02.0	Demonstrate proficiency in direct current (DC) circuits. The student will be able to:
02.01	Describe the physical laws that govern electricity and magnetism.
02.02	Identify sources of electricity.
02.03	Define voltage, current, resistance, power and energy.
02.04	Apply Ohm's law and power formulas to electrical/electronic circuits.
02.05	Read and interpret color codes and symbols to identify electrical components and values.

02.06	Measure properties of a circuit and electronic components using Digital Multimeters (DMM), LCR meters and oscilloscopes.
02.07	Calculate and measure the conductance and resistance of conductors and insulators.
02.08	Solve problems in electronics utilizing metric prefixes.
02.09	Apply Ohm's law and Kirchoff's voltage and current laws to solve series, parallel, and series-parallel circuits.
02.10	Construct and verify operation of series, parallel, and series-parallel circuits.
02.11	Analyze and troubleshoot series, parallel, and series-parallel circuits.
02.12	Apply Ohm's law and Kirchoff's voltage and current laws to bridge circuits.
02.13	Construct and verify the operation of bridge circuits.
02.14	Analyze and troubleshoot bridge circuits.
02.15	Identify and define voltage divider circuits (loaded and unloaded).
02.16	Construct and verify the operation of voltage divider circuits (loaded and unloaded).
02.17	Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
02.18	Apply maximum power transfer theory to determine the conditions under which maximum power transfer occurs in a circuit.
02.19	Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
02.20	Describe magnetic properties of circuits and devices.
02.21	Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
02.22	Setup and operate power supplies for DC circuits.
03.0	Demonstrate proficiency in alternating current (AC) circuits. The student will be able to:
03.01	Use Trigonometry to solve AC circuits.
03.02	Identify properties of an AC signal.
03.03	Identify AC sources.
03.04	Analyze and measure AC signals utilizing DMM's, oscilloscope, frequency counter and function generator.
03.05	Define the characteristics of AC capacitive and inductive circuits.
03.06	Construct and verify the operation of AC capacitive and inductive circuits.
03.07	Analyze and troubleshoot AC capacitive and inductive circuits.
03.08	Define and apply the principles of transformers to AC circuits.
03.09	Construct and verify the operation of AC circuits utilizing transformers.

	03.10 Analyze and troubleshoot AC circuits utilizing transformers.
	03.11 Construct and verify the operation of passive differentiators and integrators to determine R-C and R-L time constants.
	03.12 Compute the impedance of passive RC, RL, and RLC circuits.
	03.13 Analyze and troubleshoot passive differentiator and integrator circuits.
	03.14 Define the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel and complex).
	03.15 Construct and verify the operation of RLC circuits (series, parallel and complex).
	03.16 Define the characteristics of series and parallel resonant circuits.
	03.17 Construct and verify the operation of series and parallel resonant circuits.
	03.18 Analyze and troubleshoot R-C, R-L and RLC circuits.
	03.19 Define the characteristics of frequency selective filter circuits.
	03.20 Construct and verify the operation of frequency selective filter circuits.
	03.21 Analyze and troubleshoot frequency selective filter circuits.
	03.22 Define the characteristics of three-phase circuits.
	03.23 Define basic motor theory and operation.
	03.24 Define basic generator theory and operation.
	03.25 Setup and operate power supplies for AC circuits.
	03.26 Analyze and measure power in AC circuits.
	03.27 Define power factor and power factor correction in AC circuits.
04.0	Demonstrate proficiency in technical recording and reporting. The student will be able to:
	04.01 Use computer application programs (e.g., word processor, database, spreadsheet) to create reports and record and analyze data.
	04.02 Use schematic capture and simulation programs to create figures and gather data for technical reporting.
	04.03 Write reports and make oral presentations.
	04.04 Maintain a lab notebook documenting procedures, activities, observations, calculations, and results of conducted experiments.
05.0	Demonstrate proficiency in advanced direct current (DC) circuit network analysis. The student will be able to:
	05.01 Analyze multi source circuits using superposition theorem.
	05.02 Analyze circuits using Thevenin's theorem.
	05.03 Analyze circuits using Norton's theorem.

	05.04 Use or understand branch current, Nodal, source transformation and/or mesh current methods to analyze DC circuits.
	05.05 Analyze circuits using maximum power transfer theorem.
06.0	Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis. The student will be able to:
	06.01 Explain the principles of electromagnetism.
	06.02 Apply Faraday's law of induced voltages to simple solenoids.
	06.03 Solve for mutual inductance in a coupled circuit.
	06.04 Use or understand branch current, nodal, source transformation and/or mesh current methods to analyze AC circuits.
	06.05 Identify the effects of transient spikes in RC, RL, and RLC circuits.
	06.06 Identify the effects of loading on transformers.
	06.07 Analyze multi source circuits using superposition theorem.
	06.08 Analyze circuits using Thevenin's theorem.
	06.09 Analyze circuits using Norton's theorem.
	06.10 Analyze circuits using maximum power transfer theorem.
	06.11 Design and Simulate AC Circuits using engineering software.
07.0	Demonstrate proficiency robotics and automation. The student will be able to:
	07.01 Describe the major parts of a robotic system.
	07.02 Explain and use sensors used in robotics applications.
	07.03 Describe the operation of DC motors, gearing, and electronic control.
	07.04 Describe proportional and derivative feedback control systems.
	07.05 Construct robot platforms.
	07.06 Explain serial communications and data collection.
	07.07 Write control programs for robots.
	07.08 Download programs to robots and test them.
	07.09 Describe shaft encoding and infrared sensing.
	07.10 Explain ultrasonic distance sensing.
	07.11 Describe the architecture and provide a system overview for the hardware and software found in a typical automated work cell.
	07.12 Analyze and interpret typical PLC ladder logic programs.

08.0	Demonstrate proficiency in modeling and simulation. The student will be able to:
08.01	Define Interactive Simulation/Intelligent Systems/Automated Equipment, Robotics, Artificial Intelligence.
08.02	Demonstrate an understanding of Modeling and Simulation Paradigms and Concepts/Types, Randomness, Time, Application, Domain.
08.03	Demonstrate an understanding of Modeling Methods/Definition, Non-Executable Models, Executable Models, and other Model Types.
08.04	Explain Architecture and Conceptual Modeling/What does a Modeling and Simulation System do? Explain Interoperability Techniques, Live, Virtual and Constructive, Phases of Modeling.
08.05	Define Hardware - Outputs/Glasses (Filter glasses, Shutter glasses)/Sound and Audio (Human Auditory System, 3D Sound, Head-based unit)/Haptic Feedback/Visual Displays/Vestibular and Other Senses
08.06	Define Modeling, Mathematics and Physics/Geometry Modeling/Kinematics Modeling/Physical Modeling/Model Management.
08.07	Define 3D and Graphics/Computer Graphic/Dynamic Objects/Perspective Views/3D Clipping/Stereoscopic Vision/Rendering Image, Algorithms/Mapping (Texture, Bumps) Shadows, Reflection, Refraction.
08.08	Demonstrate an understanding of Applications/Creating an Application (From other Media, from an existing VR System)/Industrial (Manufacturing, Robotics)/Training Simulators/Education/Arts/Entertainment and Games/Medical/Military.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Automation**
Specialization Tract: **Advanced Manufacturing**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615040601
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Advanced Manufacturing specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Manufacturing career cluster.

The content includes but is not limited to instruction in maintenance techniques, computer aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Understand, operate, and maintain industrial automation systems.
02.0 Troubleshoot industrial automation systems.
03.0 Apply the principles of robotics to automated systems.
04.0 Create and operate human machine interfaces to control automated systems.

Florida Department of Education
Student Performance Standards

Program Title: **Automation**
CIP Number: **0615040601**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Understand, operate and maintain industrial automation systems. The student will be able to:
01.01	Create and interpret schematic diagrams.
01.02	Explain, operate, maintain, and program industrial control systems.
01.03	Integrate control systems and equipment with production and production support mechanisms.
02.0	Troubleshoot industrial automation systems. The student will be able to:
02.01	Demonstrate troubleshooting techniques to identify root cause, errors and faults of a problem.
02.02	Use troubleshooting data to make systems improvement.
02.03	Identify issues requiring additional expertise.
02.04	Participate in troubleshooting and resolution teams effectively.
02.05	Troubleshoot problems and perform minor repairs to industrial automation systems.
03.0	Apply the principles of robotics to automated systems. The student will be able to:
03.01	Identify and describe the essential components and characteristics of a robotic system.
03.02	Analyze industrial tasks for the selection of robotic equipment.
03.03	Understand, choose, and implement appropriate sensors and actuators for robotic applications.
03.04	Program a robotic device for a specific industrial application.
04.0	Create and operate human machine interfaces to control automated systems. The student will be able to:
04.01	Apply appropriate industrial standards in the development of HMI.
04.02	Establish communication for data flow between interface and controlled equipment.
04.03	Perform interface testing and troubleshooting.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Applied Technology Specialist**
Specialization Tract: **Advanced Technology**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615061203
Program Type	College Credit Certificate (CCC)
Program Length	16 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Advanced Technology specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to assembly, verification, testing, building and updating mechanical and electrical interfaces and systems.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate a fundamental understanding of electronics and electricity.
02.0 Demonstrate proficiency in using tools, instruments, and testing devices.
03.0 Demonstrate proficiency in soldering and basic laboratory practices.
04.0 Demonstrate proficiency in surface mount soldering.
05.0 Demonstrate proficiency in fiber optics terminations.

Florida Department of Education
Student Performance Standards

Program Title: **Applied Technology Specialist**
CIP Number: **0615061203**
Program Length: **16 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate a fundamental understanding of electronics and electricity. The student will be able to:
	01.01 Use appropriate electrical circuit grounding techniques.
	01.02 Solve circuit problems using appropriate units and notation.
	01.03 Operate appropriate test equipment.
02.0	Demonstrate proficiency in using tools, instruments and testing devices. The student will be able to:
	02.01 Identify and use hand tools properly.
	02.02 Use inspection equipment appropriately.
	02.03 Implement appropriate testing techniques and procedures.
	02.04 Use appropriate measurement tools.
	02.05 Use appropriate safety monitoring and testing equipment.
	02.06 Communicate issues with visual tools.
03.0	Demonstrate proficiency in soldering basic laboratory practices. The student will be able to:
	03.01 Apply proper Occupational Safety Health Administration (OSHA) safety standards.
	03.02 Make electrical connections.
	03.03 Demonstrate acceptable soldering techniques.
	03.04 Demonstrate acceptable de-soldering techniques.
	03.05 Demonstrate electrostatic discharge (ESD) safety procedures.
	03.06 Describe the construction of printed circuit boards (PCB's).
	03.07 Explain the theoretical concepts of soldering.
	03.08 Demonstrate rework and repair techniques.
04.0	Demonstrate proficiency in basic surface mount soldering. The student will be able to:

	04.01	Identify SMD components.
	04.02	Understand concern specific to SMD components.
	04.03	Identify proper soldering techniques to each component type
	04.04	Solder and de-solder chip components.
	04.05	Solder and de-solder J-Leaded components.
	04.06	Solder and de-solder Gull Wing components.
	04.07	Effectively identify and demonstrate the quality requirements used to inspect soldered connections.
	04.08	Demonstrate the skills required for circuit board rework and repair.
	04.09	Demonstrate the proper selection and use of procedural requirements, tools, materials, and methods required to comply with the applicable standards.
05.0	Demonstrate proficiency in fiber optics termination. The student will be able to:	
	05.01	Define the basics of a fiber optic system.
	05.02	Define the advantages and types of a fiber optic system.
	05.03	Understand how to install cables and prepare ends.
	05.04	Understand how to install different types of connectors.
	05.05	Understand how to make loss measurements.
	05.06	Understand how to install splices.
	05.07	Understand how to certify and troubleshoot a fiber system.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Lean Manufacturing**
Specialization Tract: **Advanced Manufacturing**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615061302
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Advanced Manufacturing specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to maintenance techniques, computer aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in the use of quality assurance methods and quality control concepts.
02.0 Identify lean and six sigma concepts in manufacturing environments.
03.0 Identify, implement and/or interpret supply chain and operations management concepts and techniques.

Florida Department of Education
Student Performance Standards

Program Title: **Lean Manufacturing**
CIP Number: **0615061302**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in use of quality assurance methods and quality control concepts. The student will be able to:
01.01	Apply quality methods to industrial processes.
01.02	Apply quality principles to manufactured products.
01.03	Document quality measurements and observations.
02.0	Identify lean and six sigma concepts in manufacturing environments. The student will be able to:
02.01	Explain product manufacturing requirements.
02.02	Explain the role of each stakeholder in production operations.
02.03	Demonstrate and apply resources planning, six sigma, and lean manufacturing principles to production and process planning.
02.04	Participate in a continuous process improvement event involving multiple disciplines.
03.0	Identify, implement, and/or interpret supply chain and operations management concepts and techniques. The student will be able to:
02.01	Use appropriate software for supply chain management strategies.
02.02	Illustrate how efficiency and effectiveness are necessary attributes of good operations management.
02.03	Apply simulations used for layout and design of production operations.
02.04	Apply engineering economy factors in equipment justification.
02.05	Calculate machinery utilization.
02.06	Demonstrate warehouse throughput systems.
02.07	Demonstrate basic principles and methods of controlling work in progress.
02.08	Follow raw materials from their source to distribution of the product.
02.09	Develop strategies to identify improvement opportunities, prioritize and develop an implementation plan optimize production operations.
02.10	Demonstrate strategies to optimize raw materials and products inventories to minimize waste
02.11	Integrate control systems and equipment with production and production support mechanisms.

02.12	Demonstrate automatic inventory accounting related monitoring and control systems.
02.13	Implement automatic tracking of materials and products using bar codes, machine vision and sensing, and/or infrared technologies.
02.14	Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Pneumatics, Hydraulics and Motors for Manufacturing**
Specialization Tract: **Advanced Manufacturing**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615061303
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Advanced Manufacturing specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to maintenance techniques, computer aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of industrial processes and material properties.
02.0 Demonstrate a fundamental understanding of electronics and electricity.
03.0 Understand, operate, troubleshoot, and maintain pneumatic, hydraulic, and electromechanical components and/or systems.

Florida Department of Education
Student Performance Standards

Program Title: **Pneumatics, Hydraulics and Motors for Manufacturing**
CIP Number: **0615061303**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate knowledge of industrial processes and materials properties. The student will be able to:
01.01	Explain current manufacturing processes to include modern trends (3-D printing, etc.).
01.02	Determine available and needed resources for the production process.
01.03	Describe the factors considered for design, maintenance, procurement and handling.
01.04	Analyze process changes for impact on product.
01.05	Identify principles and practices of production timing.
01.06	Identify effect of time, motion, and procedural changes on productivity.
01.07	Demonstrate knowledge of raw materials properties and requirements.
01.08	Follow engineering specifications and documentation in equipment setup.
01.09	Explain the importance of routine maintenance.
01.10	Identify customer needs. Document product and process compliance with customer requirements.
02.0	Demonstrate a fundamental understanding of electronics and electricity. The student will be able to:
02.01	Use appropriate electrical circuit grounding techniques.
02.02	Solve circuit problems using appropriate units and notation.
02.03	Operate appropriate test equipment.
03.0	Understand, operate, troubleshoot, and maintain pneumatic, hydraulic and electromechanical components and/or systems. The student will be able to:
03.01	Identify, classify and describe the function of pneumatic, hydraulic and electrical machines and components.
03.02	Construct and interpret flow diagrams of pneumatic, hydraulic, and electromechanical systems.
03.03	Configure, install, operate, and maintain pneumatic, hydraulic and electromechanical components, devices and/or machines.
03.04	Troubleshoot errors, faults, and inconsistencies in pneumatic, hydraulic and electromechanical components, machines and/or systems.

03.05	Define special applications of electromechanical, hydraulic and pneumatic machines and devices used in manufacturing and process equipment.
03.06	Describe limitations of electromechanical, pneumatic and hydraulic machinery.
03.07	Use safe practices while operating, troubleshooting, and maintaining industrial equipment.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Semiconductor Cleanroom Operator**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615061601
Program Type	College Credit Certificate (CCC)
Program Length	18 credit hours
CTSO	SkillsUSA
SOC Code(s) (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.rg/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Semiconductor Engineering Technology AS degree program (pending).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Manufacturing career cluster; provides technical skill proficiency and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills and occupation-specific skills and knowledge of all aspects of the Manufacturing career cluster.

The content includes but is not limited to electrical and digital circuits, installation and programming of robotic systems and silicon and wafer fabrication to include photolithography, plasma etching and advanced packaging.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 18 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in electrical circuits.
03.0 Demonstrate proficiency in digital circuits.
04.0 Demonstrate an understanding of silicon and wafer fabrication.
05.0 Demonstrate safe clean room practices and policies.
06.0 Demonstrate an understanding of packaging and wafer level advanced packaging.
07.0 Demonstrate employability skills.

Florida Department of Education
Student Performance Standards

Program Title: **Semiconductor Cleanroom Operator**
CIP Number: **0615061601**
Program Length: **18 credit hours**

This certificate program is part of the Semiconductor Engineering Technology AS degree program (pending). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in laboratory practices. The student will be able to:
01.01	Apply Occupational Safety Health Administration (OSHA) safety standards in an electronics laboratory environment when required.
01.02	Analyze drawings and electronic schematics to make proper electrical and component connections and to also identify obvious faulty connections.
01.03	Identify and use electrical/electronic hand and power tools (wire stripper, wire needle-nose clipper, solder and desolder station, etc.).
01.04	Practice electrostatic discharge (ESD) safety procedures.
01.05	Describe various applications of automation and robotics.
01.06	Describe the construction of printed circuit boards (PCBs).
01.07	Use circuit simulation programs to solve problems, verify circuit functionality and design circuits.
01.08	Demonstrate the use of instrumentation and module analytical software.
01.09	Read and interpret data sheet specifications for electronic components.
01.10	Identify basic limitations of multi-meters, oscilloscopes, function generators and power supplies.
01.11	Describe maintenance procedures, specifically in a total productive maintenance (TPM) in a manufacturing setting.
01.12	Identify different types of personal protection equipment (PPE), their requirements and where they are used.
01.13	Know the lock-out tag-out (LOTO) regulations.
02.0	Demonstrate proficiency in electrical circuits. The student will be able to:
02.01	Describe the physical laws that govern electricity and magnetism.
02.02	Identify sources of electricity.
02.03	Define voltage, current, resistance, power and energy.
02.04	Apply Ohm's law and power formulas to electrical/electronic circuits.
02.05	Read and interpret color codes and symbols to identify electrical components and values.

	02.06	Measure properties of a circuit using Digital Multi-meter (DMM) and oscilloscopes.
	02.07	Calculate and measure the conductance and resistance of conductors and insulators.
	02.08	Solve problems in electronics utilizing metric prefixes.
	02.09	Apply Ohm's law and Kirchoff's voltage and current laws to solve series, parallel and series-parallel circuits.
	02.10	Construct and verify operation of series, parallel and series-parallel circuits.
	02.11	Analyze and troubleshoot series, parallel and series-parallel circuits.
	02.12	Apply Ohm's law and Kirchoff's voltage and current laws to bridge circuits.
	02.13	Construct and verify the operation of bridge circuits.
	02.14	Analyze and troubleshoot bridge circuits.
	02.15	Identify and define voltage divider circuits (loaded and unloaded).
	02.16	Construct and verify the operation of voltage divider circuits (loaded and unloaded).
	02.17	Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
	02.18	Apply maximum power transfer theory to determine the conditions under which maximum power transfer occurs in a circuit.
	02.19	Construct and verify the operation of direct current (DC) and alternating current (AC) circuits that demonstrate the maximum power transfer theory.
	02.20	Describe magnetic properties of circuits and devices.
	02.21	Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
	02.22	Setup and operate power supplies for DC and AC circuits.
03.0	Demonstrate proficiency in digital circuits. The student will be able to:	
	03.01	Define and apply numbering systems to codes and arithmetic operations.
	03.02	Analyze and minimize logic circuits using Boolean and Karnaugh Map (K-Map) operations.
	03.03	Demonstrate proficiency in the use of logic probes for digital circuits.
	03.04	Describe the various logic families and their electrical characteristics, e.g., Transistor-Transistor Logic (TTL), Complimentary Metal-Oxide Semiconductor (CMOS), etc.
	03.05	Use pulsers/pulse generators/clock signals to drive the inputs of digital circuits.
	03.06	Use oscilloscopes to analyze and troubleshoot digital circuits.
	03.07	Use logic analyzers to analyze and troubleshoot digital circuits.
	03.08	Determine the fan-out of digital circuits based on integrated circuit (IC) limitations.
	03.09	List the various types of logic gates and their truth tables.

	03.10 Construct combinational logic circuits using IC.
	03.11 Troubleshoot combinational and sequential logic circuits.
	03.12 Identify and analyze types of flip-flops and their truth tables.
	03.13 Construct flip-flops using IC.
	03.14 Troubleshoot flip-flop circuits.
	03.15 Identify types of registers and counters.
	03.16 Construct registers and counters using flip-flops and logic gates.
	03.17 Troubleshoot registers and counters.
	03.18 Analyze, construct and troubleshoot clock and timing circuits.
	03.19 Identify, construct and troubleshoot adder/subtractor logic circuits.
	03.20 Identify, construct and troubleshoot encoders and decoders.
	03.21 Identify, construct and troubleshoot multiplexer and demultiplexer circuits.
	03.22 Identify types of memory circuits.
	03.23 Describe and examine the uses of digital-to-analog and analog-to-digital conversions.
	03.24 Construct and troubleshoot digital-to-analog and analog-to-digital circuits.
	03.25 Identify, construct, and troubleshoot digital display circuits.
	03.26 Program Programmable Logic Devices (PLD).
04.0	Demonstrate an understanding of silicon and wafer fabrication. The student will be able to:
	04.01 Define silicon and other semiconductor substrate materials and describe its use.
	04.02 Define and understand a transistor.
	04.03 Describe the basics of wafer fabrication.
	04.04 Define and understand Moore’s Law.
05.0	Demonstrate safe clean room practices and policies. The student will be able to:
	05.01 Demonstrate clean room practices to include gowning and de-gowning routines.
	05.02 Know how to read safety data sheets (SDS) and identify necessary information.
	05.03 Demonstrate proper wafer handling techniques.
	05.04 Demonstrate the need for contamination control.

06.0	Demonstrate an understanding of packaging and wafer level advanced packaging. The student will be able to:
	06.01 Define and describe singulation, die pick and place and wire bond.
	06.02 Define types of single die packaging.
	06.03 Define and describe advanced packaging and interposer technologies.
07.0	Demonstrate employability skills. The student will be able to:
	07.01 Conduct a job search.
	07.02 Secure information about a job.
	07.03 Identify and create documents that may be required when applying for a job to include a professional resume.
	07.04 Complete a job application form correctly after identifying appropriate job descriptions.
	07.05 Demonstrate competence in job interview techniques.
	07.06 Demonstrate knowledge of how to make appropriate decisions and judgements.
	07.07 Demonstrate appropriate work/behavioral habits.
	07.08 Demonstrate acceptable employee personal hygiene and health.
	07.09 Demonstrate knowledge of the Occupational Safety and Health Standard 29CFR-1910.1200, Hazard Communication.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Composite Fabrication and Testing**
Specialization Tract: **Advanced Technology**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615061700
Program Type	College Credit Certificate (CCC)
Program Length	22 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Advanced Technology specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to specialized courses in Applied Technology areas for design, assembly, and fabrication using composite materials.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of industrial safety, health, and environmental requirements.
02.0 Demonstrate proficiency in using tools, instruments, and testing devices.
03.0 Demonstrate basic troubleshooting skills.
04.0 Demonstrate proficiency in composite fundamentals.

Florida Department of Education
Student Performance Standards

Program Title: **Composite Fabrication and Testing**
CIP Number: **0615061700**
Program Length: **22 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate an understanding of industrial safety, health, and environmental requirements. The student will be able to:
01.01	Identify and select appropriate Personal Protective Equipment (PPE).
01.02	Follow appropriate safety procedures.
01.03	Follow applicable environmental laws and regulations.
01.04	Identify and report unsafe conditions and practices.
01.05	Explain when a machine or a process should be stopped to investigate an unsafe condition.
01.06	Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
01.07	Use and evaluate information resources such as SDS (Safety Data Sheets).
02.0	Demonstrate proficiency in using tools, instruments, and testing devices. The student will be able to:
02.01	Identify and use hand tools properly.
02.02	Use inspection equipment appropriately.
02.03	Implement appropriate testing techniques and procedures.
02.04	Use appropriate measurement tools.
02.05	Use appropriate safety monitoring and testing equipment.
02.06	Communicate issues with visual tools.
03.0	Demonstrate basic troubleshooting skills. The student will be able to:
03.01	Apply critical thinking skills to identify problems.
03.02	Identify symptoms and changes in a system.
03.03	Apply root cause analysis techniques to identify problem causes.
03.04	Evaluate corrective action options.
03.05	Properly document all corrective actions.
04.0	Demonstrate proficiency in composite fundamentals. The student will be able to:
04.01	Identify and characterize composite materials and commodities.

04.02	Identify uses and hazards involved in handling common composite supplies.
04.03	Explain how properties of materials determine their classification and use.
04.04	Identify symptoms/causes of delaminating.
04.05	Identify symptoms and causes of faulty bonds.
04.06	Demonstrate knowledge of handling composite materials, adhesives, solvents, etc.
04.07	Identify tools used in composite fabrication and repair.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Laboratory activities are an integral part of this program and include the proper use of test equipment, such as a Digital multimeter, measurement devices, some hand and small power tools, composite fabrication and design equipment, as well as various chemicals including resins, laminates and solvents. Special emphasis is placed on the safe handling of equipment and chemicals used in the composite industry.

These activities include instruction in the use of safety procedures, tools, equipment, materials, and processes related to these occupations. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Six Sigma Black Belt Certificate**
Specialization Tract: **Quality**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615070202
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Quality specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to the six sigma methodology of problem solving, strategic improvement, business transformation and process improvement. The specifics of this certificate program will focus on the theory and application of methods to improve the quality of process outputs by identifying and removing the causes of defects and minimizing variability in manufacturing or business processes. Six Sigma uses a set of quality management methods including statistical methods to improve customer satisfaction, reduce cycle time, and reduce defects.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in Six Sigma theories.
02.0 Demonstrate proficiency in developing a Six Sigma project.

Florida Department of Education
Student Performance Standards

Program Title: **Six Sigma Black Belt Certificate**
CIP Number: **0615070202**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in Six Sigma theories. The student will be able to:
01.01	Apply the five steps of the DMAIC model.
01.02	Establish an advanced quality plan using the theories of Six Sigma.
01.03	Apply the DOE in manufacturing and non-manufacturing environments using the proper techniques.
01.04	Apply the techniques of Process Failure Modes and Effects Analysis (PFMEA).
01.05	Implement the 5S's method of sorting, setting in order, shining, standardizing, and sustaining.
01.06	Apply the Six Sigma standards to non-manufacturing environments.
02.0	Demonstrate proficiency in developing a Six Sigma project. The student will be able to:
02.01	Frame and Detail a Capstone Project using the Six Sigma tools.
02.02	Describe the economic evaluation of engineering alternatives and analysis of cost allocation.
02.03	Calculate net profit, marginal rate of returns, maximum profit, return on investment, cash flow analysis and breakeven points when solving problems.
02.04	Solve problems involving alternative designs, materials, or methods.
02.05	Analyze the factor of equivalence in engineering economic problems.
02.06	Solve problems related to replacement versus augmentation for economic choices.
02.07	Discuss how capital projects are identified and evaluated (Return on Investment -ROI)
02.08	Describe how final projects are selected.
02.09	Define the requirements of the project plan.
02.10	Develop the initial project schedule.
02.11	Describe each phase of the project as it relates to the budget.
02.12	Develop timeline charts for planning and tracking.
02.13	Apply the scheduling control systems.

02.14	Identify the voice of the customer as the feedback mechanism.
02.15	Define and describe the scheduling techniques when applied in the project environment.
02.16	Apply the six sigma methodology to service type environments.
02.17	Apply the Theory of Constraints to identify the obstacles, lean to remove the obstacles, and six sigma to create the standard of work and remove variations.
02.18	Understand the requirements for a successful implementation of six sigma using customer centric approach, organizational alignment, and quality improvement and how they are interdependent.
02.19	Align the Six Sigma project objectives to business strategy and prioritize projects accordingly.
02.20	Use data collection strategies and graphical analysis in the project environment.

Additional Information

Laboratory Activities

Laboratory activities are an integral part of this program. The Capstone Project systematically bridges the Six Sigma Methodology and theory with actual hands-on application of the various DMAIC Tools in support of variation reduction. These activities include application and instruction in the use of Six Sigma tools, statistics, project management, engineering analysis, financial analysis and supporting materials, and processes related to these occupations. Equipment and supplies should be provided to enhance hands-on project-based experiences for students.

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Lean Six Sigma Green Belt Certificate**
Specialization Tract: **Quality**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615070203
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Quality specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to, the concepts, theories, and tools of the Lean Manufacturing and Six Sigma as used in the manufacturing and services industries. The program covers the methods used in Lean and Six Sigma such as: continuous flow, overall equipment effectiveness (OEE), Kaizen, process mapping, the 5S's, total productive maintenance (TPM), cellular manufacturing, the DMAIC, self-directed work teams, the kanban system, design for manufacturing, and value steam mapping.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in lean manufacturing/production.
02.0 Demonstrate proficiency in developing self-directed work teams.
03.0 Demonstrate proficiency in the tools of lean manufacturing.
04.0 Demonstrate proficiency in basic Six Sigma concepts.

Florida Department of Education
Student Performance Standards

Program Title: **Lean Six Sigma Green Belt Certificate**
CIP Number: **0615070203**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:
01.0 Demonstrate proficiency in lean manufacturing/production. The student will be able to:
01.01 Describe and explain the concepts of lean manufacturing.
01.02 Apply the theories of lean manufacturing to a manufacturing and service environment for improvement.
01.03 Identify and apply procedures to achieve Just-in-Time.
01.04 Identify and apply the techniques in continual improvement.
01.05 Describe and explain supply chain management.
01.06 Develop the techniques to manage change in the manufacturing environment.
01.07 Identify and explain basic cellular manufacturing concepts associated with basic cellular manufacturing concepts.
02.0 Demonstrate proficiency in developing self-directed work teams. The student will be able to:
02.01 Describe and explain development and organization of a self-directed work team.
02.02 Create work plans.
02.03 Identify the steps in ending a project.
02.04 Use data effectively in identifying issues.
02.05 Implement changes through planning and communications.
02.06 Update appropriate documentation in a project.
03 Demonstrate proficiency in the tools of lean manufacturing. The student will be able to:
03.01 Define the tools required to implement and maintain a Lean Manufacturing facility.
03.02 Describe and explain mistake proofing.
03.03 Describe and apply the concept 5's.
03.04 Describe and explain the visual solutions workplace environment.
03.05 Identify and explain the changeover techniques used in production.

	03.06	Describe the terms used in overall equipment effectiveness (OEE).
	03.07	Describe and explain the process of total productive maintenance (TPM).
	03.08	Identify the techniques used in the kanban system for just-in-time (JIT).
	03.09	Identify and apply value stream mapping and other mapping methods.
04.0	Demonstrate proficiency in Six Sigma concepts. The student will be able to:	
	04.01	Describe and explain the philosophy and methodology of Six Sigma.
	04.02	Define the five steps of the DMAIC (define, measure, analyze, improve, and control) model used in Six Sigma for quality improvement.
	04.03	Establish an advanced quality plan.
	04.04	Benchmark a project.
	04.05	Develop the basic cause-and-effect diagram (fishbone diagram).
	04.06	Describe and develop the central limit theorem.
	04.07	Develop a control plan to aid in production.
	04.08	Define the cost-benefit analysis on the shop floor.
	04.09	Define and describe the design of experiments (DOE) used in manufacturing processes.
	04.10	Apply the DOE in manufacturing and non-manufacturing environments using the proper techniques.
	04.11	Apply the techniques of Process Failure Modes and Effects Analysis (PFMEA).
	04.12	Maintain and check the process through quality auditing.
	04.13	Describe the role that other continuous process improvement efforts play in the workplace.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Structural Assembly Technician**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615080102
Program Type	College Credit Certificate (CCC)
Program Length	17 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Aerospace Technology AS degree program (1615080100)

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to specialized courses in Aerospace Technology areas for design, assembly, and fabrication of spacecraft, launch vehicle or aircraft systems.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to:

01.0 Demonstrate appropriate communications skills.
02.0 Demonstrate appropriate math skills.
03.0 Demonstrate appropriate understanding of material science.
04.0 Demonstrate understanding of safe, efficient, professional work practices.
05.0 Demonstrate the use and maintenance of industry tools.
06.0 Perform basic electricity, electronic and fiber optics skills.
07.0 Demonstrate the ability to fabricate component parts to specifications.
08.0 Prepare, analyze, and evaluate technical reports and data.
09.0 Select, configure, calibrate, operate, and evaluate precision test equipment.
10.0 Demonstrate employability skills.

Florida Department of Education
Student Performance Standards

Program Title: **Structural Assembly Technician**
CIP Numbers: **0615080102**
Program Length: **17 credit hours**

This certificate program is part of the Aerospace Technology AS degree program, (1615080100). At the completion of this program, the student will be able to:	
01.0	Demonstrate appropriate communications skills. The student will be able to:
01.01	Write logical and understandable statements, or phrases, to complete with accuracy the technical documentation commonly used in business and industry.
01.02	Analyze and draw conclusion from graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
01.03	Interpret and follow written and oral instructions.
01.04	Review technical documentation for accuracy and applicability.
02.0	Demonstrate appropriate math skills. The student will be able to:
02.01	Solve ratio, proportion, and percentage problems.
02.02	Calculate volume, weight, area, circumference and perimeter measurements of various geometrical shapes, to include rectangles, squares, and cylinders.
02.03	Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches.
02.04	Add, subtract, multiply and divide fractions, decimals, and whole numbers.
03.0	Demonstrate appropriate understanding of material science. The student will be able to:
03.01	Identify and characterize materials and commodities used in the aerospace industry.
03.02	Identify uses and hazards and emergency procedures involved in handling common materials and commodities used in the aerospace industry.
03.03	Identify materials compatibility/incompatibility.
03.04	Demonstrate knowledge of chemical processes involved in metal treatments and polymerization.
03.05	Predict molecular action as a result of temperature extremes, chemical reaction, and moisture content.
03.06	Recognize modes and manifestations' of corrosion.
03.07	Identify various types of materials contamination.
03.08	Identify symptoms and causes of metal failure (e.g., fatigue, ductile, brittle).
03.09	Identify symptoms/causes of failures in composite materials including faulty bonds and de-laminations.

04.0	Demonstrate understanding of safe efficient professional work practices. The student will be able to:
04.01	Observe work area rules and regulations.
04.02	Practice proper foreign object debris (FOD) procedures to include identification, tool control, materials control, inventory and housekeeping.
04.03	Recognize and resolve static electricity hazards.
04.04	Demonstrate professional work ethics.
05.0	Demonstrate the use and maintenance of industry tools. The student will be able to:
05.01	Identify the proper tool for a specific application.
05.02	Inspect tools for cleanliness.
05.03	Inspect tools for functionality.
05.04	Clean/decontaminate tools/equipment.
05.05	Perform hoisting and rigging operations using proper techniques.
06.0	Perform basic electricity, electronic, and fiber optics skills. The student will be able to:
06.01	Define the relationship between current, voltage, resistance and power in DC and AC circuits.
06.02	Identify the sources of DC and AC power to include generators, batteries, photovoltaic, fuel cells, transformers, converters and inverters.
06.03	Identify the basic components of DC and AC circuits.
06.04	Solve problems in series, parallel, series-parallel and voltage divider circuits.
06.05	Read and interpret electrical circuit diagrams.
06.06	Measure circuit values to include voltage, current, resistance, continuity, capacitance, inductance and electromagnetism.
06.07	Measure AC circuit parameters to include frequency, period, time, wavelength, peak-to-peak, RMS, phase and instantaneous values.
06.08	Demonstrate basic soldering skills and the identification of components common to electronics.
06.09	Troubleshoot electrical systems.
07.0	Demonstrate the ability to fabricate component parts to specifications. The student will be able to:
07.01	Apply basic trigonometric functions to fabrication planning.
07.02	Demonstrate a basic knowledge of machine tools.
07.03	Interpret a basic drawing/blueprint.
07.04	Produce a layout/template.

	07.05 Fabricate a sample project.
	07.06 Demonstrate the use of brake and shear.
	07.07 Demonstrate the ability to finish a component per given requirements.
	07.08 Demonstrate the use of precision measuring tools including micrometer and vernier caliper, square, etc.
	07.09 Identify and describe metal joining processes (e.g., welds, brazing, etc.).
08.0	Prepare, analyze and evaluate technical reports and data. The student will be able to:
	08.01 Interpret technical drawings and schematics.
	08.02 Demonstrate application of technical drawings and/or schematic specifications.
	08.03 Demonstrate application of work authorization document to task.
09.0	Select, configure, calibrate, operate, and evaluate precision test equipment. The student will be able to:
	09.01 Verify tool and equipment calibration.
	09.02 Configure test set up.
	09.03 Perform test operations.
	09.04 Evaluate test results.
	09.05 Identify precision measuring and test equipment.
10.0	Demonstrate employability skills. The student will be able to:
	10.01 Conduct a job search.
	10.02 Secure information about a job.
	10.03 Identify acceptable work habits.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Aerospace Technician**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615080103
Program Type	College Credit
Program Length	43 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Aerospace Technology AS degree program (1615080100).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, and a combination of theory and laboratory activities to gain the necessary cognitive and manipulative skills to perform preventive and corrective maintenance, engineering support, and maintain product quality.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to:

01.0 Demonstrate appropriate communications skills.
02.0 Demonstrate appropriate math skills.
03.0 Demonstrate appropriate understanding of material science.
04.0 Demonstrate understanding of safe, efficient, professional work practices.
05.0 Demonstrate the knowledge, testing and repair of spacecraft systems.
06.0 Demonstrate the use and maintenance of industry tools.
07.0 Perform basic electricity, electronic and fiber optics skills.
08.0 Demonstrate an understanding of appropriate safety/OSHA rules and regulations.
09.0 Demonstrate the ability to fabricate component parts to specifications.
10.0 Prepare, analyze, and evaluate technical reports and data.
11.0 Demonstrate the ability to evaluate problems, troubleshoot and implement appropriate corrective action.
12.0 Select, configure, calibrate, operate, and evaluate precision, non-destructive test equipment.
13.0 Demonstrate appropriate knowledge of the operation and repair of high pressure hydraulic and pneumatic systems.
14.0 Demonstrate employability skills.

Florida Department of Education
Student Performance Standards

Program Title: **Aerospace Technician**
CIP Numbers: **0615080103**
Program Length: **43 credit hours**

This certificate program is part of the Aerospace Technology AS degree program, (1615080100). At the completion of this program, the student will be able to:	
01.0	Demonstrate appropriate communications skills. The student will be able to:
01.01	Write logical and understandable statements, or phrases, to complete with accuracy the technical documentation commonly used in business and industry.
01.02	Analyze and draw conclusion from graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
01.03	Interpret and follow written and oral instructions.
01.04	Formulate questions coherently and concisely.
01.05	Review technical documentation for accuracy and applicability.
01.06	Demonstrate appropriate verbal and written communication skills.
01.07	Effectively use electronic communication systems such as e-mail and computer-based management systems.
02.0	Demonstrate appropriate math skills. The student will be able to:
02.01	Solve ratio, proportion, and percentage problems.
02.02	Calculate volume, weight, area, circumference, and perimeter measurements of various geometrical shapes, to include rectangles, squares, and cylinders.
02.03	Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches.
02.04	Add, subtract, multiply, and divide fractions, decimals, and whole numbers.
03.0	Demonstrate appropriate understanding of material science. The student will be able to:
03.01	Identify and characterize materials and commodities used in the aerospace industry.
03.02	Identify uses and hazards and emergency procedures involved in handling common materials and commodities used in the aerospace industry.
03.03	Identify materials compatibility/incompatibility.
03.04	Demonstrate knowledge of chemical processes involved in metal treatments and polymerization.
03.05	Predict molecular action as a result of temperature extremes, chemical reaction, and moisture content.
03.06	Recognize modes and manifestations of corrosion.

	03.07 Identify various types of materials contamination.
	03.08 Identify symptoms and causes of metal failure (e.g., fatigue, ductile, brittle).
	03.09 Identify symptoms/causes of failures in composite materials including faulty bonds and de-laminations.
04.0	Demonstrate understanding of safe efficient professional work practices. The student will be able to:
	04.01 Observe work area rules and regulations.
	04.02 Characterize clean room/controlled environment procedures.
	04.03 Practice proper foreign object debris (FOD) procedures to include identification, tool control, materials control, inventory and housekeeping.
	04.04 Recognize and resolve static electricity hazards.
	04.05 Demonstrate professional work ethics.
	04.06 Demonstrate knowledge of ISO standards.
	04.07 Identify gaps in quality control processes using quality assurance techniques.
05.0	Demonstrate the knowledge, testing and repair of spacecraft systems. The student will be able to:
	05.01 Identify spacecraft systems and sub systems and how they relate to the entire spacecraft.
	05.02 Demonstrate understanding of the operation of spacecraft systems.
	05.03 Identify operational differences between expendable and reusable spacecraft.
	05.04 Demonstrate knowledge of basic principles of hydraulics/pneumatics.
	05.05 Demonstrate knowledge of basic principles of pyrotechnic devices.
	05.06 Demonstrate knowledge of basic principles of rocket propulsion.
	05.07 Demonstrate knowledge of basic principles of electro-mechanical systems.
	05.08 Demonstrate basic knowledge of ground support equipment.
	05.09 Assemble/disassemble components from various systems.
	05.10 Demonstrate basic knowledge of how to modify or rework major systems and components to close tolerances.
	05.11 Perform fit check/functional test.
	05.12 Operate ground support equipment (GSE).
	05.13 Operate switches, circuit breakers and valves.
	05.14 Demonstrate a knowledge of thermal control systems.
06.0	Demonstrate the use and maintenance of industry tools. The student will be able to:

06.01	Identify the proper tool for a specific application.
06.02	Inspect tools for cleanliness.
06.03	Inspect tools for functionality.
06.04	Clean/decontaminate tools/equipment.
06.05	Perform hoisting and rigging operations using proper techniques.
07.0	Perform basic electricity, electronic and fiber optics skills. The student will be able to:
07.01	Define the relationship between current, voltage, resistance and power in DC and AC circuits.
07.02	Identify the sources of DC and AC power to include generators, batteries, photovoltaic, fuel cells, transformers, converters and inverters.
07.03	Identify the basic components of DC and AC circuits.
07.04	Solve problems in series, parallel, series-parallel and voltage divider circuits.
07.05	Read and interpret electrical circuit diagrams.
07.06	Measure circuit values to include voltage, current, resistance, continuity, capacitance, inductance and electromagnetism.
07.07	Measure AC circuit parameters to include frequency, period, time, wavelength, peak-to-peak, RMS, phase and instantaneous values.
07.08	Perform electrical wire interconnection system fabrication, repair and troubleshooting.
07.09	Demonstrate basic soldering skills and the identification of components common to electronics.
07.10	Troubleshoot electrical systems.
07.11	Demonstrate safety procedures when handling fiber optics.
07.12	Identify different types of fiber optic materials and define their characteristics.
07.13	Make terminations, splices, and connections.
07.14	Test fiber optic systems using various test equipment.
07.15	Perform fiber optic troubleshooting and diagnosis.
07.16	Define and test various types of motors and motor control systems.
08.0	Demonstrate an understanding of appropriate safety/OSHA rules and regulations. The student will be able to:
08.01	Identify workplace hazards.
08.02	Use appropriate personal protective equipment.
08.03	Use appropriate lifting techniques.
08.04	Place catch nets/bags.

	08.05 Set up safe work zone.
	08.06 Implement lock out/tag out.
	08.07 Use buddy system where required.
	08.08 Monitor breathing zones and wind direction.
	08.09 Interpret safety equipment readings.
	08.10 Research and apply safety/OSHA regulations to various workplace environments.
	08.11 Identify hazardous materials handling and precautions using applicable publications.
	08.12 Demonstrate appropriate fire extinguisher use.
	08.13 Demonstrate safe confined space entry procedure.
	08.14 Perform a workplace risk assessment and resolve identified discrepancies.
09.0	Demonstrate the ability to fabricate component parts to specifications. The student will be able to:
	09.01 Apply basic trigonometric functions to fabrication planning.
	09.02 Demonstrate a basic knowledge of machine tools.
	09.03 Interpret a basic drawing/blueprint.
	09.04 Produce a layout/template.
	09.05 Fabricate a sample project.
	09.06 Demonstrate the use of brake and shear.
	09.07 Demonstrate the ability to finish a component per given requirements.
	09.08 Demonstrate the use of precision measuring tools including micrometer and vernier caliper, square, etc.
	09.09 Fabricate a project per drawings and specifications.
	09.10 Identify and describe metal joining processes (e.g., welds, brazing, etc.).
	09.11 Complete a repair project per drawings and specifications.
	09.12 Inspect finished product for conformity.
10.0	Prepare, analyze and evaluate technical reports and data. The student will be able to:
	10.01 Interpret technical drawings and schematics.
	10.02 Demonstrate application of technical drawings and/or schematic specifications.
	10.03 Demonstrate application of work authorization document to task.

	10.04 Perform technical reporting and documentation.
	10.05 Identify and perform work team protocols (engineering support).
	10.06 Interpret technical drawings and schematics.
11.0	Demonstrate the ability to evaluate problems, troubleshoot and implement appropriate corrective actions. The student will be able to:
	11.01 Analyze a given job.
	11.02 Select appropriate equipment for a given job.
	11.03 Select appropriate materials and supplies for a given job.
	11.04 Identify essential personnel for a given job.
	11.05 Apply troubleshooting skills where necessary.
	11.06 Identify and take corrective action where necessary.
12.0	Select, configure, calibrate, operate and evaluate precision test equipment. The student will be able to:
	12.01 Select appropriate test equipment for given test.
	12.02 Verify tool and equipment calibration.
	12.03 Configure test set up.
	12.04 Perform test operations.
	12.05 Evaluate test results.
	12.06 Identify precision measuring and test equipment.
	12.07 Differentiate between destructive and non-destructive testing.
	12.08 Perform basic non-destructive test on metals and composite materials.
13.0	Demonstrate appropriate knowledge of the operation and repair of high pressure hydraulic and pneumatic systems. The student will be able to:
	13.01 Identify various mechanical connections.
	13.02 Identify the function of various types of regulators, valves, and gauges.
	13.03 Identify unique safety requirements and hazards involved with various fluid systems.
	13.04 Identify and inspect components and conduits for compatibility with commodities.
	13.05 Differentiate between dedicated and multi-purpose components and conduits.
	13.06 Assemble, operate, inspect, and test fluid systems.
14.0	Demonstrate employability skills. The student will be able to:

14.01	Conduct a job search.
14.02	Secure information about a job.
14.03	Identify acceptable work habits.
14.04	Identify the steps for making appropriate job changes.
14.05	Explain and identify the steps, procedures, and components of the Aerospace Technician Certification written, oral and performance tests.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **CNC Composite Fabricator/Programmer**
Specialization Tract: **Mechanical Design and Fabrication**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615080501
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Mechanical Design and Fabrication specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to maintenance techniques, computer-aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Generate and interpret computer-aided drawings.
02.0 Explain the principles, concepts and applications in composite fabrication operations and processes.
03.0 Demonstrate proficiency in the set-up and operation of manual and CNC machining centers.
04.0 Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software.

Florida Department of Education
Student Performance Standards

Program Title: **CNC Composite Fabricator/Programmer**
CIP Number: **0615080501**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Generate and interpret computer-aided drawings. The student will be able to:
01.01	Apply current industrial computer aided-drawing practices.
01.02	Import and export various file types.
01.03	Create and interpret technical drawings.
02.0	Explain the principles, concepts and applications in composite fabrication operations and processes. The student will be able to:
02.01	Demonstrate the safe and proper use of production equipment.
02.02	Apply and use basic safety equipment (PPE).
02.03	Apply OSHA safety rules concerning PPE for eye protection.
02.04	Apply OSHA safety rules concerning PPE for hearing protection.
03.0	Demonstrate proficiency in the set-up and operation of manual and CNC machining centers. The student will be able to:
03.01	Explain operation and maintenance procedures used for machine tools.
03.02	Identify cutting tool geometry and cutting tool materials used in CNC machining.
03.03	Demonstrate efficient toolpath processes used in 2D and 3D High Speed CNC machining operations.
03.04	Identify and perform CNC Code 4 used in toolpath operations.
03.05	Identify and implement appropriate CAM toolpath operations used in CNC machining.
03.06	Identify metal alloys and their properties in machining.
03.07	Demonstrate job planning procedures in machining.
03.08	Demonstrate and apply acceptable procedures in CNC job planning, tooling, selection, and programming.
04.0	Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software. The student will be able to:
04.01	Create geometry for post-processing used in CAD/CAM software

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Mechanical Designer and Programmer**
Specialization Tract: **Mechanical Design and Fabrication**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615080503
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Mechanical Design and Fabrication specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to theory and application of solid modeling techniques used in product design and fabrication. At completion students are qualified to take the certification exam offered by Solid Works. Students will also be introduced to computer aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation. The program explores additive machine processes (rapid prototyping) which will enable a student to become proficient in technological advances within the industry such as 3-D printing.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in the set-up and operation of manual and CNC machining centers.
02.0 Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software.
03.0 Demonstrate proficiency in solid modeling design and programming.

Florida Department of Education
Student Performance Standards

Program Title: **Mechanical Designer and Programmer**
CIP Number: **0615080503**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in the set-up and operation of manual and CNC machining centers. The student will be able to:
01.01	Explain operation and maintenance procedures used for machine tools.
01.02	Identify cutting tool geometry and cutting tool materials used in CNC machining.
01.03	Demonstrate efficient toolpath processes used in 2D and 3D High Speed CNC machining operations.
01.04	Identify and perform CNC Code 4 used in toolpath operations.
01.05	Identify and implement appropriate CAM toolpath operations used in CNC machining.
01.06	Identify metal alloys and their properties in machining.
01.07	Demonstrate job planning procedures in machining.
01.08	Demonstrate and apply acceptable procedures in CNC job planning, tooling, selection, and programming.
02.0	Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software. The student will be able to:
02.01	Create geometry for post-processing used in CAD/CAM software.
03.0	Demonstrate proficiency in solid modeling design and programming. The student will be able to:
03.01	Create working drawings to include orthographic views, sections and dimensions using a solid model.
03.02	Identify appropriate applications for additive manufacturing processes to solid models.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Rapid Prototyping Specialist**
Specialization Tract: **Digital Manufacturing**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615130211
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Digital Manufacturing specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to maintenance techniques, computer aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in 3D digital modeling software packages for product design.
02.0 Demonstrate proficiency in the use of digital tools for product design.
03.0 Demonstrate proficiency in the principles, concepts, and applications in digital manufacturing processes.

Florida Department of Education
Student Performance Standards

Program Title: **Rapid Prototyping Specialist**
CIP Number: **0615130211**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in 3D digital modeling software packages for product design. The student will be able to:
01.01	Create basic solid models.
01.02	Create the standard drawing views to document the design.
01.03	Create an assembly model with functional sufficient mates and constraints.
01.04	Analyze part tolerances and dimensional precision.
02.0	Demonstrate proficiency in the use of digital tools for product design. The student will be able to:
02.01	Create two and three-dimensional drawings related to industrial design.
02.02	Analyze and refine an industrial design as necessary.
02.03	Describe the fundamentals of product and system design as it relates to the manufacturing and structural considerations in design.
02.04	Describe the process of product and systems design.
02.05	Describe the fundamentals of material selection for product and system design.
02.06	Use various measuring machines and instruments for parts analysis.
02.07	Capture physical 3D objects and reverse engineer accurate CAD models from 3D scans.
02.08	Analyze part tolerances and precision and understand how they impact design performance.
03.0	Demonstrate proficiency in the principles, concepts, and applications in digital manufacturing processes. The student will be able to:
03.01	Fabricate a part or an assembly using an additive manufacturing machine.
03.02	Compare the differing properties and characteristics of common materials used for additive manufacturing models.
03.03	Describe the various additive manufacturing processes and terminology.
03.04	Demonstrate integration of fasteners for robust assemblies of additive manufacturing produced components.
03.05	Describe the role of where different additive manufacturing methods and where they apply in the design and production lifecycle.
03.06	Demonstrate basic troubleshooting of additive manufacturing processes.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Computer-Aided Design and Drafting**
Specialization Tract: **Digital Design and Modeling**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615130304
Program Type	College Credit Certificate (CCC)
Program Length	24 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Digital Design and Modeling specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to specialized courses in Applied Technology areas for design, assembly, and fabrication using various software packages.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate knowledge of using 2D and solid modeling software.
02.0 Demonstrate proficiency in 2D CAD and basic solid modeling fundamentals.
03.0 Demonstrate proficiency in engineering design fundamentals.
04.0 Demonstrate proficiency in advanced solid modeling tools and commands.
05.0 Demonstrate proficiency in advanced solid modeling, assemblies, and drawings.

Florida Department of Education
Student Performance Standards

Program Title: **Computer-Aided Design and Drafting**
CIP Number: **0615130304**
Program Length: **24 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate knowledge of using 2D and solid modeling software. The student will be able to:
01.01	Select the correct CAD command for specified tasks.
01.02	Develop the standard drawing arrangement needed for a standard information layout for specific drawing types.
01.03	Demonstrate proficiency in various plotting and printing options of CAD drawings.
01.04	Create and plots multiple setup and sizes of drawings.
01.05	Develop the attributes and standards needed for information in a drawing templates for a specific drawing.
01.06	Implement existing CAD library files for new drawings.
01.07	Develop appropriate new library files when necessary.
01.08	Demonstrate sketch, modeling and drawing commands.
01.09	Demonstrate setup of drawing environment with multiple Layout sheets.
01.10	Apply standard dimensioning rules for Architectural, Mechanical, and Electrical.
01.11	Create the standard drawing views to document the design procedures.
02.0	Demonstrate proficiency in 2D CAD and basic solid modeling fundamentals. The student will be able to:
02.01	Implement the CAD commands for sketching and three-dimensional modeling.
02.02	Implement and apply the CAD three-dimensional coordinate system, work planes and surfaces for creating three-dimensional objects.
02.03	Convert sketches into extruded features.
02.04	Create the desired sketch to show the design intent in the solid modeling procedures.
02.05	Perform analyses on the sketch procedures and refine the sketch to be fully defined.
02.06	Align, rotate, and mirror two-dimensional and three-dimensional objects.
02.07	Choose and apply a type of material to a solid model.
02.08	Create bottom-up assembly and drawings.

	02.09 Implement and apply basic software utilities for arranging, detailing, and plotting multiple views of an solid and assembly.
	02.10 Customize screen, toolbars, and pull-down menus.
03.0	Demonstrate proficiency in engineering design fundamentals. The student will be able to:
	03.01 Create two and three-dimensional models and generate drawings related to graphic and industrial design.
	03.02 Define fundamental two-dimensional and three-dimensional concepts of graphic and industrial design.
	03.03 Measure and calculate properties of parts and assembly.
	03.04 Perform analyses and refine industrial design.
	03.05 Demonstrate basic design principles of visual and spatial form as applied to products.
	03.06 Describe the fundamentals of product and system design as it relates to the manufacturing and physical considerations in design.
	03.07 Describe the theories related to product and systems design.
	03.08 Solve elementary problems related to the form and function of objects and structures.
	03.09 Describe the fundamentals of material selection for product and system design.
	03.10 Define the type of analysis of machined elements of a part or assembly.
	03.11 Conduct a system design analysis and identify the major phases.
	03.12 Implement sustainable practices in simulation design analysis.
	03.13 Apply design features to the two- and three-dimensional drawings.
04.0	Demonstrate proficiency in advanced solid modeling tools commands. The student will be able to:
	04.01 Create and execute advanced templates.
	04.02 Apply and edit dimensions on a sketch and drawing.
	04.03 Create and use multiple work planes for advanced functions.
	04.04 Create solid models by extruding, revolving, sweeping, lofting, and shelling.
	04.05 Create and modify bottom-up assemblies.
	04.06 Define parts and components of an assembly in a BOM link to an Excel directory.
	04.07 Define parts of an assembly in a directory by balloons or labeling.
	04.08 Create exploded views of an assembly.
	04.09 Create multiple configurations of an individual part.
	04.10 Create configurations and add them to a part library.

	04.11 Perform advanced mating using multiple parts or sub-assemblies.
	04.12 Render a three-dimensional model and assembly.
	04.13 Render a solid model or assembly.
05.0	Demonstrate proficiency in advanced solid modeling and assembly. The student will be able to:
	05.01 Choose the appropriate design process for generating an advanced solid model.
	05.02 Select the correct advanced process for specified tasks.
	05.03 Perform sketch analyses on the sketch procedures and refine the sketch to define the modeling process.
	05.04 Create advanced assemblies using smart mates.
	05.05 Create and modify bottom up and top-down assemblies.
	05.06 Perform advanced surfacing of a part to create a solid model.
	05.07 Create sheet metal and flat pattern for parts and assemblies.
	05.08 Create structural elements in weldment for welded parts.
	05.09 Create weldment assemblies and cut list for welded projects.
	05.10 Create detailed molds or die cavities of parts and assemblies.
	05.11 Derive component parts from an edited mold base.
	05.12 Apply basic drawing concepts to molded parts.
	05.13 Apply the rapid prototyping processes for specific applications.
	05.14 Perform reverse engineering using the proper tools.
	05.15 Fabricate a part or an assembly using a rapid prototype machine.
	05.16 Describe the processes used in reverse engineering and scanning.
	05.17 Apply reverse engineering or scanning processes for specific applications.
	05.18 Fabricate a part or an assembly using reverse engineering or scanning equipment.
	05.19 Create a set of working shop drawings for manufactured parts.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Students are urged to join local and national AutoCAD and Solid Modeling user groups.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Alternative Energy Systems Specialist**
Specialization Tract: **Alternative Energy**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615170101
Program Type	College Credit Certificate (CCC)
Program Length	18 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Alternative Energy specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The purpose of this CCC is to prepare students to meet the industry-specific educational needs for technicians in the new and emerging alternative and renewable energy fields, including (but not limited to) occupational titles such as: Electrical Engineering Technician, Industrial Engineering Technician, Solar Photovoltaic Installer and Solar Power Plant Technician, Solar Thermal Installer and Technician, Energy Auditor, and Smart Grid Technician. This program also provides supplemental training for persons previously or currently employed in occupations related to energy production and storage, manufacturing and construction.

The content includes but is not limited to electronics, electricity and energy concepts; alternative energy sources and systems; energy storage, distribution and conversion; operation and performance of an alternative energy system; and policies and business practices affecting alternative energy occupations.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate a fundamental understanding of electronics and electricity.
02.0 Demonstrate an understanding of industrial safety, health, and environmental requirements.
03.0 Characterize alternative energy sources and technologies.
04.0 Characterize the operation and performance of solar energy systems.
05.0 Apply policy, regulation and good business practices for alternative energy systems.

Florida Department of Education
Student Performance Standards

Program Title: **Alternative Energy Technology Specialist**
CIP Number: **0615170101**
Program Length: **18 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate a fundamental understanding of electronics and electricity. The student will be able to:
01.01	Use appropriate electrical circuit grounding techniques.
01.02	Solve circuit problems using appropriate units and notation.
01.03	Operate appropriate test equipment.
02.0	Demonstrate an understanding of industrial safety, health, and environmental requirements. The student will be able to:
02.01	Identify and select appropriate Personal Protective Equipment (PPE).
02.02	Follow appropriate safety procedures.
02.03	Follow applicable environmental laws and regulations.
02.04	Identify and report unsafe conditions and practices.
02.05	Explain when a machine or a process should be stopped to investigate an unsafe condition.
02.06	Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
02.07	Use and evaluate information resources such as SDS (Safety Data Sheets).
03.0	Characterize renewable energy sources and technologies. The student will be able to:
03.01	Describe alternative and renewable energy sources used for power production.
03.02	Define basic energy terms.
03.03	Discuss the feasibility of emerging energy resources.
03.04	Describe the major sources, scale, and impacts of alternative and renewable energy.
03.05	Draw and label a diagram of a solar electric renewable energy system.
03.06	Distinguish between various renewable energy sources and energy potential.
03.07	Describe the social and environmental impact of renewable energy technologies vs. traditional energy sources.
03.08	Explain the difference between passive solar and active solar thermal systems.

	03.09 Evaluate advantages and disadvantages of various renewable energy sources.
	03.10 Compare site selection requirements for various renewable energy installations.
	03.11 Compute cost/benefit analysis and return on investment calculations for a project.
	03.12 Evaluate local, state, and federal renewable energy rebates and incentives.
	03.13 Explain the methods used to connect renewable energy systems to a home or building.
04.0	Characterize the operation and performance of solar energy systems. The student will be able to:
	04.01 Describe the operation of various solar energy systems.
	04.02 Design and choose a solar energy system for optimal production based on the sun's position.
	04.03 Distinguish between an azimuth and tilt angle calculation.
	04.04 Review the methodology for using an azimuth and altitude calculation to determine max output from a collector or concentrator.
	04.05 Specify components of solar energy systems.
	04.06 Calculate the energy produced, efficiency, and power derived from an installed system.
	04.07 Demonstrate proper safety practices in solar energy system installations and operations.
	04.08 Demonstrate standard practices in system checkout, maintenance and troubleshooting a solar energy system.
	04.09 Determine appropriately sized components for a solar energy system.
	04.10 Describe benefits of renewable energy systems to the end customer through case studies.
05.0	Apply policy, regulation and good business practices for renewable energy systems. The student will be able to:
	05.01 Examine current US energy and natural resources policies and regulations.
	05.02 Compare and contrast US energy and natural resources policies and regulations to others around the world.
	05.03 Discuss the effects of financial, technical, and economic trends on the past, current, and future energy industry.
	05.04 Demonstrate best practices for minimizing energy utilization.
	05.05 Apply best practices based for energy production and resources use.
	05.06 Discuss how different climatic, geological, atmospheric, and human activities influence energy production and utilization.
	05.07 Identify conservation practices for natural resources used for energy production.
	05.08 Explain the environmental impacts of energy extraction, conservation, and storage systems.
	05.09 Discuss how the conversion to alternative energy affects various business sectors.
	05.10 Discuss the application of governmental regulations and policy for energy production and utilization.

05.11	Compare and contrast local, state, and federal policy which positively and negatively effects the advancement of renewable energy investment and development.
05.12	Explain structure of electrical power distribution system.
05.13	Explain modernization steps being taken for improving the electrical power grid.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Solar Energy Technician**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615170301
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The program is designed to prepare individuals for employment as solar energy technicians, or to provide supplemental training for persons previously or currently employed in the electrical, plumbing or roofing industries. This program prepares individuals to assemble, install, operate, maintain, troubleshoot and repair solar thermal or photovoltaic equipment. Graduates of this program will be prepared to enter advanced training and education in specialized electrical, plumbing, building construction, electronics and related fields. They may also be employed as trainees in the solar energy industry. The content includes, but is not limited to, DC circuits, AC circuits, solar thermal, and photovoltaic systems. Integrated into this content will be communications skills, leadership skills, human relations skills, employability skills, safe and efficient work practices, use of circuit diagrams and schematics, soldering, laboratory practices and technical recording and reporting.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in direct current (DC) circuits.
03.0 Demonstrate proficiency in alternating current (AC) circuits.
04.0 Demonstrate proficiency in solar thermal systems.
05.0 Demonstrate proficiency in photovoltaic systems.
06.0 Demonstrate employability skills.

Florida Department of Education
Student Performance Standards

Program Title: **Solar Energy Technician**
CIP Number: **0615170301**
Program Length: **12 credit hours**

This certificate program is part of the Electronics Engineering Technology AS degree program (1615030301). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in laboratory practices. The student will be able to:
01.01	Apply Occupational Safety Health Administration (OSHA) safety standards in an electronics laboratory environment when required.
01.02	Analyze drawings and electronic schematics to make proper electrical and component connections and to also identify obvious faulty connections.
01.03	Identify and use electrical/electronic hand and power tools (wire stripper, wire needle-nose clipper, solder and desolder station, etc.).
01.04	Explain the theoretical and practical concepts of soldering including soldering paste and conductive glue.
01.05	Identify non-functional solder connections.
01.06	Practice acceptable soldering, de-soldering, rework, and repair techniques.
01.07	Practice electrostatic discharge (ESD) safety procedures.
01.08	Describe the construction of printed circuit boards (PCBs).
01.09	Use circuit simulation programs to solve problems, verify circuit functionality and design circuits.
01.10	Demonstrate the use of instrumentation and module analytical software.
01.11	Read and interpret data sheet specifications for electronic components.
01.12	Identify basic limitations of multi-meters, oscilloscopes, function generators, and power supplies.
01.13	Use digital multi-meters (DMM), oscilloscopes, function generators, and power supplies to build, analyze and trouble shoot electrical/electronic circuits.
02.0	Demonstrate proficiency in direct current (DC) circuits. The student will be able to:
02.01	Describe the physical laws that govern electricity and magnetism.
02.02	Identify sources of electricity.
02.03	Define voltage, current, resistance, power and energy.
02.04	Apply Ohm's law and power formulas to electrical/electronic circuits.
02.05	Read and interpret color codes and symbols to identify electrical components and values.

	02.06 Measure properties of a circuit and electronic components using Digital Multimeters (DMM), LCR meters and oscilloscopes.
	02.07 Calculate and measure the conductance and resistance of conductors and insulators.
	02.08 Solve problems in electronics utilizing metric prefixes.
	02.09 Apply Ohm's law and Kirchoff's voltage and current laws to solve series, parallel, and series-parallel circuits.
	02.10 Construct and verify operation of series, parallel, and series-parallel circuits.
	02.11 Analyze and troubleshoot series, parallel, and series-parallel circuits.
	02.12 Apply Ohm's law and Kirchoff's voltage and current laws to bridge circuits.
	02.13 Construct and verify the operation of bridge circuits.
	02.14 Analyze and troubleshoot bridge circuits.
	02.15 Identify and define voltage divider circuits (loaded and unloaded).
	02.16 Construct and verify the operation of voltage divider circuits (loaded and unloaded).
	02.17 Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
	02.18 Apply maximum power transfer theory to determine the conditions under which maximum power transfer occurs in a circuit.
	02.19 Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
	02.20 Describe magnetic properties of circuits and devices.
	02.21 Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
	02.22 Setup and operate power supplies for DC circuits.
03.0	Demonstrate proficiency in alternating current (AC) circuits. The student will be able to:
	03.01 Identify properties of an AC signal.
	03.02 Identify AC sources.
	03.03 Analyze and measure AC signals utilizing VOM, DVM, oscilloscope, frequency counter and function generator.
	03.04 Define the characteristics of three-phase circuits.
	03.05 Define the operation of basic motor theory and Induction motor theory.
	03.06 Define basic generator theory and operation.
	03.07 Setup and operate power supplies for AC circuits.
	03.08 Utilize Power Analyzers to Analyze and measure power in AC circuits.
04.0	Demonstrate proficiency in solar thermal systems. The student will be able to:

04.01	Create sun path charts and site solar irradiance audit.
04.02	Explain how a passive solar thermal system works.
04.03	Install solar thermal systems.
04.04	Determine the best location for collector roof mounting.
04.05	Understand the concepts of wind loading, collector, and piping freeze protection.
04.06	Size a solar thermal system based on family size and local solar irradiance.
04.07	Explain how an active solar thermal system works.
04.08	Install AC and DC water pumps, electronic controllers, and temperature sensors.
04.09	Describe the latest Florida solar rebates, and federal solar tax credits.
05.0	Demonstrate proficiency in photovoltaic systems. The student will be able to:
05.01	Determine the available solar resource and conduct site assessments for PV installations.
05.02	Determine the performance and operating characteristics of PV systems and components.
05.03	Define appropriate code-compliant configurations for PV systems and equipment.
05.04	Plan and prepare for PV system installations, including customer relations, developing performance expectations, responsibilities and schedule.
05.05	Implement and modify, as required, mechanical designs for PV systems that meet the performance, architectural and structural requirements for given applications.
05.06	Implement and modify, as required, electrical designs for PV systems that meet the safety, code-compliance and functional requirements for given applications
05.07	Conduct acceptance tests and inspections, and commission PV system installations.
05.08	Evaluate, troubleshoot, and maintain PV systems.
05.09	Describe the principles of Wind, Geothermal, Biomass, and tidal wave energy systems.
06.0	Demonstrate employability skills. The student will be able to:
06.01	Conduct a job search.
06.02	Secure information about a job.
06.03	Identify documents that may be required when applying for a job.
06.04	Complete a job application form correctly.
06.05	Demonstrate competence in job interview techniques.
06.06	Demonstrate knowledge of how to make appropriate decisions.

06.07	Demonstrate appropriate work/behavioral habits.
06.08	Demonstrate acceptable employee personal hygiene and health.
06.09	Demonstrate knowledge of the Occupational Safety and Health Standard 29CFR-1910.1200, Hazard Communication.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Medical Quality Systems**
Specialization Tract: **Biomedical Systems**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0641010105
Program Type	College Credit Certificate (CCC)
Program Length	15 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Biomedical Systems specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to specialized courses used in the medical device manufacturing areas in quality assurance.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate knowledge of the Food and Drug Administration (FDA) regulations and compliance for biomedical systems.
02.0 Demonstrate knowledge in the design and manufacture of biomedical systems.
03.0 Demonstrate knowledge of risk management for biomedical products development and production.
04.0 Demonstrate knowledge of quality audits for biomedical systems.

Florida Department of Education
Student Performance Standards

Program Title: **Medical Quality Systems**
CIP Number: **0641010105**
Program Length: **15 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Demonstrate knowledge of the Food and Drug Administration (FDA) regulations and compliance for biomedical systems. The student will be able to:
01.01	Describe how the FDA is organized.
01.02	Locate the Code of Federal Regulations (CFR) specific to the FDA regulations that apply to biomedical systems manufacturers.
01.03	Describe the role of the FDA's standing advisory committee, the Center for Devices and Radiological Health (CDRH).
01.04	Define medical devices, products, and systems and their federal classifications.
01.05	Explain the 510(k) Premarket Notification Process including Applications (PMA).
01.06	Explain an investigational device exemption (IDE).
01.07	Explain the differences between Class I, II, and III devices.
01.08	Describe and explain the Federal Food, Drug, and Cosmetic Act (FDCA).
01.09	Define and describe good laboratory and clinical practices.
01.10	Define and describe the quality system regulations (QSRs).
01.11	Define and describe Current Good Manufacturing Practices.
01.12	Define and describe foreign regulatory systems, i.e., the European Union (EU).
01.13	Identify and explain the components of ISO 13485/ISO 13488.
02.0	Demonstrate knowledge in the design and manufacture of biomedical systems. The student will be able to:
02.01	Describe uses for which products could be designed.
02.02	Apply the steps identified in the FDA's regulatory requirements 21 CFR 820.30 Design Control.
02.03	Describe the various product design methodologies and their associated lifecycles.
02.04	Define, describe, and list product specifications.
02.05	Describe, list, and apply failure modes and effects analysis (FMEA) to increase product safety.
02.06	Demonstrate how various components of the design and development process effect reliability.

02.07	Describe concurrent product and process development.
02.08	Describe and compare installation and operation qualifications.
02.09	Recognize process optimization.
02.10	Develop and analyze process flow maps.
02.11	Differentiate between verification and validation.
02.12	Describe and determine how a design requirement is verified.
02.13	Describe and analyze how customer needs are validated.
02.14	Describe how a process output can be verified.
02.15	Describe and analyze process capability.
02.16	Define the terms associated with production scale-up.
02.17	Describe and analyze production scheduling.
02.18	Describe a market release package with multiple components.
02.19	Determine a root cause of a problem is determined.
03.0	Demonstrate knowledge of risk management for biomedical products development and production. The student will be able to:
03.01	Describe the FDA's definition of risk management.
03.02	Explain how the subparts to the FDA's regulatory requirements 21 CFR 820 Quality System Regulation (QSR) relate to risk management.
03.03	Explain the process of identifying the key risk management activities critical to a successful risk management process.
03.04	Explain the components of ISO 14971 and how they provide effective management of the risks associated with the use of medical devices.
03.05	Explain how the components of risk management identified in ISO 14971 relate to the FDA's Quality System Regulation (QSR).
03.06	Develop a comprehensive risk management plan.
03.07	Identify internal and external sources for determining product hazards.
03.08	Estimate a risk using risk analysis tools and techniques.
03.09	Evaluate a risk using risk evaluation tools and techniques.
03.10	Identify the steps associated with risk control.
03.11	Identify the risk elements that can be reduced to decrease the risk associated with a hazard.
03.12	Describe the process of verification and explain its role in risk control.
03.13	Explain the relationship between risk control measures and the introduction of new hazards.

03.14	Explain the difference between residual risk and overall residual.
03.15	Develop a risk management report.
03.16	List and describe the elements of corrective action and preventive action (CAPA) associated with Post Production Information.
04.0	Demonstrate knowledge of quality audits for biomedical systems. The student will be able to:
04.01	Define terms associated with quality auditing.
04.02	Describe the characteristics of internal and external quality audits.
04.03	Describe the relationship between the quality audit and the FDA regulatory requirement 21 CFR 820.20 (c).
04.04	List factors that can influence the credibility of quality audits.
04.05	Describe the purpose and characteristics of a confidentiality agreement.
04.06	Describe the auditor's responsibilities when illegal or unsafe conditions or activities are discovered during an audit.
04.07	Identify sources in a medical device manufacturing organization that generate performance history data for review prior to performing a quality audit.
04.08	Identify the quality auditing strategies for data collection.
04.09	Describe the purpose and scope of the quality audit opening and closing meetings.
04.10	Identify auditable quality records in a medical device manufacturing company as defined by the FDA regulatory requirements 21 CFR 820.180.
04.11	Describe the relationship of risk and criticality in analyzing audit data.
04.12	Describe the difference between compliance issues and effectiveness issues and giving examples of each.
04.13	Describe record retention requirements.
04.14	Identify effective communication techniques that can be successfully used in a quality audit.
04.15	Conduct a simulated audit that conforms to FDA regulatory requirements.
04.16	Write a comprehensive audit report.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Chemical Laboratory Specialist**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0641030101
Program Type	College Credit Certificate (CCC)
Program Length	37 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Chemical Technology AS degree program (1641030100).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to development of chemical and other scientific skills. The program completer will be able to assist chemists, biochemists and chemical engineers by performing chemical, biological and physical laboratory tests for various purposes such as quality control monitoring of on-going production operations, research and development, and the maintenance of health and safety standards in the laboratory.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate basic knowledge of chemical concepts.
02.0 Demonstrate knowledge of chemical kinetics and thermodynamics.
03.0 Demonstrate skills in the safe handling of chemical materials and equipment.
04.0 Exercise safely in the laboratory and adhere to safety, health, and environmental regulations.
05.0 Demonstrate conceptual and laboratory knowledge in the area of organic chemistry and/or physics and/or biology and/or engineering and/or biotechnology and/or chemical instrumentation.

Florida Department of Education
Student Performance Standards

Program Title: **Chemical Laboratory Specialist**
CIP Number: **0641030101**
Program Length: **37 credit hours**

This certificate program is part of the Chemical Technology AS degree program (1641030100). At the completion of this program, the student will be able to:	
01.0	Demonstrate basic knowledge of chemical concepts. The student will be able to:
01.01	Write chemical formulas and use correct chemical nomenclature for inorganic compounds.
01.02	Classify inorganic compounds according to a variety of chemical and physical properties.
01.03	Name and write the symbols for the elements and describe characteristics of the common groupings of elements.
01.04	Describe the basic reactions that occur between commonly used chemical substances.
01.05	Read, write, balance, and interpret chemical equations.
01.06	Solve a variety of basic chemical problems using equations and/or dimensional analysis.
01.07	Classify chemicals according to reactivity.
01.08	Demonstrate knowledge of chemical composition and stoichiometry.
01.09	Demonstrate an understanding of empirical gas laws and theory relating to the behavior of gases.
01.10	Demonstrate a basic understanding of energy as it relates to chemical and other processes.
01.11	Demonstrate a basic understanding of the laws and theories relating to the structure of the atom and how this relates to the Periodic Table.
01.12	Demonstrate a basic understanding of molecular structure and chemical bonding,
01.13	Describe the structure and properties of liquids and solids.
01.14	Describe solutions and their properties, and perform calculations involving solution concentrations, composition and colligative properties.
02.0	Demonstrate knowledge of chemical kinetics and thermodynamics. The student will be able to:
02.01	Demonstrate a basic understanding of chemical kinetics
02.02	Demonstrate a basic understanding of chemical equilibria.
02.03	Demonstrate a working knowledge of acid/base equilibria.
02.04	Demonstrate a working knowledge of precipitation equilibria,

	02.05	Demonstrate a working knowledge of redox chemistry.
	02.06	Use the concepts of heat, work, energy, enthalpy, entropy, and Gibbs Free Energy to discuss how energetics and change are interrelated in chemical processes and solve related problems.
	02.07	Demonstrate a basic knowledge of radioactivity.
03.0	Demonstrate skills in the safe handling of chemical materials and equipment. The student will be able to:	
	03.01	Properly identify and use a variety of common chemistry laboratory glassware.
	03.02	Use common chemistry laboratory equipment to include such items as hot plates, stirrers, laboratory balances and centrifuges.
	03.03	Preparing solutions of specific concentration from pure substances
	03.04	Performing dilutions to prepare solution of specific concentration
	03.05	Purify chemicals using techniques such as filtering, extracting, crystallization, precipitation, distilling, etc.
	03.06	Use basic analytical chemistry procedures and concepts of measurements in volumetric, gravimetric, and electrochemical analyses and correctly perform associated calculations.
	03.07	Prepare samples for analysis, including digesting, ashing, dissolving, grinding, purifying, diluting, and chemically altering as appropriate before analysis.
	03.08	Determine pH using pH paper, indicators, and instrumental methods.
	03.09	Calculate molarity, molality, mole fraction, weight percent, and normality of solutions, given the appropriate information.
	03.10	Conduct analytical tests using acid-base, oxidation-reduction, and complexometric titrations.
	03.11	Perform gravimetric, volumetric, and electrochemical analyses and achieve results within acceptable limits of precision and accuracy.
	03.12	Apply statistical methods for analyzing experimental data.
	03.13	Calibrate instruments per manufacture’s specifications and record in related logbook.
04.0	Exercise safety in the laboratory and adhere to safety, health and environmental regulations. The student will be able to:	
	04.01	Be aware of and follow federal, state, and local legislation pertaining to safety, health, and environmental regulations.
	04.02	Recognize that each company has policies and safety plans that include evacuation procedures, emergency numbers, rules, and practices.
	04.03	Explain the Federal Law as recorded in (29 CFR-1910.1200) and how it applies to chemical laboratory technicians.
	04.04	Recognize, apply, and respond appropriately to the hazard symbols and toxicology sections of Safety Data Sheets (SDS).
	04.05	Choose the proper safety equipment for conducting a variety of laboratory tasks (e.g., proper hoods, shields).
	04.06	Choose and demonstrate the use of personal protective equipment to be used in a variety of situations (e.g., eye wear, special clothing).
	04.07	Demonstrate safe handling procedures (e.g., handling cylinders, glassware, and laboratory instruments).

	04.08 Describe the various categories of hazardous materials.
	04.09 Discuss federal, state, and local regulations for the proper storage and disposal of chemicals.
	04.10 Make informed and appropriate decisions on how and where to store chemical materials to minimize hazards.
	04.11 Given a safety data sheet, explain each section of the sheet.
	04.12 Define and give an example of the major physical and health hazards which are likely to be encountered in the industrial laboratory.
	04.13 List the information needed on each hazardous material when conducting an inventory.
	04.14 Demonstrate the human health effects associated with exposure to hazardous materials.
	04.15 Follow federal, state, and local regulations for the proper storage and disposal of sharps and biological materials.
05.0	Demonstrate conceptual and laboratory knowledge in the area of organic chemistry and/or analytical chemistry and/or physics and/or biology and/or engineering and/or biotechnology and/or chemical instrumentation. Students will be competent in two or more of the following areas of specialization. The student will be able to:
Specialty I: Organic Chemistry	
	05.01 Draw Lewis structures, deduce atomic orbital hybridizations and describe molecular shapes for organic structures.
	05.02 Classify organic reactions in common groups, write chemical equations and describe unique features for each type.
	05.03 Describe, name, and give common reactions of alkanes, alkenes, and alkynes.
	05.04 Describe, name, and give common reactions of alcohols, ethers, and halides.
	05.05 Describe, name, and give common reactions of aldehydes and ketones.
	05.06 Describe, name, and give common reactions of carboxylic acids and esters.
	05.07 Describe, name, and give common reactions of amines and amides.
	05.08 Describe and name simple carbohydrates, simple lipids, and amino acids.
	05.09 Describe the basic concepts of proteins and their structure.
	05.10 Describe the basic concepts of polymerization reactions.
	05.11 Apply concepts of chemical reactivity, kinetics, stoichiometry, and equilibrium to chemical syntheses and analyses.
	05.12 Crystallize, evaporate, sublime, extract, and use phase separations and/or other purification and separation techniques.
	05.13 Perform organic chemical reactions using glassware and techniques typically employed in organic chemistry laboratories (e.g., ‘quick fit glassware, anhydrous conditions etc.)
	05.14 Determine reaction yields using chemical stoichiometry.
	05.15 Use chemical and instrumental techniques to determine the structure of organic materials.

Specialty II: Physics	
05.16	Solve physical problems dealing with mass, distance, area, volume, relative position, motion, velocity, kinetic and potential energy, momentum, force, acceleration, heat, sound, and related concepts.
05.17	Use analytical reasoning in solving problems dealing with a variety of physical quantities and phenomena.
05.18	Use basic concepts and terminology from physics and related applications as found in the industrial workplace.
05.19	Use basic laboratory instruments for determining length, mass, time, temperature, and other easily measurable physical quantities.
05.20	Collect and manipulate numerical data in controlled experiments involving physical parameters to discover the mathematical functions by which the variables are related.
05.21	Analyze physical behavior and know how to properly apply principles of physics related to basic mechanics and sound.
05.22	Characterize physical properties of gases, liquids, and solids and describe their reactions to changes of temperature and pressure.
05.23	Choose the appropriate equipment for measuring physical properties based on specified accuracy and precision requirements.
05.24	Solve physical problems dealing with basic concepts in electricity, magnetism, light, optics, and thermodynamics.
05.25	Analyze physical behavior and know how to properly apply principles of physics related to basic electricity, magnetism, light, optics and thermodynamics.
Specialty III: Biology	
05.26	Name the components of the cell theory and relate each to basic concepts of life.
05.27	Identify the structural characteristics, components, and functions of cells.
05.28	Given a list of cellular activities or characteristics, relate them to the correct cell structure.
05.29	Explain the consequences of energy in terms of its availability to living organisms, and how it is transferred through food chains.
05.30	Know why energy is limited in amount. Know and be able to explain the consequences of energy in terms of its availability to living organisms, both now and in the future. Know how it is used and transferred through food chains.
05.31	Explain how sunlight is trapped as an energy source and how this trapped energy is used to synthesize simple organic molecules. Describe the basic role or activity of chloroplasts and chlorophyll, cyclic and non-cyclic photophosphorylation, carbon dioxide reduction and fixation.
05.32	Describe the sequential events of mitosis.
05.33	Describe the sequential events of meiosis.
05.34	Solve and interpret various genetics problems involving Mendelian principles.
05.35	List and describe ways and give examples of how man has altered his environment, both positively and negatively, and be able to detail some of the consequences of this action.
05.36	Give the basic characteristics of the carbon, nitrogen, and hydrological cycles.
05.37	Describe the effects of the increasing human population upon natural resources use and depletion, degradation of the environment, social and economic problems both within nations and between nations, etc.

05.38	State the basic morphologic types of Eubacteria.
05.39	Diagram and describe the structural components of bacterial cells using a microscope.
05.40	Describe bacterial cell lifecycle and apoptosis.
05.41	Distinguish gram positive cells and gram-negative cells from a description of cell wall chemical components.
05.42	Successfully demonstrate the correct staining procedure for general staining, Gram staining, acid-fast staining, spore staining, capsular staining, and flagellar staining.
05.43	Describe the characteristics that identify by form fungi, bacterium, and viruses, and show how they are distinguished from other organisms.
05.44	List the factors that affect colonial growth.
Specialty IV: Engineering	
05.45	Utilize vectors to solve engineering problems.
05.46	Utilize calculus to solve engineering problems
05.47	Analyze particles and rigid bodies in equilibrium.
05.48	Analyze situations where a force causes a rigid body to rotate.
05.49	Characterize the static and rotational properties of irregular shaped rigid bodies.
05.50	Analyze the distribution of forces and moments within a structural member.
05.51	Analyze the equilibrium of rigid bodies subjected to dry friction.
05.52	Analyze the motion of particles.
05.53	Analyze the kinetics of particles using Newton's Second Law, the methods of work and energy and the methods of impulse and momentum.
05.54	Analyze the kinetics of a system of particles.
05.55	Analyze the motion of rigid bodies.
05.56	Analyze the effect of forces on rigid bodies in two dimensions.
05.57	Analyze the kinetics of rigid bodies using the methods of work, energy, impulse, and momentum in two dimensions.
05.58	Produce accurate diagrams of two- and three-dimensional objects using a design and drafting software package.
05.59	Solve mathematical problems using software packages such as: Excel, MathCAD and MATLAB.
05.60	Acquire the team building skills typically found in the engineering profession.
Specialty V: Biotechnology	
05.61	Demonstrate an understanding of the operating principles, safety features, and use of various equipment found in a biotechnology laboratory.

05.62	Demonstrate an understanding the importance of a sterile working environment and proper aseptic techniques for culturing bacterial.
05.63	Demonstrate an understanding of the operating expression, regulation, and safety features and use of common purification techniques.
05.64	Demonstrate an understanding of the methodologies required for nucleic acid technology.
05.65	Demonstrate an understanding of the science and scientific basis of biotechnology including traditional methodologies, fermentation, and industrial microbiology.
05.66	Demonstrate a basic understanding of the concept of bioethics, safety concerns of bioengineered products and the licensing and patenting process for biotechnology products.
05.67	Implement proper aseptic techniques and disposal procedures for potentially biohazardous materials.
Specialty VI: Chemical Instrumentation	
05.68	Describe the basic scientific principles behind a variety of instrumental methods used in a modern chemical laboratory.
05.69	Describe the major components of each instrumental method studied and the role that each component plays in making the chemical measurement.
05.70	Choose an instrument appropriate for a given analysis and identify the limitations of the instrument.
05.71	Properly prepare samples and properly calibrate each instrument.
05.72	Apply proper safety precautions for laboratory instruments and equipment.
05.73	Adjust instrument settings to handle varied chemical samples under a variety of conditions.
05.74	Describe the basic concepts of chemical/physical separation techniques and apply separation techniques to the analysis of materials.
05.75	Choose appropriate sample preparation techniques for physical characterization measurements and/or analysis of structure, concentration, and composition.
05.76	Apply basic knowledge of organic and inorganic chemistry, including nomenclature, classification in chemical groups, chemical and physical characteristics, and chemical reactivity to instrumental analysis.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Scientific Workplace Preparation**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0641030102
Program Type	College Credit Certificate (CCC)
Program Length	26 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Chemical Technology AS degree program (1641030100).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to development of communication skills, mathematical skills, computer skills, a basic knowledge of scientific concepts in addition to modeling ethical responsibility. The program completer will be able to assist scientist by performing basic scientific laboratory tests for various purposes such as quality control monitoring of on-going production operations, research and development, and the maintenance of health and safety standards in the laboratory.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate appropriate written and oral communication skills.
02.0 Demonstrate appropriate mathematical skills to solve basic problems in the sciences.
03.0 Demonstrate appropriate interpersonal skills, decision-making strategies, and awareness of self-worth, ethics and values.
04.0 Demonstrate computer competence.
05.0 Demonstrate basic knowledge of scientific concepts.
06.0 Demonstrate basic knowledge of chemical concepts.

Florida Department of Education
Student Performance Standards

Program Title: **Scientific Workplace Preparation**
CIP Number: **0641030102**
Program Length: **26 credit hours**

This certificate program is part of the Chemical Technology AS degree program (1641030100). At the completion of this program, the student will be able to:	
01.0	Demonstrate appropriate written and oral communication skills. The student will be able to:
01.01	Write logical, readable, and understandable sentences and paragraphs.
01.02	Carefully read, accurately follow, and demonstrate an understanding of written instructions, standard operating procedures, and accepted manufacturing practices.
01.03	Read and evaluate ideas recognizing assumptions and implications.
01.04	Carefully follow and deliver oral instructions and other spoken information related to the workplace.
01.05	Prepare, outline, and deliver a short oral presentation.
01.06	Participate in group discussion as a member and as a leader.
01.07	Prepare visual material to support an oral presentation.
01.08	Answer and ask questions coherently and concisely.
01.09	Give clear, concise instructions.
01.10	Read technical manuals, reports and journals.
01.11	Read and prepare diagrams and charts.
01.12	Maintain legibly written logs and notes.
01.13	Keep detailed and accurate records.
01.14	Maintain an accurate and legible notebook.
01.15	Accurately report data.
01.16	Write detailed standard operating procedures.
01.17	Professionally compose memos, letters, and reports.
02.0	Demonstrate appropriate mathematical skills to solve basic problems in the sciences. The student will be able to:
02.01	Calculate ratios.
02.02	Perform unit conversions.

	02.03 Perform calculations using exponents and exponential functions
	02.04 Perform calculations using logarithms and logarithmic functions.
	02.05 Use appropriate significant figures.
	02.06 Recognize patterns in data.
	02.07 Solve single-unknown algebraic equations.
	02.08 Accurately interpret and construct graphs.
	02.09 Plot data, calculate slopes and intercepts of linear graphs.
	02.10 Perform calculations using roots. (square, cube, etc.)
	02.11 Solve simultaneous equations.
	02.12 Solve quadratic equations.
	02.13 Solve word problems using arithmetic and algebra.
03.0	Demonstrate appropriate interpersonal skills, decision-making strategies, and awareness of self-worth, ethics and values. The student will be able to:
	03.01 Discuss the importance of teamwork and have experience working as a member of a team for planning, performing, analyzing, and reporting.
	03.02 Demonstrate critical thinking skills.
	03.03 Demonstrate high ethical standards in all aspects of work.
	03.04 Apply quality principles to all aspects of work.
	03.05 Recognize sources and symptoms of stress and learn how to manage one's response to it.
	03.06 Determine the importance of initiative and responsibility and examine the possible repercussions of action vs. non-action.
	03.07 Demonstrate the ability to problem solve effectively and resolve typical workplace conflicts.
	03.08 Apply decision-making strategies to workplace situations.
	03.09 Explain the basis for employer expectations: the written and unwritten "rules for success."
	03.10 Recognize the "culture" of an organization or employer and evaluate its impact on the individual.
	03.11 Develop an awareness of diversity and multi-culturalism.
04.0	Demonstrate computer competence. The student will be able to:
	04.01 Demonstrate use of computer hardware and peripherals.
	04.02 Demonstrate appropriate use of computer software applications and tools.
05.0	Demonstrate basic knowledge of scientific concepts. The student will be able to:

05.01	Discuss the scientific method.
05.02	Understand the need to organize and classify natural phenomena.
05.03	Discuss relationships between characteristics of natural phenomena.
05.04	Dissect a natural system into its component parts
05.05	Model natural phenomena.
05.06	Understand that nature behaves in predictable ways.
05.07	Discuss methods of observing natural changes, from extremely slow changes to extremely fast changes.
05.08	Discuss the variation of naturally occurring phenomena
05.09	Discuss the diversity found within classes of natural organisms
06.0	Demonstrate basic knowledge of chemical concepts. The student will be able to:
06.01	Write chemical formulas and use correct chemical nomenclature for inorganic compounds.
06.02	Classify inorganic compounds according to a variety of chemical and physical properties.
06.03	Name and write the symbols for the elements and describe characteristics of the common groupings of elements.
06.04	Describe the basic reactions that occur between commonly used chemical substances.
06.05	Read, write, balance and interpret chemical equations.
06.06	Solve a variety of basic chemical problems using equations and/or dimensional analysis.
06.07	Classify chemicals according to reactivity.
06.08	Demonstrate knowledge of chemical composition and stoichiometry.
06.09	Demonstrate an understanding of empirical gas laws and theory relating to the behavior of gases.
06.10	Demonstrate a basic understanding of energy as it relates to chemical and other processes.
06.11	Demonstrate a basic understanding of the laws and theories relating to the structure of the atom and how this relates to the Periodic Table.
06.12	Demonstrate a basic understanding of molecular structure and chemical bonding,
06.13	Describe the structure and properties of liquids and solids.
06.14	Describe solutions and their properties, and perform calculations involving solution concentrations, composition and colligative properties.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Microcomputer Repairer / Installer**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0647010406
Program Type	College Credit Certificate (CCC)
Program Length	15 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the linkbelow.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Computer Engineering Technology AS degree program (1615120100).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Manufacturing career cluster.

The content includes but is not limited to the study of computer systems architecture.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in microcomputers and computer systems architecture.
02.0 Understand, install, configure, and troubleshoot issues relating to computer hardware and software.
03.0 Demonstrate proficiency in direct current circuits and network analysis.
04.0 Demonstrate proficiency in alternating current circuits and network analysis.
05.0 Demonstrate proficiency in analog electronics.
06.0 Demonstrate proficiency in digital electronics.

Florida Department of Education
Student Performance Standards

Program Title: **Microcomputer Repairer / Installer**
CIP Number: **0647010406**
Program Length: **15 credit hours**

This certificate program is part of the Computer Engineering Technology AS degree program (1615120100). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in microcomputers and computer systems architecture. The student will be able to:
01.01	Draw the block diagram and describing the basic architecture of a microcomputer.
01.02	Identify and give functional descriptions of data, address, and control buses.
01.03	Identify and define priorities and interrupts at system level.
01.04	Define and list direct memory access handling systems.
01.05	Define functions of advanced memory techniques (e.g., virtual, pipeline, cache).
01.06	Identify the various types of RAM and ROM memories and their interfacing to the microprocessor/microcontroller.
02.0	Understand, install, configure and troubleshoot issues relating to computer hardware and software. The student will be able to:
02.01	Describe the functions and major components (BIOS, task management, etc.) of a computer operating system.
02.02	Use an operating system for activities such as data and file management.
02.03	Identify various coding schemes (ASCII, etc.).
02.04	Identify the major hardware platforms.
02.05	Set up and use multiple hardware platforms built on various processor architectures.
02.06	Use system software to perform routine maintenance tasks such as backup, hard drive defragmentation, etc.
02.07	Use both stand-alone operating systems and network operating systems.
02.08	Describe and demonstrate the primary features and functions of the major categories of applications software (word processing, database, spreadsheet, presentation, email, browsers, etc.).
02.09	Describe the functions of major components of a computer system.
02.10	Discuss various computer applications in society.
02.11	Describe the categories of computers.
02.12	Recognize the value of computer literacy within an individual’s personal and career environments.
02.13	Set up and configure systems and peripherals.

	02.14 Set up and upgrade BIOS.
	02.15 Install and configure storage and I/O device interfaces.
	02.16 Describe the architecture of a typical microcomputer system.
	02.17 Perform component maintenance tasks on microcomputer systems.
	02.18 Perform preventive maintenance tasks on microcomputer systems.
	02.19 Describe issues that affect system design and construction (redundancy, fault tolerance, etc.).
03.0	Demonstrate proficiency in direct current circuits and network analysis. The student will be able to:
	03.01 Solve problems in electronic units utilizing metric prefixes.
	03.02 Relate electricity to the nature of matter.
	03.03 Identify sources of electricity.
	03.04 Define voltage, current, resistance, power and energy.
	03.05 Read and interpret color codes and symbols to identify electrical components and values.
	03.06 Measure properties of a circuit using digital multi-meter (DMM) and oscilloscopes.
	03.07 Construct and verify operation of series circuits.
04.0	Demonstrate proficiency in alternating current circuits and network analysis. The student will be able to:
	04.01 Identify properties of an AC signal.
	04.02 Identify AC sources.
	04.03 Analyze and measure AC signals utilizing VOM, DVM, oscilloscope, frequency counter and function generator.
05.0	Demonstrate proficiency in analog electronics -The student will be able to:
	05.01 Construct, analyze, and troubleshoot diode circuits.
	05.02 Construct, analyze, and troubleshoot bipolar junction transistor biased circuits.
	05.03 Construct, analyze, and troubleshoot multistage amplifiers.
	05.04 Construct power supply regulator circuits.
	05.05 Construct active filter circuits.
	05.06 Construct oscillator circuits.
06.0	Demonstrate proficiency in digital electronics. The student will be able to:
	06.01 Construct combinational logic circuits using integrated circuits.

06.02	Troubleshoot logic circuits.
06.03	Construct digital display circuits.
06.04	Demonstrate proficiency in the use of function generators and oscilloscopes for digital circuits.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **CNC Machinist/Fabricator**
Specialization Tract: **Mechanical Design and Fabrication**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0648051002
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Engineering Technology AS degree program (1615000001) under the Mechanical Design and Fabrication specialization.

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to maintenance techniques, computer aided drafting/design skills, technical communications, maintenance and operation of various industrial components, quality control and testing, material handling protocols, and proper usage of tools and instrumentation.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Generate and interpret computer-aided drawings.
02.0 Demonstrate proficiency in the principles, concepts, and applications in metal fabrication methods.
03.0 Demonstrate proficiency in the set-up and operation of manual and CNC machining centers.
04.0 Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software.

Florida Department of Education
Student Performance Standards

Program Title: **CNC Machinist/Fabricator**
CIP Number: **0648051002**
Program Length: **12 credit hours**

This certificate program is part of the Engineering Technology AS degree program (1615000001). At the completion of this program, the student will be able to:	
01.0	Generate and interpret computer-aided drawings. The student will be able to:
01.01	Apply current industrial computer aided-drawing practices.
01.02	Import and export various file types.
01.03	Create and interpret technical drawings.
02.0	Demonstrate proficiency in the principles, concepts, and applications in metal fabrication methods. The student will be able to:
02.01	Identify and understand machining mathematical concepts, operations and measuring systems.
02.02	Interpret and identify mechanical drawings geometric features by referencing orthographic views, dimensions.
02.03	Demonstrate and identify the concepts and applications of Geometric Dimensioning and Tolerancing.
02.04	Identify properties of materials for metal fabrication and Machining processes.
02.05	Demonstrate safe use and operation of hand tools and power tools.
02.06	Identify processes in job planning and part layout.
02.07	Demonstrate proper setup and safe operation of metal forming equipment.
02.08	Identify appropriate applications of sheet metal forming and fastening.
02.09	Demonstrate and identify the proper use and reading of precision measuring.
03.0	Demonstrate proficiency in the set-up and operation of manual and CNC machining centers. The student will be able to:
03.01	Explain operation and maintenance procedures used for machine tools.
03.02	Identify cutting tool geometry and cutting tool materials used in CNC machining.
03.03	Demonstrate efficient toolpath processes used in 2D and 3D High Speed CNC machining operations.
03.04	Identify and perform CNC Code 4 used in toolpath operations.
03.05	Identify and implement appropriate CAM toolpath operations used in CNC machining.
03.06	Identify metal alloys and their properties in machining.

	03.07 Demonstrate job planning procedures in machining.
	03.08 Demonstrate and apply acceptable procedures in CNC job planning, tooling, selection, and programming.
04.0	Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software. The student will be able to:
	01.04 Create geometry for post-processing used in CAD/CAM software.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Industry Operations Specialist**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0652020502
Program Type	College Credit Certificate (CCC)
Program Length	9 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose
This certificate program is part of the Industrial Management Technology AS degree program (1652020501).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, principles of management, personnel management, and general business procedures.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply strategies for effective management of personnel following appropriate guidelines.
02.0 Employ creative thinking to achieve business objectives and solve problems.
01.0 Demonstrate an understanding of entrepreneurship.

Florida Department of Education
Student Performance Standards

Program Title: **Industry Operations Specialist**
CIP Number: **0652020502**
Program Length: **9 credit hours**

This certificate program is part of the Industrial Management AS degree program (1652020501). At the completion of this program, the student will be able to:	
01.0	Apply strategies for effective management of personnel following appropriate guidelines. The student should be able to:
01.01	Diagnose unacceptable performance.
01.02	Determine effective discipline procedures.
01.03	Undertake disciplinary action.
01.04	Plan appraisal interviews.
01.05	Conduct appraisal interviews.
01.06	Implement transfer, demotion, and termination procedures.
01.07	Conduct hiring interviews.
01.08	Implement recruitment procedures.
01.09	Discuss the performance appraisal with an employee.
01.10	Identify employees for promotion.
02.0	Employ creative thinking to achieve business objectives and solve problems. The student should be able to:
02.01	Utilize techniques for maximum production of ideas.
02.02	Establish and maintain conditions necessary for creative problem solving.
02.03	Oversee the problem-solving process.
03.0	Demonstrate an understanding of entrepreneurship. The student should be able to:
03.01	Identify characteristics of the American enterprise system.
03.02	Define inflation and deflation.
03.03	Identify characteristics of global enterprise systems.
03.04	Determine the results of a change in demand or a change in supply.
03.05	List factors that contribute to economic growth.

03.06	Identify characteristics of different types of business ownership.
03.07	Choose appropriate action in a situation requiring application of business ethics.
03.08	Demonstrate an understanding of federal, state, and local taxes and their computation.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Skills USA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Engineering Technology**
Career Cluster: **Manufacturing**

AS	
CIP Number	1615000001
Program Type	College Credit
Program Length	60 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, technical competency, safe and efficient work practices and a combination of theory and laboratory activities to gain the necessary cognitive and manipulative skills to perform preventive and corrective maintenance and support for engineering design, processes, production, testing, and/or maintaining product quality.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Engineering Technology and Industrial Applications: production materials and processes, quality, computer-aided drafting, electronics, mechanics, instrumentation and safety.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of eight specializations with one common core. It is recommended that students complete the core or demonstrate a mastery of the student performance standards contained in the core before advancing to the course(s) in the

next level of specialization. The common core consists of 18 credit hours of technical core courses from the following areas: instrumentation and measurement, manufacturing processes and materials, quality, computer-aided drafting, electronics, and safety. The total Associate in Science degree program consists of 60 credit hours.

The 18 credit hour technical core has been defined to align with the Manufacturing Skills Standards Council's (MSSC) skills standards. MSSC skill standards define the knowledge, skills, and performance needed by today's frontline manufacturing workers. After completing this core and the General Education requirements, it is anticipated that students will be prepared to pass the MSSC Production Technician Certification.

Program Length

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of industrial processes and material properties.
02.0 Generate and interpret computer-aided design/drafting.
03.0 Demonstrate a fundamental understanding of electricity and electronics.
04.0 Demonstrate an understanding of industrial safety, health, and environmental requirements.
05.0 Demonstrate proficiently in the use of quality assurance methods and quality control concepts.
06.0 Demonstrate proficiency in using tools, instruments and testing devices.
07.0 Demonstrate basic troubleshooting skills.
08.0 Demonstrate appropriate communication skills.
09.0 Demonstrate appropriate math skills.
10.0 Demonstrate an understanding of modern business practices and strategies.
11.0 Demonstrate employability skills and identify career opportunities.

In addition, students will complete the objectives in one of the following specializations:

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
CIP Numbers: **1615000001**
Program Length: **60 credit hours**

At the completion of this program, the student will be able to:	
01.0	Demonstrate knowledge of industrial processes and materials properties. The student will be able to:
01.01	Explain current manufacturing processes to include modern trends.
01.02	Determine available and needed resources for the production process.
01.03	Describe the factors considered for design, maintenance, procurement and handling.
01.04	Analyze process changes for impact on product.
01.05	Identify principles and practices of production timing.
01.06	Identify effect of time, motion, and procedural changes on productivity.
01.07	Demonstrate knowledge of raw materials properties and requirements.
01.08	Follow engineering specifications and documentation in equipment setup.
01.09	Explain the importance of maintenance.
01.10	Document product and process compliance with customer requirements and needs.
02.0	Generate and interpret computer-aided design/drafting. The student will be able to:
02.01	Apply current industrial computer aided design and drafting practices.
02.02	Import and export various file types and formats.
02.03	Create and interpret technical drawings.
03.0	Demonstrate a fundamental understanding of electronics and electricity. The student will be able to:
03.01	Use appropriate electrical circuit grounding techniques.
03.02	Use appropriate electrical circuit bonding techniques.
03.03	Solve circuit problems using appropriate units and notation.
03.04	Operate appropriate test equipment.
04.0	Demonstrate an understanding of industrial safety, health, and environmental requirements. The student will be able to:
04.01	Identify and select appropriate Personal Protective Equipment (PPE).

	04.02 Follow appropriate safety procedures.
	04.03 Follow applicable environmental laws and regulations.
	04.04 Identify and report unsafe conditions and practices.
	04.05 Explain when a machine or a process should be stopped to investigate an unsafe condition.
	04.06 Demonstrate knowledge of regulatory agency requirements, corrective actions and fines.
	04.07 Use and evaluate information resources such as SDS (Safety Data Sheets).
05.0	Demonstrate proficiency in use of quality assurance methods and quality control concepts. The student will be able to:
	05.01 Apply quality methods to industrial processes.
	05.02 Apply quality principles to manufactured products.
	05.03 Document quality measurements and observations.
06.0	Demonstrate proficiency in using tools, instruments and testing devices. The student will be able to:
	06.01 Identify and use hand tools properly.
	06.02 Operate inspection equipment appropriately.
	06.03 Apply appropriate testing techniques and procedures.
	06.04 Use appropriate measurement tools.
	06.05 Operate/use appropriate safety monitoring and testing equipment.
07.0	Demonstrate basic troubleshooting skills. The student will be able to:
	07.01 Apply critical thinking skills to identify problems.
	07.02 Identify discrepancies and changes in a system.
	07.03 Properly document process changes.
	07.04 Apply root cause analysis techniques to identify problem causes.
	07.05 Evaluate and implement corrective action option(s).
	07.06 Properly document all corrective actions.
08.0	Demonstrate appropriate communication skills. The student will be able to:
	08.01 Write logical and understandable statements and phrases.
	08.02 Accurately complete forms commonly used in industry.
	08.03 Read and understand graphs, charts, diagrams, and common table formats.

	08.04 Read and follow written instructions.
	08.05 Demonstrate an understanding of; and ability to follow oral instructions.
	08.06 Demonstrate knowledge of technical language and technical acronyms.
	08.07 Demonstrate and promote teamwork.
09.0	Demonstrate appropriate math skills. The student will be able to:
	09.01 Solve problems for appropriate scalars and vectors.
	09.02 Calculate tolerance(s).
	09.03 Use different unit systems appropriately.
	09.04 Convert between different units and unit systems.
	09.05 Use appropriate notation.
	09.06 Solve simple algebraic equations.
10.0	Demonstrate an understanding of modern business practices and strategies. The student will be able to:
	10.01 Demonstrate knowledge of production processes to meet business requirements.
	10.02 Demonstrate knowledge of the alignment of a company's business objectives with production goals.
11.0	Demonstrate employability skills and identify career opportunities. The student will be able to:
	11.01 Describe the appropriate steps to acquire employment.
	11.02 Respond appropriately to professional criticism.
	11.03 Identify and practice professional work ethics and habits.

Program Title: **Engineering Technology**
Specialization Tract: **Advanced Manufacturing**

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as a Manufacturing Engineering Technician or Advanced Manufacturing or Production Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Understand, operate, troubleshoot, and maintain pneumatic, hydraulic, and electromechanical components and/or systems.
13.0 Identify lean and six sigma concepts in manufacturing environments.
14.0 Understand, operate, and maintain industrial automation systems.
15.0 Troubleshoot industrial automation systems.
16.0 Apply the principles of robotics to automated systems.
17.0 Create and operate human machine interfaces to control automated systems.
18.0 Identify, implement and/or interpret supply chain and operations management concepts and techniques.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Advanced Manufacturing**

CTE Standards and Benchmarks	
12.0	Understand, operate, troubleshoot, and maintain pneumatic, hydraulic and electromechanical components and/or systems. The student will be able to:
12.01	Identify, classify, and describe the functions of pneumatic, hydraulic, and electromechanical machines and components.
12.02	Construct and interpret flow diagrams of pneumatic, hydraulic, and electromechanical systems.
12.03	Configure, install, operate, and maintain pneumatic, hydraulic, and electromechanical components, devices and/or machines.
12.04	Troubleshoot errors, faults, and inconsistencies in pneumatic, hydraulic, and electromechanical components, machines and/or systems.
12.05	Define special applications of electromechanical, hydraulic, and pneumatic machines and devices used in manufacturing and process equipment.
12.06	Describe limitations of electromechanical, pneumatic and hydraulic systems.
12.07	Use safe practices while operating, troubleshooting, and maintaining industrial equipment.
13.0	Identify lean and six sigma concepts in manufacturing environments. The student will be able to:
13.01	Explain product manufacturing requirements.
13.02	Explain the role of each stakeholder in production operations.
13.03	Demonstrate and apply resources planning, six sigma, and lean manufacturing principles to production and process planning.
13.04	Demonstrate the continuous improvement process through cross-functional collaboration.
14.0	Understand, operate, and maintain industrial automation systems. The student will be able to:
14.01	Create and interpret schematic diagrams.
14.02	Explain, operate, maintain, and program industrial control systems.
14.03	Integrate control systems and equipment with production and production support mechanisms.
15.0	Troubleshoot industrial automation systems. The student will be able to:
15.01	Demonstrate troubleshooting techniques to identify root cause, errors and faults of a problem.
15.02	Use troubleshooting data to make systems improvement.
15.03	Identify issues requiring advanced skills.

	15.04 Troubleshoot problems and perform minor repairs to industrial automation systems.
16.0	Apply the principles of robotics to automated systems. The student will be able to:
	16.01 Identify the essential components and characteristics of a robotic system.
	16.02 Analyze industrial tasks for the selection of robotic equipment.
	16.03 Identify and implement appropriate connected sensors and actuators for robotic applications.
	16.04 Program a robotic device for a required task.
	16.05 Re-implement the robot to a new task.
17.0	Create and operate human machine interfaces to control automated systems. The student will be able to:
	17.01 Apply appropriate industrial standards in the development of HMI program.
	17.02 Establish communication for data flow between interface and controlled equipment.
	17.03 Perform interface testing and troubleshooting.
18.0	Identify, implement, and/or interpret supply chain and operations management concepts and techniques. The student will be able to:
	18.01 Use appropriate software for supply chain management strategies.
	18.02 Illustrate how efficiency and effectiveness are necessary attributes of good operations management.
	18.03 Apply simulations used for layout and design of production operations.
	18.04 Apply engineering economy factors in equipment justification.
	18.05 Calculate machinery utilization.
	18.06 Demonstrate warehouse throughput systems.
	18.07 Demonstrate basic principles and methods of controlling work in progress.
	18.08 Follow raw materials from their source to distribution of the product.
	18.09 Develop strategies to identify improvement opportunities, prioritize and develop an implementation plan optimize production operations.
	18.10 Demonstrate strategies to optimize raw materials and products inventories to minimize waste
	18.11 Integrate control systems and equipment with production and production support mechanisms.
	18.12 Demonstrate automatic inventory accounting related monitoring and control systems.
	18.13 Implement automatic tracking of materials and products using bar codes, machine vision and sensing, and/or infrared technologies.
	18.14 Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.

Program Title: **Engineering Technology**
Specialization Tract: **Advanced Technology**

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Engineering Technician or Advanced Technology Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Demonstrate proficiency in soldering and basic laboratory practices.
13.0 Demonstrate proficiency in surface mount soldering.
14.0 Demonstrate proficiency in fiber optics terminations.
15.0 Demonstrate proficiency in instrumentation fundamentals.
16.0 Demonstrate proficiency in destructive and non-destructive testing.
17.0 Demonstrate proficiency in composite fundamentals.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Advanced Technology**

CTE Standards and Benchmarks	
12.0	Demonstrate proficiency in soldering basic laboratory practices. The student will be able to:
12.01	Apply proper Occupational Safety Health Administration (OSHA) safety standards.
12.02	Make electrical connections.
12.03	Demonstrate acceptable soldering techniques.
12.04	Demonstrate acceptable de-soldering techniques.
12.05	Demonstrate electrostatic discharge (ESD) safety procedures.
12.06	Describe the construction of printed circuit boards (PCB's).
12.07	Explain the theoretical concepts of soldering.
12.08	Demonstrate rework and repair techniques.
13.0	Demonstrate proficiency in basic surface mount soldering. The student will be able to:
13.01	Identify SMD components.
13.02	Understand concern specific to SMD components.
13.03	Identify proper soldering techniques to each component type
13.04	Solder and de-solder chip components.
13.05	Solder and de-solder J-Leaded components.
13.06	Solder and de-solder Gull Wing components.
13.07	Effectively identify and demonstrate the quality requirements used to inspect soldered connections.
13.08	Demonstrate the skills required for circuit board rework and repair.
13.09	Demonstrate the proper selection and use of procedural requirements, tools, materials, and methods required to comply with the applicable standards.
14.0	Demonstrate proficiency in fiber optics termination. The student will be able to:
14.01	Define the basics of a fiber optic system.
14.02	Define the advantages and types of a fiber optic system.

	14.03 Understand how to install cables and prepare ends.
	14.04 Understand how to install different types of connectors.
	14.05 Understand how to make loss measurements.
	14.06 Understand how to install splices.
	14.07 Understand how to certify and troubleshoot a fiber system.
15.0	Demonstrate proficiency in knowledge of instrumentation fundamentals. The student will be able to:
	15.01 Demonstrate an understanding of instrument symbols and identifiers.
	15.02 Demonstrate an understanding of the fundamentals of pressure measurements.
	15.03 Demonstrate an understanding of the fundamentals of flow measurements.
	15.04 Demonstrate an understanding of the fundamentals of liquid levels measurements.
	15.05 Demonstrate an understanding of the fundamental temperature measurements.
	15.06 Demonstrate an understanding of the fundamentals of control systems.
16.0	Demonstrate proficiency in destructive and non-destructive testing. The student will be able to:
	16.01 Demonstrate an understanding of the concepts of inspection procedures used in NDT.
	16.02 Demonstrate an understanding of the basic types of NDT.
	16.03 Demonstrate an understanding of hardness testing using both destructive and non-destructive testing.
	16.04 Demonstrate an understanding of magnetic particle testing used in NDT.
	16.05 Demonstrate an understanding of dye penetrant testing used in NDT.
	16.06 Select, configure, calibrate, and operate NDT equipment.
17.0	Demonstrate proficiency in composites fundamentals. The student will be able to:
	17.01 Identify and characterize composite materials and commodities.
	17.02 Identify uses and hazards involved in handling common composite supplies.
	17.03 Explain how properties of materials determine their classification and use.
	17.04 Identify symptoms/causes of delaminating.
	17.05 Identify symptoms and causes of faulty bonds.
	17.06 Demonstrate knowledge of handling composite materials, adhesives, solvents, etc.
	17.07 Identify tools used in composite fabrication and repair.

Program Title: **Engineering Technology**
Specialization Tract: **Alternative Energy**

Specialization Concepts and Content: The purpose of this program is to prepare students to meet the industry-specific educational needs for technicians in the new and emerging alternative and renewable energy fields, including, but not limited to, occupational titles such as: Electrical Engineering Technician, Industrial Engineering Technician, Solar Photovoltaic Installer and Solar Power Plant Technician, Solar Thermal Installer and Technician, Energy Auditor, and Smart Grid Technician. This program also provides supplemental training for persons previously or currently employed in occupations related to energy production and storage, manufacturing and construction.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Interpret AC and DC circuit fundamentals related to energy technologies.
13.0 Characterize renewable energy sources and technologies.
14.0 Apply energy storage, distribution, and conversion systems principles.
15.0 Characterize the operation and performance of solar energy systems.
16.0 Apply policy, regulation, and good business practices for renewable energy systems.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Alternative Energy**

CTE Standards and Benchmarks	
12.0	Interpret AC and DC circuit fundamentals related to energy technologies. The student will be able to:
12.01	Apply Ohm's law to parallel circuits.
12.02	Define and apply the principles of transformers to AC circuits.
12.03	Analyze and troubleshoot series circuits.
12.04	Define the characteristics of polyphase circuits.
12.05	Define basic motor and generator theory and operation.
12.06	Analyze and measure power.
12.07	Solve problems in electronic units utilizing metric prefixes and engineering notation.
12.08	Identify sources of electricity.
12.09	Define and describe voltage, current, resistance, power and energy.
12.10	Apply Ohm’s law and power formulas.
12.11	Read and interpret color codes and symbols to identify electrical components and values.
12.12	Measure properties of circuits using appropriate bench equipment.
12.13	Compute conductance and measure resistance of conductors and insulators.
12.14	Construct and verify the operation of series circuits.
12.15	Analyze and troubleshoot AC capacitive and inductive circuits.
12.16	Solve basic trigonometric problems as applicable to AC circuits.
12.17	Construct and verify the operation of parallel circuits.
12.18	Analyze and troubleshoot parallel circuits.
12.19	Measure values of resistors, capacitors and inductors.
12.20	Interpret basic DC and AC circuit schematics.
12.21	Utilize applicable voltage and current Laws in DC and AC circuits.

	12.22 Apply math knowledge required for fundamental DC and AC circuit analysis.
	12.23 Practice safety procedures required in an electrical lab environment.
13.0	Characterize renewable energy sources and technologies. The student will be able to:
	13.01 Describe alternative and renewable energy sources used for power production.
	13.02 Define basic energy terms.
	13.03 Discuss the feasibility of emerging energy resources.
	13.04 Describe the major sources, scale, and impacts of alternative and renewable energy.
	13.05 Draw and label a diagram of a solar electric renewable energy system.
	13.06 Distinguish between various renewable energy sources and energy potential.
	13.07 Describe the social and environmental impact of renewable energy technologies vs. traditional energy sources.
	13.08 Explain the difference between passive solar and active solar thermal systems.
	13.09 Evaluate advantages and disadvantages of various renewable energy sources.
	13.10 Compare site selection requirements for various renewable energy installations.
	13.11 Compute cost/benefit analysis and return on investment calculations for a project.
	13.12 Evaluate local, state, and federal renewable energy rebates and incentives.
	13.13 Explain the methods used to connect renewable energy systems to a home or building.
14.0	Apply energy storage, distribution, and conversion systems principals. The student will be able to:
	14.01 Explain appropriate safety procedures of energy storage devices and equipment.
	14.02 Calculate the energy usage requirements of a typical building structure.
	14.03 Optimize the energy storage performance based on the characteristics of various energy storage systems.
	14.04 Define the role of inverters in energy storage systems.
	14.05 Choose an appropriate inverter for a particular application.
	14.06 Interpret interface circuit diagrams for connecting power sources to system components.
	14.07 Describe current and emerging energy storage systems.
	14.08 Interpret fundamental energy and energy production concepts.
15.0	Characterize the operation and performance of solar energy systems. The student will be able to:
	15.01 Describe the operation of various solar energy systems.

15.02	Design and choose a solar energy system for optimal production based on the sun's position.
15.03	Distinguish between an azimuth and tilt angle calculation.
15.04	Review the methodology for using an azimuth and altitude calculation to determine max output from a collector or concentrator.
15.05	Specify components of solar energy systems.
15.06	Calculate the energy produced, efficiency, and power derived from an installed system.
15.07	Demonstrate proper safety practices in solar energy system installations and operations.
15.08	Demonstrate standard practices in system checkout, maintenance and troubleshooting a solar energy system.
15.09	Determine appropriately sized components for a solar energy system.
15.10	Describe benefits of renewable energy systems to the end customer through case studies.
16.0	Apply policy, regulation, and good business practices for renewable energy systems. The student will be able to:
16.01	Examine current US energy and natural resources policies and regulations.
16.02	Compare and contrast US energy and natural resources policies and regulations to others around the world.
16.03	Discuss the effects of financial, technical, and economic trends on the past, current, and future energy industry.
16.04	Demonstrate best practices for minimizing energy utilization.
16.05	Apply best practices based for energy production and resources use.
16.06	Discuss how different climatic, geological, atmospheric, and human activities influence energy production and utilization.
16.07	Identify conservation practices for natural resources used for energy production.
16.08	Explain the environmental impacts of energy extraction, conservation, and storage systems.
16.09	Discuss how the conversion to alternative energy affects various business sectors.
16.10	Discuss the application of governmental regulations and policy for energy production and utilization.
16.11	Compare and contrast local, state, and federal policy which positively and negatively effects the advancement of renewable energy investment and development.
16.12	Explain structure of electrical power distribution system.
16.13	Explain modernization steps being taken for improving the electrical power grid.

Program Title: **Engineering Technology**
Specialization Tract: **Biomedical Systems**

Specialization Concepts and Content: The purpose of this program is to prepare students to meet the critical industry-specific educational needs for quality assurance, laboratory specialization, and regulatory standards that are required for the biomedical industry for initial employment with an occupational title as laboratory technician, research associate, clinical data manager, document manager, quality assurance technician, quality systems auditor, and quality compliance specialist in various specialized areas of regulated industries, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Demonstrate knowledge of the Food and Drug Administration (FDA) regulations and compliance for biomedical systems.
13.0 Demonstrate knowledge in the design and manufacture of biomedical systems.
14.0 Demonstrate knowledge of risk management for biomedical products development and production.
15.0 Demonstrate knowledge of quality audits for biomedical systems.
16.0 Demonstrate knowledge of document and data management and control.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Biomedical Systems**

CTE Standards and Benchmarks	
12.0	Demonstrate knowledge of the Food and Drug Administration (FDA) regulations and compliance for biomedical systems. The student will be able to:
12.01	Describe how the FDA is organized.
12.02	Locate the Code of Federal Regulations (C.F.R.) specific to the FDA regulations that apply to biomedical systems manufacturers.
12.03	Describe the role of the FDA's standing advisory committee, the Center for Devices and Radiological Health (CDRH).
12.04	Define medical devices, products, and systems and their federal classifications.
12.05	Explain the 510(k) Premarket Notification Process including Applications (PMA).
12.06	Explain an investigational device exemption (IDE).
12.07	Explain the differences between Class I, II, and III devices.
12.08	Describe and explain the Federal Food, Drug, and Cosmetic Act (FDCA).
12.09	Define and describe good laboratory and clinical practices.
12.10	Define and describe the quality system regulations (QSRs).
12.11	Define and describe Current Good Manufacturing Practices.
12.12	Define and describe foreign regulatory systems, i.e., the European Union (EU).
12.13	Identify and explain the components of ISO 13485/ISO 13488.
13.0	Demonstrate knowledge in the design and manufacture of biomedical systems. The student will be able to:
13.01	Describe uses for which products could be designed.
13.02	Apply the steps identified in the FDA's regulatory requirements 21 CFR 820.30 Design Control.
13.03	Describe the various product design methodologies and their associated lifecycles.
13.04	Define, describe, and list product specifications.
13.05	Describe, list, and apply failure modes and effects analysis (FMEA) to increase product safety.
13.06	Demonstrate how various components of the design and development process effect reliability.
13.07	Describe concurrent product and process development.

13.08	Describe and compare installation and operation qualifications.
13.09	Recognize process optimization.
13.10	Develop and analyze process flow maps.
13.11	Differentiate between verification and validation.
13.12	Describe and determine how a design requirement is verified.
13.13	Describe and analyze how customer needs are validated.
13.14	Describe how a process output can be verified.
13.15	Describe and analyze process capability.
13.16	Define the terms associated with production scale-up.
13.17	Describe and analyze production scheduling.
13.18	Describe a market release package with multiple components.
13.19	Determine a root cause of a problem is determined.
14.0	Demonstrate knowledge of risk management for biomedical products development and production. The student will be able to:
14.01	Describe the FDA's definition of risk management.
14.02	Explain how the subparts to the FDA's regulatory requirements 21 CFR 820 Quality System Regulation (QSR) relate to risk management.
14.03	Explain the process of identifying the key risk management activities critical to a successful risk management process.
14.04	Explain the components of ISO 14971 and how they provide effective management of the risks associated with the use of medical devices.
14.05	Explain how the components of risk management identified in ISO 14971 relate to the FDA's Quality System Regulation (QSR).
14.06	Develop a comprehensive risk management plan.
14.07	Identify internal and external sources for determining product hazards.
14.08	Estimate a risk using risk analysis tools and techniques.
14.09	Evaluate a risk using risk evaluation tools and techniques.
14.10	Identify the steps associated with risk control.
14.11	Identify the risk elements that can be reduced to decrease the risk associated with a hazard.
14.12	Describe the process of verification and explain its role in risk control.
14.13	Explain the relationship between risk control measures and the introduction of new hazards.
14.14	Explain the difference between residual risk and overall residual.

	14.15 Develop a risk management report.
	14.16 List and describe the elements of corrective action and preventive action (CAPA) associated with Post Production Information.
15.0	Demonstrate knowledge of quality audits for biomedical systems. The student will be able to:
	15.01 Define terms associated with quality auditing.
	15.02 Describe the characteristics of internal and external quality audits.
	15.03 Describe the relationship between the quality audit and the FDA regulatory requirement 21 CFR 820.20 (c).
	15.04 List factors that can influence the credibility of quality audits.
	15.05 Describe the purpose and characteristics of a confidentiality agreement.
	15.06 Describe the auditor's responsibilities when illegal or unsafe conditions or activities are discovered during an audit.
	15.07 Identify sources in a medical device manufacturing organization that generate performance history data for review prior to performing a quality audit.
	15.08 Identify the quality auditing strategies for data collection.
	15.09 Describe the purpose and scope of the quality audit opening and closing meetings.
	15.10 Identify auditable quality records in a medical device manufacturing company as defined by the FDA regulatory requirements 21 CFR 820.180.
	15.11 Describe the relationship of risk and criticality in analyzing audit data.
	15.12 Describe the difference between compliance issues and effectiveness issues and giving examples of each.
	15.13 Describe record retention requirements.
	15.14 Identify effective communication techniques that can be successfully used in a quality audit.
	15.15 Conduct a simulated audit that conforms to FDA regulatory requirements.
	15.16 Write a comprehensive audit report.
16.0	Demonstrate knowledge of document and data management and control. The student will be able to:
	16.01 Describe how the change control procedures are organized.
	16.02 Locate the Code of Federal Regulations (C.F.R.) specific to the FDA regulations that apply to change control.
	16.03 Discuss the importance of maintaining the records of changes to documents.
	16.04 Review and discuss the product device master record (DMR).
	16.05 Define the terms associated with the change control documents.
	16.06 Increment and determine which code should be used by the change procedure for components including software, assemblies, devices, and associated documentation such as labeling, process procedures, and assembly drawings.

16.07	Develop and implement a change control form.
16.08	Describe how document management and control procedures are organized.
16.09	Determine the importance of maintaining document management.
16.10	Define the terms associated with document management and control.
16.11	List the procedures to be followed for preparing, reviewing, and correcting documents.
16.12	Discuss and explain the importance of document security.
16.13	Develop a documentation management plan for a company.
16.14	Define the terms associated with clinical data management.
16.15	Describe the clinical protocol development and implementation.
16.16	Discuss and explain the linkages between clinical trials and product development.

Program Title: **Engineering Technology**
Specialization Tract: **Digital Design and Modeling**

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as computer aided design (CAD) specialists, industrial designers, product designers, architectural, civil, or mechanical drafters, technicians, or detailers in various specialized areas of industry that use digital design and modeling, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Demonstrate knowledge of using 2D and solid modeling software.
13.0 Demonstrate proficiency in 2D CAD and basic solid modeling fundamentals.
14.0 Demonstrate proficiency in engineering design fundamentals.
15.0 Demonstrate proficiency in advanced solid modeling tools and commands.
16.0 Demonstrate proficiency in advanced solid modeling, assemblies, and drawings.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Digital Design and Modeling**

CTE Standards and Benchmarks	
12.0	Demonstrate knowledge of using 2D and solid modeling software. The student will be able to:
12.01	Select the correct CAD command for specified tasks.
12.02	Develop the standard drawing arrangement needed for a standard information layout for specific drawing types.
12.03	Demonstrate proficiency in various plotting and printing options of CAD drawings.
12.04	Create and plot multiple setup and sizes of drawings.
12.05	Develop the attributes and standards needed for information in a drawings template for a specific drawing.
12.06	Implement existing CAD library files for new drawings.
12.07	Develop appropriate new library files when necessary.
12.08	Demonstrate sketch, modeling and drawing commands.
12.09	Demonstrate setup of drawing environment with multiple Layout sheets.
12.10	Apply standard dimensioning rules for Architectural, Mechanical, and Electrical.
12.11	Create the standard drawing views to document the design procedures.
13.0	Demonstrate proficiency in 2D CAD and basic solid modeling fundamentals. The student will be able to:
13.01	Implement the CAD commands for sketching and three-dimensional modeling.
13.02	Implement and apply the CAD three-dimensional coordinate system, work planes and surfaces for creating three-dimensional objects.
13.03	Convert sketches into extruded features.
13.04	Create the desired sketch to show the design intent in the solid modeling procedures.
13.05	Perform analyses on the sketch procedures and refine the sketch to be fully defined.
13.06	Align, rotate, and mirror two-dimensional and three-dimensional objects.
13.07	Choose and apply a type of material to a solid model.
13.08	Create bottom-up assembly and drawings.
13.09	Implement and apply basic software utilities for arranging, detailing, and plotting multiple views of a solid and assembly.

	13.10 Customize screen, toolbars, and pull down menus.
14.0	Demonstrate proficiency in engineering design fundamentals. The student will be able to:
	14.01 Create two and three-dimensional models and generate drawings related to graphic and industrial design.
	14.02 Define fundamental two-dimensional and three-dimensional concepts of graphic and industrial design.
	14.03 Measure and calculate properties of parts and assemblies.
	14.04 Perform analyses and refine industrial design.
	14.05 Demonstrate basic design principles of visual and spatial form as applied to products.
	14.06 Describe the fundamentals of product and system design as it relates to the manufacturing and physical considerations in design.
	14.07 Describe the theories related to product and systems design.
	14.08 Solve elementary problems related to the form and function of objects and structures.
	14.09 Describe the fundamentals of material selection for product and system design.
	14.10 Define the type of analysis of machined elements of a part or assembly.
	14.11 Conduct a system design analysis and identify the major phases.
	14.12 Implement sustainable practices in simulation design analysis.
	14.13 Apply design features to the two- and three-dimensional drawings.
15.0	Demonstrate proficiency in advanced solid modeling tools and commands. The student will be able to:
	15.01 Create and execute advanced templates.
	15.02 Apply and edit dimensions on a sketch and drawing.
	15.03 Create and use multiple work planes for advanced functions.
	15.04 Create solid models by extruding, revolving, sweeping, lofting, and shelling.
	15.05 Create and modify bottom-up assemblies.
	15.06 Define parts and components of an assembly in a BOM link to an Excel directory.
	15.07 Define parts of an assembly in a directory by balloons or labeling.
	15.08 Create exploded views of an assembly.
	15.09 Create multiple configurations of an individual part.
	15.10 Create configurations and add them to a part library.
	15.11 Perform advanced mating using multiple parts or sub-assemblies.

	15.12 Render a three-dimensional model and assembly.
	15.13 Render a solid model or assembly.
16.0	Demonstrate proficiency in advanced solid modeling and assembly. The student will be able to:
	16.01 Choose the appropriate design process for generating an advanced solid model.
	16.02 Select the correct advanced process for specified tasks.
	16.03 Perform sketch analyses on the sketch procedures and refine the sketch to define the modeling process.
	16.04 Create advanced assemblies using smart mates.
	16.05 Create and modify bottom up and top-down assemblies.
	16.06 Perform advanced surfacing of a part to create a solid model.
	16.07 Create sheet metal and flat pattern for parts and assemblies.
	16.08 Create structural elements in weldment for welded parts.
	16.09 Create weldment assemblies and cut list for welded projects.
	16.10 Create detailed molds or die cavities of parts and assemblies.
	16.11 Derive component parts from an edited mold base.
	16.12 Apply basic drawing concepts to molded parts.
	16.13 Apply the rapid prototyping processes for specific applications.
	16.14 Perform reverse engineering using the proper tools.
	16.15 Fabricate a part or an assembly using a rapid prototype machine.
	16.16 Describe the processes used in reverse engineering and scanning.
	16.17 Apply reverse engineering or scanning processes for specific applications.
	16.18 Fabricate a part or an assembly using reverse engineering or scanning equipment.
	16.19 Create a set of working shop drawings for manufactured parts.

Program Title: **Engineering Technology**
Specialization Tract: **Digital Manufacturing**

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Rapid Prototyping, Digital Manufacturing Specialists, industrial designers, product designers, architectural, civil, or mechanical drafters, technicians, or detailers in various specialized areas of industry that use digital design and modeling and rapid prototyping, direct digital manufacturing and CNC machining technologies , or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Demonstrate proficiency in 3D digital modeling software packages for product design.
13.0 Demonstrate proficiency in digital tools for product design.
14.0 Demonstrate proficiency in the principles, concepts, and applications in digital manufacturing processes.
15.0 Demonstrate proficiency in the principles, concepts, and applications in fabrication methods.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Digital Manufacturing**

CTE Standards and Benchmarks	
12.0	Demonstrate proficiency in 3D digital modeling software packages for product design. The student will be able to:
12.01	Create basic solid models.
12.02	Create the standard drawing views to document the design.
12.03	Create an assembly model with functional sufficient mates and constraints.
12.04	Analyze part tolerances and dimensional precision.
13.0	Demonstrate proficiency in use of digital tools for product design. The student will be able to:
13.01	Create two and three-dimensional drawings related to industrial design.
13.02	Analyze and refine an industrial design as necessary.
13.03	Describe the fundamentals of product and system design as it relates to the manufacturing and structural considerations in design.
13.04	Describe the process of product and systems design.
13.05	Describe the fundamentals of material selection for product and system design.
13.06	Use various measuring machines and instruments for parts analysis.
13.07	Capture physical 3D objects, and reverse engineer accurate CAD models from 3D scans.
13.08	Analyze part tolerances and precision and understand how they impact design performance.
14.0	Demonstrate proficiency in the principles, concepts and applications in digital manufacturing processes. The student will be able to:
14.01	Fabricate a part or an assembly using an additive manufacturing machine.
14.02	Compare the differing properties and characteristics of common materials used for additive manufacturing models.
14.03	Describe the various additive manufacturing processes and terminology.
14.04	Demonstrate integration of fasteners for robust assemblies of additive manufacturing produced components.
14.05	Describe the role of where different additive manufacturing methods and where they apply in the design and production lifecycle.
14.06	Demonstrate basic troubleshooting of additive manufacturing processes.
15.0	Demonstrate proficiency in the principles, concepts and applications in fabrication methods. The student will be able to:

15.01	Describe and compare traditional manufacturing methods with additive manufacturing.
15.02	Identify and characterize composite materials and commodities.
15.03	Identify uses and hazards involved in handling common composite supplies.
15.04	Demonstrate knowledge of handling composite materials, adhesives, solvents, etc. for safety.

Program Title: **Engineering Technology**
Specialization Tract: **Electronics**

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Electronics or Electronics Test Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Demonstrate proficiency in soldering and basics and laboratory practices.
13.0 Demonstrate proficiency in basic direct current (DC) circuits.
14.0 Demonstrate proficiency in alternating current (AC) circuits.
15.0 Demonstrate proficiency in solid state devices.
16.0 Demonstrate proficiency in digital circuits.
17.0 Demonstrate proficiency in analog circuits.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Electronics**

CTE Standards and Benchmarks	
12.0	Demonstrate proficiency in soldering basics and laboratory practices. The student will be able to:
12.01	Apply proper Occupational Safety Health Administration (OSHA) safety standards.
12.02	Make electrical connections.
12.03	Identify and use hand tools properly.
12.04	Identify and use power tools properly.
12.05	Explain the theoretical concepts of soldering.
12.06	Identify and discuss the different soldering techniques and arrangements for Through-Hole and Surface Mounted components.
12.07	Demonstrate the proper technique for solder electrical connections per the requirements of industry standards.
12.08	Demonstrate the proper technique for de-soldering electrical connections.
12.09	Demonstrate the proper technique for de-soldering electrical connections.
12.10	Describe the fabrication and assembly processes of Printed Circuit Boards (PCB's).
12.11	Show ability to read, understand and trace through schematic drawings.
13.0	Demonstrate proficiency in basic direct current (DC) circuits. The student will be able to:
13.01	Define the characteristics of basic DC circuits.
13.02	Solve problems in electronic units utilizing metric prefixes.
13.03	Identify sources of electricity.
13.04	Define and describe voltage, current, resistance, power, and energy.
13.05	Apply Ohm's law and power formulas.
13.06	Read and interpret codes and symbols to identify electrical components and values.
13.07	Measure properties of circuits using a digital multimeter meter (DMM) and oscilloscopes.
13.08	Set up and operate power supplies for DC circuits.
13.09	Compute conductance and measure resistance of conductors and insulators.

13.10	Apply Ohm's law to series circuits.
13.11	Construct and verify the operation of series circuits.
13.12	Analyze and troubleshoot series circuits.
13.13	Apply Ohm's law to parallel circuits.
13.14	Construct and verify the operation of parallel circuits.
13.15	Analyze and troubleshoot parallel circuits.
13.16	Measure values of resistors, capacitors, and inductors to include 4 wire measurement techniques.
13.17	Analyze and troubleshoot circuits containing capacitors and inductors.
13.18	Apply various network theorems to DC circuits.
13.19	Select substitute components in troubleshooting.
14.0	Demonstrate proficiency in alternating current (AC) circuits. The student will be able to:
14.01	Solve basic trigonometric problems as applicable to AC circuits.
14.02	Define the characteristics of AC capacitive circuits.
14.03	Construct and troubleshoot AC inductive and capacitive circuits.
14.04	Define and apply the principles of transformers to AC circuits.
14.05	Analyze and troubleshoot AC circuits utilizing transformers.
14.06	Construct and verify the operation of differentiators and integrators to determine R-C and R-L time constraints.
14.07	Analyze and troubleshoot differentiator and integrator circuits.
14.08	Define the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel and complex).
14.09	Define the characteristics of series and parallel resonant circuits.
14.10	Define the characteristics of frequency selective filter circuits.
14.11	Define the characteristics of polyphase circuits.
14.12	Define basic motor and generator theory and operation.
14.13	Define basic generator theory and operation.
14.14	Set up and operate power supplies for AC circuits.
14.15	Apply lumped analysis to circuits and components.
14.16	Apply various network theorems to AC circuits.

	14.17 Select substitute components in troubleshooting.
15.0	Demonstrate proficiency in solid state devices. The student will be able to:
	15.01 Identify and define properties of semiconductor materials.
	15.02 Identify and define operating characteristics and applications of junction diodes.
	15.03 Identify and define operating characteristics and applications of special purpose diodes.
	15.04 Construct and verify the operation of single and multi-stage devices.
	15.05 Identify and define operating characteristics and applications of bipolar transistors.
	15.06 Identify and define operating characteristics and applications of field effect transistors.
	15.07 Identify and define operating characteristics and applications of single-stage amplifiers.
	15.08 Construct and verify the operation of single-stage amplifiers.
	15.09 Construct and verify thyristor circuitry.
	15.10 Analyze and troubleshoot thyristor circuitry.
	15.11 Set up and operate appropriate bench equipment for solid-state devices.
	15.12 Set up and operate power supplies for solid-state devices.
	15.13 Examine appropriate solid-state circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.
	15.14 Identify and operate temperature measurement devices, including thermocouples and resistance temperature devices (RTDs).
16.0	Demonstrate proficiency in digital circuits. The student will be able to:
	16.01 Define and apply numbering systems to codes and arithmetic operations.
	16.02 Analyze and minimize logic circuits using Boolean operations.
	16.03 Set up and operate logic probes for digital circuits.
	16.04 Set up and operate power supplies for digital circuits.
	16.05 Identify types of logic gates and their truth tables.
	16.06 Construct combinational logic circuits using integrated circuits.
	16.07 Troubleshoot logic circuits.
	16.08 Analyze types of flip-flops and their truth tables.
	16.09 Identify, define and measure characteristics of integrated circuit (IC) logic families.
	16.10 Identify types of registers and counters.

16.11	Analyze clock and timing circuits.
16.12	Construct clock and timing circuits.
16.13	Identify types of arithmetic-logic circuits.
16.14	Identify types of encoding and decoding devices.
16.15	Construct encoders and decoders.
16.16	Identify types of multiplexer and demultiplexer circuits.
16.17	Identify types of memory circuits.
16.18	Identify types of digital displays.
16.19	Apply appropriate digital circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.
17.0	Demonstrate proficiency in analog circuits. The student will be able to:
17.01	Identify and define operational characteristics and applications of multistage amplifiers.
17.02	Construct multistage amplifiers.
17.03	Analyze and troubleshoot multistage amplifiers.
17.04	Identify and define operating characteristics and applications of linear integrated circuits.
17.05	Identify and define operating characteristics and applications of differential and operational amplifiers.
17.06	Construct differential and operational amplifier circuits.
17.07	Analyze and troubleshoot differential and operational amplifier circuits.
17.08	Identify and define operating characteristics and applications of active filters.
17.09	Identify and define operating characteristics and applications of active filters.
17.10	Analyze and troubleshoot active filter circuits.
17.11	Identify and define operating characteristics and applications of sinusoidal and non-sinusoidal oscillator circuits.
17.12	Construct oscillator circuits.
17.13	Analyze and troubleshoot oscillator circuits.
17.14	Examine appropriate analog circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.

Program Title: **Engineering Technology**
Specialization Tract: **Mechanical Design and Fabrication**

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Mechanical Engineering Technician, Mechanical Design Technician or Mechanical Fabrication Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Demonstrate proficiency in the principles, concepts, and applications in metal fabrication methods.
13.0 Explain the principles, concepts, and applications in composite fabrication operations and processes.
14.0 Demonstrate proficiency in the set-up and operation of manual and CNC machining centers.
15.0 Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software.
16.0 Demonstrate proficiency in 3-D solid modeling design and programming.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Mechanical Design and Fabrication**

CTE Standards and Benchmarks	
12.0	Demonstrate proficiency in the principles, concepts, and applications in metal fabrication methods. The student will be able to:
12.01	Identify and understand machining mathematical concepts, operations and measuring systems.
12.02	Interpret and identify mechanical drawings geometric features by referencing orthographic views, dimensions.
12.03	Demonstrate and identify the concepts and applications of Geometric Dimensioning and Tolerancing.
12.04	Identify properties of materials for metal fabrication and Machining processes.
12.05	Demonstrate safe use and operation of hand tools and power tools.
12.06	Identify processes in job planning and part layout.
12.07	Demonstrate proper setup and safe operation of metal forming equipment.
12.08	Identify appropriate applications of sheet metal forming and fastening.
12.09	Demonstrate and identify the proper use and reading of precision measuring.
13.0	Explain the principles, concepts, and applications in composite fabrication operations and processes. The student will be able to:
13.01	Demonstrate the safe and proper use of production equipment.
13.02	Apply and use basic safety equipment (PPE).
13.03	Apply OSHA safety rules concerning PPE for eye protection.
13.04	Apply OSHA safety rules concerning PPE for hearing protection.
14.0	Demonstrate proficiency in the set-up and operation of manual and CNC machining centers. The student will be able to:
14.01	Explain operation and maintenance procedures used for machine tools.
14.02	Identify cutting tool geometry and cutting tool materials used in CNC machining.
14.03	Demonstrate efficient toolpath processes used in 2D and 3D High Speed CNC machining operations.
14.04	Identify and perform CNC Code 4 used in toolpath operations.
14.05	Identify and implement appropriate CAM toolpath operations used in CNC machining.
14.06	Identify metal alloys and their properties in machining.

	14.07 Demonstrate job planning procedures in machining.
	14.08 Demonstrate and apply acceptable procedures in CNC job planning, tooling, selection, and programming.
15.0	Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software. The student will be able to:
	15.01 Create geometry for post-processing used in CAD/CAM software.
16.0	Demonstrate proficiency in 3-D solid modeling design and programming. The student will be able to:
	16.01 Create working drawings to include orthographic views, sections and dimensions using a solid model.
	16.02 Identify appropriate applications for additive manufacturing processes to solid models.

Program Title: **Engineering Technology**
Specialization Tract: **Protection and Control Technology**

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Protection and Control Technician, Programmable Logic Control Operator, Instrumentation and Control Technician, and Plant Electrician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Demonstrate proficiency in the construction of protection and control relay systems.
13.0 Demonstrate proficiency in the maintenance of protection and control relay systems.
14.0 Demonstrate proficiency in troubleshooting protection and control relay systems.
15.0 Demonstrate proficiency in documentation management and control.
16.0 Demonstrate proficiency in SCADA (Supervisory Control and Data Acquisition) automation methods.
17.0 Demonstrate proficiency in protection and control technology safety protocols.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Protection and Control Technology**

CTE Standards and Benchmarks	
12.0	Demonstrate proficiency in the construction of protection and control relay systems. The student will be able to:
12.01	Illustrate the use of a project print package and construction scope with timeline.
12.02	Illustrate the use of protection and control standards and templates.
12.03	Explore power transformer theory, applications, assembly, processing, testing and commissioning.
12.04	Explore power circuit breaker theory, applications, assembly, testing, and commissioning.
12.05	Explore instrument transformer theory and applications (CT's and PT's).
12.06	Explore switches and miscellaneous devices.
12.07	Analyze protection and control enclosure construction practices.
12.08	Explore protection and control DC systems (Batteries and chargers).
12.09	Explore ground field, and equipment grounding applications.
12.10	Analyze protection and control applications and testing for electrical apparatus.
12.11	Explore protection and control relaying pilot channel communication schemes.
13.0	Demonstrate proficiency in the maintenance of protection and control relay systems. The student will be able to:
13.01	Analyze the theory of operation associated with electro-mechanical, microprocessor relays, and programmable logic controllers.
13.02	Illustrate the need for a relay maintenance testing program with set time intervals.
13.03	Illustrate protection and control relay and Power Line Carrier test set use and proficiency.
13.04	Illustrate the basic use of various hand tools and test equipment.
13.05	Illustrate the ability to use manufactures instructions, books, and white papers.
13.06	Discuss emergent electrical equipment replacement.
13.07	Discuss emergency electrical equipment replacement.
13.08	Illustrate performing protection and control relay in-service checks.
13.09	Analyze stored energy system proficiency relating to power circuit breakers, switch gear, and various mechanisms.

14.0	Demonstrate proficiency in troubleshooting protection and control relay systems. The student will be able to:
14.01	Analyze and apply OHM's law with regard to DC circuits.
14.02	Analyze and apply 3 phase A.C. power theory and applications.
14.03	Identify principles of impedance in an A.C. circuit (Resistance, capacitance, and inductance).
14.04	Analyze and apply miscellaneous electrical formulas associated with different electrical loads.
14.05	Analyze and apply relay protection and control schemes associated with electrical apparatus.
14.06	Illustrate proficiency in the use and application of relay protection and control settings and logic.
14.07	Illustrate proficiency in writing a trouble-shooting guide.
14.08	Analyze what it takes to make the right electrical repair.
15.0	Demonstrate proficiency in documentation management and control. The student will be able to:
15.01	Outline managing NERC protection and control relay testing records.
15.02	Outline managing NERC Substation apparatus testing records.
15.03	Explore (E.C.) engineering change request process (Engineer change approval process).
15.04	Analyze electric circuit functional testing and tracking process.
15.05	Illustrate red lining prints and documentation revision processes.
15.06	Determine the as-built documentation revision process.
15.07	Illustrate substation operating instructions.
15.08	Analyze protection and control relay settings, and relay event report archival process.
15.09	Outline writing functional testing guidelines.
15.10	Outline construction project material close out.
16.0	Demonstrate proficiency in SCADA (Supervisory Control and Data Acquisition) automation methods. The student will be able to:
16.01	Illustrate the use of various SCADA communications protocols.
16.02	Demonstrate knowledge of various SCADA hardware systems and applications.
16.03	Illustrate the use of SCADA test equipment.
16.04	Discuss cyber security knowledge and awareness.
16.05	Discuss the purpose of an "EMS" Energy Management System. (Energy Control Center).
16.06	Discuss NERC CIP and PRC regulations.

17.0	Demonstrate proficiency in protection and control technology safety protocols. The student will be able to:
17.01	Demonstrate proficiency in electrical safety and personal protection.
17.02	Illustrate the dangers of electrical back feed situations and step potential hazards.
17.03	Analyze switching and tagging principles.
17.04	Identify electrical lockout/tag out principles.
17.05	Analyze human performance fundamentals and best practices.
17.06	Explore safety using approved work methods.
17.07	Outline performing “Risk Assessments” cause and effect.
17.08	Discuss Arc Flash requirements.
17.09	Identify stored energy sources and the associated dangers.

Program Title: **Engineering Technology**
Specialization Tract: **Quality**

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Quality Assurance Technician, Process and Production Technician, or Engineering Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Demonstrate proficiency in lean manufacturing/production.
13.0 Demonstrate proficiency in developing self-directed work teams.
14.0 Demonstrate proficiency in the tools of lean manufacturing.
15.0 Demonstrate proficiency in Six Sigma concepts.
16.0 Demonstrate proficiency in Six Sigma theories.
17.0 Demonstrate proficiency in developing a Six Sigma project.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Quality**

CTE Standards and Benchmarks	
12.0	Demonstrate proficiency in lean manufacturing/production. The student will be able to:
12.01	Describe and explain the concepts of lean manufacturing.
12.02	Apply the theories of lean manufacturing to a manufacturing and service environment for improvement.
12.03	Identify and apply procedures to achieve Just-in-Time.
12.04	Identify and apply the techniques in continual improvement.
12.05	Describe and explain supply chain management.
12.06	Develop the techniques to manage change in the manufacturing environment.
12.07	Identify and explain basic cellular manufacturing concepts associated with basic cellular manufacturing concepts.
13.0	Demonstrate proficiency in developing self-directed work teams. The student will be able to:
13.01	Describe and explain development and organization of a self-directed work team.
13.02	Create work plans.
13.03	Identify the steps in ending a project.
13.04	Use data effectively in identifying issues.
13.05	Implement changes through planning and communications.
13.06	Update appropriate documentation in a project.
14.0	Demonstrate proficiency in the tools of lean manufacturing. The student will be able to:
14.01	Define the tools required to implement and maintain a Lean Manufacturing facility.
14.02	Describe and explain mistake proofing.
14.03	Describe and apply the concept 5's.
14.04	Describe and explain the visual solutions workplace environment.
14.05	Identify and explain the changeover techniques used in production.
14.06	Describe the terms used in overall equipment effectiveness (OEE).

	14.07 Describe and explain the process of total productive maintenance (TPM).
	14.08 Identify the techniques used in the kanban system for just-in-time (JIT).
	14.09 Identify and apply value stream mapping and other mapping methods.
15.0	Demonstrate proficiency in Six Sigma concepts. The student will be able to:
	15.01 Describe and explain the philosophy and methodology of Six Sigma.
	15.02 Define the five steps of the DMAIC (define, measure, analyze, improve, and control) model used in Six Sigma for quality improvement.
	15.03 Establish an advanced quality plan.
	15.04 Benchmark a project.
	15.05 Develop the basic cause-and-effect diagram (fishbone diagram).
	15.06 Describe and develop the central limit theorem.
	15.07 Develop a control plan to aid in production.
	15.08 Define the cost-benefit analysis on the shop floor.
	15.09 Define and describe the design of experiments (DOE) used in manufacturing processes.
	15.10 Apply the DOE in manufacturing and non-manufacturing environments using the proper techniques.
	15.11 Apply the techniques of Process Failure Modes and Effects Analysis (PFMEA).
	15.12 Maintain and check the process through quality auditing.
	15.13 Describe the role that other continuous process improvement efforts play in the workplace.
16.0	Demonstrate proficiency in Six Sigma theories. The student will be able to:
	16.01 Apply the five steps of the DMAIC model.
	16.02 Establish an advanced quality plan using the theories of Six Sigma.
	16.03 Apply the DOE in manufacturing and non-manufacturing environments using the proper techniques.
	16.04 Apply the techniques of Process Failure Modes and Effects Analysis (PFMEA).
	16.05 Implement the 5S's method of sorting, setting in order, shining, standardizing, and sustaining.
	16.06 Apply the Six Sigma standards to non-manufacturing environments.
17.0	Demonstrate proficiency in developing a Six Sigma project. The student will be able to:
	17.01 Frame and Detail a Capstone Project using the Six Sigma tools.
	17.02 Describe the economic evaluation of engineering alternatives and analysis of cost allocation.

17.03	Calculate net profit, marginal rate of returns, maximum profit, return on investment, cash flow analysis and breakeven points when solving problems.
17.04	Solve problems involving alternative designs, materials, or methods.
17.05	Analyze the factor of equivalence in engineering economic problems.
17.06	Solve problems related to replacement versus augmentation for economic choices.
17.07	Discuss how capital projects are identified and evaluated (Return on Investment -ROI)
17.08	Describe how final projects are selected.
17.09	Define the requirements of the project plan.
17.10	Develop the initial project schedule.
17.11	Describe each phase of the project as it relates to the budget.
17.12	Develop timeline charts for planning and tracking.
17.13	Apply the scheduling control systems.
17.14	Identify the voice of the customer as the feedback mechanism.
17.15	Define and describe the scheduling techniques when applied in the project environment.
17.16	Apply the Six Sigma methodology to service type environments.
17.17	Apply the Theory of Constraints to identify the obstacles, lean to remove the obstacles, and six sigma to create the standard of work and remove variations.
17.18	Understand the requirements for a successful implementation of six sigma using customer centric approach, organizational alignment, and quality improvement and how they are interdependent.
17.19	Align the Six Sigma project objectives to business strategy and prioritize projects accordingly.
17.20	Use data collection strategies and graphical analysis in the project environment.

Program Title: **Engineering Technology**
Specialization Tract: **Supply Chain Automation**

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as a Supply Chain Automation Engineering Technician, Supply Chain and Operations Management, Manufacturing Engineering Technician, Advanced Manufacturing or Production Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations to install, operate, support, upgrade or maintain automated material handling equipment and systems that support the supply chain and automated distribution centers.

Standards

After successfully completing this program, the student will be able to perform the following:

12.0 Demonstrate proficiency in print reading and interpreting industrial diagrams and blueprints.
13.0 Demonstrate proficiency in automated warehousing and materials handling.
14.0 Demonstrate an understanding of machine fundamentals, components, maintenance, and mechanical troubleshooting.
15.0 Demonstrate current and emerging strategies and technologies used to collect, analyze, record, and share information in manufacturing and supply chain automation.
16.0 Demonstrate proficiency in industrial control systems.
17.0 Demonstrate proficiency in troubleshooting of Automated Controls Systems
18.0 Demonstrate proficiency in fabrication techniques applied in supply chain automation systems.

Florida Department of Education
Student Performance Standards

Program Title: **Engineering Technology**
Specialization Tract: **Supply Chain Automation**

CTE Standards and Benchmarks	
12.0	Demonstrate proficiency in print reading and interpreting industrial diagrams and blueprints. The student will be able to:
12.01	Define print and schematic related to manufacturing and automation systems such as electrical, fluid power, and piping.
12.02	Recognize and name a variety of geometric shapes.
12.03	Describe types and use of scales.
12.04	Demonstrate an understanding of 2D and 3D views.
12.05	Explain types and procedures of sketching including section views.
12.06	Define the use of a leader line.
12.07	Describe the general rules for dimension placement.
12.08	Define types, features and applications of tolerance.
12.09	Explain the purpose of a wiring diagram as well as symbols and lines on an electrical schematic.
12.10	Describe the function of various components in a piping system.
12.11	Name and describe the ways of joining pipe.
12.12	Explain and identify various pipes and kind of fittings and valves.
13.0	Demonstrate proficiency in automated warehousing. The student will be able to:
13.01	Explain the functions and procedures for public and private automated warehouses.
13.02	Develop common warehouse documents.
13.03	Explain the importance of maintaining inventory records of automated warehouse
13.04	Analyze computerized warehouse data for planning, organizing, staffing, directing and controlling warehouse operations.
13.05	Identify various labeling and packaging schemes.
13.06	Identify the equipment needed and appropriate methods for storage to facilitate an efficient warehouse.
13.07	Integrate warehouse control systems and equipment with production.
13.08	Develop routine warehouse operation and maintenance schedules.

14.0	Demonstrate an understanding of machine fundamentals, maintenance, and mechanical troubleshooting. The student will be able to:
14.01	Perform routine maintenance of machines and equipment.
14.02	Identify the characteristics of seals, bearing, lubricants, and fasteners.
14.03	Explain torque, stress, stretch, corrosion, galling and thread types.
14.04	Troubleshoot major components of an automation and manufacturing system.
14.05	Identify and explain the function of subcomponents.
14.06	Identify the types and functions of lubricant additives.
14.07	Apply proper lubrication to mechanical system.
14.08	Operate various types of motor and pump oil flushes.
14.09	Use precision measuring instruments in an automated system.
14.10	Describe hand and power tools, belts/sheaves, bearings, gears, couplings, pumps, and shaft alignments.
14.11	Install seals, bearings, fasteners, chain and gear drives
14.12	Demonstrate disassemble and assemble pumping stations.
14.13	Troubleshoot problems and perform minor repairs to warehouse automation and robotic systems
15.0	Demonstrate current and emerging strategies and technologies used to collect, analyze, record, and share information in manufacturing and supply chain automation. The student will be able to:
15.01	Identify, install and use hardware necessary to support manufacturing and supply chain application software.
15.02	Use supply chain automation technology tools to maintain, secure and monitor operations.
15.03	Use inventory and control systems and software to purchase materials, supplies, and equipment (e.g., Last In, First Out [LIFO]; First In, First Out [FIFO]; Just in Time [JIT]; LEAN).
16.0	Demonstrate proficiency in industrial control systems. The student will be able to:
16.01	Analyze common industrial control systems. (e.g., Servomechanisms, Motion Control, Batch Process Control, and Sequential Process)
16.02	Describe differences between motion and process control manufacturing equipment.
16.03	Operate various types and function of DC motors.
16.04	Describe the different types of motions that are controlled by servomechanisms.
16.05	Install various types of single and three-phase AC motors.
16.06	Examine different control circuits, e.g., two-wire controls, three-wire controls, hands-off-automatic controls, multi-pushbuttons, mechanical interlock for reversing control, sequence control, etc.
16.07	Analyze inductive, capacitive, and Hall Effect proximity sensors.

16.08	Install various types of relays, transformers, and electric motors.
16.09	Assemble different jogging control circuits using a control relay and a reversing starter or reversing starter and a selector Switch.
16.10	Understand the common control modes used by industrial controllers.
16.11	Identify the elements of solid-state motor controls and variable speed drives.
16.12	Install components in hydraulic, pneumatic, and fluid power systems
16.13	Install types of gears, couplings, belts and chains used in the automation systems.
16.14	Explain the difference between overload current and short circuit current.
16.15	Identify the differences between open-loop and closed-loop systems.
17.0	Demonstrate troubleshooting fundamentals of Automated Controls Systems. The student will be able to:
17.01	Describe the proper troubleshooting safety procedures of an automated system.
17.02	Identify the various factors of the troubleshooting process.
17.03	Describe system-troubleshooting techniques containing sensors, PLCs, Robots, HMIs and other common manufacturing and automation equipment.
17.04	Troubleshoot reduced voltage starters.
17.05	Define and explain the difference between linear and rotary actuation.
17.06	Construct and troubleshoot manual and magnetic motor circuits.
17.07	Construct and troubleshoot relay logic circuits.
17.08	Analyze and troubleshoot variable frequency and variable speed AC and DC drives.
17.09	Troubleshoot timing control circuits.
17.10	Troubleshoot industrial power distribution systems.
17.11	Analyze, construct, and troubleshoot photoelectric, proximity sensor circuits and transducer circuits.
17.12	Troubleshoot pump system failure conditions (e.g., cavitation).
18.0	Demonstrate proficiency in fabrication techniques applied in supply chain automation systems. The student will be able to:
18.01	Understand the processes of separating, forming, and conditioning, fabricating, and finishing of materials.
18.02	Apply safe fabrication techniques in an automation system.
18.03	Make minor repairs to equipment and accessories of an automation system.
18.04	Describe fabrication techniques used in automation systems.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030(4), F.A.C., identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science (AS) degree and the Associate of Applied Science (AAS) degree. In addition, Rule 6A-14.0303, F.A.C., implements s. 1007.25, F.S., and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Alternative Energy Systems Specialist (0615170101) – 18 credit hours
Applied Technology Specialist (0615061203) – 16 credit hours
Automation (0615040601) – 12 credit hours
CNC Composite Fabricator/Programmer (0615080501) – 12 credit hours
CNC Machinist/Fabricator (0648051002) – 12 credit hours
CNC Machinist Operator/Programmer (0615000015) – 12 credit hours
Composite Fabrication and Testing (0615061700) – 19 credit hours
Computer-Aided Design and Drafting (0615130304) – 24 credit hours
Digital Manufacturing Specialist (0615000009) – 24 credit hours
Electronics Aide (0615030313) – 12 credit hours
Engineering Technology Support Specialist (0615000007) – 18 credit hours
Lean Manufacturing (0615061302) – 12 credit hours
Lean Six Sigma Green Belt Certificate (0615070203) – 12 credit hours
Mechanical Designer and Programmer (0615080503) – 12 credit hours
Mechatronics (0615000013) – 30 credit hours
Medical Quality Systems (0641010105) – 15 credit hours
Pneumatics, Hydraulics and Motors for Manufacturing (0615061303) – 12 credit hours
Rapid Prototyping Specialist (0615130211) – 12 credit hours
Six Sigma Black Belt Certificate (0615070202) – 12 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: **Electronics Engineering Technology**
Career Cluster: **Manufacturing**

AS	
CIP Number	1615030301
Program Type	College Credit
Program Length	68 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to DC circuits, AC circuits, solid-state devices, analog circuits, digital circuits and microprocessor systems. Integrated into this content will be communications skills, leadership skills, human relations skills, employability skills, safe and efficient work practices, use of circuit diagrams and schematics, soldering, laboratory practices and technical recording and reporting.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Electronics Engineering industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 68 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in direct current (DC) circuits.
03.0 Demonstrate proficiency in advanced direct current (DC) circuit network analysis.
04.0 Demonstrate proficiency in alternating current (AC) circuits.
05.0 Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis.
06.0 Demonstrate proficiency in solid-state devices.
07.0 Demonstrate proficiency in design and analysis of discrete solid-state circuits.
08.0 Demonstrate proficiency in analog and linear integrated circuits.
09.0 Demonstrate proficiency in digital circuits.
10.0 Demonstrate proficiency in microprocessor/microcontroller systems.
11.0 Demonstrate proficiency in technical recording and reporting.
12.0 Demonstrate proficiency in programming, design and analysis of microprocessor/microcontroller based systems.
13.0 Demonstrate employability skills.

Optional standards for programs specializing in Laser and Photonics
14.0 Demonstrate proficiency in photonics, optics, and lasers.
15.0 Demonstrate proficiency in electro-optical devices.

Optional standards for programs specializing in Telecommunications
16.0 Demonstrate proficiency in telecommunications.

Optional standards for programs specializing in Robotics and Simulation
17.0 Demonstrate proficiency in robotics and automation.
18.0 Demonstrate proficiency in modeling and simulation.

Optional standards for programs specializing in Solar Energy Technician
19.0 Demonstrate proficiency in solar thermal systems.
20.0 Demonstrate proficiency in photovoltaic systems.

Florida Department of Education
Student Performance Standards

Program Title: **Electronics Engineering Technology**
CIP Numbers: **1605030301**
Program Length: **68 credit hours**

At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in laboratory practices. The student will be able to:
01.01	Apply Occupational Safety Health Administration (OSHA) safety standards in an electronics laboratory environment when required.
01.02	Analyze drawings and electronic schematics to make proper electrical and component connections and to also identify obvious faulty connections.
01.03	Identify and use electrical/electronic hand and power tools (wire stripper, wire needle-nose clipper, solder and desolder station, etc.).
01.04	Explain the theoretical and practical concepts of soldering including soldering paste and conductive glue.
01.05	Identify non-functional solder connections.
01.06	Practice acceptable soldering, de-soldering, rework, and repair techniques.
01.07	Practice electrostatic discharge (ESD) safety procedures.
01.08	Describe the construction of printed circuit boards (PCBs).
01.09	Use circuit simulation programs to solve problems, verify circuit functionality and design circuits.
01.10	Demonstrate the use of instrumentation and module analytical software.
01.11	Read and interpret data sheet specifications for electronic components.
01.12	Identify basic limitations of multi-meters, oscilloscopes, function generators, and power supplies.
01.13	Use digital multi-meters (DMM), oscilloscopes, function generators, and power supplies to build, analyze and trouble shoot electrical/electronic circuits.
02.0	Demonstrate proficiency in direct current (DC) circuits. The student will be able to:
02.01	Describe the physical laws that govern electricity and magnetism.
02.02	Identify sources of electricity.
02.03	Define voltage, current, resistance, power, and energy.
02.04	Apply Ohm's law and power formulas to electrical/electronic circuits.
02.05	Read and interpret color codes and symbols to identify electrical components and values.
02.06	Measure properties of a circuit and electronic components using digital multimeters (DMN), LCR meters, and oscilloscopes.

	02.07 Calculate and measure the conductance and resistance of conductors and insulators.
	02.08 Solve problems in electronics utilizing metric prefixes.
	02.09 Apply Ohm's law and Kirchoff's voltage and current laws to solve series, parallel, and series-parallel circuits.
	02.10 Construct and verify operation of series, parallel, and series-parallel circuits.
	02.11 Analyze and troubleshoot series, parallel, and series-parallel circuits.
	02.12 Apply Ohm's law and Kirchoff's voltage and current laws to bridge circuits.
	02.13 Construct and verify the operation of bridge circuits.
	02.14 Analyze and troubleshoot bridge circuits.
	02.15 Identify and define voltage divider circuits (loaded and unloaded).
	02.16 Construct and verify the operation of voltage divider circuits (loaded and unloaded).
	02.17 Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
	02.18 Apply maximum power transfer theory to determine the conditions under which maximum power transfer occurs in a circuit.
	02.19 Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
	02.20 Describe magnetic properties of circuits and devices.
	02.21 Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
	02.22 Setup and operate power supplies for DC circuits.
03.0	Demonstrate proficiency in advanced direct current (DC) circuit network analysis. The student will be able to:
	03.01 Analyze multi source circuits using superposition theorem.
	03.02 Analyze circuits using Thevenin's theorem.
	03.03 Analyze circuits using Norton's theorem.
	03.04 Use or understand branch current, Nodal, source transformation and/or mesh current methods to analyze DC circuits.
	03.05 Analyze circuits using maximum power transfer theorem.
04.0	Demonstrate proficiency in alternating current (AC) circuits. The student will be able to:
	04.01 Use Trigonometry to solve AC circuits.
	04.02 Identify properties of an AC signal.
	04.03 Identify AC sources.
	04.04 Analyze and measure AC signals utilizing DMM's, oscilloscope, frequency counter and function generator.

04.05	Define the characteristics of AC capacitive and inductive circuits.
04.06	Construct and verify the operation of AC capacitive and inductive circuits.
04.07	Analyze and troubleshoot AC capacitive and inductive circuits.
04.08	Define and apply the principles of transformers to AC circuits.
04.09	Construct and verify the operation of AC circuits utilizing transformers.
04.10	Analyze and troubleshoot AC circuits utilizing transformers.
04.11	Construct and verify the operation of passive differentiators and integrators to determine R-C and R-L time constants.
04.12	Compute the impedance of passive RC, RL, and RLC circuits.
04.13	Analyze and troubleshoot passive differentiator and integrator circuits.
04.14	Define the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel and complex).
04.15	Construct and verify the operation of R-C, R-L and RLC circuits (series, parallel and complex).
04.16	Define the characteristics of series and parallel resonant circuits.
04.17	Construct and verify the operation of series and parallel resonant circuits.
04.18	Analyze and troubleshoot R-C, R-L and RLC circuits.
04.19	Define the characteristics of frequency selective filter circuits.
04.20	Construct and verify the operation of frequency selective filter circuits.
04.21	Analyze and troubleshoot frequency selective filter circuits.
04.22	Define the characteristics of three-phase circuits.
04.23	Define the operation of basic motor theory and Induction motor theory.
04.24	Define basic generator theory and operation.
04.25	Setup and operate power supplies for AC circuits.
04.26	Utilize Power Analyzers to Analyze and measure power in AC circuits.
04.27	Define power factor and power factor correction in AC circuits.
05.0	Demonstrate proficiency in alternating current (AC) network and coupled circuit analysis. The student will be able to:
05.01	Explain the principles of electromagnetism.
05.02	Apply Faraday's law of induced voltages to simple solenoids.
05.03	Solve for mutual inductance in a coupled circuit.

05.04	Use or understand branch current, nodal, source transformation and/or mesh current methods to analyze AC circuits.
05.05	Identify the effects of transient spikes in RC, RL, and RLC circuits.
05.06	Identify the effects of loading on transformers.
05.07	Analyze multi source circuits using superposition theorem.
05.08	Analyze circuits using Thevenin's theorem.
05.09	Analyze circuits using Norton's theorem.
05.10	Analyze circuits using maximum power transfer theorem.
05.11	Design and Simulate AC Circuits using engineering software.
06.0	Demonstrate proficiency in solid-state devices. The student will be able to:
06.01	Identify and define properties of semiconductor materials.
06.02	Identify and define operating characteristics and applications of junction diodes.
06.03	Identify and define operating characteristics and applications of special diodes, such as varactor diodes, LED, Zener diodes, etc.
06.04	Construct diode circuits.
06.05	Analyze and troubleshoot diode circuits.
06.06	Identify and define operating characteristics and applications of bipolar junction transistors (BJT).
06.07	Identify and define operating characteristics and applications of Metal Oxide Semiconductor Field Effect Transistors (MOSFETs).
06.08	Identify and define operating characteristics and applications of single-stage amplifiers.
06.09	Construct single-stage amplifiers.
06.10	Analyze and troubleshoot single-stage amplifiers.
06.11	Identify and define operating characteristics and applications of thyristor circuits.
06.12	Construct thyristor circuitry.
06.13	Analyze and troubleshoot thyristor circuitry.
06.14	Demonstrate proficiency in the use of curve tracers and/or transistor testers.
07.0	Demonstrate proficiency in design and analysis of discrete solid-state circuits. The student will be able to:
07.01	Construct, analyze, and troubleshoot regulator circuits using zener diodes.
07.02	Construct, analyze, and troubleshoot bipolar junction transistor biased circuits.
07.03	Construct, analyze, and troubleshoot field effect transistor biased circuits.

07.04	Construct, analyze small signal amplifier circuits using bipolar junction or field effect transistors.
07.05	Identify, define, construct, analyze, and troubleshoot multistage amplifiers.
07.06	Identify, define, construct, analyze, and troubleshoot power amplifiers.
07.07	Analyze low and high frequency amplifier responses.
07.08	Discuss troubleshooting techniques applied to discrete solid-state circuits.
07.09	Discuss performance and applications for discrete solid-state circuits.
07.10	Analyze discrete solid-state circuits using computer programs.
08.0	Demonstrate proficiency in analog and linear integrated circuits. The student will be able to:
08.01	Identify and define operating characteristics and applications of unregulated, linear, or switch-mode power supplies and basic passive filters.
08.02	Construct, analyze, and troubleshoot unregulated power supplies and basic passive filters.
08.03	Identify and define operating characteristics and applications of differential amplifiers including operational amplifiers.
08.04	Construct, analyze, and troubleshoot differential and operational amplifier circuits.
08.05	Identify and analyze different amplifier classes and their applications.
08.06	Construct, analyze, and troubleshoot different amplifier classes.
08.07	Identify and define characteristics of power amplifiers including audio power amplifiers.
08.08	Solve problems in heat sinking and power limitations for audio frequency power amplifiers.
08.09	Construct, analyze and troubleshoot power amplifier circuits including audio power amplifiers.
08.10	Identify and define operating characteristics of power supply regulator circuits.
08.11	Construct, analyze and troubleshoot power supply regulator circuits.
08.12	Identify and define operating characteristics of linear integrated circuits especially operational amplifiers, including time and frequency responses.
08.13	Construct, analyze and troubleshoot operational amplifier circuits including active filters, sinusoidal and non-sinusoidal oscillators, negative and positive feedback circuits, phase shift circuits, phase-locked loop circuits, integrator, and differentiator circuits.
08.14	Select the integrated circuit (IC) appropriate to the defined parameters of a circuit.
08.15	Identify and define operating characteristics and applications of optoelectronic devices i.e. opto-isolators, IR receivers, etc.
08.16	Construct, analyze and troubleshoot optoelectronic circuits.
08.17	Describe fundamental concepts of modulation and demodulation.
08.18	Identify, define, construct, analyze and troubleshoot operating characteristics and applications of linear /non-linear integrated circuits/amplifier circuits.

09.0	Demonstrate proficiency in digital circuits. The student will be able to:
09.01	Define and apply numbering systems to codes and arithmetic operations.
09.02	Analyze and minimize logic circuits using Boolean and Karnaugh Map (K-Map) operations.
09.03	Demonstrate proficiency in the use of logic probes for digital circuits.
09.04	Describe the various logic families and their electrical characteristics, i.e., transistor-transistor logic (TTL), Complimentary Metal-Oxide Semiconductor (CMOS), etc.
09.05	Use pulsers/pulse generators/clock signals to drive the inputs of digital circuits.
09.06	Use oscilloscopes and function generators to analyze and troubleshoot digital circuits.
09.07	Use logic analyzers to analyze and troubleshoot digital circuits.
09.08	Determine the fan-out of digital circuits based on IC limitations.
09.09	List the various types of logic gates and their truth tables.
09.10	Construct combinational logic circuits using integrated circuits.
09.11	Troubleshoot combinational and sequential logic circuits.
09.12	Identify and analyze types of flip-flops and their truth tables.
09.13	Construct flip-flops using integrated circuits.
09.14	Troubleshoot flip-flop circuits.
09.15	Identify types of registers and counters.
09.16	Construct registers and counters using flip-flops and logic gates.
09.17	Troubleshoot registers and counters.
09.18	Analyze, construct, and troubleshoot clock and timing circuits.
09.19	Identify, construct, and troubleshoot adder/subtractor logic circuits.
09.20	Identify, construct, and troubleshoot encoders and decoders.
09.21	Identify, construct, and troubleshoot multiplexer and demultiplexer circuits.
09.22	Identify types of memory circuits.
09.23	Describe and examine the uses of digital-to-analog and analog-to-digital conversions.
09.24	Construct and troubleshoot digital-to-analog and analog-to-digital circuits.
09.25	Identify, construct, and troubleshoot digital display circuits.
09.26	Program Programmable Logic Devices (PLD).

10.0	Demonstrate proficiency in microprocessor/microcontroller systems. The student will be able to:
10.01	Distinguish between the microcontroller and the microprocessor.
10.02	Demonstrate knowledge and architecture of the central processing units (CPU) operation and processes.
10.03	Demonstrate the use of software to examine the operation of the CPU.
10.04	Analyze BUS concepts.
10.05	Identify and analyze addressing concepts.
10.06	Write, assemble, execute, and debug software instructions and programs.
10.07	Identify the various types of RAM and ROM memories and their interfacing to the microprocessor/microcontroller.
10.08	Interface input and output devices with the microprocessor/microcontroller.
10.09	Setup and operate an oscilloscope to test and evaluate a microprocessor/microcontroller system.
10.10	Setup and operate a logic analyzer to test and troubleshoot a microprocessor/microcontroller system.
11.0	Demonstrate proficiency in technical recording and reporting. The student will be able to:
11.01	Use computer application programs (e.g., word processor, database, spreadsheet) to create reports and record and analyze data.
11.02	Use schematic capture and simulation programs to create figures and gather data for technical reporting.
11.03	Write reports and make oral presentations.
11.04	Maintain a lab notebook documenting procedures, activities, observations, calculations, and results of conducted experiments.
12.0	Demonstrate proficiency in programming, design and analysis of microprocessor/microcontroller-based systems. The student will be able to:
12.01	Analyze the connections for interrupt driven input/output.
12.02	Write a machine-level program and verify correct operation of simple input/output devices.
12.03	Implement the addition of RAM in a microprocessor/microcontroller system.
12.04	Erase and program an EEPROM and flash memory.
12.05	Write a machine-level program to initialize a peripheral interface adaptor.
12.06	Analyze and draw a timing diagram showing all pertinent bus signals in a microprocessor/microcontroller system.
12.07	Use timing diagrams to analyze the instruction cycle of a microprocessor/microcontroller.
12.08	Program/Configure and interface input/output devices.
12.09	Program and interface a data link (e.g., serial, parallel, USB) using a microprocessor/microcontroller.
12.10	Write programs in a high-level language (e.g., C, C++, or C#) using data movement, logical and shifting instructions.

	12.11 Write programs in a high-level language (e.g., C, C++, or C#) using control loops and integer arithmetic operations on arrays of numbers.
13.0	Demonstrate employability skills. The student will be able to:
	13.01 Conduct a job search.
	13.02 Secure information about a job.
	13.03 Identify documents that may be required when applying for a job.
	13.04 Complete a job application form correctly.
	13.05 Demonstrate competence in job interview techniques.
	13.06 Demonstrate knowledge of how to make appropriate decisions.
	13.07 Demonstrate appropriate work/behavioral habits.
	13.08 Demonstrate acceptable employee personal hygiene and health.
	13.09 Demonstrate knowledge of the Occupational Safety and Health Standard 29CFR-1910.1200, Hazard Communication.
Optional standards for programs specializing in Laser and Photonics	
14.0	Demonstrate proficiency in photonics, optics and lasers. The student will be able to:
	14.01 Describe the nature and properties of light.
	14.02 Demonstrate the proper handling of optical components and positioning equipment.
	14.03 Describe the different light sources used in the photonics industry.
	14.04 Demonstrate understanding of laser safety for both beam and non-beam hazards.
	14.05 Setup and operate basic optical systems.
	14.06 Demonstrate understanding of geometrical and physical optics.
	14.07 Demonstrate understanding of the principles of lasers.
	14.08 List and describe the operational characteristics of lasers.
	14.09 Categorize and explain the operation of lasers.
	14.10 Explain the construction, operation, and applications of optical detectors.
	14.11 Explain the principles of human vision and related laser safety issues.
	14.12 List and explain the characteristics of photonic devices used for imaging, display and storage.
	14.13 Explain a fiber optic datalink.
	14.14 Demonstrate understanding of attenuation in fiber optics links (including the loss of all fiber, splices and connectors).

	14.15 Demonstrate how to terminate single and multi-mode connectors.
	14.16 Perform fusion splicing of fiber.
	14.17 Conduct optical power source measurements.
	14.18 Conduct and interpret OTDR measurements.
	14.19 Properly arrange fibers in splice cassettes.
15.0	Demonstrate proficiency in electro-optical devices. The student will be able to:
	15.01 Demonstrate proficiency in fundamentals of light.
	15.02 Demonstrate proficiency in reflection, refraction, and mirrors.
	15.03 Demonstrate proficiency in measurement of maximum power and pulse energy.
	15.04 Define radiation sources, their types, properties, and applications.
	15.05 Demonstrate proficiency in measurement of detector rise time.
	15.06 Demonstrate proficiency in prisms, optical filters, resonator, and beam splitters.
	15.07 Demonstrate proficiency in characteristics of a helium-neon laser.
	15.08 Demonstrate proficiency in the use of photo detectors, and LEDs.
	15.09 Demonstrate proficiency in bandwidth in optical power measurements.
	15.10 Demonstrate proficiency in different applications of solid-state lasers.
	15.11 Demonstrate proficiency in explaining and describing different types of gases used as active media or lasers.
	15.12 Demonstrate proficiency in calculating the power, irradiance, and area of a laser beam.
	15.13 Demonstrate proficiency in energy-transfer processes that increase the lower lasing level in gas lasers and solid-state lasers.
	15.14 Explain the processes that account for all the light energy striking a surface.
	15.15 Demonstrate proficiency in safety precautions when operating a laser.
	15.16 Demonstrate proficiency in four elements of a laser.
Optional standards for programs specializing in Telecommunications	
16.0	Demonstrate proficiency in telecommunications. The student will be able to:
	16.01 Demonstrate understanding of the basics of communication systems.
	16.02 Demonstrate understanding of AM modulation.
	16.03 Understand the AM spectrum.

16.04	Demonstrate understanding of SSB modulation.
16.05	Demonstrate understanding of the SSB spectrum.
16.06	Demonstrate understanding of the AM demodulation process.
16.07	Demonstrate understanding of FM modulation.
16.08	Demonstrate understanding of FM demodulation.
16.09	Demonstrate understanding of tuned LC filters.
16.10	Demonstrate understanding of the mixing up/down process and resulting spectrum.
16.11	Demonstrate understanding of the performance IF and ZIF systems.
16.12	Demonstrate understanding of impedance matching requirements.
16.13	Demonstrate understanding of the basic of receiver noise and the effect on system performance.
16.14	Demonstrate understanding of antennas, transmission lines, and radio wave propagation.
16.15	Demonstrate understanding of microwave techniques.
16.16	Demonstrate understanding of satellite communications.
16.17	Demonstrate understanding of data communications.
16.18	Demonstrate understanding of fiber-optic communications.
16.19	Demonstrate understanding of high-definition television systems.
16.20	Demonstrate understanding of the telephone system and its applications.
16.21	Demonstrate understanding of software defined radio and its implications.
Optional standards for programs specializing in Robotics and Simulation	
17.0	Demonstrate proficiency in robotics and automation. The student will be able to:
17.01	Describe the major parts of a robotic system.
17.02	Explain and use sensors used in robotics applications.
17.03	Describe the operation of DC motors, gearing, and electronic control.
17.04	Describe proportional and derivative feedback control systems.
17.05	Construct robot platforms.
17.06	Explain serial communications and data collection.
17.07	Write control programs for robots.

17.08	Download programs to robots and test them.
17.09	Describe shaft encoding and infrared sensing.
17.10	Explain ultrasonic distance sensing.
17.11	Describe the architecture and provide a system overview for the hardware and software found in a typical automated work cell.
17.12	Analyze and interpret typical PLC ladder logic programs.
18.0	Demonstrate proficiency in modeling and simulation. The student will be able to:
18.01	Define Interactive Simulation/Intelligent Systems/Automated Equipment, Robotics, Artificial Intelligence.
18.02	Demonstrate an understanding of Modeling and Simulation Paradigms and Concepts/Types, Randomness, Time, Application, Domain.
18.03	Demonstrate an understanding of Modeling Methods/Definition, Non-Executable Models, Executable Models, and other Model Types.
18.04	Explain Architecture and Conceptual Modeling/What does a Modeling and Simulation System do? Explain Interoperability Techniques, Live, Virtual and Constructive, Phases of Modeling.
18.05	Define Hardware - Outputs/Glasses (Filter glasses, Shutter glasses)/Sound and Audio (Human Auditory System, 3D Sound, Head-based unit)/Haptic Feedback/Visual Displays/Vestibular and Other Senses
18.06	Define Modeling, Mathematics and Physics/Geometry Modeling/Kinematics Modeling/Physical Modeling/Model Management.
18.07	Define 3D and Graphics/Computer Graphic/Dynamic Objects/Perspective Views/3D Clipping/Stereoscopic Vision/Rendering Image, Algorithms/Mapping (Texture, Bumps) Shadows, Reflection, Refraction.
18.08	Demonstrate an understanding of Applications/Creating an Application (From other Media, from an existing VR System)/Industrial (Manufacturing, Robotics)/Training Simulators/Education/Arts/Entertainment and Games/Medical/Military.
Optional standards for programs specializing in Solar Energy Technician	
19.0	Demonstrate proficiency in solar thermal systems. The student will be able to:
19.01	Create sun path charts and site solar irradiance audit.
19.02	Explain how a passive solar thermal system works.
19.03	Install solar thermal systems.
19.04	Determine the best location for collector roof mounting.
19.05	Understand the concepts of wind loading, collector and piping freeze protection.
19.06	Size a solar thermal system based on family size and local solar irradiance.
19.07	Explain how an active solar thermal system works.
19.08	Install AC and DC water pumps, electronic controllers, and temperature sensors.
19.09	Describe the latest Florida solar rebates, and federal solar tax credits.

20.0	Demonstrate proficiency in photovoltaic systems. The student will be able to:
20.01	Determine the available solar resource and conduct site assessments for PV installations.
20.02	Determine the performance and operating characteristics of PV systems and components.
20.03	Define appropriate code-compliant configurations for PV systems and equipment.
20.04	Plan and prepare for PV system installations, including customer relations, developing performance expectations, responsibilities and schedule.
20.05	Implement and modify, as required, mechanical designs for PV systems that meet the performance, architectural and structural requirements for given applications.
20.06	Implement and modify, as required, electrical designs for PV systems that meet the safety, code-compliance, and functional requirements for given applications
20.07	Conduct acceptance tests and inspections, and commission PV system installations.
20.08	Evaluate, troubleshoot, and maintain PV systems.
20.09	Describe the principles of Wind, Geothermal, Biomass, and tidal wave energy systems.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030(4), F.A.C., identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science (AS) degree and the Associate of Applied Science (AAS) degree. In addition, Rule 6A-14.0303, F.A.C., implements s. 1007.25, F.S., and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

Career and Technical Student Organization (CTSO)

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Program Length

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The standard length of this program is sixty-eight credit hours according to Rule 6A-14.030, F.A.C.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Basic Electronics Technician (0615030310) – 14 credit hours
Electronics Technician (0615030309) – 31 credit hours
Laser and Photonics Technician (0615030411) – 12 credit hours
Robotics and Simulation Technician (0615040514) – 12 credit hours
Solar Energy Technician (0615170301) – 12 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: **Biomedical Equipment Technician**
Career Cluster: **Manufacturing**

AS	
CIP Number	1615040102
Program Type	College Credit
Program Length	60 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to designing, manufacturing, evaluating, troubleshooting, repairing and testing various types of biomedical equipment. Additionally, students will learn to function in a hospital or industry environment through an internship at a local biomedical department. During the internship, students will be assigned routine duties as biomedical equipment technicians.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply written and verbal skills.
02.0 Apply mathematical skills.
03.0 Apply basic software skills related to biomedical engineering technology.
04.0 Understand basic pneumatics, hydraulics, and mechanical principles.
05.0 Understand basic biomedical principles.
06.0 Understand basic networking principles.
07.0 Understand basic electronics/computer principles.
08.0 Understand laser/optics/acoustic principles.

Florida Department of Education
Student Performance Standards

Program Title: **Biomedical Equipment Technician**
CIP Numbers: **1615040102**
Program Length: **60 credit hours**

At the completion of this program, the student will be able to:	
01.0	Apply written and verbal skills. The student will be able to:
01.01	Apply written composition principles.
01.02	Demonstrate verbal presentation approaches.
01.03	Demonstrate proficiency in verbal and written communication.
01.04	Demonstrate reasoning and creative thinking ability.
01.05	Apply word processing skills for technical report writing.
01.06	Work effectively in a team environment.
02.0	Apply mathematical skills. The student will be able to:
02.01	Understand mathematical functions, algebra, and complex numbers.
02.02	Understand exponential and logarithmic functions and graphs.
02.03	Understand statistical measures and quality control.
02.04	Demonstrate proficiency in solving basic algebraic expressions and systems of equations.
02.05	Analyze technical applications with computer and calculator-based tools.
02.06	Interpret elementary statistical measures.
03.0	Apply basic software skills related to biomedical engineering technology. The student will be able to:
03.01	Understand word processing software functions.
03.02	Understand database software functions.
03.03	Understand spreadsheet software functions.
03.04	Understand blue-print reading skills.
03.05	Understand Internet browser functions.
03.06	Demonstrate proficiency in using word processors for written reports and communication.
03.07	Demonstrate proficiency in searching and working with databases.

	03.08 Demonstrate proficiency in using spreadsheets for basic data analysis.
	03.09 Demonstrate proficiency in using software to analyze and troubleshoot basic biomedical systems.
	03.10 Demonstrate proficiency in utilizing Internet resources.
04.0	Understand basic pneumatics, hydraulics, and mechanical principles. The student will be able to:
	04.01 Identify hydraulic and pneumatic properties.
	04.02 Demonstrate proficiency in reading and understanding of hydraulic and pneumatic diagrams.
	04.03 Understand uses and operation of biomedical fluid valves.
	04.04 Understand uses and operation of biomedical pneumatic valves and regulators.
	04.05 Demonstrate the use of biomedical instrumentation.
	04.06 Demonstrate proficiency in troubleshooting basic mechanical, hydraulic, and pneumatic systems.
05.0	Understand basic biomedical principles. The student will be able to:
	05.01 Understand basic anatomy and physiology.
	05.02 Understand basic medical terminology.
	05.03 Understand principles of selected biomedical instrumentation.
	05.04 Identify biomedical sensors and transducers.
	05.05 Identify and demonstrate the use of selected biomedical instrumentation.
	05.06 Demonstrate proficiency in analyzing, testing, troubleshooting, repairing, and calibrating selected biomedical instrumentation.
06.0	Understand basic networking principles. The student will be able to:
	06.01 Understand basic network software and hardware technologies.
	06.02 Demonstrate proficiency in understanding broad-based vendor independent network hardware technologies such as Local Area Networks (LAN) which include wired and wireless technologies.
	06.03 Demonstrate proficiency in understanding basics in principle software protocols such as TCP/IP functions.
	06.04 Demonstrate proficiency in relating network technology to real world applications in the biomedical field such as:
	• Laboratory Information Systems (LIS)
	• Hospital Information Systems (HIS)
	• Medical Instrumentation Interfacing
	• Cyber security (to include network security)
07.0	Understand basic electronics/computer principles. The student will be able to:

07.01	Understand and apply basic electrical signals.
07.02	Understand basic linear/nonlinear DC analysis.
07.03	Understand basic linear AC analysis.
07.04	Understand basic digital analysis.
07.05	Utilize electrical passive, active, linear, and non-linear components.
07.06	Understand microprocessors and microcontrollers.
07.07	Understand power systems.
07.08	Understand data acquisition techniques.
07.09	Understand computer interface concepts.
07.10	Demonstrate proficiency in reading electrical diagrams.
07.11	Demonstrate proficiency in analyzing, troubleshooting, and repairing basic electrical systems.
07.12	Demonstrate proficiency in electrical measurements.
07.13	Demonstrate proficiency in computer interfacing.
07.14	Demonstrate proficiency in loading system software in computer based equipment.
07.15	Demonstrate proficiency in hardware replacement in computer based equipment.
08.0	Understand laser/optics/acoustic principles. The student will be able to:
08.01	Understand basic light and optics principles.
08.02	Understand photocells.
08.03	Understand light sensors.
08.04	Understand lasers and safety protocols.
08.05	Understand principles of aligning and troubleshooting basic biomedical optical systems.
08.06	Understand sound wave properties and ultrasound devices.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030(4), F.A.C., identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science (AS) degree and the Associate of Applied Science (AAS) degree. In addition, Rule 6A-14.0303, F.A.C., implements s. 1007.25, F.S., and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

Career and Technical Student Organization (CTSO)

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Medical Device Design and Manufacturing (0615040108) – 28 credit hours
Medical Device Networking and Cybersecurity (0615040109) – 23 credit hours
Medical Equipment Repair (0615040107) – 23 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Program Length

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The standard length of this program is sixty credit hours according to Rule 6A-14.030, F.A.C.

Florida Department of Education
Curriculum Framework

Program Title: **Manufacturing Technology**
Career Cluster: **Manufacturing**

AS	
CIP Number	1615061307
Program Type	College Credit
Program Length	64 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, and a combination of theory and laboratory activities to gain the necessary cognitive and manipulative skills to perform preventive and corrective maintenance, engineering support, and maintain product quality.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 64 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Perform engineering support.
02.0 Perform corrective maintenance.
03.0 Perform preventive maintenance.
04.0 Maintain product quality standards.
05.0 Perform material handling procedures.
06.0 Apply workplace safety practices.
07.0 Apply process engineering change notices.
08.0 Demonstrate appropriate communication skills.
09.0 Demonstrate appropriate math skills.
10.0 Demonstrate appropriate understanding of basic science.
11.0 Demonstrate employability skills.
12.0 Demonstrate an understanding of entrepreneurship.

Florida Department of Education
Student Performance Standards

Program Title: **Manufacturing Technology**
CIP Numbers: **1615061307**
Program Length: **64 credit hours**

At the completion of this program, the student will be able to:	
01.0	Perform engineering support. The student will be able to:
01.01	Modify or adjust equipment per engineering specifications.
01.02	Modify or recommend modifications to incorrect engineering drawings, schematics or blueprints.
01.03	Setup or modify new equipment per engineering specifications.
02.0	Perform corrective maintenance. The student will be able to:
02.01	Define the problem
02.02	Interview operator regarding the problem.
02.03	Identify any recent changes in the system.
02.04	Identify the symptoms.
02.05	Isolate potential sources/causes of problems.
02.06	Identify exact source/cause of problems.
02.07	Consult reference materials.
02.08	Evaluate repair options.
02.09	Document repairs and adjustments made.
02.10	Document final settings.
02.11	Notify the affected area team leader of the resolution of the problem.
03.0	Perform preventive maintenance. The student will be able to:
03.01	Develop preventive maintenance plan.
03.02	Follow preventive/predictive maintenance procedures.
03.03	Clean the equipment.
03.04	Perform general inspections.
03.05	Report abnormalities requiring maintenance.

	03.06 Perform minor repairs.
	03.07 Rebuild equipment, sub-assemblies and components.
	03.08 Ensure suitability of replacement parts.
	03.09 Replace sub-assemblies/components.
04.0	Maintain product quality standards. The student will be able to:
	04.01 Monitor process for quality.
	04.02 Inspecting product for quality.
	04.03 Document quality measurements or observations by filling out quality charts and records.
	04.04 Compare process measurements to standards.
	04.05 Identify root cause.
	04.06 Take corrective action.
05.0	Perform material handling procedures. The student will be able to:
	05.01 Determine types of material/hazardous materials.
	05.02 Select appropriate handling tools/machinery.
	05.03 Perform material handling procedures with appropriate safety procedures.
	05.04 Complete appropriate documentation inventory, hazardous materials etc.
06.0	Apply workplace safety practices. The student will be able to:
	06.01 Communicate any new or revised safety procedures.
	06.02 Update personnel about current safety guidelines.
	06.03 Wear personal safety equipment.
	06.04 Follow area-posted safety guidelines.
	06.05 Follow OSHA guidelines.
	06.06 Maintain a clean and safe work environment
	06.07 Maintain personal safety equipment.
	06.08 Report unsafe conditions/practices.
	06.09 Locate emergency exits and alarms.
	06.10 Comply with company-established safety practices.

	06.11 Use appropriate firefighting procedures.
07.0	Apply process engineering change notices. The student will be able to:
	07.01 Review effects of Engineering Change Notices (ECNs).
	07.02 Take action on ECNs.
	07.03 Implement action on ECNs.
	07.04 Update ECN database.
08.0	Demonstrate appropriate communication skills. The student will be able to:
	08.01 Write logical and understandable statements, or phrases, to accurately fill out forms/invoices commonly used in business and industry.
	08.02 Read and understand graphs, charts, diagrams and tables commonly used in this industry/occupation area.
	08.03 Read and follow written and oral instructions.
	08.04 Answer and ask questions coherently and concisely.
	08.05 Read critically by recognizing assumptions and implications and by evaluating ideas.
	08.06 Demonstrate appropriate telephone/communication skills.
09.0	Demonstrate appropriate math skills. The student will be able to:
	09.01 Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares and cylinders.
	09.02 Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches.
	09.03 Add, subtract, multiply and divide using fractions, decimals and whole numbers.
	09.04 Determine the correct purchase price, to include sales tax for a materials list containing a minimum of six items.
	09.05 Demonstrate an understanding of federal, state and local taxes and their computation.
10.0	Demonstrate appropriate understanding of basic science. The student will be able to:
	10.01 Understand molecular action as a result of temperature extremes, chemical reaction, and moisture content.
	10.02 Draw conclusions or make inferences from data.
	10.03 Identify health related problems which may result from exposure to work related chemicals and hazardous materials and know the proper precautions required for handling such materials.
	10.04 Understand pressure measurement in terms of P.S.I., inches of mercury and K.P.A.
11.0	Demonstrate employability skills. The student will be able to:
	11.01 Conduct a job search.
	11.02 Secure information about a job.

11.03	Identify documents which may be required when applying for a job interview.
11.04	Complete a job application form correctly.
11.05	Demonstrate competence in job interview techniques.
11.06	Identify or demonstrate appropriate responses to criticism from employer, supervisor or other employees.
11.07	Identify acceptable work habits.
11.08	Demonstrate knowledge of how to make job changes appropriately.
11.09	Demonstrate acceptable employee health habits.
11.10	Demonstrate knowledge of the Federal Law as recorded in (29 CFR-1910.1200).
12.0	Demonstrate an understanding of entrepreneurship. The student will be able to:
12.01	Define entrepreneurship.
12.02	Describe the importance of entrepreneurship to the American economy.
12.03	List the advantages and disadvantages of business ownership.
12.04	Identify the risks involved in ownership of a business.
12.05	Identify the necessary personal characteristics of a successful entrepreneur.
12.06	Identify the business skills needed to operate a small business efficiently and effectively.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030(4), F.A.C., identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science (AS) degree and the Associate of Applied Science (AAS) degree. In addition, Rule 6A-14.0303, F.A.C., implements s. 1007.25, F.S., and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

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Florida Department of Education
Curriculum Framework

Program Title: **Semiconductor Engineering Technology**
Career Cluster: **Manufacturing**

AS	
CIP Number	1615061600
Program Type	College Credit
Program Length	60 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.rg/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills and occupation-specific skills, and knowledge of all aspects of the Manufacturing career cluster.

The content includes but is not limited to electrical and digital circuits, installation and programming of robotic systems and silicon and wafer fabrication to include photolithography, plasma etching and advanced packaging.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in electrical circuits.
03.0 Demonstrate proficiency in digital circuits.
04.0 Demonstrate proficiency in programming, design and analysis of microprocessor/microcontroller-based systems.
05.0 Demonstrate proficiency in robotics, automation and installation.
06.0 Demonstrate an understanding of silicon and wafer fabrication.
07.0 Demonstrate safe clean room practices and policies.
08.0 Demonstrate an understanding of photolithography and pattern generation.
09.0 Demonstrate an understanding of plasma etching for wafer manufacturing.
10.0 Demonstrate an understanding of metrology testing and applications.
11.0 Demonstrate an understanding of packaging and wafer level advanced packaging.
12.0 Demonstrate employability skills.

Florida Department of Education
Student Performance Standards

Program Title: **Semiconductor Engineering Technology**
CIP Number: **1615061600**
Program Length: **60 credit hours**

At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in laboratory practices. The student will be able to:
01.01	Apply Occupational Safety Health Administration (OSHA) safety standards in an electronics laboratory environment when required.
01.02	Analyze drawings and electronic schematics to make proper electrical and component connections and to also identify obvious faulty connections.
01.03	Identify and use electrical/electronic hand and power tools (wire stripper, wire needle-nose clipper, solder and desolder station, etc.).
01.04	Practice electrostatic discharge (ESD) safety procedures.
01.05	Describe various applications of automation and robotics.
01.06	Describe the construction of printed circuit boards (PCBs).
01.07	Use circuit simulation programs to solve problems, verify circuit functionality and design circuits.
01.08	Demonstrate the use of instrumentation and module analytical software.
01.09	Read and interpret data sheet specifications for electronic components.
01.10	Identify basic limitations of multi-meters, oscilloscopes, function generators and power supplies.
01.11	Describe maintenance procedures, specifically in a total productive maintenance (TPM) in a manufacturing setting.
01.12	Identify different types of personal protection equipment (PPE), their requirements and where they are used.
01.13	Know the lock-out tag-out (LOTO) regulations.
02.0	Demonstrate proficiency in electrical circuits. The student will be able to:
02.01	Describe the physical laws that govern electricity and magnetism.
02.02	Identify sources of electricity.
02.03	Define voltage, current, resistance, power and energy.
02.04	Apply Ohm's law and power formulas to electrical/electronic circuits.
02.05	Read and interpret color codes and symbols to identify electrical components and values.
02.06	Measure properties of a circuit using Digital Multi-meter (DMM) and oscilloscopes.

	02.07	Calculate and measure the conductance and resistance of conductors and insulators.
	02.08	Solve problems in electronics utilizing metric prefixes.
	02.09	Apply Ohm's law and Kirchoff's voltage and current laws to solve series, parallel and series-parallel circuits.
	02.10	Construct and verify operation of series, parallel and series-parallel circuits.
	02.11	Analyze and troubleshoot series, parallel and series-parallel circuits.
	02.12	Apply Ohm's law and Kirchoff's voltage and current laws to bridge circuits.
	02.13	Construct and verify the operation of bridge circuits.
	02.14	Analyze and troubleshoot bridge circuits.
	02.15	Identify and define voltage divider circuits (loaded and unloaded).
	02.16	Construct and verify the operation of voltage divider circuits (loaded and unloaded).
	02.17	Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
	02.18	Apply maximum power transfer theory to determine the conditions under which maximum power transfer occurs in a circuit.
	02.19	Construct and verify the operation of direct current (DC) and alternating current (AC) circuits that demonstrate the maximum power transfer theory.
	02.20	Describe magnetic properties of circuits and devices.
	02.21	Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
	02.22	Setup and operate power supplies for DC and AC circuits.
03.0	Demonstrate proficiency in digital circuits. The student will be able to:	
	03.01	Define and apply numbering systems to codes and arithmetic operations.
	03.02	Analyze and minimize logic circuits using Boolean and Karnaugh Map (K-Map) operations.
	03.03	Demonstrate proficiency in the use of logic probes for digital circuits.
	03.04	Describe the various logic families and their electrical characteristics, e.g., Transistor-Transistor Logic (TTL), Complimentary Metal-Oxide Semiconductor (CMOS), etc.
	03.05	Use pulsers/pulse generators/clock signals to drive the inputs of digital circuits.
	03.06	Use oscilloscopes to analyze and troubleshoot digital circuits.
	03.07	Use logic analyzers to analyze and troubleshoot digital circuits.
	03.08	Determine the fan-out of digital circuits based on integrated circuits (IC) limitations.
	03.09	List the various types of logic gates and their truth tables.
	03.10	Construct combinational logic circuits using IC.

	03.11 Troubleshoot combinational and sequential logic circuits.
	03.12 Identify and analyze types of flip-flops and their truth tables.
	03.13 Construct flip-flops using IC.
	03.14 Troubleshoot flip-flop circuits.
	03.15 Identify types of registers and counters.
	03.16 Construct registers and counters using flip-flops and logic gates.
	03.17 Troubleshoot registers and counters.
	03.18 Analyze, construct and troubleshoot clock and timing circuits.
	03.19 Identify, construct and troubleshoot adder/subtractor logic circuits.
	03.20 Identify, construct and troubleshoot encoders and decoders.
	03.21 Identify, construct and troubleshoot multiplexer and demultiplexer circuits.
	03.22 Identify types of memory circuits.
	03.23 Describe and examine the uses of digital-to-analog and analog-to-digital conversions.
	03.24 Construct and troubleshoot digital-to-analog and analog-to-digital circuits.
	03.25 Identify, construct and troubleshoot digital display circuits.
	03.26 Program Programmable Logic Devices (PLD).
04.0	Demonstrate proficiency in programming, design and analysis of microprocessor/microcontroller-based systems. The student will be able to:
	04.01 Analyze the connections for interrupt driven input/output.
	04.02 Write a machine-level program and verify correct operation of simple input/output devices.
	04.03 Analyze and draw a timing diagram showing all pertinent bus signals in a microprocessor/microcontroller system.
	04.04 Use timing diagrams to analyze the instruction cycle of a microprocessor/microcontroller.
	04.05 Program and interface input/output devices.
	04.06 Program and interface a data link (e.g., serial, parallel, USB) using a microprocessor/microcontroller.
	04.07 Write programs in a high-level language (e.g., C, C++, or C#) using data movement, logical and shifting instructions.
05.0	Demonstrate proficiency in robotics, automation and installation. The student will be able to:
	05.01 Describe the major parts and operation of a robotic system.
	05.02 Explain and use sensors used in robotics applications.

	05.03 Describe proportional and derivative feedback control systems.
	05.04 Explain communication protocols (e.g., Ethernet, networks, communication busses)
	05.05 Write control programs for robots.
	05.06 Download programs to robots and test them.
	05.07 Describe the architecture and provide a system overview for the hardware and software found in a typical automated work cell.
	05.08 Describe, analyze and interpret typical Programmable Logic Control (PLC) ladder logic programs.
	05.09 Demonstrate the proper installation of hardware and software
	05.10 Demonstrate programming the robot to go to the calibration position.
	05.11 Demonstrate correct alignment and leveling of the robot.
	05.12 Confirm absence of vibration.
	05.13 Demonstrate proper cable management.
	05.14 Demonstrate full range of motion and reach study check.
	05.15 Demonstrate safety settings including safety modes.
	05.16 Describe safety Checksum and its purpose.
	05.17 Demonstrate the proper installation of an End of Arm Tool (EOAT).
	05.18 Describe the role of sensors and demonstrate the proper installation of sensors.
	05.19 Describe the role of actuators and demonstrate the proper installation of actuators.
06.0	Demonstrate an understanding of silicon and wafer fabrication. The student will be able to:
	06.01 Define silicon and other semiconductor substrate materials and describe its use.
	06.02 Define and understand a transistor.
	06.03 Describe the basics of wafer fabrication.
	06.04 Define and understand Moore’s Law.
07.0	Demonstrate safe clean room practices and policies. The student will be able to:
	07.01 Demonstrate clean room practices to include gowning and de-gowning routines.
	07.02 Know how to read safety data sheets (SDS) and identify necessary information.
	07.03 Demonstrate proper wafer handling techniques.
	07.04 Demonstrate the need for contamination control.

08.0	Demonstrate an understanding of photolithography and pattern generation. The student will be able to:
08.01	Define photolithography and its use in wafer manufacturing
08.02	Define pattern generation as it relates to wafer fabrication.
08.03	Define and demonstrate Statistical Process Control (SPC).
09.0	Demonstrate an understanding of plasma etching for wafer manufacturing. -- The student will be able to:
09.01	Define Plasma and Plasma Etch methods and equipment (e.g., reactive ion etch, inductively coupled plasma (ICP)).
09.02	Demonstrate a visual check of plasma process conditions.
09.03	Demonstrate an understanding of theory and equipment for End Point Detection.
09.04	Demonstrate an understanding of wet, dry and thermal wafer process procedures.
09.05	Demonstrate an understanding of plasma deposition in wafer fabrication.
10.0	Demonstrate an understanding of metrology testing and applications. The student will be able to:
10.01	Demonstrate visual and instrument checks of wafer film thickness and statistical uniformity.
10.02	Know and identify common wafer defects.
10.03	Demonstrate an understanding of how the following metrology tools work and the data they provide. (e.g., Scanning Electron Microscope (SEM), Film Thickness Monitor, Laser surface Profilometer and Roughness, Stylus Profilometer)
10.04	Demonstrate an understanding of electrical wafer probing.
11.0	Demonstrate an understanding of packaging and wafer level advanced packaging. The student will be able to:
11.01	Define and describe singulation, die pick and place and wire bond.
11.02	Define types of single die packaging.
11.03	Define and describe advanced packaging and interposer technologies.
12.0	Demonstrate employability skills. The student will be able to:
12.01	Conduct a job search.
12.02	Secure information about a job.
12.03	Identify and create documents that may be required when applying for a job to include a professional resume.
12.04	Complete a job application form correctly after identifying appropriate job descriptions.
12.05	Demonstrate competence in job interview techniques.
12.06	Demonstrate knowledge of how to make appropriate decisions and judgements.
12.07	Demonstrate appropriate work/behavioral habits.

12.08	Demonstrate acceptable employee personal hygiene and health.
12.09	Demonstrate knowledge of the Occupational Safety and Health Standard 29CFR-1910.1200, Hazard Communication.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030(4), F.A.C., identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science (AS) degree and the Associate of Applied Science (AAS) degree. In addition, Rule 6A-14.0303, F.A.C., implements s. 1007.25, F.S., and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

0615061601 Semiconductor Cleanroom Operator (pending) - 18 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: **Aerospace Technology**
Career Cluster: **Manufacturing**

AS	
CIP Number	1615080100
Program Type	College Credit
Program Length	64 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, and a combination of theory and laboratory activities to gain the necessary cognitive and manipulative skills to perform preventive and corrective maintenance, engineering support, and maintain product quality.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 64 credit hours.

Standards

After successfully completing this program, the student will be able to:

01.0 Demonstrate appropriate communications skills.
02.0 Demonstrate appropriate math skills.
03.0 Demonstrate appropriate understanding of material science.
04.0 Demonstrate understanding of safe, efficient, professional work practices.
05.0 Demonstrate the knowledge, testing and repair of spacecraft and launch vehicle systems.
06.0 Demonstrate the use and maintenance of industry tools.
07.0 Perform basic electricity, electronic and fiber optics skills.
08.0 Demonstrate an understanding of appropriate safety/OSHA rules and regulations.
09.0 Demonstrate the ability to fabricate component parts to specifications.
10.0 Prepare, analyze, and evaluate technical reports and data.
11.0 Demonstrate the ability to evaluate problems, troubleshoot and implement appropriate corrective action.
12.0 Select, configure, calibrate, operate, and evaluate precision, non-destructive test equipment.
13.0 Demonstrate appropriate knowledge of the operation and repair of hydraulic, pneumatic, and propellant systems.
14.0 Demonstrate employability skills.

Florida Department of Education
Student Performance Standards

Program Title: **Aerospace Technology**
CIP Numbers: **1615080100**
Program Length: **64 credit hours**

At the completion of this program, the student will be able to:	
01.0	Demonstrate appropriate communications skills. The student will be able to:
01.01	Write logical and understandable statements, or phrases, to complete with accuracy the technical documentation commonly used in business and industry.
01.02	Analyze and draw conclusion from graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
01.03	Interpret and follow written and oral instructions.
01.04	Formulate questions coherently and concisely.
01.05	Review technical documentation for accuracy and applicability.
01.06	Demonstrate appropriate verbal and written communication skills.
01.07	Effectively use electronic communication systems such as e-mail and computer-based management systems.
02.0	Demonstrate appropriate math skills. The student will be able to:
02.01	Solve ratio, proportion, and percentage problems.
02.02	Calculate volume, weight, area, circumference, and perimeter measurements of various geometrical shapes, to include rectangles, squares, and cylinders.
02.03	Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches.
02.04	Add, subtract, multiply, and divide fractions, decimals, and whole numbers.
03.0	Demonstrate appropriate understanding of material science. The student will be able to:
03.01	Identify and characterize materials and commodities used in the aerospace industry.
03.02	Identify uses and hazards and emergency procedures involved in handling common materials and commodities used in the aerospace industry.
03.03	Identify materials compatibility/incompatibility.
03.04	Demonstrate knowledge of chemical processes involved in metal treatments and polymerization.
03.05	Predict molecular action as a result of temperature extremes, chemical reaction, and moisture content.
03.06	Recognize modes and manifestations of corrosion.
03.07	Identify various types of materials contamination.

	03.08 Identify symptoms and causes of metal failure (e.g., fatigue, ductile, brittle).
	03.09 Identify symptoms/causes of failures in composite materials including faulty bonds and delaminations.
04.0	Demonstrate understanding of safe efficient professional work practices. The student will be able to:
	04.01 Observe work area rules and regulations.
	04.02 Characterize clean room/controlled environment procedures.
	04.03 Practice proper foreign object debris (FOD) procedures to include identification, tool control, materials control, inventory and housekeeping.
	04.04 Recognize and resolve static electricity hazards.
	04.05 Demonstrate professional work ethics.
	04.06 Demonstrate knowledge of ISO standards.
	04.07 Identify gaps in quality control processes using quality assurance techniques.
05.0	Demonstrate the knowledge, testing and repair of spacecraft and launch vehicle systems. The student will be able to:
	05.01 Identify spacecraft systems and sub systems and how they relate to the entire spacecraft.
	05.02 Demonstrate understanding of the operation of spacecraft systems.
	05.03 Identify operational differences between expendable and reusable spacecraft.
	05.04 Demonstrate knowledge of basic principles of hydraulics/pneumatics systems.
	05.05 Demonstrate knowledge of basic principles of pyrotechnic devices.
	05.06 Demonstrate knowledge of basic principles of rocket propulsion.
	05.07 Demonstrate knowledge of basic principles of electro-mechanical systems.
	05.08 Demonstrate basic knowledge of ground support equipment.
	05.09 Assemble/disassemble components from various systems.
	05.10 Demonstrate basic knowledge of how to modify or rework major systems and components to close tolerances.
	05.11 Perform fit check/functional test.
	05.12 Operate ground support equipment (GSE).
	05.13 Operate switches, circuit breakers and valves.
	05.14 Demonstrate a knowledge of thermal control systems.
	05.15 Demonstrate knowledge of basic principles of spacecraft/launch vehicle control systems.
	05.16 Demonstrate knowledge of basic principles of spacecraft/launch vehicle electrical systems.

	05.17 Demonstrate knowledge of basic principles of spacecraft/launch vehicle environmental systems.
	05.18 Demonstrate knowledge of basic principles of spacecraft/launch vehicle communication systems.
06.0	Demonstrate the use and maintenance of industry tools. The student will be able to:
	06.01 Identify the proper tool for a specific application.
	06.02 Inspect tools for cleanliness.
	06.03 Inspect tools for functionality.
	06.04 Clean/decontaminate tools/equipment.
	06.05 Perform hoisting and rigging operations using proper techniques.
07.0	Perform basic electricity, electronic and fiber optics skills. The student will be able to:
	07.01 Define the relationship between current, voltage, resistance and power in DC and AC circuits.
	07.02 Identify the sources of DC and AC power to include generators, batteries, photovoltaic, fuel cells, transformers, converters and inverters.
	07.03 Identify the basic components of DC and AC circuits.
	07.04 Solve problems in series, parallel, series-parallel and voltage divider circuits.
	07.05 Read and interpret electrical circuit diagrams.
	07.06 Measure circuit values to include voltage, current, resistance, continuity, capacitance, inductance, and electromagnetism.
	07.07 Measure AC circuit parameters to include frequency, period, time, wavelength, peak-to-peak, RMS, phase, and instantaneous values.
	07.08 Perform electrical wire interconnection system fabrication, repair, and troubleshooting.
	07.09 Demonstrate basic soldering skills and the identification of components common to electronics.
	07.10 Troubleshoot electrical systems.
	07.11 Demonstrate safety procedures when handling fiber optics.
	07.12 Identify different types of fiber optic materials and define their characteristics.
	07.13 Make terminations, splices, and connections.
	07.14 Test fiber optic systems using various test equipment.
	07.15 Perform fiber optic troubleshooting and diagnosis.
	07.16 Define and test various types of motors and motor control systems.
	07.17 Identify the functions of diodes, transistors, power supplies, filters, and operational amplifiers in solid state circuits.
08.0	Demonstrate an understanding of appropriate safety/OSHA rules and regulations. The student will be able to:

08.01	Identify workplace hazards.
08.02	Use appropriate personal protective equipment.
08.03	Use appropriate lifting techniques.
08.04	Place catch nets/bags.
08.05	Set up safe work zone.
08.06	Implement lock out/tag out.
08.07	Use buddy system where required.
08.08	Monitor breathing zones and wind direction.
08.09	Interpret safety equipment readings.
08.10	Research and apply safety/OSHA regulations to various workplace environments.
08.11	Identify hazardous materials handling and precautions using applicable publications.
08.12	Demonstrate appropriate fire extinguisher use.
08.13	Demonstrate safe confined space entry procedure.
08.14	Perform a workplace risk assessment and resolve identified discrepancies.
09.0	Demonstrate the ability to fabricate component parts to specifications. The student will be able to:
09.01	Apply basic trigonometric functions to fabrication planning.
09.02	Demonstrate a basic knowledge of machine tools.
09.03	Interpret a basic drawing/blueprint.
09.04	Produce a layout/template.
09.05	Fabricate a sample project.
09.06	Demonstrate the use of brake and shear.
09.07	Demonstrate the ability to finish a component per given requirements.
09.08	Demonstrate the use of precision measuring tools including micrometer and vernier caliper, square, etc.
09.09	Fabricate a project per drawings and specifications.
09.10	Identify and describe metal joining processes (e.g., welds, brazing, etc.).
09.11	Complete a repair project per drawings and specifications.
09.12	Inspect finished product for conformity.

	09.13 Demonstrate a basic knowledge of additive manufacturing.
	09.14 Identify and describe composite and adhesive joining processes
10.0	Prepare, analyze and evaluate technical reports and data. The student will be able to:
	10.01 Interpret technical drawings and schematics.
	10.02 Demonstrate application of technical drawings and/or schematic specifications.
	10.03 Demonstrate application of work authorization document to task.
	10.04 Perform technical reporting and documentation.
	10.05 Identify and perform work team protocols (engineering support).
11.0	Demonstrate the ability to evaluate problems, troubleshoot and implement appropriate corrective actions. The student will be able to:
	11.01 Analyze a given job.
	11.02 Select appropriate equipment for a given job.
	11.03 Select appropriate materials and supplies for a given job.
	11.04 Identify essential personnel for a given job.
	11.05 Apply troubleshooting skills where necessary.
	11.06 Identify and take corrective action where necessary.
12.0	Select, configure, calibrate, operate and evaluate precision test equipment. The student will be able to:
	12.01 Select appropriate test equipment for given test.
	12.02 Verify tool and equipment calibration.
	12.03 Configure test set up.
	12.04 Perform test operations.
	12.05 Evaluate test results.
	12.06 Identify precision measuring and test equipment.
	12.07 Differentiate between destructive and non-destructive testing.
	12.08 Perform basic non-destructive test on metals and composite materials.
13.0	Demonstrate appropriate knowledge of the operation and repair of hydraulic, pneumatic and propellant systems. The student will be able to:
	13.01 Identify various mechanical connections.
	13.02 Identify the function of various types of regulators, valves, and gauges.

13.03	Identify unique safety requirements and hazards involved with various fluid systems.
13.04	Identify and inspect components and conduits for compatibility with commodities.
13.05	Differentiate between dedicated and multi-purpose components and conduits.
13.06	Assemble, operate, inspect, and test fluid systems.
13.07	Identify and calculate pressure measurement in terms of P.S.I., inches of mercury, and KPA.
13.08	Describe the types of spacecraft fuels and oxidizers.
13.09	Identify and describe the characteristics and handling of cryogenics.
13.10	Identify and describe the characteristics and handling of hypergolics.
14.0	Demonstrate employability skills. The student will be able to:
14.01	Conduct a job search.
14.02	Secure information about a job.
14.03	Identify acceptable work habits.
14.04	Identify the steps for making appropriate job changes.
14.05	Explain and identify the steps, procedures, and components of the Aerospace Technician Certification written, oral and performance tests.
14.06	Develop a resume.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030(4), F.A.C., identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science (AS) degree and the Associate of Applied Science (AAS) degree. In addition, Rule 6A-14.0303, F.A.C., implements s. 1007.25, F.S., and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

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SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

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Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificate:

Aerospace Technician (0615080103) – 43 credit hours
Structural Assembly Technician (0615080102) – 17 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: **Simulation Technology**
Career Cluster: **Manufacturing**

AS	
CIP Number	1615080101
Program Type	College Credit
Program Length	68 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, and a combination of theory and laboratory activities to gain the necessary cognitive and manipulative skills to perform preventive and corrective maintenance, engineering support, and maintain product quality.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 68 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in installation and assembly.
02.0 Demonstrate proficiency in testing.
03.0 Demonstrate proficiency in quality control and customer relations.
04.0 Demonstrate proficiency in troubleshooting.
05.0 Demonstrate proficiency in repair.
06.0 Demonstrate proficiency in test/tool calibration.
07.0 Demonstrate proficiency in maintenance.
08.0 Demonstrate proficiency in computer hardware/software.
09.0 Demonstrate proficiency in electronics assembly and cabling.
10.0 Demonstrate proficiency in network plus.
11.0 Demonstrate proficiency in professional and customer service.
12.0 Demonstrate proficiency in electronic devices and circuits.
13.0 Demonstrate proficiency in computer software applications.
14.0 Demonstrate proficiency in DC/AC circuits and lab.
15.0 Demonstrate proficiency in using “two dimensional and three-dimensional design related” software for creating objects and their interaction in virtual space.
16.0 Demonstrate proficiency in the use of virtual simulators.
17.0 Demonstrate an understanding of Information Assurance.

Florida Department of Education
Student Performance Standards

Program Title: **Simulation Technology**
CIP Numbers: **1615080101**
Program Length: **68 credit hours**

At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in installation and assembly. The student will be able to:
01.01	Identify safety issues.
01.02	Identify components.
01.03	Use appropriate grounding techniques.
01.04	Obtain documentation.
01.05	Remove bad part(s) if applicable.
01.06	Perform hardware/software installation.
01.07	Discuss quality management and ISO 9001 standards.
01.08	Clean-up workspace.
01.09	Proficient in using the appropriate tools needed in installation and assembly.
02.0	Demonstrate proficiency in testing. The student will be able to:
02.01	Read test instructions.
02.02	Identify test tools and equipment.
02.03	Identify documentation resources.
02.04	Follow industry safety standards.
02.05	Turn power on.
02.06	Perform electro-mechanical tests.
02.07	Perform bench tests.
02.08	Document test results.
02.09	Generate V.V. and A test results.
02.10	Assess test results for reporting purposes.
03.0	Demonstrate proficiency in quality control and customer relations. The student will be able to:

	03.01 Recommend upgrades.
	03.02 Listen to the customer.
	03.03 Explain simulator operations and limitations to customer.
	03.04 Interact with engineers and customers.
	03.05 Proficient in formal verbal and written communication.
04.0	Demonstrate proficiency in troubleshooting. The student will be able to:
	04.01 Review user log.
	04.02 Perform diagnostic tests.
	04.03 Verify functional/operational discrepancy.
	04.04 Perform sensory inspection.
	04.05 Identify failed sub system.
	04.06 Determine if hardware or software problem.
	04.07 Identify failed component.
05.0	Demonstrate proficiency in repair. The student will be able to:
	05.01 Determine priority of repair.
	05.02 Schedule repair time.
	05.03 Replace trainee station components.
	05.04 Replace computer components.
	05.05 Replace motion components.
	05.06 Replace control components.
	05.07 Replace aural cue components.
	05.08 Replace linkage I/O components.
	05.09 Replace power distribution components.
	05.10 Replace visual sub system components.
	05.11 Repair analog devices to component level.
06.0	Demonstrate proficiency in test/tool calibration. The student will be able to:
	06.01 Assure calibration of alignment tools.

	06.02 Perform visual display alignment.
	06.03 Perform mechanical alignment.
07.0	Demonstrate proficiency in maintenance. The student will be able to:
	07.01 Perform DORTS.
	07.02 Replace or clean air/fluid filters.
	07.03 Perform visual inspection of motion system.
	07.04 Perform hydraulic fluid analysis and identify key factors in lab reports.
	07.05 Perform computer and peripheral diagnostics.
	07.06 Check power sub system.
	07.07 Perform SIM vehicle housekeeping.
	07.08 Check liquid cooling system.
	07.09 Check the U.P.S. system.
08.0	Demonstrate proficiency in computer hardware/software. The student will be able to:
	08.01 Determine if hardware or software problem.
	08.02 Identify computer software.
	08.03 Perform computer operations using industry recognized computer operating systems.
	08.04 Configure and load proper operating systems and drivers.
	08.05 Perform hardware installation.
	08.06 Replace and install computer peripherals.
	08.07 Perform computer and peripheral diagnosis.
	08.08 Identify and learn Bus architecture.
09.0	Demonstrate proficiency in electronics assembly and cabling. The student will be able to:
	09.01 Read instructions.
	09.02 Identify components.
	09.03 Perform steps to assemble IPC-601 certification.
	09.04 Learn Electro**s**tatic Discharge (E.S.D.).
10.0	Demonstrate proficiency in network plus. The student will be able to:

10.01	Describe the functions and elements of a computer network.
10.02	Describe and compare clients, servers, peers, client-server networks, peer-to peer networks.
10.03	Describe and compare the characteristics, capacities, and uses of commonly used types of bounded and unbounded network media.
10.04	Describe the functions and uses of network protocols and models.
10.05	Describe the functions, methods, and implementations of the seven layers of the Open Systems Interconnect model.
10.06	Describe the functionality, protocols, and uses of leading network protocol stacks.
10.07	Given a business scenario, apply appropriate networking concepts to create a practical network design.
11.0	Demonstrate proficiency in professional and customer service. The student will be able to:
11.01	Demonstrate personal responsibility and accountability skills.
11.02	Market company products/services.
11.03	Interact with vendors and technicians.
11.04	Ability to maintain competency in their respective fields and understand the value of continuous learning.
11.05	Perform their assigned duties with objectivity, due diligence, and professional care in accordance with proper standards.
11.06	Understand the value of maintaining privacy and confidentiality of information obtained.
12.0	Demonstrate proficiency in electronic devices and circuits. The student will be able to:
12.01	Replace analog devices to component level.
12.02	Analyze semiconductor devices and circuits.
12.03	Analyze power supply circuits, data conversion circuits and differential amplifiers.
13.0	Demonstrate proficiency in computer software applications. The student will be able to:
13.01	Define and explain elementary computer terms and concepts such as hardware, software, operating system, etc.
13.02	Explain and use operating system commands necessary to load and run software packages, such as formatting blank disks, listing a directory, deleting a file, copying a file, copying a disk.
13.03	Demonstrate appropriate care and handling of a computer, its peripherals, and software materials.
13.04	Summarize rules for legal and illegal duplication of software.
13.05	Select from among specific software packages used or demonstrated, the best one(s) to use for such tasks as retrieval, calculating, planning, research writing, and communicating.
13.06	Demonstrate the uses of a spreadsheet package.
13.07	Use a spreadsheet package to enter a spreadsheet on the computer, perform sensitivity analysis using that spreadsheet and produce a printed report/printed graphic display.

	13.08 Explain the uses of a word processing package.
	13.09 Use a word processing package to create and save a document, make changes to that document, and format and print the document.
	13.10 Explain the uses of a database management package.
	13.11 Use a data base management package to create a data file, query the database, update a data file, and generate a printed report.
	13.12 Proficient use of internet for research purposes.
	13.13 Proficient in making presentations using “presentation applications/software” tools.
14.0	Demonstrate proficiency in DC/AC circuits and lab. The student will be able to:
	14.01 Use appropriate grounding techniques.
	14.02 Learn AC/DC theory.
	14.03 Read schematics and breadboard a basic circuit from a schematic diagram.
	14.04 Solve problems using units of conversion and scientific notation.
	14.05 Solve problems involving electric charge, electric current, potential difference and energy.
	14.06 Solve problems using Ohm's Law.
	14.07 Solve problems for the resistance of metallic conductors.
	14.08 Solve problems in electric circuits involving work and power.
	14.09 Solve problems involving series and parallel resistance circuits.
	14.10 Solve problems involving series/parallel resistance circuits.
	14.11 Solve problems involving capacitance in DC circuits.
	14.12 Solve problems involving magnetic circuits.
	14.13 Solve problems involving inductance in DC circuits.
	14.14 Solve AC problems involving peak value, instantaneous, average value, and RMS value of a sine wave.
	14.15 Solve problems on factors governing reactance in AC circuits.
	14.16 Solve electrical problems using phases’ mathematics.
	14.17 Solve impedance problems in AC circuits.
	14.18 Use an oscilloscope, a multi-meter, a power supply, a signal generator to analyze basic electrical circuits.
	14.19 Prepare and complete concise, neat, and accurate lab reports.
15.0	Demonstrate proficiency in using “two dimensional and three dimensional design related” software for creating objects and their interaction in virtual space. The student will be able to:

	15.01 Explain the need to use the “design software” in appropriate jobs.
	15.02 Use the software in creating detail models.
	15.03 Proficient with the tools in the design software for creating drawings.
	15.04 Create drawings according to given scales.
	15.05 Create models from drawings.
	15.06 Convert files for transportability and rendering purposes.
	15.07 Proficient in file management for design purposes.
	15.08 Apply virtual design in creating product models.
	15.09 Use of “animation” in creating detail models.
16.0	Demonstrate proficiency in the use of virtual simulators. The students will be able to
	16.01 Explain components of simulated systems.
	16.02 Explain theory of motion/control loading simulation and cue synchronization.
	16.03 Explain trainee station design, sensor simulation and instructor/operator station design.
	16.04 Use game engines to create simulation models.
	16.05 Identify simulator applications.
	16.06 Explain the use of virtual simulators.
	16.07 Use virtual simulators.
	16.08 Explain the use of team simulators versus individual simulators.
	16.09 Explain the use of network simulators.
	16.10 Identify major milestones in simulator system life cycle.
	16.11 Explain system engineering life cycle process in creating virtual simulators.
17.0	Demonstrate an understanding of Information Assurance. The student will be able to
	17.01 Explain ethical issues related to Information assurance.
	17.02 Identify the different technologies related to Information assurance.
	17.03 Explain the foundations of Information Assurance.
	17.04 Differentiate between data confidentiality, integrity, availability, identification, authentication, and nonrepudiation.
	17.05 Explain security policies, standards, guidelines, procedures, business continuity planning, and disaster recovery.

17.06	Differentiate between physical and network security.
17.07	Identify Information Assurance threats and attacks.
17.08	Explain available “information assurance” counter measures for threats and attacks.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030(4), F.A.C., identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science (AS) degree and the Associate of Applied Science (AAS) degree. In addition, Rule 6A-14.0303, F.A.C., implements s. 1007.25, F.S., and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Florida Department of Education
Curriculum Framework

Program Title: **Computer Engineering Technology**
Career Cluster: **Manufacturing**

AS	
CIP Number	1615120100
Program Type	College Credit
Program Length	68 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with industry and academic standards and applied technical knowledge and skills needed to prepare for further education and careers such as Applications engineer, Controls engineer, Design engineer, Embedded hardware engineer, Embedded software engineer, Field engineer, Instrumentation engineer, Sales engineer, Systems engineer; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Manufacturing career cluster.

The content includes but is not limited to computer systems architecture, software engineering, computer communications, programming, and analysis and design of computer systems and will prepare graduates with skills necessary to enter careers in the design, development, analysis, application, installation, operation, and/or maintenance of computer systems and their associated software systems.

This degree program includes a highly technical core that addresses essential skills and knowledge in electronics (Standards 1-5) and computing (Standards 6-9). These core standards prepare individuals to assemble, install, operate, maintain, troubleshoot and repair computer and electronic equipment used in industry by providing a comprehensive foundation in the design, theory, and analysis of computer and electronic systems and applications.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 68 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in direct current circuits and network analysis.
03.0 Demonstrate proficiency in alternating current circuits and network analysis.
04.0 Demonstrate proficiency in analog electronics.
05.0 Demonstrate proficiency in digital electronics.
06.0 Demonstrate proficiency in microcomputers and computer systems architecture.
07.0 Demonstrate proficiency in software engineering fundamentals.
08.0 Demonstrate proficiency in the analysis and design of data and computer communications systems.
09.0 Demonstrate proficiency with high-level computer programming languages, data structures, and operating system principles emphasizing the hardware/software interface.
10.0 Demonstrate appropriate communication skills.
11.0 Demonstrate appropriate math skills at or above the level of algebra and trigonometry.
12.0 Demonstrate appropriate understanding of the natural sciences.
13.0 Demonstrate employability skills.
14.0 Demonstrate proficiency in technical recording and reporting.
15.0 Understand, install, configure, and troubleshoot issues relating to computer hardware and software.

Florida Department of Education
Student Performance Standards

Program Title: **Computer Engineering Technology**
CIP Numbers: **1615120100**
Program Length: **68 credit hours**

At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiency in laboratory practices. The student will be able to:
01.01	Apply proper Occupational Safety Health Administration (OSHA) safety standards.
01.02	Analyze drawings and electronic schematics to make proper electrical connections and identify obvious faulty connections.
01.03	Identify and use electrical/electronic hand tools properly (wire stripper, wire nose, clippers, etc.).
01.04	Identify and use power tools associated with electrical/electronic industry properly (solder and de-solder station, etc.).
01.05	Explain the theoretical concepts of soldering.
01.06	Identify proper solder connections.
01.07	Demonstrate acceptable soldering techniques.
01.08	Demonstrate acceptable de-soldering techniques.
01.09	Demonstrate solder rework and repair techniques.
01.10	Demonstrate electrostatic discharge (ESD) safety procedures.
01.11	Describe the construction of printed circuit boards (PCBs).
01.12	Demonstrate proficiency in the use of an operating system.
01.13	Demonstrate proficiency in the use of a high-level computer language.
01.14	Demonstrate proficiency in the use of microcomputer application programs (i.e., word processing, data base, spreadsheet, power point).
01.15	Demonstrate the use of microcomputer circuit simulation programs.
01.16	Demonstrate the use of microcomputer and instrumentation and module analytical software.
01.17	Load operating system and application software.
01.18	Read and interpret data sheet specifications for electronic components.
01.19	Demonstrate proficiency in the use of multimeters.
01.20	Demonstrate proficiency in the use of oscilloscopes.

	01.21 Demonstrate proficiency in the use of function generators.
	01.22 Demonstrate proficiency in the use of power supplies.
	01.23 Identify basic limitations of multi-meters, oscilloscopes, function generators, and power supplies.
02.0	Demonstrate proficiency in direct current circuits and network analysis. The student will be able to:
	02.01 Solve algebraic problems applied to DC circuits.
	02.02 Solve problems in electronic units utilizing metric Engineering Notation.
	02.03 Relate electricity to the nature of matter.
	02.04 Identify sources of electricity.
	02.05 Define voltage, current, resistance, power and energy.
	02.06 Apply Ohm's law and power formulas to electrical/electronic circuits.
	02.07 Read and interpret color codes and symbols to identify electrical components and values.
	02.08 Measure properties of a circuit using digital multimeters (DMM) and oscilloscopes.
	02.09 Calculate conductance and compute and measure the resistance of the conductors and insulators.
	02.10 Apply Ohm's law and Kirchoff’s voltage and current laws to series circuits.
	02.11 Construct and verify operation of series circuits.
	02.12 Analyze and troubleshoot series circuits.
	02.13 Apply Ohm's law and Kirchoff’s voltage and current laws to parallel circuits.
	02.14 Construct and verify the operation of parallel circuits.
	02.15 Analyze and troubleshoot parallel circuits.
	02.16 Apply Ohm's law and Kirchoff's voltage and current laws to series-parallel and parallel-series circuits.
	02.17 Construct and verify the operation of series-parallel and parallel-series and bridge circuits.
	02.18 Analyze and troubleshoot series-parallel and parallel-series and bridge circuits.
	02.19 Identify and define voltage divider circuits (loaded and unloaded).
	02.20 Construct and verify the operation of voltage divider circuits (loaded and unloaded).
	02.21 Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
	02.22 Apply maximum power transfer theory.
	02.23 Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.

02.24	Describe magnetic properties of circuits and devices.
02.25	Define resistor-capacitor (R-C) and resistor inductor (R-L) time constants and classify the output of differentiators and integrators.
02.26	Setup and operate power supplies for DC circuits.
02.27	Analyze DC multi source circuits using superposition theorem.
02.28	Analyze DC circuits using Thevenin's theorem.
02.29	Analyze DC circuits using Norton's theorem.
02.30	Use mesh currents, branch currents, nodal, and/or source transformation analysis to analyze DC circuits.
02.31	Analyze DC circuits using maximum power transfer theorem.
02.32	Design and simulate DC circuits using engineering software.
03.0	Demonstrate proficiency in alternating current circuits and network analysis. The student will be able to:
03.01	Solve basic trigonometric problems as applicable to electronics (prerequisite to AC).
03.02	Identify properties of an AC signal.
03.03	Identify AC sources.
03.04	Analyze and measure AC signals utilizing VOM, DVM, oscilloscope, frequency counter and function generator.
03.05	Define the characteristics of AC capacitive circuits.
03.06	Construct and verify the operation of AC capacitive circuits.
03.07	Analyze and troubleshoot AC capacitive circuits.
03.08	Define the characteristics of AC inductive circuits.
03.09	Construct and verify the operation of AC inductive circuits.
03.10	Analyze and troubleshoot AC inductive circuits.
03.11	Define and apply the principles of transformers to AC circuits.
03.12	Construct and verify the operation of AC circuits utilizing transformers.
03.13	Analyze and troubleshoot AC circuits utilizing transformers.
03.14	Construct and verify the operation of passive differentiators and integrators to determine R-C and R-L time constraints.
03.15	Compute the impedance of passive RC, RL, and RLC circuits.
03.16	Analyze and troubleshoot passive differentiator and integrator circuits.
03.17	Define the characteristics of resistive, inductive, and capacitive (RLC) circuits (series, parallel and complex).

03.18	Construct and verify the operation of RLC circuits (series, parallel and complex).
03.19	Define the characteristics of series and parallel resonant circuits.
03.20	Construct and verify the operation of series and parallel resonant circuits.
03.21	Analyze and troubleshoot R-C, R-L and RLC circuits.
03.22	Define the characteristics of frequency selective filter circuits.
03.23	Construct and verify the operation of frequency selective filter circuits.
03.24	Analyze and troubleshoot frequency selective filter circuits.
03.25	Define the characteristics of polyphase circuits.
03.26	Define basic motor theory and operation.
03.27	Define basic generator theory and operation.
03.28	Setup and operate power supplies for AC circuits.
03.29	Analyze and measure power in AC circuits.
03.30	Define power factor and power factor correction in AC circuits.
03.31	Set up and operate capacitor and inductor analyzers for AC circuits.
03.32	Analyze magnetic circuits.
03.33	Apply Faraday's law of induced voltages.
03.34	Solve for mutual inductance in a coupled circuit.
03.35	Use mesh currents, branch currents, nodal, and/or source transformation analysis to analyze circuits.
03.36	Identify the effects of transient spikes in RC, RL, and RLC circuits.
03.37	Identify the effects of loading on transformers.
03.38	Analyze multi source AC circuits using superposition theorem.
03.39	Analyze AC circuits using Thevenin's theorem.
03.40	Analyze AC circuits using Norton's theorem.
03.41	Analyze AC circuits using maximum power transfer theorem.
03.42	Design and simulate AC circuits using engineering software.
03.43	Identify three-phase power concepts.
04.0	Demonstrate proficiency in analog electronics. The student will be able to:

04.01	Analyze the construction of various types of P-N junction diodes.
04.02	Construct, analyze, and troubleshoot diode circuits.
04.03	Construct, analyze, and troubleshoot regulator circuits using Zener diodes.
04.04	Construct, analyze, and troubleshoot bipolar junction transistor biased circuits.
04.05	Construct, analyze, and troubleshoot field effect transistor biased circuits.
04.06	Construct, analyze small signal amplifier circuits using bipolar junction or field effect transistors.
04.07	Construct, analyze, and troubleshoot multistage amplifiers.
04.08	Construct, analyze, and troubleshoot power amplifiers.
04.09	Analyze low and high frequency amplifier responses.
04.10	Discuss troubleshooting techniques applied to discrete solid-state circuits.
04.11	Discuss performance and applications for discrete solid-state circuits.
04.12	Analyze discrete solid-state circuits using computer programs.
04.13	Identify and define operational characteristics and applications of multistage amplifiers.
04.14	Construct, analyze and troubleshoot multistage amplifiers.
04.15	Identify and define operating characteristics and applications of unregulated power supplies and filters.
04.16	Construct unregulated power supplies and filters.
04.17	Troubleshoot basic power supplies and filters.
04.18	Identify and define operating characteristics and applications of differential and operational amplifiers.
04.19	Construct differential and operational amplifier circuits.
04.20	Analyze and troubleshoot differential and operational amplifier circuits.
04.21	Identify and define operating characteristics of audio power amplifiers.
04.22	Construct audio power amplifiers.
04.23	Identify and analyze different amplifier classes and their applications.
04.24	Analyze and troubleshoot audio power amplifiers.
04.25	Identify and define operating characteristics and applications of power supply regulator circuits.
04.26	Construct power supply regulator circuits.
04.27	Analyze and troubleshoot power supply regulator circuits.

04.28	Identify and define operating characteristics and applications of active filters.
04.29	Construct active filter circuits.
04.30	Analyze and troubleshoot active filter circuits.
04.31	Identify and define operating characteristics and applications of sinusoidal and non-sinusoidal oscillator circuits.
04.32	Construct oscillator circuits.
04.33	Analyze and troubleshoot oscillator circuits.
04.34	Identify and define operating characteristics and applications of cathode ray tubes.
04.35	Identify and define operating characteristics and applications of optoelectronic devices.
04.36	Construct, analyze, and troubleshoot an operational amplifier circuit.
04.37	Solve problems in heat sinking and power limitations for AF power amplifiers.
04.38	Select the integrated circuit (IC) appropriate to the defined parameters of a circuit.
04.39	Analyze and troubleshoot operational amplifier circuits with negative or positive feedback.
04.40	Analyze the operational amplifier frequency response and compensation circuits.
04.41	Construct, analyze, and troubleshoot basic linear and non-linear amplifier circuits.
04.42	Construct, analyze, and troubleshoot active filters using operational amplifiers.
04.43	Construct, analyze, and troubleshoot oscillator circuits using operational amplifiers.
04.44	Construct and analyze phased lock loop circuits.
04.45	Construct and analyze integrated circuit voltage regulators.
04.46	Understand and describe fundamental modulation/demodulation concepts.
05.0	Demonstrate proficiency in digital electronics. The student will be able to:
05.01	Define and apply numbering systems to codes and arithmetic operations.
05.02	Analyze and minimize logic circuits using Boolean Algebra and Karnaugh Maps (K-Map) operations.
05.03	Demonstrate proficiency in the use of logic probes for digital circuits.
05.04	Demonstrate proficiency in the use of power supplies for digital circuits.
05.05	Demonstrate proficiency in the use of pulsers for digital circuits.
05.06	Demonstrate proficiency in the use of oscilloscopes for digital circuits.
05.07	Demonstrate proficiency in the use of logic analyzers for digital circuits.

05.08	Demonstrate proficiency in the use of pulse generators for digital circuits.
05.09	Examine power distribution and possible noise problems.
05.10	Identify types of logic gates and their truth tables.
05.11	Construct combinational logic circuits using integrated circuits.
05.12	Troubleshoot logic circuits.
05.13	Analyze types of flip-flops and their truth tables.
05.14	Construct flip-flops using integrated circuits.
05.15	Troubleshoot flip-flops.
05.16	Identify types of logic circuits using integrated circuits.
05.17	Identify types of registers and counters.
05.18	Construct registers and counters using flip-flops and logic gates.
05.19	Troubleshoot registers and counters.
05.20	Analyze clock and timing circuits.
05.21	Construct clock and timing circuits.
05.22	Troubleshoot clock and timing circuits.
05.23	Identify types of adder/subtractor logic circuits.
05.24	Construct adder/subtractor logic circuits.
05.25	Troubleshoot adder/subtractor logic circuits.
05.26	Identify types of encoding and decoding devices.
05.27	Construct encoders and decoders.
05.28	Troubleshoot encoders and decoders.
05.29	Identify types of multiplexers and demultiplexer circuits using integrated circuits.
05.30	Construct multiplexer and demultiplexer circuits using integrated circuits.
05.31	Troubleshoot multiplexer and demultiplexer circuits.
05.32	Identify types of memory circuits.
05.33	Relate the uses of digital-to-analog and analog-to-digital conversions.
05.34	Construct digital-to-analog and analog-to-digital circuits.

05.35	Troubleshoot digital-to-analog and analog-to-digital circuits.
05.36	Identify types of digital displays.
05.37	Construct digital display circuits.
05.38	Troubleshoot digital display circuits.
05.39	Identify and apply programmable logic device (PLD) concepts to logic circuits.
05.40	Analyze analog and digital circuits using computer programs
05.41	Define and apply numbering systems to codes and arithmetic operations.
05.42	Demonstrate proficiency in the use of function generators and oscilloscopes for digital circuits.
05.43	Identify types of logic gates and their truth tables.
05.44	Analyze, design, construct, troubleshoot, and verify combinational and sequential logic circuits using integrated circuits, including basic gates, flip-flops, registers, counters, arithmetic logic units, multiplexers/demultiplexers, encoders/decoders, digital displays, analog to digital and digital to analog circuits.
05.45	Identify and apply very high-speed integrated circuit hardware description language (VHDL) and PLD concepts to the design and construction of complex logic circuits.
06.0	Demonstrate proficiency in microcomputers and computer systems architecture. The student will be able to:
06.01	Draw the block diagram and describing the basic architecture of a microcomputer.
06.02	Identify and give functional descriptions of data, address, and control buses.
06.03	Describe the internal architecture and functional components of a microprocessor/microcontroller.
06.04	Identify and analyze addressing concepts.
06.05	Describe the sequence of operations in the execution of a microprocessor/microcontroller instruction.
06.06	Write, assemble, execute, and debug software instructions and programs including data movement, logical and shifting instructions.
06.07	Identify the various types of RAM and ROM memories and their interfacing to the microprocessor/microcontroller.
06.08	Analyze, design, construct, troubleshoot, and verify a microprocessor/microcontroller system, including interrupt driven input/output and Universal Asynchronous Receiver/Transmitters (UART).
06.09	Analyze and draw a timing diagram showing all pertinent bus signals in a microprocessor/microcontroller system.
07.0	Demonstrate proficiency in software engineering fundamentals. The student will be able to:
07.01	Identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements.
07.02	Describe the software life cycle.
07.03	Describe software portability and modularity.

	07.04 Demonstrate the use of maintenance and version control.
	07.05 Implement unit testing, validation, and verification.
08.0	Demonstrate proficiency in the analysis and design of data and computer communications systems. The student will be able to:
	08.01 Analyze, design, construct, troubleshoot, and verify serial and parallel, and USB communication systems using industry standard protocols in hardware and software.
	08.02 Identify and define networking and communication layers.
	08.03 Identify and define data communication protocols and networking techniques.
	08.04 Describe the different types of digital data communications systems.
	08.05 Describe data formats and transmission rates in serial data communications systems.
	08.06 Apply digital modulation techniques including pulse-amplitude modulation (PAM), pulse-code modulation (PCM), pulse-width modulation (PWM), and delta modulation.
	08.07 Analyze and design circuits for generation and detection of digital modulation.
	08.08 Apply error detection and correction in digital communication systems.
	08.09 Design and apply multiplexing techniques for computer communications.
09.0	Demonstrate proficiency with high-level computer programming languages, data structures, and operating system principles emphasizing the hardware/software interface. The student will be able to:
	09.01 Design, implement, compile, and debug technical programs in a high-level programming language using industry standard tools and techniques.
	09.02 Understand, identify, and define basic operating system concepts such as paging, memory management, process synchronization and management, basic operating system structures, threads, single and multi-user systems, and protection/security.
	09.03 Analyze and implement data structures such as linked lists, stacks, queues, trees, hash tables/maps.
	09.04 Understand and apply compilation, debugging, and file manipulation techniques.
	09.05 Apply programming language syntax to create control structures, apply sorting techniques, use arithmetic operations, create and use pointers, and perform file I/O.
	09.06 Describe and apply industry accepted techniques for solving engineering problems using, including algorithm development, flowcharting, and creation of dynamic and statically linked libraries.
	09.07 Demonstrate an understanding of the internal representation of data, data types, and operators, including little endian/big endian, and IEEE floating point.
10.0	Demonstrate appropriate communication skills. The student will be able to:
	10.01 Write logical and understandable statements, or phrases, to accurately complete forms/invoices commonly used in business and industry.
	10.02 Read and understand graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
	10.03 Follow and execute detailed verbal, graphical, and written instructions.

	10.04 Answer and ask questions coherently and concisely.
	10.05 Read critically by recognizing assumptions and implications and by evaluating ideas.
11.0	Demonstrate appropriate math skills at or above the level of algebra and trigonometry. The student will be able to:
	11.01 Demonstrate knowledge of and ability to apply college algebra.
	11.02 Demonstrate knowledge of and ability to apply trigonometry.
	11.03 Demonstrate knowledge of and ability to apply discrete math, probability, and statistics.
12.0	Demonstrate appropriate understanding of the natural sciences. The student will be able to:
	12.01 Understand and apply the scientific method of inquiry to solve problems.
	12.02 Understand and apply the International System (SI) of units and measurements.
	12.03 Understand and apply the basic principles of physics.
	12.04 Draw conclusions or make inferences from data using statistical data analysis techniques.
13.0	Demonstrate employability skills. The student will be able to:
	13.01 Conduct a job search and secure information about a job.
	13.02 Identify documents which may be required when applying for a job interview.
	13.03 Complete a job application form correctly.
	13.04 Demonstrate competence in job interview techniques.
	13.05 Demonstrate competence in project management techniques.
	13.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other employees.
	13.07 Identify acceptable work habits and address any safety concerns or issues.
	13.08 An ability to function effectively on teams.
14.0	Demonstrate proficiency in technical recording and reporting. The student will be able to:
	14.01 Demonstrate proficiency in the use of microcomputer application programs (e.g., word processor, database, and spreadsheet).
	14.02 Demonstrate the use of microcomputer circuit capture and simulation programs.
	14.03 Demonstrate the use of microcomputer analytical software.
	14.04 Record data including the use of curves and graphs.
	14.05 Write reports and make oral presentations.
	14.06 Create documentations and maintain test logs.

	14.07 Make equipment failure reports.
15.0	Understand, install, configure, and troubleshoot issues relating to computer hardware and software. The student will be able to:
	15.01 Describe the functions and major components (BIOS, task management, etc.) of a computer operating system.
	15.02 Use an operating system for activities such as data and file management.
	15.03 Identify various coding schemes (ASCII, etc.).
	15.04 Identify the major hardware platforms.
	15.05 Set up and use multiple hardware platforms built on various processor architectures.
	15.06 Use system software to perform routine maintenance tasks such as backup, hard drive defragmentation, etc.
	15.07 Use both stand-alone operating systems and network operating systems.
	15.08 Describe and demonstrate the primary features and functions of the major categories of applications software (word processing, database, spreadsheet, presentation, email, browsers, etc.).
	15.09 Describe the functions of major components of a computer system.
	15.10 Discuss various computer applications in society.
	15.11 Describe the categories of computers.
	15.12 Recognize the value of computer literacy within an individual's personal and career environments.
	15.13 Set up and configure systems and peripherals.
	15.14 Set up and upgrade BIOS.
	15.15 Install and configure storage and I/O device interfaces.
	15.16 Describe the architecture of a typical microcomputer system.
	15.17 Perform component maintenance tasks on microcomputer systems.
	15.18 Perform preventive maintenance tasks on microcomputer systems.
	15.19 Describe issues that affect system design and construction (redundancy, fault tolerance, etc.).

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030(4), F.A.C., identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science (AS) degree and the Associate of Applied Science (AAS) degree. In addition, Rule 6A-14.0303, F.A.C., implements s. 1007.25, F.S., and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificate:

Microcomputer Repairer/Installer (0647010406) – 15 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: **Chemical Technology**
Career Cluster: **Manufacturing**

AS	
CIP Number	1641030100
Program Type	College Credit
Program Length	64 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, and a combination of theory and laboratory activities to gain the necessary cognitive and manipulative skills to perform preventive and corrective maintenance, engineering support, and maintain product quality.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 64 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate appropriate written and oral communication skills.
02.0 Demonstrate appropriate mathematical skills to solve basic problems in the sciences.
03.0 Demonstrate appropriate interpersonal skills, decision-making strategies, and awareness of self-worth, ethics, and values.
04.0 Demonstrate computer competence.
05.0 Demonstrate basic knowledge of scientific concepts.
06.0 Demonstrate basic knowledge of chemical concepts.
07.0 Demonstrate knowledge of chemical kinetics and thermodynamics.
08.0 Demonstrate skills in the safe handling of chemical materials and equipment.
09.0 Exercise safely in the laboratory and adhere to safety, health and environmental regulations.
10.0 Demonstrate conceptual and laboratory knowledge in the area of organic chemistry and/or physics and/or biology and/or engineering and/or biotechnology and/or chemical instrumentation.

Florida Department of Education
Student Performance Standards

Program Title: **Chemical Technology**
CIP Numbers: **1641030100**
Program Length: **64 credit hours**

At the completion of this program, the student will be able to:	
01.0	Demonstrate appropriate communication skills. The student will be able to:
01.01	Write logical, readable, and understandable sentences and paragraphs.
01.02	Carefully read, accurately follow, and demonstrate an understanding of written instructions, standard operating procedures, and accepted manufacturing practices.
01.03	Read and evaluate ideas recognizing assumptions and implications.
01.04	Carefully follow and deliver oral instructions and other spoken information related to the workplace.
01.05	Prepare, outline, and deliver a short oral presentation.
01.06	Participate in group discussion as a member and as a leader.
01.07	Prepare visual material to support an oral presentation.
01.08	Answer and ask questions coherently and concisely.
01.09	Give clear, concise instructions.
01.10	Read technical manuals, reports, and journals.
01.11	Read and prepare diagrams and charts.
01.12	Maintain legibly written logs and notes.
01.13	Keep detailed and accurate records.
01.14	Maintain an accurate and legible notebook.
01.15	Accurately report data.
01.16	Write detailed standard operating procedures.
01.17	Professionally compose memos, letters, and reports.
02.0	Demonstrate appropriate mathematical skills to solve basic problems in the sciences. The student will be able to:
02.01	Calculate ratios.
02.02	Perform unit conversions.

	02.03 Perform calculations using exponents and exponential functions
	02.04 Perform calculations using logarithms and logarithmic functions.
	02.05 Use appropriate significant figures.
	02.06 Recognize patterns in data.
	02.07 Solve single-unknown algebraic equations.
	02.08 Accurately interpret and construct graphs.
	02.09 Plot data, calculate slopes and intercepts of linear graphs.
	02.10 Perform calculations using roots. (square, cube, etc.)
	02.11 Solve simultaneous equations.
	02.12 Solve quadratic equations.
	02.13 Solve word problems using arithmetic and algebra.
03.0	Demonstrate appropriate interpersonal skills, decision-making strategies, and awareness of self-worth, ethics, and values. The student will be able to:
	03.01 Discuss the importance of teamwork and have experience working as a member of a team for planning, performing, analyzing, and reporting.
	03.02 Demonstrate critical thinking skills.
	03.03 Demonstrate high ethical standards in all aspects of work.
	03.04 Apply quality principles to all aspects of work.
	03.05 Recognize sources and symptoms of stress and learn how to manage one's response to it.
	03.06 Determine the importance of initiative and responsibility and examine the possible repercussions of action vs. non-action.
	03.07 Demonstrate the ability to problem solve effectively and resolve typical workplace conflicts.
	03.08 Apply decision-making strategies to workplace situations.
	03.09 Explain the basis for employer expectations: the written and unwritten "rules for success".
	03.10 Recognize the "culture" of an organization or employer and evaluate its impact on the individual.
	03.11 Develop an awareness of diversity and multi-culturalism.
04.0	Demonstrate computer competence. The student will be able to:
	04.01 Demonstrate use of computer hardware and peripherals.
	04.02 Demonstrate appropriate use of computer software applications and tools.
05.0	Demonstrate basic knowledge of scientific concepts. The student will be able to:

05.01	Discuss the scientific method.
05.02	Understand the need to organize and classify natural phenomena.
05.03	Discuss relationships between characteristics of natural phenomena.
05.04	Dissect a natural system into its component parts
05.05	Model natural phenomena.
05.06	Understand that nature behaves in predictable ways.
05.07	Discuss methods of observing natural changes, from extremely slow changes to extremely fast changes.
05.08	Discuss the variation of naturally occurring phenomena
05.09	Discuss the diversity found within classes of natural organisms
06.0	Demonstrate basic knowledge of chemical concepts. The student will be able to:
06.01	Write chemical formulas and use correct chemical nomenclature for inorganic compounds.
06.02	Classify inorganic compounds according to a variety of chemical and physical properties.
06.03	Name and write the symbols for the elements and describe characteristics of the common groupings of elements.
06.04	Describe the basic reactions that occur between commonly used chemical substances.
06.05	Read, write, balance, and interpret chemical equations.
06.06	Solve a variety of basic chemical problems using equations and/or dimensional analysis.
06.07	Classify chemicals according to reactivity.
06.08	Demonstrate knowledge of chemical composition and stoichiometry.
06.09	Demonstrate an understanding of empirical gas laws and theory relating to the behavior of gases.
06.10	Demonstrate a basic understanding of energy as it relates to chemical and other processes.
06.11	Demonstrate a basic understanding of the laws and theories relating to the structure of the atom and how this relates to the Periodic Table.
06.12	Demonstrate a basic understanding of molecular structure and chemical bonding,
06.13	Describe the structure and properties of liquids and solids.
06.14	Describe solutions and their properties, and perform calculations involving solution concentrations, composition and colligative properties.
07.0	Demonstrate knowledge of chemical kinetics and thermodynamics. The student will be able to:
07.01	Demonstrate a basic understanding of chemical kinetics
07.02	Demonstrate a basic understanding of chemical equilibria.

	07.03	Demonstrate a working knowledge of acid/base equilibria.
	07.04	Demonstrate a working knowledge of precipitation equilibria,
	07.05	Demonstrate a working knowledge of redox chemistry.
	07.06	Use the concepts of heat, work, energy, enthalpy, entropy and Gibbs Free Energy to discuss how energetics and change are interrelated in chemical processes and solve related problems.
	07.07	Demonstrate a basic knowledge of radioactivity.
08.0	Demonstrate skills in the safe handling of chemical materials and equipment. The student will be able to:	
	08.01	Properly identify and use a variety of common chemistry laboratory glassware.
	08.02	Use common chemistry laboratory equipment to include such items as hot plates, stirrers, laboratory balances and centrifuges.
	08.03	Preparing solutions of specific concentration from pure substances
	08.04	Performing dilutions to prepare solution of specific concentration
	08.05	Purify chemicals using techniques such as filtering, extracting, crystallization, precipitation, distilling, etc.
	08.06	Use basic analytical chemistry procedures and concepts of measurements in volumetric, gravimetric, and electrochemical analyses and correctly perform associated calculations.
	08.07	Prepare samples for analysis, including digesting, ashing, dissolving, grinding, purifying, diluting, and chemically altering as appropriate before analysis.
	08.08	Determine pH using pH paper, indicators, and instrumental methods.
	08.09	Calculate molarity, molality, mole fraction, weight percent, and normality of solutions, given the appropriate information.
	08.10	Conduct analytical tests using acid-base, oxidation-reduction, and complexometric titrations.
	08.11	Perform gravimetric, volumetric, and electrochemical analyses and achieve results within acceptable limits of precision and accuracy.
	08.12	Apply statistical methods for analyzing experimental data.
	08.13	Calibrate instruments per manufacture’s specifications and record in related log book.
09.0	Exercise safety in the laboratory and adhere to safety, health and environmental regulations. The student will be able to:	
	09.01	Be aware of and follow federal, state, and local legislation pertaining to safety, health, and environmental regulations.
	09.02	Recognize that each company has policies and safety plans that include evacuation procedures, emergency numbers, rules, and practices.
	09.03	Explain the Federal Law as recorded in (29 CFR-1910.1200) and how it applies to chemical laboratory technicians.
	09.04	Recognize, apply, and respond appropriately to the hazard symbols and toxicology sections of Safety Data Sheets (SDS).
	09.05	Choose the proper safety equipment for conducting a variety of laboratory tasks (e.g., proper hoods, shields).

	09.06	Choose and demonstrate the use of personal protective equipment to be used in a variety of situations (e.g., eye wear, special clothing).
	09.07	Demonstrate safe handling procedures (e.g., handling cylinders, glassware, and laboratory instruments).
	09.08	Describe the various categories of hazardous materials.
	09.09	Discuss federal, state, and local regulations for the proper storage and disposal of chemicals.
	09.10	Make informed and appropriate decisions on how and where to store chemical materials to minimize hazards.
	09.11	Given a safety data sheet, explain each section of the sheet.
	09.12	Define and give an example of the major physical and health hazards which are likely to be encountered in the industrial laboratory.
	09.13	List the information needed on each hazardous material when conducting an inventory.
	09.14	Demonstrate the human health effects associated with exposure to hazardous materials.
	09.15	Follow federal, state, and local regulations for the proper storage and disposal of sharps and biological materials.
10.0	Demonstrate conceptual and laboratory knowledge in the area of organic chemistry and/or analytical chemistry and/or physics and/or biology and/or engineering and/or biotechnology and/or chemical instrumentation. Students will be competent in two or more of the following areas of specialization. The student will be able to:	
Specialty I: Organic Chemistry		
	10.01	Draw Lewis structures, deduce atomic orbital hybridizations and describe molecular shapes for organic structures.
	10.02	Classify organic reactions in common groups, write chemical equations and describe unique features for each type.
	10.03	Describe, name, and give common reactions of alkanes, alkenes, and alkynes.
	10.04	Describe, name, and give common reactions of alcohols, ethers, and halides.
	10.05	Describe, name, and give common reactions of aldehydes and ketones.
	10.06	Describe, name, and give common reactions of carboxylic acids and esters.
	10.07	Describe, name, and give common reactions of amines and amides.
	10.08	Describe and name simple carbohydrates, simple lipids, and amino acids.
	10.09	Describe the basic concepts of proteins and their structure.
	10.10	Describe the basic concepts of polymerization reactions.
	10.11	Apply concepts of chemical reactivity, kinetics, stoichiometry, and equilibrium to chemical syntheses and analyses.
	10.12	Crystallize, evaporate, sublime, extract, and use phase separations and/or other purification and separation techniques.
	10.13	Perform organic chemical reactions using glassware and techniques typically employed in organic chemistry laboratories (e.g. ‘quick fit glassware, anhydrous conditions etc.)

10.14	Determine reaction yields using chemical stoichiometry.
10.15	Use chemical and instrumental techniques to determine the structure of organic materials.
Specialty II: Physics	
10.16	Solve physical problems dealing with mass, distance, area, volume, relative position, motion, velocity, kinetic and potential energy, momentum, force, acceleration, heat, sound and related concepts.
10.17	Use analytical reasoning in solving problems dealing with a variety of physical quantities and phenomena.
10.18	Use basic concepts and terminology from physics and related applications as found in the industrial workplace.
10.19	Use basic laboratory instruments for determining length, mass, time, temperature and other easily measurable physical quantities.
10.20	Collect and manipulate numerical data in controlled experiments involving physical parameters to discover the mathematical functions by which the variables are related.
10.21	Analyze physical behavior and know how to properly apply principles of physics related to basic mechanics and sound.
10.22	Characterize physical properties of gases, liquids, and solids and describe their reactions to changes of temperature and pressure.
10.23	Choose the appropriate equipment for measuring physical properties based on specified accuracy and precision requirements.
10.24	Solve physical problems dealing with basic concepts in electricity, magnetism, light, optics and thermodynamics.
10.25	Analyze physical behavior and know how to properly apply principles of physics related to basic electricity, magnetism, light, optics and thermodynamics.
Specialty III: Biology	
10.26	Name the components of the cell and relate each to basic concepts of life.
10.27	Identify the structural characteristics, components, and functions of cells.
10.28	Given a list of cellular activities or characteristics, relate them to the correct cell structure.
10.29	Explain the consequences of energy in terms of its availability to living organisms, and how it is transferred through food chains.
10.30	Know why energy is limited in amount. Know and be able to explain the consequences of energy in terms of its availability to living organisms, both now and in the future. Know how it is used and transferred through food chains.
10.31	Explain how sunlight is trapped as an energy source and how this trapped energy is used to synthesize simple organic molecules. Describe the basic role or activity of chloroplasts and chlorophyll, cyclic and non-cyclic photophosphorylation, carbon dioxide reduction and fixation.
10.32	Describe the sequential events of mitosis.
10.33	Describe the sequential events of meiosis.
10.34	Solve and interpret various genetics problems involving Mendelian principles.
10.35	List and describe ways and give examples of how man has altered his environment, both positively and negatively, and be able to detail some of the consequences of this action.

10.36	Give the basic characteristics of the carbon, nitrogen, and hydrological cycles.
10.37	Describe the effects of the increasing human population upon natural resources use and depletion, degradation of the environment, social and economic problems both within nations and between nations, etc.
10.38	State the basic morphologic types of Eubacteria.
10.39	Diagram and describe the structural components of bacterial cells using a microscope.
10.40	Describe bacterial cell lifecycle and apoptosis.
10.41	Distinguish gram positive cells and gram-negative cells from a description of cell wall chemical components.
10.42	Successfully demonstrate the correct staining procedure for general staining, Gram staining, acid-fast staining, spore staining, capsular staining, and flagellar staining.
10.43	Describe the characteristics that identify by form fungi, bacterium, and viruses and show how they are distinguished from other organisms.
10.44	List the factors that affect colonial growth.
Specialty IV: Engineering	
10.45	Utilize vectors to solve engineering problems.
10.46	Utilize calculus to solve engineering problems
10.47	Analyze particles and rigid bodies in equilibrium.
10.48	Analyze situations where a force causes a rigid body to rotate.
10.49	Characterize the static and rotational properties of irregular shaped rigid bodies.
10.50	Analyze the distribution of forces and moments within a structural member.
10.51	Analyze the equilibrium of rigid bodies subjected to dry friction.
10.52	Analyze the motion of particles.
10.53	Analyze the kinetics of particles using Newton's Second Law, the methods of work and energy and the methods of impulse and momentum.
10.54	Analyze the kinetics of a system of particles.
10.55	Analyze the motion of rigid bodies.
10.56	Analyze the effect of forces on rigid bodies in two dimensions.
10.57	Analyze the kinetics of rigid bodies using the methods of work, energy, impulse, and momentum in two dimensions.
10.58	Produce accurate diagrams of two- and three-dimensional objects using a design and drafting software package.
10.59	Solve mathematical problems using software packages such as: (Excel, MathCAD and MATLAB).
10.60	Acquire the team building skills typically found in the engineering profession.

Specialty V: Biotechnology	
10.61	Demonstrate an understanding of the operating principles, safety features, and use of various equipment found in a biotechnology laboratory.
10.62	Demonstrate an understanding the importance of a sterile working environment and proper aseptic techniques for culturing bacterial.
10.63	Demonstrate an understanding of the operating expression, regulation, and safety features and use of common purification techniques.
10.64	Demonstrate an understanding of the methodologies required for nucleic acid technology.
10.65	Demonstrate an understanding of the science and scientific basis of biotechnology including traditional methodologies, fermentation and industrial microbiology.
10.66	Demonstrate a basic understanding of the concept of bioethics, safety concerns of bioengineered products and the licensing and patenting process for biotechnology products.
10.67	Implement proper aseptic techniques and disposal procedures for potentially biohazardous materials.
Specialty VI: Chemical Instrumentation	
10.68	Describe the basic scientific principles behind a variety of instrumental methods used in a modern chemical laboratory.
10.69	Describe the major components of each instrumental method studied and the role that each component plays in making the chemical measurement.
10.70	Choose an instrument appropriate for a given analysis and identify the limitations of the instrument.
10.71	Properly prepare samples and properly calibrate each instrument.
10.72	Apply proper safety precautions for laboratory instruments and equipment.
10.73	Adjust instrument settings to handle varied chemical samples under a variety of conditions.
10.74	Describe the basic concepts of chemical/physical separation techniques and apply separation techniques to the analysis of materials.
10.75	Choose appropriate sample preparation techniques for physical characterization measurements and/or analysis of structure, concentration, and composition.
10.76	Apply basic knowledge of organic and inorganic chemistry, including nomenclature, classification in chemical groups, chemical and physical characteristics, and chemical reactivity to instrumental analysis.

Additional Information

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Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

It is highly recommended that students complete the laboratory portion of this program in person.

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- Humanities.
- Mathematics.
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- Social Sciences.

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Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Chemical Laboratory Specialist (0641030101) – 37 credit hours
Scientific Workplace Preparation (0641030102) – 26 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: **Industrial Management Technology**
Career Cluster: **Manufacturing**

AS	
CIP Number	1652020501
Program Type	College Credit
Program Length	60 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, principles of management, personnel management, and general business procedures.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply supervision skills.
02.0 Effectively communicate in a supervisory role.
03.0 Manage human behavior.
04.0 Motivate one's self.
05.0 Motivate others.
06.0 Apply strategies for effective management of personnel following appropriate guidelines.
07.0 Employ creative thinking to achieve business objectives and solve problems.
08.0 Apply basic decision-making skills in supervision.
09.0 Demonstrate appropriate communication skills.
10.0 Demonstrate appropriate math skills.
11.0 Demonstrate an understanding of entrepreneurship.
12.0 Demonstrate knowledge of information-processing activities
13.0 Identify management functions.
14.0 Develop human relations skills.

Florida Department of Education
Student Performance Standards

Program Title: **Industrial Management Technology**
CIP Numbers: **1652020501**
Program Length: **60 credit hours**

At the completion of this program, the student will be able to:	
01.0	Apply supervision skills. The student should be able to:
01.01	Specify the responsibilities of the supervisor.
01.02	Implement human relations skills.
01.03	Understand the difference between management and leadership.
01.04	Apply differences between coaching and discipline.
01.05	Conceptualize organizational functions of management.
01.06	Develop operational objectives in alignment with organizational strategic goals.
01.07	Follow and teach accepted accident prevention practices.
01.08	Apply the principles and procedures of delegation.
01.09	Utilize motivational skills to coordinate employee and organization interest.
01.10	Develop appropriate contingency plans.
01.11	Utilize strategies for dealing with interpersonal conflicts.
01.12	Analyze causes of resistance in employees.
01.13	Implement the agreement-finding process.
01.14	Develop and implement job instructions.
01.15	Apply principles of management to employee/employer conflicts.
01.16	Demonstrate effective time-management skills and methods.
02.0	Effectively communicate in a supervisory role. The student should be able to:
02.01	Solve problems in communicating.
02.02	Exhibit appropriate habits in person-to-person communication.
02.03	Apply listening skills.
02.04	Use communication feedback effectively.

	02.05 Use persuasion skills in communicating.
	02.06 Build credibility in management actions.
	02.07 Recognize and react to non-verbal communication.
	02.08 Practice conflict management skills.
	02.09 Write a clear and effective memorandum.
	02.10 Prepare a written technical report.
	02.11 Apply verbal and non-verbal inter-cultural communication skills.
	02.12 Apply presentation skills and use presentation tools.
03.0	Manage human behavior. The student should be able to:
	03.01 Use behavior modification techniques.
	03.02 Establish operational goals and objectives.
	03.03 Identify and address emotional conflicts of workers.
	03.04 Apply self-awareness and personality assessments.
	03.05 Assess worker and supervisor roles and relationships.
	03.06 Facilitate worker acceptance to change.
	03.07 Diagnose the dynamics involved in performance appraisal.
	03.08 Understand the Americans with Disabilities Act (ADA).
	03.09 Manage cultural diversity in tasks and issues.
04.0	Motivate one's self. The student should be able to:
	04.01 Build an improved attitude and level of self-confidence.
	04.02 Conceptualize cause-and-effect relationship.
	04.03 Set personal and career goals.
	04.04 Apply self-discipline techniques.
	04.05 Determine areas of personal talent and potential for personal growth.
05.0	Motivate others. The student should be able to:
	05.01 Identify various types of motivational theories.
	05.02 Apply attitude-enrichment procedures.

	05.03 Identifies the satisfiers and dissatisfies of maintainers.
	05.04 Develop trust and credibility for worker motivation.
	05.05 Direct goal-setting procedures with workers.
	05.06 Implement participative style of supervision.
06.0	Apply strategies for effective management of personnel following appropriate guidelines. The student should be able to:
	06.01 Diagnose unacceptable performance.
	06.02 Determine effective discipline procedures.
	06.03 Undertake disciplinary action.
	06.04 Plan appraisal interviews.
	06.05 Conduct appraisal interviews.
	06.06 Implement transfer, demotion, and termination procedures.
	06.07 Conduct hiring interviews.
	06.08 Implement recruitment procedures.
	06.09 Discuss the performance appraisal with an employee.
	06.10 Identify employees for promotion.
07.0	Employ creative thinking to achieve business objectives and solve problems. The student should be able to:
	07.01 Utilize techniques for maximum production of ideas.
	07.02 Establish and maintain conditions necessary for creative problem solving.
	07.03 Oversee the problem-solving process.
08.0	Apply basic decision-making skills in supervision. The student should be able to:
	08.01 Conduct decision-making meetings.
	08.02 Employ steps of effective decision-making.
	08.03 Set operational goals and objectives.
	08.04 Select tasks to delegate.
09.0	Demonstrate appropriate communication skills. The student should be able to:
	09.01 Write logical and understandable statements to accurately complete forms/invoices commonly used in business and industry, both domestically and internationally.
	09.02 Read and understand graphs, charts, diagrams, and tables commonly used in the industrial/occupational area.

09.03	Read and follow both written and oral instructions.
09.04	Answer and ask questions coherently and concisely.
09.05	Synthesize information from a range of sources into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
09.06	Utilize appropriate communication skills, etiquette and thoroughness when using telephone, computer or other electronic media, both domestically and internationally.
10.0	Demonstrate appropriate math skills. The student should be able to:
10.01	Solve problems for volume, weight, area, circumference, and perimeter measurements for rectangles, squares, and cylinders.
10.02	Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet, and inches.
10.03	Add, subtract, multiply, and divide using fractions, decimals, and whole numbers.
10.04	Determine the correct purchase price, including sales tax, for a materials list.
10.05	Understand and calculate purchase discounts.
10.06	Demonstrate ability of metric and US standard unit conversions.
10.07	Demonstrate budget and labor hour/shift hour tracking.
11.0	Demonstrate an understanding of entrepreneurship. The student should be able to:
11.01	Identify characteristics of the American enterprise system.
11.02	Define inflation and deflation.
11.03	Identify characteristics of global enterprise systems.
11.04	Determine the results of a change in demand or a change in supply.
11.05	List factors that contribute to economic growth.
11.06	Identify characteristics of different types of business ownership.
11.07	Choose appropriate action in a situation requiring application of business ethics.
11.08	Demonstrate an understanding of federal, state, and local taxes and their computation.
12.0	Demonstrate knowledge of information-processing activities. The student should be able to:
12.01	Identify terms commonly used in information processing.
12.02	Identify automated business systems, equipment components, and media.
12.03	Interpret operations of a flowchart of a simulated business activity.
12.04	Check printout for errors, correct, and resubmit.
12.05	Demonstrate effective use of computer-based office software tools and technology.

13.0	Understand the difference between position power and personal power and when to use them. The student should be able to:
	13.01 Identify an appropriate definition of management.
	13.02 Identify management positions and styles.
	13.03 Identify the major functions of management and leadership to include planning, organizing, staffing, directing, and controlling.
	13.04 Distinguish the differences among management functions.
	13.05 Select the most effective communication systems.
14.0	Develop human relations skills. The student should be able to:
	14.01 Demonstrate appropriate work habits.
	14.02 Identify behavior that promotes cooperative human relations.
	14.03 Exhibit managing skills to allocate appropriate time to developing team member skills and abilities.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

Students may provide valid evidence of technical or industrial competencies as specified in the curriculum frameworks of an accredited postsecondary adult or postsecondary vocational institution. Students may also provide valid evidence of acquired skills through portfolios, documented work history, and registered apprenticeship programs that meet program outcomes as determined by the college.

Industrial elective credits may also be awarded based on the type of program, length of program, certifications or licenses awarded under articulation agreements between Career Certificate Program schools and/or industrial/technical license articulation agreements.

Industrial elective credits may also be satisfied by the completion of special courses and certificate programs offered by the college specified in the elective section of the college's degree plan.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030(4), F.A.C., identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science (AS) degree and the Associate of Applied Science (AAS) degree. In addition, Rule 6A-14.0303, F.A.C., implements s. 1007.25, F.S., and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS degree program includes the following College Credit Certificates:

Industry Operations Specialist (0652020502) – 9 credit hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Florida Department of Education
Curriculum Framework

Program Title: **Electronic Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	I150303	
CIP Number	0615030300	
Grade Level	30, 31	
Program Length	1400 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 10	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in electronic support services positions.

The content includes but is not limited to direct current (DC) circuits, alternating current (AC) circuits and analog circuits; solid state and digital devices; microprocessors; use of circuit diagrams and schematics; soldering and chassis assembly techniques; laboratory practices; and technical recording and reporting.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3) (b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EEV0010	Electronics Assembler	AUTO PROD 7G AVIONICS @7 7G ELECTRONIC @7 7G ENG 7G IND ENGR 7G RADIO TV %7 %G TEC ELEC @7 7G TV PROD TEC @7 7G ROBOTICS 7G	250 hours
B	EEV0100	Electronics Tester		400 hours
C	EEV0500	Electronics Equipment Repairer	AVIONICS @7 7G ELECTRONIC @7 7G RADIO TV %7 %G TEC ELEC @7 7G TV PROD TEC @7 7G	375 hours
D	EEV0616	Electronics Technician		375 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in soldering and basic laboratory practices.
02.0 Demonstrate proficiency in basic DC circuits.
03.0 Demonstrate proficiency in advanced DC circuits.
04.0 Demonstrate proficiency in AC circuits.
05.0 Demonstrate proficiency in solid state devices.
06.0 Demonstrate proficiency in digital circuits.
07.0 Demonstrate proficiency in fundamental microprocessors.
08.0 Demonstrate skills in technical recording utilizing industry recognized computer application software.
09.0 Demonstrate proficiency in analog circuits.

Florida Department of Education
Student Performance Standards

Program Title: **Electronic Technology**
Career Certificate Program Number: **I150303**

Course Description: The Electronics Assembler course prepares students for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Content emphasizes beginning skills key to the success of working in the Electronics industry. Students study basic soldering lab practices, and basic DC circuitry.

Course Number: EEV0010 **Occupational Completion Point: A** **Electronics Assembler – 250 Hours**	
01.0	Demonstrate proficiency in soldering basic laboratory practices. The student will be able to:
01.01	Apply proper Occupational Safety Health Administration (OSHA) safety standards.
01.02	Make electrical connections.
01.03	Identify and use hand tools properly.
01.04	Identify and use power tools properly.
01.05	Apply recognized industry accepted standard soldering techniques.
01.06	Apply recognized industry accepted standard desoldering techniques.
01.07	Apply recognized industry accepted standard electrostatic discharge (ESD) safety procedures.
01.08	Design and/or construct printed circuit boards (PCB's) to industry accepted standards.
01.09	Explain the theoretical concepts of industry accepted soldering techniques.
01.10	Apply recognized industry accepted standard techniques for rework and repair.
02.0	Demonstrate proficiency in basic DC circuits. The student will be able to:
02.01	Demonstrate proficiency in basic DC circuits.
02.02	Solve problems in electronic units utilizing metric prefixes.
02.03	Identify sources of electricity.
02.04	Define voltage, current, resistance, power and energy.
02.05	Apply Ohm's law and power formulas.
02.06	Read and interpret color codes and symbols to identify electrical components and values.

02.07	Measure properties of a circuit using a digital multi-meter (DMM).
02.08	Compute conductance and compute and measure resistance of conductors and insulators.
02.09	Apply Ohm's law to series circuits.
02.10	Construct and verify operation of series circuits.
02.11	Analyze and troubleshoot series circuits.
02.12	Apply Ohm's law to parallel circuits.
02.13	Construct and verify the operation of parallel circuits.
02.14	Analyze and troubleshoot parallel circuits.

Course Description: The Electronics Tester course is designed to build on the skills and knowledge students learned in the Electronics Assembler course for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Content emphasizes knowledge of working in the Electronics industry. Students study advanced DC circuitry, AC circuitry, and solid state devices.

Course Number: EEV0100 Occupational Completion Point: B Electronics Tester – 400 Hours	
03.0	Demonstrate proficiency in advanced DC circuits. The student will be able to:
03.01	Solve algebraic problems to include exponentials to DC.
03.02	Describe the relationship of DC electricity to the nature of matter.
03.03	Apply Ohm’s law to series-parallel and parallel-series circuits.
03.04	Construct and verify the operation of series-parallel and parallel-series and bridge circuits.
03.05	Troubleshoot series-parallel and parallel-series and bridge circuits.
03.06	Identify and define voltage divider circuits (loaded and unloaded).
03.07	Construct and verify the operation of voltage divider circuits (loaded and unloaded).
03.08	Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
03.09	Apply maximum power transfer theorem.
03.10	Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
03.11	Describe magnetic properties of circuits and devices.

	03.12 Determine the physical and electrical characteristics of capacitors and inductors.
	03.13 Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
	03.14 Set up and operate power supplies for DC circuits.
	03.15 Explain the theory of DC motor operation.
	03.16 Identify the practical applications for the use of a DC motor.
04.0	Demonstrate proficiency in AC circuits. The student will be able to:
	04.01 Solve basic trigonometric problem as applicable to electronics.
	04.02 Define the characteristics of AC capacitive circuits.
	04.03 Construct and verify the operation of AC capacitive circuits.
	04.04 Analyze and troubleshoot AC capacitive circuits.
	04.05 Define the characteristics of AC inductive circuits.
	04.06 Construct and verify the operation of AC inductive circuits.
	04.07 Analyze and troubleshoot AC inductive circuits.
	04.08 Define and apply the principles of transformers to AC circuits.
	04.09 Construct and verify the operation of AC circuits utilizing transformers.
	04.10 Analyze and troubleshoot AC circuits utilizing transformers.
	04.11 Construct and verify the operation of differentiators and integrators to determine R-C and R-L time constraints.
	04.12 Analyze and troubleshoot differentiator and integrator circuits.
	04.13 Define the characteristics of Resistive, Inductive, and Capacitive (RLC) circuits (series, parallel and complex).
	04.14 Construct and verify the operation of series and parallel resonant circuits.
	04.15 Define the characteristics of series and parallel resonant circuits.
	04.16 Construct and verify the operation of series and parallel resonant circuits.
	04.17 Analyze and troubleshoot R-C, R-L, and RLC circuits.
	04.18 Define the characteristics of frequency selective filter circuits.
	04.19 Construct and verify the operation of frequency selective filter circuits.
	04.20 Analyze and troubleshoot frequency selective filter circuits.
	04.21 Define the characteristics of polyphase circuits.

	04.22 Define basic motor theory and operation.
	04.23 Define basic generator theory and operation.
	04.24 Set up and operate power supplies for AC circuits.
	04.25 Set up and operate oscilloscopes for AC circuits.
	04.26 Set up and operate function generators for AC circuits.
	04.27 Analyze and measure power in AC circuits.
	04.28 Set up and operate capacitor and inductor analyzers for AC circuits.
	04.29 Explain the theory of AC motor operation.
	04.30 Identify the practical applications for the use of an AC motor.
05.0	Demonstrate proficiency in solid state devices. The student will be able to:
	05.01 Identify and define properties of semiconductor materials.
	05.02 Identify and define operating characteristics and applications of junction diodes.
	05.03 Identify and define operating characteristics and applications of special diodes, ex. Zener diodes.
	05.04 Construct diode circuits.
	05.05 Analyze and troubleshoot diode circuits.
	05.06 Identify and define operating characteristics and applications of bipolar transistors,
	05.07 Identify and define operating characteristics and applications of field effect transistors.
	05.08 Identify and define operating characteristics and applications of single-stage amplifiers.
	05.09 Construct single-stage amplifiers.
	05.10 Analyze and troubleshoot single-stage amplifiers.
	05.11 Construct thyristor circuitry.
	05.12 Analyze and troubleshoot thyristor circuitry.
	05.13 Set up and operate power supplies for solid-state devices.
	05.14 Set up and operate oscilloscopes for solid-state devices.
	05.15 Set up and operate function generators for solid-state devices.
	05.16 Set up and operate capacitor and inductor analyzers for solid-state devices.
	05.17 Set up and operate curve tracers.

05.18	Set up and operate transistor testers.

Course Description: The Electronic Equipment Repairer course is designed to build on the skills and knowledge students learned in the Electronics Tester course for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Content emphasizes knowledge of working in the Electronics industry. Students study digital circuitry, and fundamental micro-processor theory.

Course Number: EEV0500 Occupational Completion Point: C Electronic Equipment Repairer – 375 Hours	
06.0	Demonstrate proficiency in digital circuits. The student will be able to:
06.01	Define and apply numbering systems to codes and arithmetic operations.
06.02	Analyze and minimize logic circuits using Boolean operations.
06.03	Set up and operate logic probes for digital circuits.
06.04	Set up and operate power supplies for digital circuits and solve power distribution and noise problems.
06.05	Set up and operate pulsers for digital circuits.
06.06	Set up and operate oscilloscopes for digital circuits.
06.07	Set up and operate logic analyzers for digital circuits.
06.08	Set up and operate pulse generators for digital circuits.
06.09	Identify types of logic gates and their truth tables.
06.10	Construct combinational logic circuits using integrated circuits.
06.11	Troubleshoot logic circuits.
06.12	Analyze types of flip-flops and their truth tables.
06.13	Construct flip-flops using integrated circuits.
06.14	Troubleshoot flip-flops.
06.15	Identify, define and measure characteristics of integrated circuit (IC) logic families.
06.16	Identify types of registers and counters.
06.17	Construct registers and counters using flip-flops and logic gates.
06.18	Troubleshoot registers and counters.

06.19	Analyze clock and timing circuits.
06.20	Construct clock and timing circuits.
06.21	Troubleshoot clock and timing circuits.
06.22	Identify types of arithmetic-logic circuits.
06.23	Construct arithmetic-logic circuits.
06.24	Troubleshoot arithmetic-logic circuits.
06.25	Identify types of encoding and decoding devices.
06.26	Construct encoders and decoders.
06.27	Troubleshoot encoders and decoders.
06.28	Identify types of multiplexer and demultiplexer circuits.
06.29	Construct multiplexer and demultiplexer circuits using integrated circuits.
06.30	Troubleshoot multiplexer and demultiplexer circuits.
06.31	Identify types of memory circuits.
06.32	Relate the uses of digital-to-analog and analog-to-digital conversions.
06.33	Construct digital-to-analog and analog-to-digital circuits.
06.34	Troubleshoot digital-to-analog and analog-to-digital circuits.
06.35	Identify types of digital displays.
06.36	Construct digital display circuits.
06.37	Troubleshoot digital display circuits.
07.0	Demonstrate proficiency in fundamental microprocessors. The student will be able to:
07.01	Identify central processing unit (CPU) building blocks and their uses (architecture).
07.02	Safely install and remove a CPU without damaging.
07.03	Analyze bus concepts.
07.04	Analyze various memory schemes.
07.05	Use memory devices in circuits.
07.06	Troubleshoot memory device circuits.
07.07	Set up and operate oscilloscopes for microprocessor systems.

07.08	Set up and operate logic-data analyzers to troubleshoot microprocessor systems.
07.09	Identify types of input and output devices and peripherals.
07.10	Interface input and output ports to peripherals.
07.11	Analyze and troubleshoot input and output ports.
07.12	Compare and contrast macro processor programming language types.
07.13	Diagram the macro processor programming sequence using a flow chart.

Course Description: The Electronics Technician course is designed to build on the skills and knowledge students learned in the Electronics Assembler, Electronics Tester, and Electronic Equipment Repairer courses for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Content emphasizes knowledge of working in the Electronics industry. Students study technical writing and computer software skills, and analog circuitry.

Course Number: EEV0616 Occupational Completion Point: D Electronics Technician – 375 Hours	
08.0	Demonstrate skills in technical recording utilizing industry recognized computer application software. The student will be able to:
08.01	Draw and interpret electronic schematics.
08.02	Record data and design curves and graphs.
08.03	Write reports and make oral presentations.
08.04	Maintain test logs.
08.05	Make equipment failure reports.
08.06	Specify and requisition simple electronic components.
08.07	Compose technical letters and memoranda.
08.08	Write formal reports of laboratory experiences.
08.09	Draft preventive maintenance and calibration procedures.
09.0	Demonstrate proficiency in analog circuits. The student will be able to:
09.01	Identify and define operational characteristics and applications of multistage amplifiers.
09.02	Construct multistage amplifiers.
09.03	Analyze and troubleshoot multistage amplifiers.

09.04	Identify and define operating characteristics and applications of linear integrated circuits.
09.05	Identify and define operating characteristics and applications of basic power supplies and filters.
09.06	Construct basic power supplies and filters.
09.07	Identify and define operating characteristics and applications of differential and operational amplifiers.
09.08	Construct differential and operational amplifier circuits.
09.09	Analyze and troubleshoot differential and operational amplifier circuits.
09.10	Identify and define operating characteristics of audio power amplifiers.
09.11	Construct audio power amplifiers.
09.12	Analyze and troubleshoot audio power amplifiers.
09.13	Identify and define operating characteristics and applications of power supply regulator circuits.
09.14	Construct power supply regulator circuits.
09.15	Analyze and troubleshoot power supply regulator circuits.
09.16	Identify and define operating characteristics and applications of active filters.
09.17	Construct active filter circuits.
09.18	Analyze and troubleshoot active filter circuits.
09.19	Identify and define operating characteristics and applications of sinusoidal and nonsinusoidal oscillator circuits.
09.20	Construct oscillator circuits.
09.21	Analyze and troubleshoot oscillator circuits.
09.22	Identify and define operating characteristics and applications of Liquid Crystal Display (LCD), Light Emitting Diode (LED), and Three Dimensional (3D) technologies.
09.23	Identify and define operating characteristics and applications of optoelectronic devices.
09.24	Set up and operate measuring instruments for analog circuits.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Electrical and Instrumentation Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	I150404	
CIP Number	0615040400	
Grade Level	30, 31	
Program Length	1800 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the new CIP to SOC Crosswalk located in the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 11	Communications (Reading and Language Arts): 10

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, and the technical training to support professional personnel in the engineering, design, development and evaluation of electrical and instrument systems.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of five occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3) (b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EEV0650	Electrician (Construction)	ELECTRONIC @7 7G TEC ELEC @7 7G	350 hours
B	EEV0652	Instrument Mechanic		350 hours
C	EEV0654	Electrician Maintenance		300 hours
D	EEV0656	Instrument Technician		400 hours
E	EEV0658	Operating Engineer Assistant Stationary		400 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate knowledge of National Electrical Code (NEC).
02.0 Install and troubleshoot facility electrical circuits from service entrance to convenience outlets.
03.0 Demonstrate knowledge of using basic electrical drawings.
04.0 Demonstrate basic electrical construction skills.
05.0 Demonstrate understanding of DC power sources.
06.0 Demonstrate understanding of AC power sources.
07.0 Demonstrate knowledge of DC motors.
08.0 Demonstrate knowledge of AC motors.
09.0 Demonstrate knowledge of motor controls.
10.0 Demonstrate knowledge of transformers.
11.0 Demonstrate knowledge of over current protection and grounding.
12.0 Demonstrate knowledge of an industrial power distribution system.
13.0 Perform preventive and corrective maintenance on basic electrical power and control components.
14.0 Demonstrate knowledge of electrical test equipment.
15.0 Demonstrate knowledge of hydraulic and pneumatic systems.
16.0 Identify the basic principles and terminology of process control.
17.0 Identify the primary components of a process control system.
18.0 Demonstrate knowledge of using instrumentation drawings.
19.0 Demonstrate knowledge of using instrumentation test instruments.
20.0 Demonstrate knowledge of instrumentation installation techniques.
21.0 Demonstrate knowledge of programmable logic controllers (PLC).
22.0 Demonstrate knowledge of operating, troubleshooting, and maintaining distributed control systems (DCS).
23.0 Demonstrate knowledge of operating, troubleshooting, and maintaining level measurement and control devices.
24.0 Demonstrate knowledge of operating, troubleshooting, and maintaining pressure measurement and control devices.
25.0 Demonstrate knowledge of operating, troubleshooting, and maintaining temperature measurement and control devices.
26.0 Demonstrate knowledge of operating, troubleshooting, and maintaining flow measurement and control devices.
27.0 Demonstrate knowledge of operating, troubleshooting, and maintaining physical property measurement and control devices.
28.0 Demonstrate knowledge of operating, troubleshooting, and maintaining chemical property measurement and control devices.
29.0 Demonstrate process operation skills.
30.0 Demonstrate knowledge of technical reporting.

Florida Department of Education
Student Performance Standards

Program Title: **Electrical and Instrumentation Technology**
Career Certificate Program Number: **I150404**

Course Description: The Electrician (Construction) course prepares students for entry into the Electrical and Instrumentation Technology industry. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Content emphasizes beginning skills key to the success of working in the Electrical and Instrumentation industry. Students study the National Electrical Code, installation and troubleshooting of facility wiring circuits, basic electrical drawings, electrical construction skills, DC and AC power systems, DC and AC motors, motor controls, transformers, over-current and grounding, industrial power distribution systems, preventative and corrective maintenance, electrical testing equipment, and hydraulic and pneumatic systems.

Course Number: EEV0650 **Occupational Completion Point: A** **Electrician (Construction) – 350 Hours**	
01.0	Demonstrate knowledge of the National Electrical Code (NEC). The student will be able to:
01.01	Relate the NEC to general wiring practices.
01.02	Relate the NEC to wire, conduit and box sizing.
01.03	Relate the NEC to outlets, lighting, appliances and building services.
01.04	Relate the NEC to services and service calculations.
01.05	Relate the NEC to grounding and bonding requirements.
01.06	Relate the NEC to over current protection.
01.07	Relate the NEC to motor circuit wiring.
01.08	Relate the NEC to transformers.
01.09	Relate the NEC to hazardous location wiring.
01.10	Relate the NEC to emergency and alternate power systems.
01.11	Relate the NEC to industrial electrical.
02.0	Install and troubleshoot facility wiring circuits from service entrance to convenience outlets. The student will be able to:
02.01	Demonstrate the knowledge power requirements, distribution, and construction considerations to meet the needs for a safe and functional electrical system for residential, commercial, or industrial facilities.
02.02	Determine the size of service entrance equipment, components, and conductors.
02.03	Demonstrate proper methods to install service entrance, lighting circuits and equipment branch circuits.

	02.04 Demonstrate knowledge of NEC local codes, utility regulations, special ordinances and installation instructions.
	02.05 Demonstrate knowledge of optional electrical safety devices, special fixtures (explosion proof, waterproof), communications and alarm systems, timers and controllers.
	02.06 Demonstrate knowledge of the needs for, and the proper methods of facility grounding systems.
	02.07 Demonstrate the ability to troubleshoot faults in control and power circuits.
	02.08 Choose the correct test equipment to service electrical systems.
03.0	Demonstrate knowledge of using basic electrical drawings. The student will be able to:
	03.01 Demonstrate the knowledge to describe, identify and use electrical symbols and abbreviations.
	03.02 Demonstrate the knowledge to use floor plans, lighting layouts and building service drawings.
	03.03 Demonstrate the knowledge to use single line power distribution drawings.
	03.04 Demonstrate the knowledge to use elementary drawings.
	03.05 Demonstrate the knowledge to use process logic drawings.
	03.06 Demonstrate the knowledge to convert English system and metric system measurements.
	03.07 Demonstrate the knowledge to use measuring scales to take accurate system measurements.
	03.08 Demonstrate the knowledge to produce accurate electrical drawings.
	03.09 Demonstrate the knowledge to prepare an equipment and material list.
	03.10 Demonstrate the knowledge to troubleshoot using the different electrical diagrams and drawings.
04.0	Demonstrate basic electrical construction skills. The student will be able to:
	04.01 Use blueprints and associated documents to identify materials and equipment which will be needed to perform construction or maintenance task.
	04.02 Use the proper equipment to make correct and accurate bends in various types of electrical conduits.
	04.03 Use the proper equipment to thread electrical conduit.
	04.04 Make appropriate electrical terminations.
	04.05 Apply correct wiring methods to motors and motor control circuits.
	04.06 Apply correct wiring methods to transformers.
	04.07 Install non-metallic sheathed cable.
	04.08 Correctly install lighting fixtures and perform preventive and corrective maintenance.
	04.09 Correctly install switching and outlet devices.
	04.10 Correctly use power tools.

05.0	Demonstrate an understanding of DC power sources. The student will be able to:
05.01	Describe safe procedures for handling, storing, charging, and installing storage batteries.
05.02	Describe electrical characteristics of lead-acid storage batteries, dry cells and Nicad's.
05.03	Demonstrate knowledge of low voltage electronic power supplies.
05.04	Demonstrate knowledge of DC generator theory and construction for DC generators.
05.05	Perform troubleshooting and preventive maintenance on DC power sources.
06.0	Demonstrate and understanding of AC power sources. The student will be able to:
06.01	Calculate and explain power factor.
06.02	Calculate and explain power factor corrections.
06.03	Demonstrate knowledge of the theory and physical and electrical characteristics of three phase alternators.
06.04	Demonstrate knowledge of the theory and application for engine driven generating sets, including types of prime movers and transfer switches.
06.05	Demonstrate knowledge of paralleling, synchronizing, testing three phase alternators.
06.06	Demonstrate knowledge of selecting, troubleshooting, connecting, and maintaining 3-phase alternators.
06.07	Demonstrate knowledge of uninterruptable power supplies (UPS).
07.0	Demonstrate knowledge of DC motors. The student will be able to:
07.01	Demonstrate knowledge of DC motor theory and construction including series, shunt and compound motors.
07.02	Demonstrate knowledge of DC motor torque effectively speed regulation, loading and starting.
07.03	Demonstrate knowledge of performing maintenance procedures for and installation of DC motors.
07.04	Demonstrate knowledge of correctly apply testing and monitoring equipment to DC motors and machines.
07.05	Select and apply DC motor controls.
08.0	Demonstrate knowledge of AC motors. The student will be able to:
08.01	Demonstrate knowledge of single-phase AC motors.
08.02	Demonstrate the ability to select connect and troubleshoot single phase AC motors.
08.03	Demonstrate knowledge of 3-phase AC motors.
08.04	Demonstrate the ability to select, connect, troubleshoot and maintain 3-phase AC motors.
08.05	Demonstrate the ability to correctly apply testing and monitoring equipment to AC 3-phase motors.
08.06	Select and apply AC motor controls.

	08.07 Disassemble and assemble a single-phase motor.
	08.08 Disassemble and assemble a 3-phase motor.
	08.09 Perform preventative maintenance for AC motors.
09.0	Demonstrate knowledge of motor controls. The student will be able to:
	09.01 Use schematics and drawings to troubleshoot electrical failures.
	09.02 Demonstrate knowledge of motor starters.
	09.03 Design, install, operate, and troubleshoot 2-wire control.
	09.04 Design, install, operate, and troubleshoot 3-wire control.
	09.05 Design, install, operate, and troubleshoot motor control circuits that use timers.
	09.06 Design, install, operate, and troubleshoot motor control circuits that use relays.
	09.07 Design, install, operate, and troubleshoot motor control circuits that use sequences.
	09.08 Demonstrate the ability to install and troubleshoot limit switches, proximity switches and other sensors in control circuits.
	09.09 Demonstrate knowledge of variable frequency drives (VFC's).
	09.10 Demonstrate knowledge of DC motor circuits.
10.0	Demonstrate knowledge of transformers. The student will be able to:
	10.01 Demonstrate knowledge of transformer theory and application.
	10.02 Demonstrate knowledge of single-phase transformer theory and application.
	10.03 Demonstrate knowledge of theory and application of a single-phase 3-wire secondary system.
	10.04 Demonstrate knowledge of theory and application for single-phase transformers connected in 3-phase systems.
	10.05 Apply testing and monitoring equipment to transformers and their associated circuits.
	10.06 Install transformers to primary service and main switch metering equipment and secondary switching.
	10.07 Install transformer over current protection.
11.0	Demonstrate knowledge of over current protection and grounding. The student will be able to:
	11.01 List and identify types, classes and ratings of fuses and circuit breakers.
	11.02 Describe operation of fuses and breakers.
	11.03 Install fuses and breakers.
	11.04 Select and apply branch-circuit protection for appliances.

	11.05 Select and apply branch-circuit and overload protection for motors.
	11.06 Relate the NEC to the selection and installation of over current protection devices.
	11.07 Explain the purpose of equipment grounding.
	11.08 Relate the NEC to the sizing and installation of grounding systems and conductors.
	11.09 Perform preventative maintenance on grounding systems.
12.0	Demonstrate knowledge of an industrial power distribution system. The student will be able to:
	12.01 Demonstrate knowledge of a utility generation and distribution system.
	12.02 Demonstrate knowledge of a typical industrial generation and distribution system.
	12.03 Demonstrate knowledge of co-generation applications.
	12.04 Demonstrate knowledge of protective relay applications.
	12.05 Demonstrate knowledge of amperage, voltage control and power factor control techniques.
	12.06 Demonstrate knowledge of breaker controls and computer load shed considerations.
	12.07 Demonstrate knowledge of high voltage, distribution equipment, ground fault protection methods.
	12.08 Demonstrate knowledge of safety procedures including identification of equipment used for testing high voltage.
	12.09 Demonstrate knowledge of pole line isolation switches.
	12.10 Demonstrate knowledge of current transformers (CT's) and potential transformers (PT's).
13.0	Perform preventative and corrective maintenance on basic electrical power and control components. The student will be able to:
	13.01 Use technical data and manuals to perform preventative maintenance.
	13.02 Demonstrate ability to select and apply appropriate tools and testing equipment.
	13.03 Perform corrective preventative maintenance and certify completion.
	13.04 Determine the need for corrective maintenance by applying troubleshooting and analysis techniques.
	13.05 Replace parts and calibrate or adjust as necessary to bring equipment, systems, components, or machines to specifications.
	13.06 Prepare forms and reports of preventive and corrective maintenance.
14.0	Demonstrate knowledge of electrical test equipment. The student will be able to:
	14.01 Demonstrate the ability to use an analog multi-meter.
	14.02 Demonstrate the ability to use a digital multi-meter.
	14.03 Demonstrate the ability to use a "wiggy" voltmeter.

	14.04 Demonstrate the ability to use a clamp-on ammeter.
	14.05 Demonstrate the ability to use a megohmmeter.
	14.06 Demonstrate the ability to use an oscilloscope.
	14.07 Demonstrate the ability to use a high voltage tester.
	14.08 Use test equipment to systematically troubleshoot a defective system.
15.0	Demonstrate knowledge of hydraulic and pneumatic systems. The student will be able to:
	15.01 Identify principles and practical applications of hydraulic and pneumatic power.
	15.02 Identify control valves in a hydraulic and pneumatic system.
	15.03 Identify pressure and safety relief valves and vacuum breakers.
	15.04 Identify cylinders and motors.
	15.05 Remove and replace hydraulic and pneumatic systems and components.
	15.06 Identify strainers and filters in hydraulic and pneumatic systems.
	15.07 Identify reservoirs and accumulators in hydraulic and pneumatic systems.
	15.08 Identify hydraulic and pneumatic pimps on a system.
	15.09 Identify piping, tubing, and fittings on a hydraulic pneumatic system.
	15.10 Identify system interfaces.
	15.11 Identify the procedures for pneumatic and hydraulic system maintenance.
	15.12 Locate control valve failures.
	15.13 Demonstrate knowledge of regulators, volume boosters, relays and repeaters.
	15.14 Identify the components to produce instrument air.
	15.15 Demonstrate knowledge of current-to-pressure and pressure-to-current transducers.

Course Description: The Instrumentation Mechanics course is designed to build on the skills and knowledge students learned in the Electrician (Construction) course for entry into the Electrical and Instrumentation Technology industry. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Content emphasizes beginning skills key to the success of working in the Electrical and Instrumentation industry. Students study basic principles, terminology, and components of process control, instrumentation drawings, testing equipment, and installation techniques.

Course Number: EEV0652 Occupational Completion Point: B Instrument Mechanics – 350 Hours	
16.0	Identify the basic principles and terminology of process control. The student will be able to:
16.01	Identify the purpose of automatic control systems.
16.02	Identify the elements of process control.
16.03	Identify measured and manipulated variables in a control loop.
16.04	Demonstrate knowledge of proportional control.
16.05	Demonstrate knowledge of on/off control.
16.06	Determine the effects of gain, reset and derivative in a proportional control scheme.
16.07	Demonstrate knowledge of the basic laws of physics pertaining to instrumentation.
16.08	Demonstrate knowledge of the terminology associated with instrumentation and process control.
17.0	Identify the primary components of a process control system. The student will be able to:
17.01	Identify primary control elements in process loops.
17.02	Identify final control elements in process loops.
17.03	Identify electronic, pneumatic, and digital transmitters in process loops.
17.04	Identify controllers in process loops.
17.05	Identify control loop applications (level, flow, temp, pressure, or analytical).
17.06	Define the static and dynamic characteristics of instruments.
17.07	Demonstrate knowledge necessary to interface individual process loops into microprocessor-based control schemes.
18.0	Demonstrate knowledge of using instrumentation drawings. The student will be able to:
18.01	Demonstrate ability to use loop sheets.
18.02	Demonstrate ability to use flow sheets/P&IDs.
18.03	Demonstrate ability to use process logic diagrams.
18.04	Demonstrate ability to use installation drawings.
18.05	Demonstrate ability to use building layout or location drawings.
18.06	Troubleshoot using drawings.
18.07	Identify process safety devices and explain their purpose.

19.0	Demonstrate knowledge of using instrumentation test instruments. The student will be able to:
19.01	Operate basic hydraulic measuring instruments.
19.02	Operate dead weight testers.
19.03	Operate manometers.
19.04	Operate basic pneumatic measuring instruments.
19.05	Operate vacuum pumps.
19.06	Operate pressure and vacuum gauges.
19.07	Operate basic thermal measuring instruments.
19.08	Operate temperature baths.
19.09	Operate electronic calibration instruments.
19.10	Operate thermometers.
19.11	Calibrate instruments using test instruments.
19.12	Operate instrument standards.
20.0	Demonstrate knowledge of instrumentation installation techniques. The student will be able to:
20.01	Apply proper OSHA safety standards.
20.02	Make electrical connections for instrument equipment.
20.03	Identify and use hand tools properly.
20.04	Identify and use power tools properly.
20.05	Demonstrate acceptable tubing bending and installation techniques.
20.06	Identify the proper method for instrument wire installation in a cable tray.
20.07	Demonstrate the ability to properly install various instrumentation devices.
20.08	Demonstrate knowledge of “clean design” for instrument installations.

Course Description: The Electrician Maintenance course is designed to build on the skills and knowledge students learned in the Instrumentation Mechanics course for entry into the Electrical and Instrumentation Technology industry. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Content emphasizes beginning skills key to the success of working in the Electrical and Instrumentation industry. Students study programmable logic controllers (PLC).

Course Number: EEV0654 Occupational Completion Point: C Electrician Maintenance – 300 Hours	
21.0	Demonstrate knowledge of programmable logic controllers (PLC). The student will be able to:
21.01	Demonstrate knowledge of the terminology and operating components of PLC systems.
21.02	Demonstrate knowledge of the addressing schemes used in various PLC systems.
21.03	Understand and use ladder logic for various PLC systems.
21.04	Program basic relay logic in ladder logic.
21.05	Program timers and counters in ladder logic.
21.06	Program shift registers and other data manipulation routines.
21.07	Program for message displays and other output devices.
21.08	Interface PLS's to perform communications.
21.09	Load and save files on storage media.
21.10	Prepare and update documentation.
21.11	Perform local/remote interfacing.
21.12	Troubleshoot defective PLC systems.

Course Description: The Instrument Technician course is designed to build on the skills and knowledge students learned in the Electrician Maintenance course for entry into the Electrical and Instrumentation Technology industry. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Content emphasizes beginning skills key to the success of working in the Electrical and Instrumentation industry. Students study distributed control systems (DCS); level, pressure, temperature, flow, physical property, and chemical property measurement and control devices.

Course Number: EEV0656 Occupational Completion Point: D Instrument Technician – 400 Hours	
22.0	Demonstrate knowledge of operating, troubleshooting and maintaining distributed control systems (DCS). The student will be able to:
22.01	Describe the principles and purpose of a DCS system.
22.02	Describe the architecture and components of a DCS system.
22.03	Configure control points on a DCS system.
22.04	Perform data storage routines on a DCS system.

	22.05 Print graphs of control point responses from a DCS system.
	22.06 Perform data communications through PLC or discrete input/output interface units.
	22.07 Perform preventive maintenance and calibrate on DCS system devices.
	22.08 Troubleshoot and repair faults in DCS systems.
23.0	Demonstrate knowledge of operating, troubleshooting and maintaining level measurement and control devices. The student will be able to:
	23.01 Demonstrate knowledge of the terminology, physics, methods and principles of level measurement and control.
	23.02 Identify level measurement purpose and requirements.
	23.03 Identify level measurement instruments.
	23.04 Identify solid level measuring systems.
	23.05 Identify instrument calibration standards.
	23.06 Identify safe standards, installation techniques and maintenance practices as applicable to level measurement.
	23.07 Identify common causes of level measurement instrument and sensor failures.
	23.08 Troubleshoot and repair level measurement and control system failures.
	23.09 Identify ultrasonic level devices.
	23.10 Identify principles of operation for radiation type, level control devices.
	23.11 Determine correct applications for direct level measurement devices: floats, displacers, conductivity probes, etc.)
	23.12 Determine correct applications for indirect level measurement devices: (hydraulic pressure, bubble tubes, radioactive emitters and detectors, etc.)
	23.13 Design and operate a level control loop.
	23.14 Calibrate level elements, transmitters, and controllers.
	23.15 Demonstrate knowledge of final control elements and applications for level loops.
24.0	Demonstrate knowledge of operating, troubleshooting and maintaining pressure measurement and control devices. The student will be able to:
	24.01 Demonstrate knowledge of the terminology, physics, methods and principles of pressure measurement and control.
	24.02 Identify pressure measurement instruments.
	24.03 Identify pressure measurement purpose and requirements.
	24.04 Identify applications of vacuum/pressure measuring methods.
	24.05 Identify the elements of vacuum/pressure measurement systems.

	24.06 Identify safety standards, installation techniques and maintenance practices as applicable to vacuum/pressure measurement.
	24.07 Identify instrument calibration standards.
	24.08 Identify common vacuum/pressure, measuring instrument and sensor failures.
	24.09 Troubleshoot and repair vacuum/pressure measurement and control system failures.
	24.10 Demonstrate knowledge of elastic deformation elements.
	24.11 Design and operate pressure loop.
	24.12 Calibrate pressure elements, transmitters, and controllers.
	24.13 Demonstrate knowledge of differential pressure elements, principles, and applications.
	24.14 Demonstrate knowledge of applications and requirements of vacuum breakers and pressure relief devices.
	24.15 Demonstrate knowledge of final control elements and applications for vacuum/pressure loops.
25.0	Demonstrate knowledge of operating, troubleshooting and maintaining temperature measurement and control devices. The student will be able to:
	25.01 Demonstrate knowledge of the terminology, physics, methods and principles of temperature measurement and control.
	25.02 Identify temperature measurement purpose and requirements.
	25.03 Identify temperature measurement instruments.
	25.04 Identify bimetallic and fluid-filled temperature measuring instruments.
	25.05 Identify thermocouple and RTD temperature measuring instruments.
	25.06 Identify and operate pyrometers and thermometers.
	25.07 Identify safety standards, installation techniques and maintenance practices as applicable to temperature measurement.
	25.08 Identify instrument calibration standards.
	25.09 Identify common temperature measuring instrument and sensor failures.
	25.10 Troubleshoot and repair temperature measurement and control system failure.
	25.11 Design and operate a temperature control loop.
	25.12 Calibrate temperature elements, transmitters, and controllers.
	25.13 Demonstrate knowledge of final control elements and applications for temperature loops.
26.0	Demonstrate knowledge of operating, troubleshooting and maintaining flow measurement and control devices. The student will be able to:
	26.01 Demonstrate knowledge of the terminology, physics, methods and principles of fluid flow measurement and control.
	26.02 Identify flow measurement purpose and requirement.

	26.03 Identify secondary measurement devices for fluid flow.
	26.04 Identify applications for variable area instruments.
	26.05 Identify open channel flow devices.
	26.06 Identify applications for positive displacement metering.
	26.07 Identify flow displacement measurement methods.
	26.08 Identify applications for magnetic flow meters.
	26.09 Identify applications for ultrasonic flow metering methods.
	26.10 Identify safety standards, installation techniques and maintenance practices as applicable to flow measurement.
	26.11 Troubleshoot and repair flow measurement and control system failure.
	26.12 Demonstrate knowledge of Venturi tubes, flow nozzles, orifice plates and pilot tubes to measure flow.
	26.13 Demonstrate knowledge of mass flow measurement techniques.
	26.14 Demonstrate knowledge of final control elements and applications for flow loops.
	26.15 Calibrate flow elements, transmitters, and controllers.
	26.16 Design and operate a flow control loop.
27.0	Demonstrate knowledge of operating, troubleshooting and maintaining physical property measurement and control devices. The student will be able to:
	27.01 Identify weight and mass measuring units.
	27.02 Identify methods for weighing materials in motion.
	27.03 Identify weight displacement measurement methods.
	27.04 Troubleshoot and repair weight instruments.
	27.05 Perform operating systems checks, preventative maintenance and make adjustments to weight measurement loops.
	27.06 Calibrate weight elements, transmitters, and controllers.
	27.07 Understand the principles of operation for consistency measuring instruments.
28.0	Demonstrate knowledge of operating, troubleshooting and maintaining chemical property measurement and control devices. The student will be able to:
	28.01 Troubleshoot and repair pH measuring instruments.
	28.02 Perform operating systems checks and make minor adjustments to pH measuring instruments.
	28.03 Troubleshoot and repair liquid conductivity measuring instruments.
	28.04 Understand basic principles of operation and the application for gas analyzer measuring instruments.

28.05	Demonstrate knowledge of measuring instruments used to enhance a safe work environment.

Course Description: The Operating Engineer Assistant Stationary course is designed to build on the skills and knowledge students learned in the Electrician (Construction), Instrument Technician, Electrician Maintenance, and Instrument Technician courses for entry into the Electrical and Instrumentation Technology industry. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Students study process operation, and technical reporting.

Course Number: EEV0658 Occupational Completion Point: E Operating Engineer Assistant Stationary – 400 Hours	
29.0	Demonstrate process operation skills. The student will be able to:
29.01	Use PLC's to troubleshoot process systems.
29.02	Identify safety isolation procedures for removing a device from a process.
29.03	Perform operating system checks, preventive maintenance and make minor adjustments to level control loops.
29.04	Perform operating system checks, preventive maintenance and make minor adjustments to vacuum/pressure control loops.
29.05	Perform operating system checks, preventive maintenance and make minor adjustments to temperature control loops.
29.06	Perform operating system checks, preventive maintenance and make minor adjustments to flow measuring instruments.
29.07	Perform operating system checks, preventive maintenance and make minor adjustments to consistency measuring instruments.
29.08	Perform operating system checks, preventive maintenance and make minor adjustments to liquid conductivity measuring instruments.
29.09	Perform operating system checks to pneumatic and hydraulic systems.
29.10	Operate control points on a DCS system.
30.0	Demonstrate knowledge of technical reporting. The student will be able to:
30.01	Draw and interpret schematics.
30.02	Record data and prepare charts and graphs.
30.03	Write reports and make oral presentations.
30.04	Make equipment - failure reports.
30.05	Specify and requisition simple components.
30.06	Compose technical letters and memoranda.
30.07	Draw preventive maintenance and calibration procedures.

30.08 Write and use maintenance work orders.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Industrial Machinery Maintenance and Repair**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	I470303	
CIP Number	0647030300	
Grade Level	30, 31	
Program Length	1,350 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in industrial-machinery maintenance positions.

The content includes but is not limited to understanding all aspects of the industrial-machinery maintenance-technology industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of three occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3) (b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0450	Industrial Machinery Maintenance Assistant	BLDG CONST @7 7G IND ENGR 7G MACH SHOP @7 7G MILLWRIGHT 7G TEC CONSTR @7 7G	450 hours
B	ETI0456 ETI0457	Machinery Maintenance Mechanic Machinery Maintenance Technician		300 hours 150 hours
C	ETI0458	Industrial Maintenance Specialist		450 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply safety rules and procedures.
02.0 Explain basic electricity and electronics.
03.0 Perform mathematical calculations.
04.0 Use and maintain hand tools.
05.0 Use and maintain portable power tools.
06.0 Read plans and drawings.
07.0 Perform measuring and layout operations.
08.0 Demonstrate basic knowledge of industrial and manufacturing processes.
09.0 Perform benchwork skills.
10.0 Troubleshoot electrical circuits.
11.0 Identify common troubles and basic troubleshooting techniques.
12.0 Handle and apply lubricants.
13.0 Perform rigging functions.
14.0 Explain the basic elements of physics as related to industrial machinery maintenance and repair.
15.0 Install and maintain drive components.
16.0 Maintain and troubleshoot pneumatic systems.
17.0 Maintain and troubleshoot fluid-drive systems.
18.0 Maintain reciprocating, positive-displacement, and rotary air compressors.
19.0 Perform gas and electric welding and cutting operations.
20.0 Install and remove machinery.
21.0 Demonstrate conveyor-maintenance techniques.
22.0 Perform gas- and arc-welding procedures.
23.0 Perform machine-shop operations.
24.0 Maintain piping and tubing systems.
25.0 Perform pump maintenance and repair.
26.0 Identify various types of industrial-pollution control systems.
27.0 Identify boilers.
28.0 Understand internal combustion engines.
29.0 Plan an elementary predictive-preventive-maintenance (PPM) schedule.
30.0 Maintain and repair hydraulic-system components.
31.0 Troubleshoot hydraulic systems.
32.0 Maintain and troubleshoot robotic systems.
33.0 Demonstrate an understanding of employability skills and career opportunities.

Industrial Maintenance Specialist
34.0 Prepare for machinery startup.

35.0 Apply vibration-analysis skills.
36.0 Perform machinery balancing.
37.0 Demonstrate predictive-preventive-maintenance (PPM) technologies.
38.0 Use computer-maintenance-management systems (CMMS).
39.0 Perform failure analysis (FA).
40.0 Improve rotating equipment performance.
41.0 Generate machine improvements and maintenance management.

Florida Department of Education
Student Performance Standards

Program Title: **Industrial Machinery Maintenance and Repair**
Career Certificate Program Number: **I470303**

Course Description: The Industrial Machinery Maintenance Assistant course prepares students for entry into the Industrial Machinery Maintenance and Repair industry. Content emphasizes beginning skills and concepts as a recommended requisite. Students study workplace safety and organization, basics of electricity and electronics, mathematical calculations, proper use of hand and power tools, read and interpret plans and drawings, perform measuring and layout operations, industrial and manufacturing processes, benchwork skills, troubleshooting skills and techniques, lubrication processes, rigging, basic elements of physics, installation of drive components, troubleshoot pneumatic and fluid-drive systems, and maintaining air compressors.

Course Number: ETI0450 **Occupational Completion Point: A** **Industrial Machinery Maintenance Assistant – 450 Hours**	
01.0	Apply safety rules and procedures. The student will be able to:
01.01	Practice shop safety rules and procedures.
01.02	Practice personal safety rules and procedures, including the use of personal protective equipment (PPE).
01.03	Practice fire safety rules and procedures.
01.04	Practice electrical safety rules and procedures.
01.05	Practice tool safety rules and procedures.
01.06	Practice ladder and scaffolding safety rules and procedures.
01.07	Maintain a clean work and shop area.
01.08	Perform tag lockout procedures.
01.09	Identify Occupational Safety and Health Administration (OSHA) requirements and procedures.
01.10	Use Safety Data Sheets (SDS).
02.0	Explain basic electricity and electronics. The student will be able to:
02.01	Define electrical/electronic terms.
02.02	Describe direct current (DC) and alternating current (AC) circuits.
02.03	Identify the advantages and disadvantages of alternating current (AC) and direct current (DC) motors for various applications.
03.0	Perform mathematical calculations. The student will be able to:

03.01	Make job-related decimal and fraction calculations.
03.02	Solve job-related problems by adding, subtracting, multiplying, and dividing numbers.
03.03	Solve job-related problems using a hand-held calculator.
03.04	Solve job-related problems using basic formulas.
03.05	Solve job-related problems using basic geometry.
03.06	Measure a work piece and compare the measurements with blueprint specifications.
03.07	Solve job-related problems using mathematical handbooks, charts, and tables.
03.08	Convert measurements from English to metric and from metric to English units.
03.09	Solve job-related problems using proportions.
03.10	Solve job-related problems using statistics.
04.0	Use and maintain hand tools. The student will be able to:
04.01	Demonstrate the safe use of hand tools such as screwdrivers, hammers, wrenches, pliers, hacksaws, punches, chisels, drills, files, tin snips, taps, and dies.
04.02	Use measuring devices.
04.03	Use wrenches and screwdrivers.
04.04	Use pipefitting tools.
04.05	Use sheet-metal tools.
04.06	Safely use ropes, slings, pulleys, and block and tackle.
04.07	Select the proper tool for each job application.
04.08	Select correct tools for metric and standard fasteners.
04.09	Identify state-of-the-art innovations and explore their uses.
04.10	Identify and select fasteners for various applications, considering the effects of corrosion on each, including threaded fasteners, nuts, washers, rivets, locking pins, keys, self-tapping screws, locking-nut fasteners, and self-retaining nuts.
04.11	Describe the techniques and liability issues regarding retrofitting fasteners for ease of removal.
05.0	Use and maintain portable power tools. The student will be able to:
05.01	Demonstrate the safe use of portable power tools, drills, belt and disc sanders, grinders, circular saws, saber saws, metal shears, electric and pneumatic impact wrenches, rotary and pneumatic chipping hammers, drill presses, and bench grinders.
05.02	Use and maintain light- and heavy-duty drills.
05.03	Use and maintain electric hammers.

	05.04 Use and maintain pneumatic drills and hammers.
	05.05 Use and maintain power screwdrivers and nut runners.
	05.06 Use and maintain linear motion saws.
	05.07 Use and maintain circular saws.
	05.08 Use and maintain belt, pad, and disc sanders.
	05.09 Use and maintain grinders and shears.
06.0	Read plans and drawings. The student will be able to:
	06.01 Identify various types of plans and drawings (example: architectural, mechanical, electrical, etc.).
	06.02 Identify dimensions.
	06.03 Identify lists of materials and specifications.
	06.04 Identify section and detail views.
	06.05 Sketch and dimension a part.
	06.06 Disassemble and assemble parts using an exploded-view drawing.
	06.07 Interpret blueprint abbreviations.
	06.08 Identify dimensioning of radii, round holes, fillets, and chamfers.
	06.09 Identify screw threads and bolt types.
	06.10 Apply dimensional tolerances.
	06.11 Identify the metal-fabrication symbols used in blueprints.
07.0	Perform measuring and layout operations. The student will be able to:
	07.01 Perform basic geometric-construction operations.
	07.02 Safely use marking gauges, center punches, scribes, surface gauges, squares, dividers, dial indicators, protractors, surface plates, depth gauges, and circumference rules.
	07.03 Develop patterns using parallel lines, radial lines, and triangulation.
	07.04 Make metal-fabrication sketches.
	07.05 Read and measure with steel rules.
	07.06 Read and measure with micrometers.
	07.07 Read and measure with vernier tools.
	07.08 Read and measure with dial and digital calipers.

	07.09 Read and measure with dial and digital indicators.
08.0	Demonstrate basic knowledge of industrial and manufacturing processes. The student will be able to:
	08.01 Demonstrate knowledge of the use of current manufacturing processes.
	08.02 Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment.
	08.03 Understand the processes of separating, forming, conditioning, fabricating, and finishing of materials.
09.0	Perform benchwork skills. The student will be able to:
	09.01 Identify safety and shop rules.
	09.02 Cut materials by using hand hacksaws.
	09.03 Cut threads by using hand taps.
	09.04 Cut threads by using dies.
	09.05 Repair threads by chasing and thread inserts.
	09.06 Install dowel pins using tapered and straight reamers.
	09.07 Ream holes by using tapered and straight reamers.
	09.08 Hand-sharpen cutting tools by using abrasive stones.
	09.09 Hone and lap surfaces.
	09.10 Remove damaged screws and other hardware.
	09.11 Deburr workpieces.
	09.12 Demonstrate accurate dis-assembly and re-assembly of machinery components.
10.0	Troubleshoot electrical circuits. The student will be able to:
	10.01 Describe the safety requirements and precautions for troubleshooting electrical circuits.
	10.02 Disconnect and reconnect electric motors.
	10.03 Identify the parts and function of an electrical system.
	10.04 Explain how to troubleshoot a sequence of events.
	10.05 Properly use electrical test equipment for troubleshooting.
11.0	Identify common troubles and basic troubleshooting techniques. The student will be able to:
	11.01 Analyze the possible causes of common troubles in industrial machinery performance.
	11.02 Identify basic troubleshooting techniques for bearings.

	11.03 Identify basic troubleshooting techniques for pumps.
	11.04 Identify basic troubleshooting techniques for drive systems.
	11.05 Identify basic troubleshooting techniques for hydraulics.
	11.06 Identify basic troubleshooting techniques for pneumatics.
12.0	Handle and apply lubricants. The student will be able to:
	12.01 Explain the functions of lubrication.
	12.02 Explain the properties of oil lubricants.
	12.03 Identify the types, advantages, and functions of lubricant additives.
	12.04 Explain the types of circulating oils and their purposes.
	12.05 Identify grease application.
	12.06 Identify lubricating systems and methods.
	12.07 Explain lubricant storage and handling methods.
	12.08 Explain the types of oil filters and their uses.
	12.09 Lubricate a piece of industrial equipment.
	12.10 Define the role of preventive maintenance in total equipment maintenance.
	12.11 Describe the major tasks of preventive maintenance: cleaning, inspection, lubrication, minor repair, and information feedback.
	12.12 Review a typical maintenance program.
13.0	Perform rigging functions. The student will be able to:
	13.01 Demonstrate the safety procedures for performing rigging and lifting operations.
	13.02 Identify and inspect fiber and wire rope.
	13.03 Tie knots and hitches.
	13.04 Identify and use the components of rigging hardware.
	13.05 Perform rigging and lifting operations.
14.0	Explain the basic elements of physics as related to industrial machinery maintenance and repair. The student will be able to:
	14.01 Explain the standards of measurement and the impact of action and working forces, including tension, compression, torque, and shear.
	14.02 Identify the principles and laws of motion and explain how they affect acceleration and deceleration.
	14.03 Explain the relationship of work, power, and energy to the types of collisions and conservation of momentum.

14.04	Explain the operation of simple machines, including the lever, inclined plane, screw, wedge, wheel and axle, pulley, and jacking screws.
14.05	Identify the ways of producing power for mechanical efficiency, in terms of gear ratios, work forces, and the types of work done by a crane hook, forklift truck, and screw or bolt.
14.06	Use linear, liquid, and weight units of measurement to measure areas, areas within areas, and volume.
14.07	Describe the mechanical and chemical properties of materials commonly used in industry.
14.08	Explain the laws and conditions governing static and kinetic friction, the problems caused by friction, and the effects of the angle of repose.
14.09	Explain molecular action as a result of temperature extremes, chemical reaction, and moisture content.
14.10	Draw conclusions or make inferences from data.
14.11	Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
15.0	Install and maintain drive components. The student will be able to:
15.01	Demonstrate safety procedures for installing and maintaining drive components.
15.02	Identify the types of bearings, their cross-referencing, and their uses.
15.03	Remove, inspect, and/or replace bearings.
15.04	Remove and replace seals.
15.05	Perform shaft alignment.
15.06	Identify the types of belts.
15.07	Identify the types of chains.
15.08	Perform tension adjustments and alignment on belt and chain drives.
15.09	Troubleshoot belt and chain drives.
15.10	Identify the types of gears.
15.11	Remove, replace, and align gears, sprockets, and couplings.
15.12	Remove, replace, or repair V-joints and jack shafts.
15.13	Adjust gear backlash.
15.14	Troubleshoot gear drives.
15.15	Disassemble, inspect, reassemble, and adjust clutches.
15.16	Identify the types of variable-speed drives.
15.17	Troubleshoot variable-speed drives.

	15.18 Identify the types of cams and link mechanisms.
	15.19 Troubleshoot cam-and-link mechanism problems.
16.0	Maintain and troubleshoot pneumatic systems. The student will be able to:
	16.01 Explain the safety procedures for troubleshooting pneumatic systems.
	16.02 Diagram an air supply system.
	16.03 Install system components.
	16.04 Demonstrate system-maintenance techniques.
	16.05 Explain proper troubleshooting procedures.
	16.06 Troubleshoot air compressors.
	16.07 Troubleshoot, repair, and install control valves.
	16.08 Troubleshoot air motors.
17.0	Maintain and troubleshoot fluid-drive systems. The student will be able to:
	17.01 Explain the safety procedures for maintaining and troubleshooting fluid-drive systems.
	17.02 Install adjustable-speed drives.
	17.03 Troubleshoot adjustable-speed drives.
	17.04 Explain the operation of fluid couplings.
	17.05 Install fluid couplings.
	17.06 Install torque converters.
	17.07 Perform preventive maintenance.
	17.08 Apply a "dynamic" magnetic/mechanical braking device to a motor.
	17.09 Mount the equipment.
18.0	Maintain reciprocating, positive-displacement, and rotary air compressors. The student will be able to:
	18.01 Relate scientific principles to a pneumatic system.
	18.02 Demonstrate the safety procedures for maintaining and operating reciprocating, positive-displacement, and rotary air compressors.
	18.03 Identify the systems of reciprocating, positive-displacement, and rotary air compressors.
	18.04 Check oil level.
	18.05 Change oil.

18.06	Drain water from tank.
18.07	Test for efficiency of compressor.
18.08	Inspect storage tank for quality.
18.09	Test pressure control switch.

Course Description: The Machinery Maintenance Mechanic course is designed for entry into the Industrial Machinery Maintenance and Repair industry. Students study welding and cutting operations, machinery installation and removal, conveyor maintenance, machine shop operations, piping and tubing systems, pump maintenance and repair, industrial pollution control systems, boilers, and internal combustion engines.

Course Number: ETI0456 Occupational Completion Point: B (1 of 2) Machinery Maintenance Mechanic – 300 Hours	
19.0	Perform gas and electric welding and cutting operations. The student will be able to:
19.01	Identify the properties of the most commonly used metals and alloys, including hardness and malleability.
19.02	Identify welding cylinders, regulators, hoses, pressure gauges, and torches.
19.03	Describe welding-equipment safety procedures.
19.04	Demonstrate proper flame settings.
19.05	Demonstrate basic gas-welding skills.
19.06	Demonstrate procedures for adjusting and operating the oxyacetylene cutting torch.
19.07	Demonstrate freehand and guide cutting of various metal thicknesses.
19.08	Perform basic electric arc welding procedures.
20.0	Install and remove machinery. The student will be able to:
20.01	Identify the safety procedures for installing and removing machinery.
20.02	Identify the equipment required for machine installation and removal.
20.03	Prepare an area for machine installation per the manufacturer's specifications.
20.04	Rig, lift, and transport machinery to the installation site.
20.05	Install electrical hookups to machinery.
20.06	Install air hydraulic hookups to machinery.
20.07	Perform an assigned machine retrofit per the manufacturer's specifications.

	20.08 Perform an assigned machine removal and transport per specification requirements.
	20.09 Explain the importance of vibration detection.
21.0	Demonstrate conveyor-maintenance techniques. The student will be able to:
	21.01 Identify various types of conveyors.
	21.02 Identify the safety requirements and precautions for conveyor-maintenance operations.
	21.03 Adjust the tracking of a belt.
	21.04 Check a belt for wear.
	21.05 Identify the types of splices.
	21.06 Identify splicing equipment and procedures.
	21.07 Identify conveyor-maintenance techniques, including making splices with splicing equipment.
22.0	Perform gas- and arc-welding procedures. The student will be able to:
	22.01 Demonstrate the safety procedures for performing gas and arc welding and for transporting equipment.
	22.02 Identify the components of an oxy-fuel rig.
	22.03 Set up and shut down an oxy-fuel rig.
	22.04 Weld beads in a flat position.
	22.05 Weld an outside corner joint using a filler rod.
	22.06 Cut metal of various thicknesses.
	22.07 Weld beads in a flat position using E-6010 and E-7018 electrodes.
	22.08 Weld beads in horizontal and in vertical positions using E-6010 and E-7018 electrodes.
	22.09 Weld beads in an overhead position using E-6010 and E-7018 electrodes.
	22.10 Weld beads using a MIG welder.
	22.11 Weld beads using a TIG welder.
	22.12 Solder and braze metals.
	22.13 Cut stainless steel and aluminum with a plasma-arc rig.
23.0	Perform machine-shop operations. The student will be able to:
	23.01 Demonstrate safety in performing machine-shop operations.
	23.02 Identify the types of cutting tools.

	23.03 Bore a hole to a specified size.
	23.04 Cut an external V-thread.
	23.05 Identify the different types of work-holding devices.
	23.06 Prepare metal for finishing.
	23.07 Set up, use, and adjust an arbor press.
	23.08 Set up, use, and adjust a hydraulic press.
	23.09 Cut keyways with an end mill.
24.0	Maintain piping and tubing systems. The student will be able to:
	24.01 Identify the components of a piping system.
	24.02 Explain the maintenance considerations of metallic and nonmetallic piping systems.
	24.03 Describe the safety requirements for working with piping and tubing systems.
	24.04 Join copper tubing.
	24.05 Join common fittings.
	24.06 Join metallic pipe.
	24.07 Join plastic pipe.
	24.08 Explain valve operation and maintenance.
	24.09 Explain the importance of strainers, filters, and traps in piping systems.
	24.10 Bend back-to-back, stub-ups, and doglegs in electrical metallic tubing (EMT).
25.0	Perform pump maintenance and repair. The student will be able to:
	25.01 Demonstrate the safety procedures for performing pump maintenance.
	25.02 Determine pump capacity and system requirements.
	25.03 Perform pump maintenance.
	25.04 Identify packing and seal requirements.
	25.05 Explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating, diaphragm, positive placement, and vacuum pumps.
	25.06 Disassemble and reassemble a pump.
26.0	Identify various types of industrial-pollution control systems.
27.0	Identify boilers. The student will be able to:

	27.01 Identify the various types and components of heat exchangers.
	27.02 Identify the various types and components of boilers.
	27.03 Identify the various types and components of fractioning columns.
	27.04 Identify the uses of steam.
28.0	Understand internal combustion engines. The student will be able to:
	28.01 Explain the basic principles of the two-stroke-cycle combustion engine.
	28.02 Identify the types of engines, engine assemblies, and systems.
	28.03 Perform routine maintenance on engine operating systems.
	28.04 Troubleshoot and evaluate engine performance.

Course Description: The Machinery Maintenance Technician course is designed for entry into the Industrial Machinery Maintenance and Repair industry. Students explore career opportunities and requirements of a professional industrial machinery mechanic. Students study elementary predictive-preventive-maintenance planning, maintain and troubleshoot hydraulic and robotic systems, and understanding employability skills.

Course Number: ETI0457 **Occupational Completion Point: B (2 of 2)** **Machinery Maintenance Technician – 150 Hours**	
29.0	Plan an elementary predictive-preventive-maintenance (PPM) schedule. The student will be able to:
	29.01 List the types of predictive-preventive maintenance.
	29.02 Describe the purpose of preventive-maintenance schedules.
	29.03 Create a preventive-maintenance schedule form using a machine manual or the manufacturer recommendations.
	29.04 Identify troubles caused by the lack of preventive maintenance.
	29.05 Create a maintenance log and make entries for a machine or equipment.
	29.06 Create a preventive-maintenance schedule from a maintenance-failures log.
30.0	Maintain and repair hydraulic-system components. The student will be able to:
	30.01 Explain the safety procedures for installing hydraulic lines.
	30.02 Explain how heat and pressure relate to power and transmission.
	30.03 Describe the physical and chemical properties of a fluid.
	30.04 Install and maintain a contaminant-removal system.

	30.05 Determine reservoir requirements.
	30.06 Classify and select pumps for specific applications.
	30.07 Compute hose requirements.
	30.08 Select and install control valves.
31.0	Troubleshoot hydraulic systems. The student will be able to:
	31.01 Explain the safety procedures for troubleshooting hydraulic systems.
	31.02 Read a hydraulic schematic.
	31.03 Install hydraulic components.
	31.04 Explain hydraulic system troubleshooting techniques.
	31.05 Repair and replace valves.
	31.06 Repair and replace cylinders.
	31.07 Repair and replace pumps and motors.
32.0	Maintain and troubleshoot robotic systems. The student will be able to:
	32.01 Identify uses of robotics in industry.
	32.02 Identify safety procedures related to robotic systems.
	32.03 Identify mechanical, hydraulic, pneumatic, and electric/electronic components of robotic systems.
33.0	Demonstrate an understanding of employability skills and career opportunities. The student will be able to:
	33.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
	33.02 Discuss motivation and human behavior.
	33.03 Demonstrate knowledge of ways to improve reading, listening, and writing skills.
	33.04 Provide effective feedback and make suggestions.
	33.05 Demonstrate knowledge of roles and responsibilities of team members.
	33.06 Effectively communicate production and process information to internal and external customers.
	33.07 Develop personal career plan that includes goals, objectives, and strategies.
	33.08 Examine licensing, certification, and industry credentialing requirements.
	33.09 Evaluate and compare employment opportunities that match career goals.
	33.10 Identify and exhibit traits for retaining employment.

33.11	Identify opportunities and research requirements for career advancement.
33.12	Research the benefits of ongoing professional development.

Course Description: The Industrial Maintenance Specialist course is designed to build on the skills and knowledge students learned in the Industrial Machinery Maintenance Assistant, Machinery Maintenance Technician, and Machinery Maintenance Mechanic courses for entry into the Industrial Machinery Maintenance and Repair industry. Students explore career opportunities and requirements of a professional industrial machinery mechanic. Students study machinery startup, vibration analysis, machinery balancing, predictive-preventative maintenance, computer maintenance management systems, failure analysis, rotating equipment, and machine improvement.

Course Number: ETI0458 Occupational Completion Point: C Industrial Maintenance Specialist – 450 Hours	
34.0	Prepare for machinery startup. The student will be able to:
34.01	Describe the requirements and precautions for machinery startup.
34.02	Align machinery using wire line, transit, dial indicators, a computer, and laser-alignment devices.
34.03	Position and secure machinery on a foundation.
34.04	Level machinery and install balance-vibration dampeners.
34.05	Identify pipe-stress standards for machine-maintenance applications.
34.06	Perform finish alignment and check for pipe stresses in machinery- maintenance applications.
35.0	Apply vibration-analysis skills. The student will be able to:
35.01	Collect vibration data.
35.02	Interpret vibration data.
35.03	Determine velocity, acceleration, spike energy, frequency, amplitude, and other vibration sources.
35.04	Describe the safety requirements and precautions for vibration analysis.
35.05	Operate and use vibration software.
35.06	Predict and verify the condition of machinery in an industrial setting using vibration tools.
35.07	Explain the approximately 25 sources of vibration.
35.08	Explain the bearing frequency (BIFO) formulas.
35.09	Demonstrate proficiency in vibration detection.
36.0	Perform machinery balancing. The student will be able to:

	36.01 Describe the safety requirements and precautions for balancing procedures and equipment.
	36.02 Identify the principles of static balancing.
	36.03 Perform a vector balance in the classroom.
	36.04 Identify balancing standards, ISO 1940 or equal.
	36.05 Perform a stand balance in a shop.
	36.06 Perform a field balance in an industrial setting.
	36.07 Use portable or stationary balancing equipment.
37.0	Demonstrate predictive-preventive-maintenance (PPM) technologies. The student will be able to:
	37.01 Explain the use of infrared thermography.
	37.02 Explain the use of ultrasound technology.
	37.03 Explain the use of advanced alignment techniques (optical and Essinger bars).
	37.04 Explain the use of oil ferrography and the types of oil sampling.
	37.05 Explain the use of shock pulse equipment.
	37.06 Describe the safety requirements for PPM technologies.
	37.07 Demonstrate the use of one of the above predictive-maintenance procedures.
	37.08 Plan an advanced PPM schedule.
38.0	Use computer-maintenance-management systems (CMMS). The student will be able to:
	38.01 Operate CMMS software.
	38.02 Enter and close a maintenance work order with CMMS.
	38.03 Schedule a series of maintenance tasks.
	38.04 Write a detailed maintenance job plan.
	38.05 Order parts and supplies for a maintenance work order.
	38.06 Determine the personnel resources needed for a maintenance job.
39.0	Perform failure analysis (FA). The student will be able to:
	39.01 Conduct/lead a failure analysis meeting to determine the root cause of a failure.
	39.02 Create a failure-analysis form and write a minimum of two different types of failure-analysis reports.
	39.03 Explain the types of bearing failures.

	39.04 Explain the types of shaft fatigues and failures.
	39.05 Explain the types of lubrication breakdowns.
	39.06 Estimate the cost and the impact on production of a specific failure.
40.0	Improve rotating-equipment performance. The student will be able to:
	40.01 Calculate shaft-deflection ratios and use the results to improve shaft design.
	40.02 Draw or sketch equipment bases and supports of sturdy construction.
	40.03 Demonstrate and install advanced labyrinth-sealing devices.
	40.04 Demonstrate and install advanced mechanical-sealing devices.
	40.05 Run the Gates Belts or another interactive belt-design-and- tensioning computer program applied to various drives.
	40.06 Explain the benefits of synthetic oils and greases.
	40.07 Explain MTBF (mean time between equipment failure) and its cost impact when machinery life is extended.
	40.08 List seven specific machinery-improvement ideas in detail.
41.0	Generate machine improvements and maintenance management. The student will be able to:
	41.01 Review and critique machinery and base design for improvement before the equipment is placed on order.
	41.02 Identify the essential elements of effective maintenance management:
	• Reward system
	• Predictive-preventive maintenance
	• Planning
	• Work-order systems
	• Organizations
	• Goals and tracking
	• Facilities
	• Storerooms
	• Contractors
	• Shutdowns
	41.03 Write a report on the design and effective use of at least two of the essential elements of management.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Millwright**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	I470313	
CIP Number	0647030302	
Grade Level	30, 31	
Program Length	1,350 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in industrial-machinery maintenance positions.

The content includes but is not limited to understanding all aspects of the industrial-machinery maintenance-technology industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of three occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3) (b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0450	Industrial Machinery Maintenance Assistant	BLDG CONST @7 7G IND ENGR 7G MACH SHOP @7 7G MILLWRIGHT 7G TEC CONSTR @7 7G	450 hours
B	ETI0456 ETI0457	Machinery Maintenance Mechanic Machinery Maintenance Technician		300 hours 150 hours
C	ETI0459	Millwright		450 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply safety rules and procedures.
02.0 Explain basic electricity and electronics.
03.0 Perform mathematical calculations.
04.0 Use and maintain hand tools.
05.0 Use and maintain portable power tools.
06.0 Read plans and drawings.
07.0 Perform measuring and layout operations.
08.0 Demonstrate basic knowledge of industrial and manufacturing processes.
09.0 Perform benchwork skills.
10.0 Identify common troubles and basic troubleshooting techniques.
11.0 Handle and apply lubricants.
12.0 Perform rigging functions.
13.0 Explain the basic elements of physics as related to industrial machinery maintenance and repair.
14.0 Install and maintain drive components.
15.0 Maintain and troubleshoot pneumatic systems.
16.0 Maintain and troubleshoot fluid-drive systems.
17.0 Maintain reciprocating, positive-displacement, and rotary air compressors.
18.0 Perform gas and electric welding and cutting operations.
19.0 Install and remove machinery.
20.0 Demonstrate conveyor-maintenance techniques.
21.0 Perform gas- and arc-welding procedures.
22.0 Perform machine-shop operations.
23.0 Maintain piping and tubing systems.
24.0 Perform pump maintenance and repair.
25.0 Identify various types of industrial-pollution control systems.
26.0 Identify boilers.
27.0 Understand internal combustion engines.
28.0 Plan an elementary predictive-preventive-maintenance (PPM) schedule.
29.0 Maintain and repair hydraulic-system components.
30.0 Troubleshoot hydraulic systems.
31.0 Maintain and troubleshoot robotic systems.
32.0 Demonstrate an understanding of employability skills and career opportunities.

Millwright
33.0 Perform metal fabrication.
34.0 Perform precision layout.

35.0 Perform advanced rigging.
36.0 Install, remove, and align machinery.

Florida Department of Education
Student Performance Standards

Program Title: **Millwright**
Career Certificate Program Number: **I470313**

Course Description: The Industrial Machinery Maintenance Assistant course prepares students for entry into the Millwright industry. Content emphasizes beginning skills and concepts as a recommended requisite for entry into Machinery Maintenance Technician. Students study workplace safety and organization, basics of electricity and electronics, mathematical calculations, proper use of hand and power tools, read and interpret plans and drawings, perform measuring and layout operations, industrial and manufacturing processes, benchwork skills, troubleshooting skills and techniques, lubrication processes, rigging, basic elements of physics, installation of drive components, troubleshoot pneumatic and fluid-drive systems, and maintaining air compressors.

Course Number: ETI0450 **Occupational Completion Point: A** **Industrial Machinery Maintenance Assistant – 450 Hours**	
01.0	Apply safety rules and procedures. The student will be able to:
01.01	Practice shop safety rules and procedures.
01.02	Practice personal safety rules and procedures, including the use of personal protective equipment (PPE).
01.03	Practice fire safety rules and procedures.
01.04	Practice electrical safety rules and procedures.
01.05	Practice tool safety rules and procedures.
01.06	Practice ladder and scaffolding safety rules and procedures.
01.07	Maintain a clean work and shop area.
01.08	Perform tag lockout procedures.
01.09	Identify Occupational Safety and Health Administration (OSHA) requirements and procedures.
01.10	Use Safety Data Sheets (SDS).
02.0	Explain basic electricity and electronics. The student will be able to:
02.01	Define electrical/electronic terms.
02.02	Describe direct current (DC) and alternating current (AC) circuits.
02.03	Identify the advantages and disadvantages of alternating current (AC) and direct current (DC) motors for various applications.
03.0	Perform mathematical calculations. The student will be able to:

	03.01 Make job-related decimal and fraction calculations.
	03.02 Solve job-related problems by adding, subtracting, multiplying, and dividing numbers.
	03.03 Solve job-related problems using a hand-held calculator.
	03.04 Solve job-related problems using basic formulas.
	03.05 Solve job-related problems using basic geometry.
	03.06 Measure a work piece and compare the measurements with blueprint specifications.
	03.07 Solve job-related problems using mathematical handbooks, charts, and tables.
	03.08 Convert measurements from English to metric and from metric to English units.
	03.09 Solve job-related problems using proportions.
	03.10 Solve job-related problems using statistics.
04.0	Use and maintain hand tools. The student will be able to:
	04.01 Demonstrate the safe use of hand tools such as screwdrivers, hammers, wrenches, pliers, hacksaws, punches, chisels, drills, files, tin snips, taps, and dies.
	04.02 Use measuring devices.
	04.03 Use wrenches and screwdrivers.
	04.04 Use pipefitting tools.
	04.05 Use sheet-metal tools.
	04.06 Safely use ropes, slings, pulleys, and block and tackle.
	04.07 Select the proper tool for each job application.
	04.08 Select correct tools for metric and standard fasteners.
	04.09 Identify state-of-the-art innovations and explore their uses.
	04.10 Identify and select fasteners for various applications, considering the effects of corrosion on each, including threaded fasteners, nuts, washers, rivets, locking pins, keys, self-tapping screws, locking-nut fasteners, and self-retaining nuts.
	04.11 Describe the techniques and liability issues regarding retrofitting fasteners for ease of removal.
05.0	Use and maintain portable power tools. The student will be able to:
	05.01 Demonstrate the safe use of portable power tools, drills, belt and disc sanders, grinders, circular saws, saber saws, metal shears, electric and pneumatic impact wrenches, rotary and pneumatic chipping hammers, drill presses, and bench grinders.
	05.02 Use and maintain light- and heavy-duty drills.
	05.03 Use and maintain electric hammers.

	05.04 Use and maintain pneumatic drills and hammers.
	05.05 Use and maintain power screwdrivers and nut runners.
	05.06 Use and maintain linear motion saws.
	05.07 Use and maintain circular saws.
	05.08 Use and maintain belt, pad, and disc sanders.
	05.09 Use and maintain grinders and shears.
06.0	Read plans and drawings. The student will be able to:
	06.01 Identify various types of plans and drawings (example: architectural, mechanical, electrical, etc.).
	06.02 Identify dimensions.
	06.03 Identify lists of materials and specifications.
	06.04 Identify section and detail views.
	06.05 Sketch and dimension a part.
	06.06 Disassemble and assemble parts using an exploded-view drawing.
	06.07 Interpret blueprint abbreviations.
	06.08 Identify dimensioning of radii, round holes, fillets, and chamfers.
	06.09 Identify screw threads and bolt types.
	06.10 Apply dimensional tolerances.
	06.11 Identify the metal-fabrication symbols used in blueprints.
07.0	Perform measuring and layout operations. The student will be able to:
	07.01 Perform basic geometric-construction operations.
	07.02 Safely use marking gauges, center punches, scribes, surface gauges, squares, dividers, dial indicators, protractors, surface plates, depth gauges, and circumference rules.
	07.03 Develop patterns using parallel lines, radial lines, and triangulation.
	07.04 Make metal-fabrication sketches.
	07.05 Read and measure with steel rules.
	07.06 Read and measure with micrometers.
	07.07 Read and measure with vernier tools.
	07.08 Read and measure with dial and digital calipers.

	07.09 Read and measure with dial and digital indicators.
08.0	Demonstrate basic knowledge of industrial and manufacturing processes. The student will be able to:
	08.01 Demonstrate knowledge of the use of current manufacturing processes.
	08.02 Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment.
	08.03 Understand the processes of separating, forming, conditioning, fabricating, and finishing of materials.
09.0	Perform benchwork skills. The student will be able to:
	09.01 Identify safety and shop rules.
	09.02 Cut materials by using hand hacksaws.
	09.03 Cut threads by using hand taps.
	09.04 Cut threads by using dies.
	09.05 Repair threads by chasing and thread inserts.
	09.06 Install dowel pins using tapered and straight reamers.
	09.07 Ream holes by using tapered and straight reamers.
	09.08 Hand-sharpen cutting tools by using abrasive stones.
	09.09 Hone and lap surfaces.
	09.10 Remove damaged screws and other hardware.
	09.11 Deburr workpieces.
	09.12 Demonstrate accurate dis-assembly and re-assembly of machinery components.
10.0	Identify common troubles and basic troubleshooting techniques. The student will be able to:
	10.01 Analyze the possible causes of common troubles in industrial machinery performance.
	10.02 Identify basic troubleshooting techniques for bearings.
	10.03 Identify basic troubleshooting techniques for pumps.
	10.04 Identify basic troubleshooting techniques for drive systems.
	10.05 Identify basic troubleshooting techniques for hydraulics.
	10.06 Identify basic troubleshooting techniques for pneumatics.
11.0	Handle and apply lubricants. The student will be able to:
	11.01 Explain the functions of lubrication.

11.02	Explain the properties of oil lubricants.
11.03	Identify the types, advantages, and functions of lubricant additives.
11.04	Explain the types of circulating oils and their purposes.
11.05	Identify grease application.
11.06	Identify lubricating systems and methods.
11.07	Explain lubricant storage and handling methods.
11.08	Explain the types of oil filters and their uses.
11.09	Lubricate a piece of industrial equipment.
11.10	Define the role of preventive maintenance in total equipment maintenance.
11.11	Describe the major tasks of preventive maintenance: cleaning, inspection, lubrication, minor repair, and information feedback.
11.12	Review a typical maintenance program.
12.0	Perform rigging functions. The student will be able to:
12.01	Demonstrate the safety procedures for performing rigging and lifting operations.
12.02	Identify and inspect fiber and wire rope.
12.03	Tie knots and hitches.
12.04	Identify and use the components of rigging hardware.
12.05	Perform rigging and lifting operations.
13.0	Explain the basic elements of physics as related to industrial machinery maintenance and repair. The student will be able to:
13.01	Explain the standards of measurement and the impact of action and working forces, including tension, compression, torque, and shear.
13.02	Identify the principles and laws of motion and explain how they affect acceleration and deceleration.
13.03	Explain the relationship of work, power, and energy to the types of collisions and conservation of momentum.
13.04	Explain the operation of simple machines, including the lever, inclined plane, screw, wedge, wheel and axle, pulley, and jacking screws.
13.05	Identify the ways of producing power for mechanical efficiency, in terms of gear ratios, work forces, and the types of work done by a crane hook, forklift truck, and screw or bolt.
13.06	Use linear, liquid, and weight units of measurement to measure areas, areas within areas, and volume.
13.07	Describe the mechanical and chemical properties of materials commonly used in industry.
13.08	Explain the laws and conditions governing static and kinetic friction, the problems caused by friction, and the effects of the angle of repose.

	13.09 Explain molecular action as a result of temperature extremes, chemical reaction, and moisture content.
	13.10 Draw conclusions or make inferences from data.
	13.11 Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
14.0	Install and maintain drive components. The student will be able to:
	14.01 Demonstrate safety procedures for installing and maintaining drive components.
	14.02 Identify the types of bearings, their cross-referencing, and their uses.
	14.03 Remove, inspect, and/or replace bearings.
	14.04 Remove and replace seals.
	14.05 Perform shaft alignment.
	14.06 Identify the types of belts.
	14.07 Identify the types of chains.
	14.08 Perform tension adjustments and alignment on belt and chain drives.
	14.09 Troubleshoot belt and chain drives.
	14.10 Identify the types of gears.
	14.11 Remove, replace, and align gears, sprockets, and couplings.
	14.12 Remove, replace, or repair V-joints and jack shafts.
	14.13 Adjust gear backlash.
	14.14 Troubleshoot gear drives.
	14.15 Disassemble, inspect, reassemble, and adjust clutches.
	14.16 Identify the types of variable-speed drives.
	14.17 Troubleshoot variable-speed drives.
	14.18 Identify the types of cams and link mechanisms.
	14.19 Troubleshoot cam-and-link mechanism problems.
15.0	Maintain and troubleshoot pneumatic systems. The student will be able to:
	15.01 Explain the safety procedures for troubleshooting pneumatic systems.
	15.02 Diagram an air supply system.
	15.03 Install system components.

	15.04 Demonstrate system-maintenance techniques.
	15.05 Explain proper troubleshooting procedures.
	15.06 Troubleshoot air compressors.
	15.07 Troubleshoot, repair, and install control valves.
	15.08 Troubleshoot air motors.
16.0	Maintain and troubleshoot fluid-drive systems. The student will be able to:
	16.01 Explain the safety procedures for maintaining and troubleshooting fluid-drive systems.
	16.02 Install adjustable-speed drives.
	16.03 Troubleshoot adjustable-speed drives.
	16.04 Explain the operation of fluid couplings.
	16.05 Install fluid couplings.
	16.06 Install torque converters.
	16.07 Perform preventive maintenance.
	16.08 Apply a "dynamic" magnetic/mechanical braking device to a motor.
	16.09 Mount the equipment.
17.0	Maintain reciprocating, positive-displacement, and rotary air compressors. The student will be able to:
	17.01 Relate scientific principles to a pneumatic system.
	17.02 Demonstrate the safety procedures for maintaining and operating reciprocating, positive-displacement, and rotary air compressors.
	17.03 Identify the systems of reciprocating, positive-displacement, and rotary air compressors.
	17.04 Check oil level.
	17.05 Change oil.
	17.06 Drain water from tank.
	17.07 Test for efficiency of compressor.
	17.08 Inspect storage tank for quality.
	17.09 Test pressure control switch.

Course Description: The Machinery Maintenance Mechanic course is designed for entry into the Industrial Machinery Maintenance and Repair industry. Students study welding and cutting operations, machinery installation and removal, conveyor maintenance, machine shop operations, piping and tubing systems, pump maintenance and repair, industrial pollution control systems, boilers, and internal combustion engines.

Course Number: ETI0456 **Occupational Completion Point: B (1 of 2)** **Machinery Maintenance Mechanic – 300 Hours**	
18.0	Perform gas and electric welding and cutting operations. The student will be able to:
18.01	Identify the properties of the most commonly used metals and alloys, including hardness and malleability.
18.02	Identify welding cylinders, regulators, hoses, pressure gauges, and torches.
18.03	Describe welding-equipment safety procedures.
18.04	Demonstrate proper flame settings.
18.05	Demonstrate basic gas-welding skills.
18.06	Demonstrate procedures for adjusting and operating the oxyacetylene cutting torch.
18.07	Demonstrate freehand and guide cutting of various metal thicknesses.
18.08	Perform basic electric arc welding procedures.
19.0	Install and remove machinery. The student will be able to:
19.01	Identify the safety procedures for installing and removing machinery.
19.02	Identify the equipment required for machine installation and removal.
19.03	Prepare an area for machine installation per the manufacturer's specifications.
19.04	Rig, lift, and transport machinery to the installation site.
19.05	Install electrical hookups to machinery.
19.06	Install air hydraulic hookups to machinery.
19.07	Perform an assigned machine retrofit per the manufacturer's specifications.
19.08	Perform an assigned machine removal and transport per specification requirements.
19.09	Explain the importance of vibration detection.
20.0	Demonstrate conveyor-maintenance techniques. The student will be able to:
20.01	Identify various types of conveyors.
20.02	Identify the safety requirements and precautions for conveyor-maintenance operations.

	20.03 Adjust the tracking of a belt.
	20.04 Check a belt for wear.
	20.05 Identify the types of splices.
	20.06 Identify splicing equipment and procedures.
	20.07 Identify conveyor-maintenance techniques, including making splices with splicing equipment.
21.0	Perform gas- and arc-welding procedures. The student will be able to:
	21.01 Demonstrate the safety procedures for performing gas and arc welding and for transporting equipment.
	21.02 Identify the components of an oxy-fuel rig.
	21.03 Set up and shut down an oxy-fuel rig.
	21.04 Weld beads in a flat position.
	21.05 Weld an outside corner joint using a filler rod.
	21.06 Cut metal of various thicknesses.
	21.07 Weld beads in a flat position using E-6010 and E-7018 electrodes.
	21.08 Weld beads in horizontal and in vertical positions using E-6010 and E-7018 electrodes.
	21.09 Weld beads in an overhead position using E-6010 and E-7018 electrodes.
	21.10 Weld beads using a MIG welder.
	21.11 Weld beads using a TIG welder.
	21.12 Solder and braze metals.
	21.13 Cut stainless steel and aluminum with a plasma-arc rig.
22.0	Perform machine-shop operations. The student will be able to:
	22.01 Demonstrate safety in performing machine-shop operations.
	22.02 Identify the types of cutting tools.
	22.03 Bore a hole to a specified size.
	22.04 Cut an external V-thread.
	22.05 Identify the different types of work-holding devices.
	22.06 Prepare metal for finishing.
	22.07 Set up, use, and adjust an arbor press.

	22.08 Set up, use, and adjust a hydraulic press.
	22.09 Cut keyways with an end mill.
23.0	Maintain piping and tubing systems. The student will be able to:
	23.01 Identify the components of a piping system.
	23.02 Explain the maintenance considerations of metallic and nonmetallic piping systems.
	23.03 Describe the safety requirements for working with piping and tubing systems.
	23.04 Join copper tubing.
	23.05 Join common fittings.
	23.06 Join metallic pipe.
	23.07 Join plastic pipe.
	23.08 Explain valve operation and maintenance.
	23.09 Explain the importance of strainers, filters, and traps in piping systems.
	23.10 Bend back-to-back, stub-ups, and doglegs in electrical metallic tubing (EMT).
24.0	Perform pump maintenance and repair. The student will be able to:
	24.01 Demonstrate the safety procedures for performing pump maintenance.
	24.02 Determine pump capacity and system requirements.
	24.03 Perform pump maintenance.
	24.04 Identify packing and seal requirements.
	24.05 Explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating, diaphragm, positive placement, and vacuum pumps.
	24.06 Disassemble and reassemble a pump.
25.0	Identify various types of industrial-pollution control systems.
26.0	Identify boilers. The student will be able to:
	26.01 Identify the various types and components of heat exchangers.
	26.02 Identify the various types and components of boilers.
	26.03 Identify the various types and components of fractioning columns.
	26.04 Identify the uses of steam.
27.0	Understand internal combustion engines. The student will be able to:

27.01	Explain the basic principles of the two-stroke-cycle combustion engine.
27.02	Identify the types of engines, engine assemblies, and systems.
27.03	Perform routine maintenance on engine operating systems.
27.04	Troubleshoot and evaluate engine performance.

Course Description: The Machinery Maintenance Technician course is designed for entry into the Industrial Machinery Maintenance and Repair industry. Students explore career opportunities and requirements of a professional industrial machinery mechanic. Students study elementary predictive-preventive-maintenance planning, maintain and troubleshoot hydraulic and robotic systems, and understanding employability skills.

Course Number: ETI0457 Occupational Completion Point: B (2 of 2) Machinery Maintenance Technician – 150 Hours	
28.0	Plan an elementary predictive-preventive-maintenance (PPM) schedule. The student will be able to:
28.01	List the types of predictive-preventive maintenance.
28.02	Describe the purpose of preventive-maintenance schedules.
28.03	Create a preventive-maintenance schedule form using a machine manual or the manufacturer recommendations.
28.04	Identify troubles caused by the lack of preventive maintenance.
28.05	Create a maintenance log and make entries for a machine or equipment.
28.06	Create a preventive-maintenance schedule from a maintenance-failures log.
29.0	Maintain and repair hydraulic-system components. The student will be able to:
29.01	Explain the safety procedures for installing hydraulic lines.
29.02	Explain how heat and pressure relate to power and transmission.
29.03	Describe the physical and chemical properties of a fluid.
29.04	Install and maintain a contaminant-removal system.
29.05	Determine reservoir requirements.
29.06	Classify and select pumps for specific applications.
29.07	Compute hose requirements.
29.08	Select and install control valves.
30.0	Troubleshoot hydraulic systems. The student will be able to:

	30.01 Explain the safety procedures for troubleshooting hydraulic systems.
	30.02 Read a hydraulic schematic.
	30.03 Install hydraulic components.
	30.04 Explain hydraulic system troubleshooting techniques.
	30.05 Repair and replace valves.
	30.06 Repair and replace cylinders.
	30.07 Repair and replace pumps and motors.
31.0	Maintain and troubleshoot robotic systems. The student will be able to:
	31.01 Identify uses of robotics in industry.
	31.02 Identify safety procedures related to robotic systems.
	31.03 Identify mechanical, hydraulic, pneumatic, and electric/electronic components of robotic systems.
32.0	Demonstrate an understanding of employability skills and career opportunities. The student will be able to:
	32.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
	32.02 Discuss motivation and human behavior.
	32.03 Demonstrate knowledge of ways to improve reading, listening and writing skills.
	32.04 Provide effective feedback and make suggestions.
	32.05 Demonstrate knowledge of roles and responsibilities of team members.
	32.06 Effectively communicate production and process information to internal and external customers.
	32.07 Develop personal career plan that includes goals, objectives, and strategies.
	32.08 Examine licensing, certification, and industry credentialing requirements.
	32.09 Evaluate and compare employment opportunities that match career goals.
	32.10 Identify and exhibit traits for retaining employment.
	32.11 Identify opportunities and research requirements for career advancement.
	32.12 Research the benefits of ongoing professional development.

Course Description: The Millwright course is designed to build on the skills and knowledge students learned in the Industrial Machinery Maintenance Assistant, Machinery Maintenance Technician, and Machinery Maintenance Mechanic courses for entry into the Millwright industry.

Students explore career opportunities and requirements of a professional millwright. Students study metal fabrication, precision layout, advanced rigging, and installation, alignment, and removal of machinery.

Course Number: ETI0459 Occupational Completion Point: C Millwright – 450 Hours	
33.0	Perform metal fabrication. The student will be able to:
33.01	Field sketch equipment supports for applications in the millwright industry.
33.02	Read and interpret requirements in an OSHA 1910.211-219 and ANSI B15.1.
33.03	Create, design, draw, fabricate, and paint an OSHA-approved guard.
33.04	Use a Cut-A-Matic to make precision cuts.
34.0	Perform precision layout. The student will be able to:
34.01	Locate an existing benchmark and transfer it to various positions around a work area or site.
34.02	Use the triangle procedure to check established benchmarks with an optical level and a transit.
34.03	Identify and establish centerlines of equipment related to building columns.
35.0	Perform advanced rigging. The student will be able to:
35.01	Perform and interpret all rigging hand signals.
35.02	Interpret and apply load charts for slings, chokers, and cables.
35.03	Determine the weight of a load.
35.04	Determine the method of lifting.
35.05	Identify crane capacity, including the boom angle and load-swing radius.
35.06	Identify and take the necessary precautions to accommodate weather conditions, load capacity, equipment, and safety factors.
35.07	Balance different types of loads.
36.0	Install, remove, and align machinery. The student will be able to:
36.01	Identify the equipment required for machine installation and removal in millwright applications.
36.02	Operate levers, inclined planes, screws, wedges, wheel and axle assemblies, pulleys, and jacking screws.
36.03	Perform site-clearance operations and demolition and salvage procedures.
36.04	Explain the principles of machine alignment.
36.05	Explain the principles of shaft alignment.

36.06	Explain the relationship of structural problems to misalignment.
36.07	Explain the use of thermal growth by calculation and field-growth techniques such as Essinger bars.
36.08	Align machinery using wire line, transit, dial indicators, a computer, and laser-alignment devices.
36.09	Perform laser horizontal and vertical alignment.
36.10	Perform the train alignment of three or more machines and graph the results.
36.11	Prepare an area for machine installation according to the manufacturer’s specifications for selected applications.
36.12	Position and secure machinery on a foundation.
36.13	Level machinery and install balance-vibration dampeners.
36.14	Identify pipe-stress standards for millwright applications.
36.15	Perform finish alignment and check for pipe stresses in millwright applications.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Advanced Manufacturing and Production Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J100200	
CIP Number	0615040606	
Grade Level	30, 31	
Program Length	600 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in Advanced Manufacturing and Production positions.

The content includes but is not limited to providing students with a foundation of knowledge and technically oriented experiences in the study of automation technology, its application in manufacturing, engineering and robotics, and its effect upon our lives and the choosing of an occupation. The content and activities will also include the study of enterprise systems, safety, quality, and leadership skills. This program focuses on transferable skills and stresses understanding and demonstration of the technological tools, machines, instruments, materials, processes and systems in business and industry.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0400	Entry-Level Production Worker	AUTO PROD 7G ELECTRONIC @7 7G ENG 7G TECH ED 1 @2 ENG&TEC ED1@2	150 hours
B	ETI0431	Production Quality and Assurance		150 hours
C	ETI0432	Manufacturing and Production Processes		150 hours
D	ETI0453	Manufacturing and Production Maintenance		150 hours

National Standards

Industry or National Standards to the corresponding standards and/or benchmarks for the Automation and Production Systems Technology program can be found using the following link: http://www.msscusa.org

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of technology.
02.0 Demonstrate an understanding of Design for Manufacturing (DFM).
03.0 Demonstrate an understanding of workplace safety and workplace organization.
04.0 Demonstrate an understanding of workplace communication skills and teamwork.
05.0 Demonstrate an understanding of basic machine tools.
06.0 Demonstrate the ability to read and interpret blueprints and schematics.
07.0 Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings.
08.0 Demonstrate proficiently in the use of quality assurance methods and quality control concepts.
09.0 Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods.
10.0 Demonstrate an understanding of modern business practices and enterprise systems.
11.0 Demonstrate an understanding of and be able to select production processes.
12.0 Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control.
13.0 Demonstrate the ability to properly identify, organize, plan, allocate resources, document, and produce a mass-produced product via a master project.
14.0 Demonstrate an understanding of industrial tools and processes inclusive of: Manual Milling (Optional), CNC machines, and Welding (Optional).
15.0 Demonstrate proficiency in computer control and robotics.
16.0 Demonstrate an understanding of mechanisms.
17.0 Demonstrate a fundamental understanding of AC/DC electrical and electrical control.
18.0 Demonstrate a fundamental understanding of Programmable Logic Control.
19.0 Demonstrate an understanding of fluid power.
20.0 Demonstrate the abilities to use and maintain technological products and systems.
21.0 Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies.

Florida Department of Education
Student Performance Standards

Program Title: **Advanced Manufacturing and Production Technology**
Career Certificate Program Number: **J100200**

Course Description: The Entry-Level Production Worker course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students gain an understanding of technology and the concept of Design for Manufacturing, study workplace safety and workplace organization, workplace communication skills, and basic machine operation.

Course Number: ETI0400 **Occupational Completion Point: A** **Entry-Level Production Worker – 150 Hours**	
01.0	Demonstrate an understanding of technology. The student will be able to:
01.01	Define and understand the concept of “Technology”.
01.02	Explain “Technological Literacy” and what it means to be “Technologically Literate”.
01.03	Classify the resources of technology.
01.04	Illustrate the nature and development of technological knowledge and processes.
01.05	Identify and describe technological systems. (e.g., open-loop, closed-loop, system, subsystem)
01.06	Compare and contrast current and past technological systems.
01.07	Identify and give examples of criteria and constraints applied to a product or system.
01.08	Identify and give examples of optimization and trade-offs.
01.09	Apply systems thinking logic and creativity with appropriate compromises.
01.10	Define management systems applicable to process planning, organizing and controlling work.
01.11	Assess and evaluate technological systems embedded within larger technological, social and environmental systems.
01.12	Explain technological innovation results when ideas, knowledge or skills are shared within a technology, among technologies, and across other industries.
01.13	Identify and discuss ethical considerations important in the development, selection and use of technologies.
01.14	Assess how the evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.
01.15	Select technologies to conserve water, soil, and energy through such techniques as reusing, reducing and recycling.
02.0	Demonstrate an understanding of Design for Manufacturing (DFM). The student will be able to:

	02.01	Describe and apply the engineering and design process.
	02.02	Identify design principles to include, but not limited to, Design for Manufacturing (DFM) used to evaluate existing designs, to collect data, and to guide the design process.
	02.03	Apply the engineering design process to construct a prototype or a working model used to test a design concept by making actual observations and necessary adjustments.
	02.04	Analyze competing requirements of a design.
	02.05	Evaluate a design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.
	02.06	Describe the influence of personal characteristics, such as creativity, resourcefulness and the ability to visualize and think abstractly on the Engineering Design process.
	02.07	Create and populate a graph or table identifying how the fields of science, technology, engineering and mathematics apply to a manufactured product.
	02.08	Utilize a multidisciplinary approach to solving technological problems.
03.0	Demonstrate an understanding of workplace safety and workplace organization. The student will be able to:	
	03.01	Wear appropriate Personal Protective Equipment (PPE).
	03.02	Follow appropriate safety procedures.
	03.03	Follow applicable safety and environmental laws and regulations.
	03.04	Maintain a clean and safe work environment.
	03.05	Maintain personal protection equipment.
	03.06	Report unsafe conditions and practices.
	03.07	Locate emergency equipment, exits and alarms.
	03.08	Comply with established safety practices.
	03.09	Explain appropriate fire extinguishing procedures.
	03.10	Explain when a machine or a process should be stopped to investigate an unsafe condition.
	03.11	Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
	03.12	Demonstrate knowledge of government and company procedures, rules and regulations concerning incident investigations.
	03.13	Use and evaluate information resources such as SDS (Safety Data Sheets).
	03.14	Describe safe identification, handling, monitoring, and measurement of hazardous materials.
	03.15	Use appropriate electrical and mechanical safety procedures.
	03.16	Selecting and use personal protective equipment (PPE).

	03.17 Explain Lock Out/Tag Out requirements and procedures.
	03.18 Explain the safety benefits of a 6S work environment.
	03.19 Demonstrate knowledge of ergonomic impact of work techniques.
	03.20 Describe the Federal Law as recorded in (29 CFR-1910.1200).
04.0	Demonstrate an understanding of workplace communication skills and teamwork. The student will be able to:
	04.01 Write logical and understandable statements, or phrases, to accurately complete forms commonly used in business and industry.
	04.02 Demonstrate an understanding of appropriate use of productivity tools. (e.g., software, computers, networks, etc.)
	04.03 Read and understand graphs, charts, diagrams and common table formats.
	04.04 Read and follow written instructions.
	04.05 Demonstrate knowledge of technical language and technical acronyms.
	04.06 Demonstrate an understanding of and ability to follow oral instructions.
	04.07 Answer and ask questions coherently and concisely.
	04.08 Read critically to identify oversights and assumptions.
	04.09 Interact with co-workers using communication tools appropriately.
	04.10 Create and deliver a short presentation using a presentation application.
	04.11 Explain the benefits of teamwork.
	04.12 Define member roles of a high-performance team.
	04.13 Compare and contrast various types of teams.
	04.14 Select and analyze the stages of teambuilding.
	04.15 Develop and participate in teambuilding exercises.
	04.16 Explain the importance of setting goals both personally and as a team.
	04.17 Understand the importance of building consensus.
	04.18 Formulate a process for building consensus.
	04.19 Understand the value of resolving conflict.
	04.20 Develop a plan for resolving conflict within a team.
05.0	Demonstrate an understanding of basic machine tools. The student will be able to:
Simple Machines	

05.01	Define simple machine.
05.02	Understand and construct a wheel and axle.
05.03	Understand and construct a pulley system.
05.04	Understand and construct the three classes of levers.
05.05	Understand and construct an inclined plane.
05.06	Understand and construct a wedge.
05.07	Understand and construct a screw.
Hand Tools	
05.08	Use a bench vise to hold material for a benchwork operation.
05.09	Change a blade on a hacksaw.
05.10	Cut a piece of stock to length using a hacksaw.
05.11	Stamp letters in a part using a letter/number stamp set.
05.12	Deburr a part using a file.
05.13	Clean and store a file.
05.14	Chamfer a part using a file.
05.15	Square the ends of a part using a file.
05.16	Identify three common metal stock shapes: sheet, flat, round.
Band Saw Operation	
05.17	Select stock size and type (sheet, flat, round) given a part drawing and prepare for cutting.
05.18	Use a horizontal band saw to cut stock to a specified length.
05.19	Use a vertical band saw to cut stock to a specified length.
Drill Press Operation	
05.20	Create layout lines on stock (examples: sheet, flat and round).
05.21	Use the prick punch, center punch, and ball-peen hammer to prepare holes for drilling.
05.22	Determine the size of a drill.
05.23	Select and change the spindle speeds of a floor drill press.
05.24	Install a twist drill into a drill chuck.

05.25	Mount a workpiece in a drill press vise.
05.26	Drill holes using cutting fluid.
05.27	Select a drill and drill a hole for reaming.
05.28	Select a reamer and ream a hole.
05.29	Drill a pilot hole to prepare a hole for countersinking.
05.30	Select a countersink and countersink a hole.
05.31	Drill the pilot hole for the counterboring operation.
05.32	Select a counterbore and counterbore a hole.
05.33	Select drill size and drill the holes for the tapping operation.
05.34	Use a countersink to chamfer a hole.
05.35	Select a tap and thread a hole using a tap and a tap wrench.

Course Description: The Production Quality and Assurance course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students study how to accurately read and interpret blueprints and schematics; graphic design and computer-aided drawing; quality assurance methods and quality control concepts; use of precision measurement tools and instruments; and understanding modern business practices.

Course Number: ETI0431 Occupational Completion Point: B Production Quality and Assurance – 150 Hours	
06.0	Demonstrate the ability to read and accurately interpret blueprints and schematics. The student will be able to:
06.01	Define basic blueprint terminology used in manufacturing.
06.02	Differentiate between dimensions of location and size.
06.03	Interpret Linear, Circular, and Angular dimension features on a print.
06.04	Identify general note symbols and their applications within a manufacturing environment.
06.05	Locate notes on a print using industry standards.
06.06	Interpret commonly used abbreviations and terminology used on prints in the manufacturing environment.
06.07	Determine tolerances associated with dimensions on a drawing.
06.08	Determine if a part dimension is within tolerance using conventional tolerancing.
06.09	Calculate the limits of a dimension given its tolerance.

06.10	Determine a dimension of an object given an undimensioned scaled drawing.
06.11	Identify types of lines within a drawing.
06.12	Interpret and understand information from a blueprint title block.
06.13	Check for revisions.
06.14	Recognize the changes through which the design has progressed from the original design.
06.15	Interpret the meaning of the revision block symbols and notations.
06.16	Identify orthographic views.
06.17	Recognize the three basic orthographic views which may be represented on a drawing; front, top, right side.
06.18	Construct an orthographic view.
06.19	Identify isometric views.
06.20	Interpret the isometric view on a drawing containing both orthographic and isometric views.
06.21	Identify positions of views: top, front, side, auxiliary, and section of an orthographic drawing.
06.22	Draw an actual part using orthographic principles.
06.23	Determine the scale of the view or section.
06.24	Calculate appropriate scale of view or section based on the title block information, physical scaling of view and standard drawing scale
06.25	Identify the size and type of fasteners used in an assembly drawing.
06.26	Produce a detailed blueprint from sketches.
07.0	Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings. The student will be able to:
07.01	Apply current industrial design software computer aided-drawing practices.
07.02	Apply standard dimensioning and tolerance rules.
07.03	Import and export various file types.
07.04	Use industrial design software to open and change the views of CAD drawings.
07.05	Use standard industrial design software commands in the editing of a drawing.
07.06	Use industrial design software to create a single view drawing.
07.07	Use industrial design software to create a multi-view drawing.
07.08	Use industrial design software to dimension a drawing.
07.09	Use industrial design software to create a full sectional view for an object.

	07.10	Use industrial design software to create a bent sectional view for an object.
	07.11	Use industrial design software to create an offset sectional view for an object.
	07.12	Use industrial design software to draw a thread representation.
	07.13	Create a custom 3D coordinate system orientation.
	07.14	Create a 3D object using 3D drawing commands.
	07.15	Open and change the view of a solid model.
08.0	Demonstrate proficiency in the use of quality assurance methods and quality control concepts. The student will be able to:	
	08.01	Demonstrate knowledge of quality systems. (e.g., Statistical Process Control (SPC), Six Sigma, Total Quality Management (TQM) and International Standards Organization (ISO) 9000)
	08.02	Select and use quality systems to identify problems and record quality issues.
	08.03	Demonstrate knowledge of statistics for making accurate decisions about quality data.
	08.04	Demonstrate knowledge of various statistical quality tools (e.g., histograms, Cpk, X bar and R charts and range).
	08.05	Create control charts (e.g., variables and attributes) using linear relationships and properties of parallel lines.
	08.06	Record and analyze quality issues in the production process using tools such as Root Cause Failure Analyses (RCFA).
	08.07	Use Pareto analysis to identify priorities for solving multiple sub–standard product problems.
	08.08	Demonstrate knowledge of performance indicators that can be readily understood by operators.
	08.09	Develop records on quality process which are maintained to appropriate standards.
	08.10	Chart outcomes of quality processes according to appropriate methods and standards.
	08.11	Demonstrate knowledge of the importance of accurate and precise data for quality process performance.
	08.12	Analyze quality process performance data to identify trends.
	08.13	Examine previous documentation on similar process issues to identify possible solutions.
	08.14	Recommend actions that are clear, concise and supported by data.
	08.15	Identify the circumstances for prompt corrective actions related to product quality.
	08.16	Implement closed-loop corrective action follow-up activities which include spot checks, quality documentation and an audit to optimize the outcomes of the corrective steps.
	08.17	Document product quality following corrective action and identify documentation and records transmittal required for customers.
	08.18	Determine disposition of sub-standard product.
	08.19	Identify follow-up activities that indicate that corrective action was taken.
	08.20	Describe and explain the concepts of Lean Manufacturing.

	08.21 Identify value stream mapping, just-in-time procedures, and techniques of continual improvement.
	08.22 Describe the changes necessary in implementing waste-free manufacturing (WFM) in a lean environment.
	08.23 Describe and explain supply chain management.
	08.24 Describe and explain the use of the 6S's, (sort, set in order, shine, standardize, sustain, safety).
09.0	Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods. The student will be able to:
	09.01 Use measurement tools appropriately.
	09.02 Maintain and store inspection tools appropriately.
	09.03 Determine accuracy and precision when using inspection tools, measuring equipment and procedures.
	09.04 Use and convert both U.S. measurement and Standard International (S.I.) metric systems.
	09.05 Demonstrate knowledge of inspection equipment, calibration standards, and requirements.
	09.06 Verify calibration of inspection equipment.
	09.07 Demonstrate knowledge of appropriate automated inspection systems.
	09.08 Use appropriate safety monitoring and testing equipment.
	09.09 Implement appropriate testing regimens.
	09.10 Use multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.
	09.11 Research measurement tools for non-mechanical systems and products. (e.g., pH, °Brix)
10.0	Demonstrate an understanding of modern business practices and enterprise systems. The student will be able to:
	10.01 Research economic statistics.
	10.02 Research commodity price data.
	10.03 Use a spreadsheet application to analyze economic data.
	10.04 Select materials and process for a product using cost as a factor.
	10.05 Interpret a Bill of Materials.
	10.06 Create a Bill of Materials for a product.
	10.07 Demonstrate knowledge of the alignment of a company's business objectives with production goals.
	10.08 Compare and contrast various business structures. (e.g., sole-proprietor, S-Corporation, Limited-Liability Corporation, C-Corporation, etc.)
	10.09 Identify the necessary personal characteristics of a successful entrepreneur.
	10.10 Identify the business leadership skills needed to operate a business efficiently and effectively.

10.11	Identify the key elements of a business plan and apply them in the creation of a business plan.
10.12	Identify and explain personal and organizational consequences of unethical or illegal behaviors in the workplace.
10.13	Interpret and explain written organizational policies and procedures.

Course Description: The Manufacturing and Production Processes course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students study how to select production processes; computer-aided manufacturing and flexible manufacturing planning; produce a product via a master project; manual milling machines, computer-numeric-control machines, and welding systems; and robotic systems used in manufacturing.

Course Number: ETI0432 Occupational Completion Point: C Manufacturing and Production Processes – 150 Hours	
11.0	Demonstrate an understanding of and be able to select production processes. The student will be able to:
11.01	Identify customer needs.
11.02	Determine available and needed resources for the production process.
11.03	Make job assignments and coordinate workflow.
11.04	Communicate production and material requirements to meet product specifications.
11.05	Establish set-up and operation procedures are available and up to date.
11.06	Read and interpret a production schedule and manufacturing work order.
11.07	Demonstrate knowledge of production processes, including flow and bottlenecks.
11.08	Document product and process compliance with customer requirements.
11.09	Compare and contrast various production processes. (e.g., push, pull, just-in-time, work cell, batch, etc.)
12.0	Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control. The student will be able to demonstrate:
12.01	Identify manufacturing process variables that must be controlled for quality and reliability.
12.02	Identify the process for making job assignments and coordinating workflow.
12.03	Identify and explain Enterprise Resource Planning (ERP) and Material Resource Planning (MRP).
12.04	Understand and predict lead-time required for a production plan.
12.05	Read and interpret bills of materials and routing sheets.
12.06	Identify methods of productivity measurement and improvement.
12.07	Apply principles and practice of various production processes such as just-in-time (JIT) inventory control in performing a physical

	inventory.
13.0	Demonstrate the ability to properly identify, organize, plan, allocate resources, document and produce a mass-produced product via a master project. The student will be able to:
13.01	Work in a team and use a multi-step design process to design a prototype.
13.02	Create a Design Portfolio documenting research and student development.
13.03	Create a Technology Sector Research Report.
13.04	Create an Industry Market Report.
13.05	Create a Bill of Material (BOM) for your solution.
13.06	Create and build a prototype using specified design constraints (time, expenses, materials, safety considerations, etc.).
13.07	Create and deliver a presentation to communicate project results.
14.0	Demonstrate an understanding of industrial tools and processes inclusive of: Manual Milling 9Optional), CNC Machines, and Welding Technology (Optional). The student will be able to:
Manual Milling Processes (Optional when manual mill is NOT available to students)	
14.01	Operate manual controls on a milling machine.
14.02	Use a milling machine micrometer collar to measure table movement.
14.03	Face a piece of stock to length.
14.04	Mill a step using the micrometer collars on the milling machine.
14.05	Mill a step on a part using layout lines.
14.06	Mill a slot to a specific depth.
14.07	Mill a part.
CNC Mill Programming and Operation	
14.08	Write and edit a CNC program that uses common industry accepted tasks.
14.09	Enter and edit a CNC mill program using a text editor.
14.10	Simulate and edit a CNC mill program.
14.11	Determine the size and cutting direction of an end mill.
14.12	Mount a tool in a CNC mill.
14.13	Operate a CNC Mill.
14.14	Determine CNC program coordinates based on a dimensioned part drawing.
14.15	Select tooling for a CNC operation.

14.16 Determine the spindle speed for various machining operations.
14.17 Determine the feed rate for a machining operation.
14.18 Locate the PRZ (Program Reference Zero) of a part in a CNC mill using an edge-finder.
14.19 Determine the tool offsets in a CNC mill.
14.20 Create a precision part using PRZ (Program Reference Zero) and tool offset measurements.
14.21 Convert coordinates between absolute and incremental positioning methods.
14.22 Interpret a CNC mill program that uses basic G- and M-Codes.
Welding (Optional when welding equipment is NOT available to students)
14.23 Identify a specified weld using a welding symbol.
14.24 Draw welding symbols.
14.25 Demonstrate an understanding of the steps necessary to create a project from a welding drawing.
14.26 Prepare metal for welding.
14.27 Demonstrate an understanding of weld quality analysis using various testing procedures. (i.e., dye penetrant, guided bend)
14.28 Design a welded project.
15.0 Demonstrate proficiency in computer control and robotics. The student will be able to:
Programmable Logic Controllers (PLC)
15.01 Demonstrate proficiently an understanding of Binary concepts.
15.02 Wire input and output devices to a PLC.
15.03 Open, download, monitor, run and stop a PLC processor file using PLC programming software.
15.04 View the status of Input and Output Data Tables.
15.05 Create, enter, save, and edit a PLC program using PLC programming software.
15.06 Generate and print out a ladder logic report using PLC software.
15.07 Design a PLC program to jog two motors.
15.08 Design a PLC program to control the start/stop of two motors.
15.09 Design a PLC program to interlock two motors.
15.10 Design a PLC program that uses a safety interlock to control the operation of a machine.
15.11 Design a reciprocating actuator sequence PLC program.

15.12 Design a continuous cycle clamp and drill sequence PLC program.
Basic Robot Operation
15.13 Power up and shut down servo robot.
15.14 Jog a servo robot and adjust the fast and slow jog speed settings.
15.15 Move parts using the manual jog function.
15.16 Home a servo robot.
15.17 Manually operate the gripper using the teach pendant.
15.18 Use a teach pendant to teach robot position points, test teach points and edit teach points.
15.19 Use a teach pendant to delete a program file.
15.20 Use a teach pendant to enter a servo robot program that uses standard commands.
15.21 Run a servo robot program using a teach pendant.
15.22 Stop a servo robot program using functions on a teach pendant.
15.23 Design a program to perform a basic material handling task.
15.24 Store and retrieve multiple programs in a robot controller.
15.25 Use PC software to enter and edit a robot program offline and online.
15.26 Use PC software to delete a program.
15.27 Use PC software to power up, jog, home, and power down a servo robot
15.28 Use PC software to run a servo robot program.
15.29 Connect digital input and output devices to a robot controller.
15.30 Use PC software to enter program commands that uses a manual operator station and will unload an automatic machine.
15.31 Design a robot program that performs a basic assembly task using linear motion.
15.32 Enter a robot program that uses the World Coordinate motion commands.
15.33 Design and enter a robot program that uses Tool Coordinate motion commands.
Application Development and Flexible Manufacturing Cells
15.34 Construct a flow chart given a general sequence of operations.
15.35 Connect a solenoid-operated pneumatic valve to the output of a robot and operate.
15.36 Design a robot program that will load and unload an automatic machine.

15.37 Teach points with a double-jointed robot arm using the full range of its work envelope.
15.38 Design a robot program that uses a robot's double-jointed design.
15.39 Design a robot program given a general description of the application.
15.40 Connect and configure a servo conveyor to a servo robot (optional when conveyor is available to students).
15.41 Design and run a robot program that uses a non-servo DC motor attached to a robot controller axis.
15.42 Design a robot program that uses a servo conveyor.
15.43 Design a robot program that uses a conveyor (optional when conveyor is available to students).
15.44 Design and enter a robot program that uses conditional commands.
15.45 Design a robot program that sorts parts.
15.46 Design and enter a robot program that uses subroutine commands.
15.47 Design a robot application using a subroutine.
15.48 Program a robot that uses a servo traverse axis.
15.49 Design and enter a robot program that uses a servo gripper.
15.50 Develop a robot-to-solid state I/O interface wiring diagram.
15.51 Interface a robot discrete I/O using a relay.
15.52 Design a robot program to control an FMS (Flexible Manufacturing System) workstation via discrete I/O.
15.53 Design a robot program that will unload two or more automatic machines.
15.54 Design a robot program that encompasses the skills, techniques and components in a flexible manufacturing system.
Production Control
15.55 Enter a robot program that uses an input command.
15.56 Enter a robot program that uses arithmetic and relational operators.
15.57 Design and enter a robot program that has loop commands.
15.58 Design a robot application using loop commands.
15.59 Design and enter a robot program that uses counter commands.
15.60 Design and enter a robot program that stops a production process if a quality standard is not met.
Quality Control
15.61 Document the current location of a robot in Cartesian coordinates.

15.62	Design and run a robot program that uses points stored in Cartesian coordinates.
15.63	Design and run a robot program to perform go no-go inspections.
15.64	Design and run a robot program that uses a variable name.
15.65	Design and run a robot program that uses a command that will output messages or the contents of variables from the robot controller to the computer screen.
15.66	Design and run a robot program to inspect parts by measuring them in its gripper.

Course Description: The Manufacturing and Production Maintenance course prepares students for entry into the advanced manufacturing industry. Content emphasizes beginning skills key to the success of working in the manufacturing industry. Students study mechanisms; AC/DC electrical control; programmable logic control; fluid power; maintenance of technological systems; and exploration of employability and career opportunities.

Course Number: ETI0453 Occupational Completion Point: D Manufacturing and Production Maintenance – 150 Hours	
16.0	Demonstrate an understanding of mechanisms. The student will be able to:
Levers and Linkages	
16.01	For the relation (m, w) calculate the weights (range) of objects given mass (domain) of objects.
16.02	Calculate the compression rate of a spring using Hooke's Law.
16.03	Use a spring scale to measure the weight of an object and the force on an object.
16.04	Calculate torque.
16.05	Calculate the moment caused by a force.
16.06	Calculate and measure the mechanical advantage of a first-class, second-class and third-class lever.
16.07	Calculate the coefficient of friction given application data.
16.08	Measure the force required to overcome friction in different applications.
16.09	Calculate and measure the mechanical advantage of an inclined plane
16.10	Connect and operate a slider crank linkage.
16.11	Connect and operate a double rocker linkage.
16.12	Connect and operate a crank rocker linkage.
16.13	Connect and operate a cam and cam follower.
16.14	Measure the velocity and dwell of a cam.

16.15 Connect and operate a turnbuckle.
Power Transmission Systems
16.16 Use a spirit level to determine orientation of a surface.
16.17 Select a fastener size and type for a motor mount and correct for a soft foot condition.
16.18 Level an electric motor.
16.19 Select a key size.
16.20 Measure the actual size of a key and key seat.
16.21 Assemble a hub to a shaft using a key fastener.
16.22 Use a digital tachometer to measure motor speed.
16.23 Use a prony brake to measure shaft torque.
16.24 Calculate rotary mechanical power.
16.25 Identify shaft size given a sample.
16.26 Install and adjust a pillow block antifriction bearing and shaft.
16.27 Install a flexible jaw coupling.
16.28 Align two shafts using a straight edge and feeler gage.
Pulley Systems and Gear Drives
16.29 Measure the mechanical advantage of a fixed pulley.
16.30 Measure the mechanical advantage of a movable pulley.
16.31 Calculate and measure the mechanical advantage of a pulley combination.
16.32 Connect and operate a gear drive system.
16.33 Calculate and measure the mechanical advantage of a gear drive.
V-belt Drives
16.34 Calculate pulley ratio.
16.35 Calculate the shaft speed and torque of a belt drive system.
16.36 Install and align a fractional HP V-belt drive with a finished bore.
16.37 Determine the belt deflection force for a given application.
16.38 Adjust belt tension using an adjustable mounting base.

16.39	Use a belt tension tester to measure belt tension.
Chain Drives	
16.40	Calculate sprocket ratio.
16.41	Calculate the shaft speed and torque of a chain drive system.
16.42	Install and align a roller chain drive system with adjustable centers.
16.43	Determine allowable chain sag for a given application.
16.44	Use a rule and a straight edge to measure chain sag.
16.45	Adjust chain sag to a specified amount using adjustable centers.
16.46	Install and remove a chain with a master link.
17.0	Demonstrate a fundamental understanding of AC/DC electrical and electrical control. The student will be able to:
17.01	Demonstrate knowledge of AC/DC theory.
17.02	Check electrical components for UL and CSA approval.
17.03	Understand how to use an AC tester to check for electricity.
17.04	Use appropriate grounding techniques.
17.05	Connect and operate a circuit with a load.
17.06	Use a Digital Multi-Meter (DMM) to properly measure voltage, current, resistance and continuity.
17.07	Solve circuit problems using appropriate units and notation.
17.08	Solve problems using Ohm’s Law.
17.09	Solve problems using Watt’s Law.
17.10	Solve problems involving series and parallel impedance in circuits.
17.11	Solve problems involving capacitance in circuits.
17.12	Test a capacitor with a DMM.
17.13	Measure the voltage across a charged capacitor.
17.14	Calculate the time to charge and discharge a capacitor.
17.15	Following specific safety instructions safely discharge a capacitor.
17.16	Solve problems involving inductance in circuits.
17.17	Operate a circuit using a fuse, test and replace a fuse.

17.18	Operate a circuit using a circuit breaker, test and reset a circuit breaker.
17.19	Connect and operate a relay in a circuit.
17.20	Solve problems involving combination circuits.
17.21	Connect and operate a basic rheostat.
17.22	Design, connect, and operate a voltage divider network.
17.23	Solve problems involving a transformer
17.24	Size, connect, and operate a transformer.
17.25	Troubleshoot a transformer.
17.26	Design a control transformer circuit to provide a given output voltage.
18.0	Demonstrate a fundamental understanding of Programmable Logic Control. The student will be able to:
18.01	Read and interpret the operation of a circuit given a ladder diagram.
18.02	Connect and operate a logic circuit given a ladder diagram.
18.03	Design a ladder diagram using one or more logic elements.
18.04	Design, connect, and operate a control circuit to operate a solenoid valve.
18.05	Read and interpret a basic ladder diagram with detached symbology.
18.06	Design, connect, and operate a relay to energize a fluid power solenoid.
18.07	Connect and operate a relay to perform a seal-in function.
18.08	Connect and operate an event sequencing circuit given a ladder diagram.
18.09	Design a logic circuit that uses a limit switch to sequence an event.
18.10	Connect and operate a single-cycle cylinder reciprocation circuit.
18.11	Connect and operate a continuous-cycle cylinder reciprocation circuit.
18.12	Design a continuous-cycle cylinder reciprocation circuit with a safety interlock.
18.13	Connect and operate a control circuit with a timer relay.
18.14	Connect and operate a control circuit to perform an unloaded start of a motor.
18.15	Design a control circuit to perform time-driven sequencing.
18.16	Connect and operate a dual-cylinder control circuit using two limit switches.
18.17	Design a continuous-cycle multiple-cylinder circuit.

18.18 Connect and operate a circuit having both automatic and manual modes of operation.
18.19 Connect and operate a control circuit to simulate a two-pushbutton jog circuit.
19.0 Demonstrate an understanding of fluid power. The student will be able to:
Pneumatic Circuits and Power Systems
19.01 Identify pneumatic symbols.
19.02 Read a pneumatic pressure gage and flow meter.
19.03 Calculate the extension force of a cylinder given its size and pressure.
19.04 Determine the pressure needed to create a known output force on an extending cylinder.
19.05 Measure the force output of an extending cylinder.
19.06 Calculate the retraction force of a cylinder given its size and pressure.
19.07 Convert between gage and absolute pressures.
19.08 Solve problems using Boyle's Law.
19.09 Convert air volumes at pressures to free air volumes.
19.10 Measure pressure drop (Delta P) across pneumatic components.
19.11 Connect equipment and perform basic pneumatic operations.
19.12 Connect a pneumatic circuit given a schematic.
19.13 Draw a pneumatic schematic from the actual circuit connections on a machine.
19.14 Design a multiple actuator pneumatic circuit.
19.15 Connect pneumatic speed control circuits.
19.16 Design speed control circuits.
19.17 Connect and operate pneumatic Directional Control Valve (DCV) applications.
19.18 Design a rapid traverse-slow feed pneumatic circuit.
19.19 Design a pneumatic circuit to sequence two cylinders.
19.20 Design a pneumatic circuit that uses an externally air piloted DCV.
Vacuum Systems
19.21 Convert between units of mercury and units of air pressure.
19.22 Connect and read a vacuum gage and manometer.

19.23	Convert between units of water column and units of water pressure.
19.24	Connect and operate a vacuum generator.
19.25	Calculate vacuum cup lift force.
19.26	Connect and operate a vacuum cup.
19.27	Design the vacuum cup portion of a handling rack.
Hydraulic Circuits and Power Systems	
19.28	Read a hydraulic pressure gage, flow meter and the liquid level and temperature in the reservoir.
19.29	Calculate the extension force of a cylinder given its size and pressure.
19.30	Measure the force output of an extending cylinder.
19.31	Calculate the retraction force of a cylinder given its size and pressure.
19.32	Measure the force output of a retracting cylinder.
19.33	Measure the pressure drop (Delta P) across a hydraulic component.
19.34	Convert between absolute pressure and gage hydraulic pressure.
19.35	Calculate the extend speed, retract speed, and cylinder stroke time of a hydraulic cylinder given its size and a flow rate.
19.36	Draw a hydraulic schematic from the actual circuit connections on a pictorial.
19.37	Draw a hydraulic circuit given a schematic.
19.38	Operate a hydraulic power unit.
19.39	Connect equipment and perform basic hydraulic operations.
19.40	Connect and operate hydraulic Directional Control Valve (DCV) applications.
19.41	Design and connect hydraulic speed control circuits.
19.42	Design and connect a multiple actuator hydraulic circuit, an independent speed control circuit and a two-speed actuator circuit.
20.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
Overall Maintenance Process	
20.01	Discuss preventive and predictive maintenance methods for manufacturing environments.
20.02	Demonstrate knowledge of principles of Total Productive Maintenance (TPM).
20.03	Recognize potential maintenance issues with basic production systems and determine when to inform maintenance personnel about issues.
20.04	Diagnose a system that is malfunctioning and use tools, materials, machines and knowledge to repair it.

20.05	Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
20.06	Operate systems so that they function in the way they were designed.
20.07	Use computers and calculators to access, retrieve, organize, process, maintain, interpret and evaluate data and information in order to communicate.
20.08	Develop and follow maintenance schedules.
20.09	Identify the most common causes of failure of equipment in order to diagnosis problem quickly.
20.10	Demonstrate knowledge of what different equipment alarms indicate.
20.11	Understand the procedure for making on-process adjustments during production.
20.12	Examine the concept of troubleshooting within basic manufacturing maintenance areas.
20.13	Identify equipment failures in manufacturing maintenance areas.
20.14	Describe root cause analysis methods.
20.15	Use materials management to know what is recyclable and what is not.
20.16	Use monitoring or diagnostic devices to find out when equipment is operating correctly.
20.17	Use appropriate maintenance tools to maintain machines.
Documentation of Maintenance	
20.18	Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.
20.19	Demonstrate knowledge of the procedures for logging repairs and work order requests.
20.20	Demonstrate knowledge of statistical method charts to ensure that equipment is producing a quality product.
20.21	Demonstrate knowledge of forms and procedures for correctly documenting processes (e.g., preventative maintenance forms).
20.22	Read diagrams, schematics, manuals, and specifications to understand how to repair equipment.
20.23	Document repairs, replacement parts, problems and corrective actions to maintain log to determine patterns of operation.
20.24	Review maintenance log/checklist to ensure that recommended preventative procedures are followed.
Specific Maintenance Operations	
20.25	Demonstrate knowledge of proper and safe functioning of mechanical power transmission equipment.
20.26	Demonstrate knowledge of lubrication procedures and requirements.
20.27	Demonstrate knowledge of the selection, design and safe functioning of belt, chain and roller chain drive equipment.
20.28	Demonstrate knowledge of fluid transport.
20.29	Identify standard types of industrial pumps and determine the causes and maintenance procedures for shaft seal failure, shaft

	misalignment and pump cavitations.
21.0	Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies. The student will be able to:
21.01	Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
21.02	Discuss motivation and human behavior.
21.03	Develop a personal stress management plan.
21.04	Demonstrate knowledge of ways to improve reading, listening and writing skills.
21.05	Demonstrate knowledge of techniques for making effective presentations to internal and external customers.
21.06	Provide effective feedback and make suggestions.
21.07	Demonstrate appropriate customer service skills and techniques.
21.08	Explain the characteristics of a high-performance team and how to assess team member personality types.
21.09	Engage in team activities such as a team icebreaker exercise, developing a team constitution, brainstorming session and reaching a decision by consensus.
21.10	Demonstrate knowledge of roles and responsibilities of production team members.
21.11	Align team goals (that are specific, documented, measurable and achievable) to customer and business production needs.
21.12	Communicate production and process information to team members.
21.13	Organize or participate on a high-performance team to construct and analyze a project.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as

instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Industrial Machinery and Controls Technician**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J100300	
CIP Number	0615040607	
Grade Level	30,31	
Program Length	1200 Hours	
Teacher Certification	Refer to the **Program Structure** section.	
CTSO	SkillsUSA	
SOC Code (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to limited to broad, transferable skills, stresses the understanding of all aspects of the computer numeric control as it relates to the machining industry, and demonstrates such elements of the industry as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 1200 clock hours.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0580	Industrial Machinery and Controls Assistant	Electronic 7G Electronic@7 Electrical 7G Electrical@7 Millwright 7G Auto Prod 7G	300 Hours
B	ETI0581	Industrial Machinery and Controls Associate	Electronic 7G Electronic@7 Electrical 7G Electrical@7 Millwright 7G Auto Prod 7G	300 Hours
C	ETI0582	Industrial Machinery and Controls Technician I	Electronic 7G Electronic@7 Electrical 7G Electrical@7 Millwright 7G Auto Prod 7G	300 Hours
D	ETI0583	Industrial Machinery and Controls Technician II	Electronic 7G Electronic@7 Electrical 7G Electrical@7 Millwright 7G Auto Prod 7G	300 Hours

National Standards (NS)

Programs identified as having Industry or National Standards have been cross walked with the corresponding standards and/or benchmarks. Industry or National Standards for the Industrial Machinery and Controls Technician program can be found using the following link: www.msscusa.org

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will have demonstrated mastery the following student learning outcomes:

01.0 Demonstrate an understanding of the importance of health, safety, and safety awareness in the workplace.
02.0 Identify, use, and maintain the hand tools and accessories used in the Industrial Machinery Control Field.
03.0 Demonstrate an understanding of basic electricity.
04.0 Apply mathematics knowledge Industrial Machinery Control Field.
05.0 Demonstrate an understanding of basic Direct-Current (DC), power sources electrical-circuit skills.
06.0 Demonstrate proficiency in soldering.
07.0 Identify, use, and maintain the power tools and accessories used in the Industrial Control field.
08.0 Demonstrate an understanding of Alternating Current (AC) and power sources.
09.0 Demonstrate knowledge of overcurrent protection and grounding.
10.0 Demonstrate the ability to read, interpret, relay logic drawings and schematics.
11.0 Demonstrate further understanding of electricity.
12.0 Demonstrate understanding of Alternating Current (AC) and Direct Current (DC) motors.
13.0 Demonstrate knowledge of a Three Phase Industrial Distribution system.
14.0 Demonstrate know of Three Phase Motor Control Circuits.
15.0 Demonstrate proficiency in electrical test equipment.
16.0 Demonstrate knowledge of discrete input and output devices.
17.0 Demonstrate an understanding of industry standard mechanical concepts and components.
18.0 Demonstrate a fundamental understanding of Programable Logic Controllers.
19.0 Demonstrate competency in motor drives.
20.0 Identify the components of industry standard pneumatic and hydraulic systems describe their functions from engineering drawings.
21.0 Demonstrate knowledge of analog input and output devices.
22.0 Demonstrate an understanding of workplace communication skills and teamwork Industrial Machinery Control Field.
23.0 Demonstrate an understanding of automatic control and process control systems.
24.0 Demonstrate Industrial Machinery Control Field maintenance techniques.
25.0 Demonstrate the basic knowledge of industrial and manufacturing processes and procedures.
26.0 Identify common Industry Standard troubleshooting techniques.
27.0 Demonstrate predictive, preventative, total productive maintenance techniques.

Florida Department of Education
Student Performance Standards

Program Title: **Industrial Machinery and Controls Technician**
Career Certificate Program Number: **J100300**

Course Description:
The Industrial Machinery and Controls Assistant course prepares students for entry into the Industrial Machinery and Control fields. Students will begin their journey with introduction into basic subjects that are necessary to be a successful Industrial Machinery and Controls Technician. The content will emphasize fundamental building blocks in health and safety awareness, hand and power tools, soldering, basic electricity AC and DC, grounding and bonding, basic control circuits, interpreting logic diagrams and mathematics.

Course Number: ETI0580 **Occupational Completion Point: A** **Industrial Machinery and Controls Assistant – 300 Hours**	
01.0	Demonstrate an Understanding of the importance of health, safety, and safety awareness in the workplace. The student will be able to:
01.01	Identify and practice shop site safety rules, requirements, and procedures.
01.02	Describe personal and jobsite safety rules and requirements.
01.03	Clean work area and maintain in a safe condition.
01.04	Select wear and maintain the proper Personal Protective equipment.
01.05	Explain the use of lockout, tagout, tryout electrical and mechanical apparatus.
01.06	Demonstrate knowledge of fire prevention practices and extinguishing procedures.
01.07	Uses SDS Sheets.
01.08	Complying with company safety and emergency procedures.
01.09	Demonstrate good work practices and identify the risks of failing to comply with safety rules and regulations.
01.10	Understand the role of the Occupational Safety and Health Administration (OSHA) in industry.
02.0	Identify, use, and maintain the hand tools and accessories used in the Industrial Machinery Control Field. The student will be able to:
02.01	Identify proper selection and the use of hand tools.
02.02	Demonstrate the use of a bench vise and holding material properly.
02.03	Determine screw and thread sizes.
02.04	Cut threads and chase threads using hand taps and dies.
02.05	Deburr parts and material using a file.

03.0	Demonstrate an understanding of basic electricity. The student will be able to:
	03.01 Describe sources of electricity and ways it's produced.
	03.02 Know the difference between conductors and insulators.
	03.03 Define energize and de-energize.
	03.04 Define voltage, current, resistance, and how it's applied to ohms law.
	03.05 Electrical hazards and effect on the body.
	03.06 Define the difference between AC and DC.
04.0	Apply mathematics knowledge Industrial Machinery Control Field. The student will be able to:
	04.01 Demonstrate a proficiency in arithmetic and algebra.
	04.02 Demonstrate a proficiency working with conversion formulas.
	04.03 Demonstrate a proficiency working with electrical formulas.
	04.04 Demonstrate a proficiency working with mechanical formulas.
	04.05 Demonstrate a proficiency working with fluid formulas.
05.0	Demonstrate an understanding of basic Direct-Current (DC), power sources and electrical-circuit skills. The student will be able to:
	05.01 Demonstrate how to check for proper polarity on DC source.
	05.02 Construct, analyze and explain switching on DC series circuits.
	05.03 Draw and label components in a DC series switching circuit
	05.04 Construct, Analyze and explain switching on DC parallel circuits.
	05.05 Construct, analyze and explain combination switching on DC circuits.
	05.06 Construct, analyze and explain relationships between voltage and current on DC series connected loads.
	05.07 Construct, analyze and explain relationships between voltage and current on DC parallel connected loads.
	05.08 Construct, analyze and explain relationships between voltage and current on DC combination connected loads.
06.0	Demonstrate proficiency in soldering. The student will be able to:
	06.01 Apply recognized industry accepted standard soldering techniques.
	06.02 Apply recognized industry accepted standard de-soldering techniques.
	06.03 Apply industry recognized standards for rework and repair.
07.0	Identify, use and maintain the power tools and accessories used in the Industrial Control field. The student will be able to:

	07.01 Demonstrate knowledge of hand and stationary operated power operated drills.
	07.02 Demonstrate knowledge of hand and stationary operated power operated saws.
	07.03 Demonstrate knowledge of hand and stationary operated power operated grinders.
08.0	Demonstrate an understanding of Alternating Current (AC) and power sources. The student will be able to:
	08.01 Explain basic Alternating Current (AC) theory.
	08.02 Demonstrate how to check for proper phasing on a single-phase AC Circuit.
	08.03 Construct, analyze and explain switching on AC series circuits.
	08.04 Draw and label components in an AC series switching circuit.
	08.05 Construct, analyze and explain switching on AC parallel circuits.
	08.06 Draw and label components in an AC parallel switching circuit.
	08.07 Construct, analyze and explain combination switching on AC circuits.
	08.08 Construct, analyze and explain relationships between voltage and current on AC series connected loads.
	08.09 Construct, analyze and explain relationships between voltage and current on AC parallel connected loads.
	08.10 Construct, analyze and explain relationships between voltage and current on AC combination connected loads.
09.0	Demonstrate knowledge of overcurrent protection and grounding. The student will be able to:
	09.01 Demonstrate an understanding of the concept of grounding and bonding, why it is essential to safety.
	09.02 Demonstrate an understanding of fault conditions: overcurrent, short circuit, and ground fault.
	09.03 Discuss the dangers, conditions of ARC Flash and ARC Blast.
	09.04 Operate a circuit using a circuit breaker, test and reset a circuit breaker.
	09.05 Operate a circuit using a fuse, test and replace a fuse.
10.0	Demonstrate the ability to read, interpret, relay logic drawings and schematics. The student will be able to:
	10.01 Define the operation of an electromechanical relay.
	10.02 Identify the types of industry standard relays and describe their applications.
	10.03 Interpret industry standard symbols on a ladder diagram.
	10.04 Make appropriate electrical combinations.
	10.05 Construct, analyze and troubleshoot industry standard relay logic circuits such as: (i.e., latching circuit, anti-plugging, E-Stop safety circuit, hand/off/auto relay circuit, remote/local/relay circuit, and timing control circuit).

Course Description:
The Industrial Machinery and Controls Associate course is designed to build on the skills and knowledge learned in the Industrial Machinery and Controls Assistant course. The students will learn the fundamentals of power formulas, transformers, three phase power, AC and DC motors, three phase control circuits, and the use of electrical test equipment that is commonly used in the industry.

Course Number: ETI0581 Occupational Completion Point: B Industrial Machinery and Controls Associate – 300 Hours	
11.0	Demonstrate further understanding of electricity. The student will be able to:
11.01	Demonstrate knowledge in applying Ohms law to power formulas.
11.02	Identify the physical and electrical characteristics of capacitors and inductors.
11.03	Follow specific safety instructions to discharge and test a capacitor with a DMM.
11.04	Explain the principles of electromagnetism, mutual induction, and transformer action.
11.05	Analyze the principles of transformers to AC circuits.
11.06	Trouble shoot a single-phase transformer.
11.07	Demonstrate knowledge of AC power equations.
12.0	Demonstrate understanding of Alternating Current (AC) and Direct Current (DC) motors. The student will be able to:
12.01	Demonstrate knowledge of Industry Standard DC Motors: Series, Shunt and Compound.
12.02	Demonstrate knowledge of Industry Standard Three Phase Motors: Squirrel Cage, Wound Rotor, Synchronous Duty.
12.03	Demonstrate the ability to connect three phase motor for low or high voltage operation.
12.04	Demonstrate the ability to check and change the rotation three phase motor.
12.05	Demonstrate the ability to troubleshoot common motor problems.
12.06	Demonstrate an understanding of a stepper motor.
12.07	Demonstrate an understanding of a servo motor.
12.08	Demonstrate an understanding of an inverter duty motor.
13.0	Demonstrate knowledge of a Three Phase Industrial Distribution System. The student will be able to:
13.01	Demonstrate the knowledge to use single line power distribution drawings.
13.02	Describe how three phase power is produced.
13.03	Demonstrate the ability to identify line to line, line to neutral, line to ground in industry low voltage applications.
13.04	Demonstrate the difference between wye and delta connections.

14.0	Demonstrate know of Three Phase Motor Control Circuits. The student will be able to:
14.01	Apply correct wiring methods to motor and motor control circuits.
14.02	Use schematics and drawings to install and troubleshoot motor controls.
14.03	Construct and trouble shoot full voltage three phase magnetic motor starter.
14.04	Construct and trouble shoot full voltage three phase magnetic reversing motor starter.
14.05	Construct and trouble shoot full voltage three phase magnetic reversing motor starter with an Emergency Stop circuit, short circuit, and overload protection.
14.06	Demonstrate the ability to troubleshoot between control and power circuits.
15.0	Demonstrate proficiency in electrical test equipment. The student will be able to:
15.01	Demonstrate the ability to use an analog meter
15.02	Demonstrate the ability to use a digital meter.
15.03	Demonstrate the ability to use an amp probe.
15.04	Demonstrate the ability to an amp in series with a circuit.
15.05	Demonstrate the ability to use a megohmmeter.
15.06	Demonstrate the ability to use an oscilloscope.
15.07	Use test equipment to troubleshoot a defective system.

Course Description:
The Industrial Machinery and Controls Technician I course is designed to build on the skills and knowledge learned in the Industrial Machinery and Controls Associate course. The course is designed to give students experience with industry standard items that the technician will encounter in the field. This course will provide training in discrete and analog input and output devices, mechanical concepts and components, fundamentals of Programmable Logic Controllers, fundamentals of motor drives, fundamentals of pneumatic and hydraulics, and communication and team building skills.

Course Number: ETI0582 Occupational Completion Point: C Industrial Machinery and Controls Technician I – 300 Hours	
16.0	Demonstrate knowledge of discrete input and output devices. The student will be able to:
16.01	Demonstrate the ability to install and troubleshoot industry standard discrete input devices (i.e., push buttons, limit switches, proximity switches, etc.).
16.02	Demonstrate the ability to install and troubleshoot industry standard discrete output devices (i.e., horns, buzzers, sirens, waring/strobe lights, etc.).
17.0	Demonstrate an understanding of industry standard mechanical concepts and components. The student will be able to:

	17.01 Explain the operation of wheel, axle, and pulley system.
	17.02 Explain the operation of levers.
	17.03 Explain the operation of an incline plane and wedge.
	17.04 Explain the operation of a screw.
	17.05 Explain the operation of a gear train and rack and pinion.
	17.06 Explain the operation of a clutch.
	17.07 Explain the operation of a cam and cam follower.
	17.08 Demonstrate an understanding of bearings and bushings.
	17.09 Demonstrate an understanding of couplings, belts, and chains.
	17.10 Determine shaft size from a sample.
	17.11 Measure the actual size of a key and keyway.
18.0	Demonstrate a fundamental understanding of Programmable Logic Controllers. The student will be able to:
	18.01 Define the major components of a PLC.
	18.02 Define discrete inputs and outputs.
	18.03 Define analog inputs and outputs.
	18.04 Identify various addressing schemes in a PLC.
	18.05 Interpret, Analyze components and their operation of a PLC ladder logic diagram.
	18.06 Wire input and output discrete devices to a PLC.
	18.07 Determine if a device is sinking or sourcing.
	18.08 Demonstrate knowledge in basic PLC interfacing and functions.
	18.09 Connecting a PLC to a PC.
	18.10 Open, download, monitor, run and stop a PLC processor file using PLC programming software.
19.0	Demonstrate competency in motor drives. The student will be able to:
	19.01 Identify the types of motor controls and describe their operations.
	19.02 Identify the major components of a DC Drive.
	19.03 Demonstrate knowledge of vary the speed of a DC Drive.
	19.04 Describe the industry standard types of braking in a DC Drive.

	19.05 Demonstrate troubleshooting knowledge on a DC Drive System.
	19.06 Demonstrate knowledge of an AC soft starter.
	19.07 Identify the major sections of a Variable Frequency Drive.
	19.08 Describe the industry standard types the of braking in an AC Drive.
	19.09 Demonstrate knowledge of programming Variable Frequency Drives.
	19.10 Demonstrate troubleshooting knowledge on a Variable Frequency Drive System.
20.0	Identify the components of industry standard pneumatic and hydraulic systems and describe their functions from engineering drawings. The student will be able to:
	20.01 Demonstrate proficiency in checking, cleaning, and maintaining pneumatic filters and regulators.
	20.02 Explain the industry standard pneumatic components such as: Flow controls, valves, and cylinders
	20.03 Demonstrate proficiency in explaining and adjusting pneumatic regulators.
	20.04 Demonstrate knowledge identifying industry standard ports and ways of pneumatic valves.
	20.05 Demonstrate proficiency installing, trouble shooting and replacing solenoid activated pneumatic valves.
	20.06 Demonstrate proficiency installing, troubleshooting, and replacing pneumatic cylinders.
	20.07 Demonstrate the proficiency in identifying, installing, and industry standard replacing pneumatic fittings, tubing, and hoses.
	20.08 Identify basic troubleshooting techniques for pneumatic systems.
	20.09 Demonstrate proficiency in checking, cleaning, and maintaining hydraulic filters and regulators.
	20.10 Explain the industry standard hydraulic components such as: flow controls, valves, and cylinders
	20.11 Explain why hydraulic fluids must kept clean for a system to function properly.
	20.12 Explain the function of a hydraulic pump and demonstrate proficiency on checking the amp draw on a hydraulic motor.
	20.13 Demonstrate proficiency and explain the function and adjusting hydraulic regulators
	20.14 Explain the function of hydraulic pressure relief valve and hydraulic pressure accumulator.
	20.15 Demonstrate the knowledge identifying industry standard ports and ways of hydraulic valves.
	20.16 Demonstrate proficiency installing, trouble shooting and replacing solenoid activated hydraulic valves.
	20.17 Demonstrate proficiency installing, troubleshooting, and replacing hydraulic cylinders.
	20.18 Demonstrate the proficiency in identifying, installing, replacing industry standard hydraulic fittings, tubing, and hoses.
	20.19 Identify basic troubleshooting techniques for hydraulic systems.
	20.20 Explain the advantage and disadvantage of pneumatic and hydraulic systems.

21.0	Demonstrate knowledge of analog input and output devices. The student will be able to:
21.01	Demonstrate the ability to install and troubleshoot industry standard Thermocouples (T/C).
21.02	Demonstrate the ability to install and troubleshoot industry standard Resistance Temperature Detectors (RTD).
21.03	Demonstrate the ability to install and troubleshoot industry standard level detectors.
21.04	Demonstrate the ability to install and troubleshoot industry standard pressure sensors.
21.05	Demonstrate the ability to install and troubleshoot industry standard weight load cell sensors.
21.06	Demonstrate the ability to install and troubleshoot industry standard flow sensors.
21.07	Demonstrate an understanding of linear actuators.
21.08	Demonstrate an understanding of rotary actuators.
21.09	Demonstrate an understanding of energy sources for actuators. Electrical, pneumatic, and hydraulic.
21.10	Demonstrate an understanding of industry standard signals to actuators: 4-20ma, 0-5 vdc, 0-10vdc.
22.0	Demonstrate an understanding of workplace communication skills and teamwork Industrial Machinery Control Field. The student will be able to:
22.01	Demonstrate proficiency in following written and verbal instructions.
22.02	Demonstrate proficiency in understanding charts, graphs, and diagrams.
22.03	Demonstrate knowledge in writing and asking coherent questions and statements.
22.04	Interpret and explain written organizational policies and procedures.
22.05	Identify and exhibit positive work behaviors needed to be employable and retain employment.
22.06	Explain why honesty and integrity are important personally and as team, and the consequences of unethical and illegal behavior.
22.07	Explain the benefits of team building participating team building events.
22.08	Explain the benefits of consensus building and conflict resolution.
22.09	Explain the benefits of ongoing professional development.

Course Description:
The Industrial Machinery and Controls Technician II course is designed to build on the skills and knowledge learned in the Industrial Machinery and Controls Technician I course. In the Industrial Machinery and Controls Technician II course the students will learn how the various components and controls are incorporated together to control industrial machinery. The students will study types of automated control, mechanical maintenance techniques, process control and procedures, troubleshooting techniques, and predictive, preventative, and total productive maintenance techniques.

Course Number: ETI0583 Occupational Completion Point: D Industrial Machinery and Controls Technician II – 300 Hours	
23.0	Demonstrate an understanding of automatic control and process control systems. The student will be able to:
23.01	Identify the purpose of Automatic Control Systems and process control elements.
23.02	Identify the measured and manipulated variables in control loop.
23.03	Identify industry standard controllers.
23.04	Demonstrate knowledge with On/Off control.
23.05	Demonstrate knowledge with Proportional control.
23.06	Demonstrate knowledge of PID- Proportional, Integer, Derivative.
23.07	Demonstrate knowledge of a Wheatstone Bridge as measuring device.
23.08	Demonstrate the ability to use signal injection to troubleshoot a process controller.
23.09	Demonstrate the ability to use signal injection to troubleshoot an actuator.
23.10	Demonstrate the ability to install and troubleshoot a current to pressure transducer.
24.0	Demonstrate Industrial Machinery Control Field maintenance techniques. The student will be able to:
24.01	Use Original Equipment Manufacturer (OEM) manuals, diagrams, and literature on how to repair equipment.
24.02	Demonstrate knowledge of lubrication procedures and requirements.
24.03	Assemble a hub to a shaft using a key fastener.
24.04	Install and remove a chain with a master link, adjust chain for proper sag.
24.05	Identify industry standard belts
24.06	Check alignment of motor pulley and driven pulley and adjust belt tension.
24.07	Perform shaft alignment on motor coupling system.
24.08	Remove, and replace a sprockets, gears and couplings.
24.09	Identify industry standard types of gears.
24.10	Demonstrate knowledge on gear backlash.
24.11	Remove, identify, and replace bearings.
24.12	Remove, identify, and replace seals.
24.13	Identify basic troubleshooting techniques for drive systems.

25.0	Demonstrate the basic knowledge of industrial and manufacturing processes and procedures. The student will be able to:
25.01	Demonstrate proficiently in PLC control applications, the student will construct, install, program, and troubleshoot projects. (i.e., PLC to control pneumatic operation of solenoids and cylinders, VFD to control motor speed of fan, etc.)
25.02	Describe the concept of Lean Manufacturing.
25.03	Describe the uses of the 6S's (sort, set in order, shine, standardize, sustain, safety)
26.0	Identify common Industry Standard troubleshooting techniques. The student will be able to:
26.01	Explain the importance of learning the process of the facility and establishing a damage control plan.
26.02	Demonstrate Analytical troubleshooting procedures (i.e., knowledge on problems, causes and actions, knowledge on specifying troubles, etc.).
26.03	Determine root cause analysis.
26.04	Demonstrate signal injection as a troubleshooting technique.
26.05	Demonstrate signal substitution as a troubleshooting technique.
26.06	Explain the use of problem statements and why questions.
26.07	Demonstrate an understanding on to prevent future occurrence of the problem
27.0	Demonstrate predictive, preventative, total productive maintenance techniques. The student will be able to:
27.01	Demonstrate knowledge of why maintenance strategies are crucial to a business.
27.02	Explain the benefit and types of preventative maintenance.
27.03	Demonstrate knowledge of Total Productive Maintenance.
27.04	Describe the benefits of Autonomous Maintenance.
27.05	Demonstrate knowledge of logging repairs and work order request.
27.06	Review maintenance logs and checklist to ensure correct maintenance tasks have been completed.
27.07	Explain the benefits of Computer Maintenance Management System (CMMS).
27.08	Demonstrate knowledge of knitting, color coding, threshold indicators.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Advanced Composites**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J100400	
CIP Number	0615061701	
Grade Level	30, 31	
Program Length	600 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communication (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Manufacturing career cluster.

The content includes but is not limited to general composites information, composite safety, math skills, print reading, quality assurance and inspection, FOD and compliance, measurement, composite processes, tooling, core, curing, bonding, and assembly.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of one occupational completion point.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0462	Composites Technician 1	Auto Prod 7G	300 hours
	ETI0463	Composites Technician 2		300 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will have demonstrated mastery the following student learning outcomes:

01.0 Demonstrate an understanding of composites.
02.0 Demonstrate an understanding of workplace safety and organization.
03.0 Demonstrate the ability to read and interpret prints and part drawings.
04.0 Understand the methodologies of quality assurance methods and quality control concepts.
05.0 Demonstrate an understanding of foreign object debris (FOD) and compliance.
06.0 Understand the importance and use of measurement tools, instruments, and testing devices.
07.0 Demonstrate learned processes of composite processes.
08.0 Demonstrate the learned principles of tooling and molds.
09.0 Demonstrate the ability to perform precision assembly.
10.0 Perform final inspection and compare part to specified standard.

Florida Department of Education
Student Performance Standards

Program Title: **Advanced Composites**
Career Certificate Program Number: **J100400**

Course Description: This program offers a series of courses that provide relevant and detailed content, along with applicable technical knowledge and skills needed to prepare for a career in the advanced composites manufacturing industry. This program will provide foundational knowledge and hands-on skills necessary, including an introduction to inspection and repair processes, proper conduct and procedures, understanding of basic design considerations and the use of common fabrication techniques for composite structures, knowledge of the applications of advanced composites in industry, and the career paths available.

Course Number: ETI0462 **Occupational Completion Point: A** **Composites Technician – 300 Hours**	
01.0	Demonstrate an understanding of composites. The student will be able to:
01.01	Compare and contrast the material properties of various matrix materials (resins), reinforcements (fabrics), and core materials.
01.02	Demonstrate knowledge of basic design considerations in working with these materials to create composite products.
01.03	Recognize and define composites and advanced composites and explain the advantages and disadvantages of composite materials and products.
01.04	Describe important milestones in the history of composite technologies and outline several typical applications of composite in various industries.
01.05	Explain the difference between open mold, closed mold, and prepeg layup techniques.
02.0	Demonstrate an understanding of workplace safety and organization. The student will be able to:
02.01	Explain the hazards and workplace precautions that need to be taken when working with hazardous chemicals and materials.
02.02	Safely select and prepare materials and molds to make basic composite parts.
02.03	Demonstrate knowledge of the elements of Lean Manufacturing.
02.04	Use safe practices while in a shop environment (including actions in an emergency, lifting, lock out tag out, etc.).
02.05	Interpret Safety Data Sheets (SDS).
02.06	Demonstrate ability to identify hazardous materials.
02.07	Use Personal Protective Equipment (PPE) appropriately.
02.08	Apply equipment specific safety knowledge in a shop environment.
02.09	Demonstrate safety precautions when dealing with chips, sharp objects, compressed gas, and hazardous chemicals.
02.10	Distinguish between functional and non-functional tools and equipment.

03.0	Demonstrate the ability to read and interpret prints and part drawings. The student will be able to:
03.01	Interpret prints to setup and execute projects.
03.02	Demonstrate knowledge of the different types of sketches, prints, and drawings used in industry.
03.03	Identify and use basic elements of drawings and prints.
03.04	Identify and use principles of tolerances and classes of fits.
03.05	Interpret, create, and manipulate sketches, isometric drawings, and orthographic drawings.
03.06	Interpret a 2-D drawing and render as a 3-D drawing and vice versa (Spatial Visualization).
04.0	Understand the methodologies of quality assurance and quality control concepts. The student will be able to:
04.01	Explain different non-destructive testing inspection (NDI) methods.
04.02	Employ destructive and non-destructive testing methods to evaluate the quality of a laminated part.
04.03	Describe the technology, benefits, and drawbacks of NDI test methods used to verify the quality of a composite laminate, and the proper applications of each.
05.0	Demonstrate an understanding of foreign object debris (FOD) and compliance. The student will be able to:
05.01	Recognize the importance of a clean room environment.
05.02	Demonstrate use of FOD control devices.
05.03	Demonstrate traceability and compliance using industry standard documentation.

Course Number: ETI0463 **Occupational Completion Point: A** **Composites Technician – 300 Hours**	
06.0	Understand the importance and use of measurement tools, instruments, and testing devices. The student will be able to:
06.01	Explain and define semi-precision and precision measurement.
06.02	Document, use and maintain semi-precision and precision measurement tools.
06.03	Choose the appropriate semi-precision and precision measurement tool for an assigned task.
06.04	Conduct measurements using semi-precision and precision measurement tools.
06.05	Apply measurement, basic math, geometry and trigonometry to solve problems typical in industrial manufacturing and repair environments.
07.0	Demonstrate learned processes of composite processes. The student will be able to:
07.01	Compare at least three composite molding technologies commonly found in the industry by discussing benefits, drawbacks, and the proper applications of each.

	07.02 Assemble basic vacuum bags for simple shapes using a standard layup schedule.
	07.03 Demonstrate the ability to perform a wet layup with a vacuum bag molding process according to industry standards.
	07.04 Perform a Vacuum Infusion Process.
	07.05 Demonstrate the ability to calculate or determine key fabrication parameters (i.e., Resin Content, fiber weight, Mix Ratio, cure time, cure temperature, consolidation pressure, and debulking).
	07.06 Perform core processing.
	07.07 Conduct curing a composite part using an oven.
	07.08 Perform adhesive bonded assembly and repair techniques with an emphasis on surface preparation and joint design.
08.0	Demonstrate the learned principles of tooling and molds. The student will be able to:
	08.01 Fabricate a viable composite mold according to Industry Standards from a supplied dimensional drawing.
	08.02 Analyze common fabrication techniques and the tooling required for each including the benefits, drawbacks, and design requirements.
	08.03 Explain how the Coefficient of Thermal Expansion (COE), Thermal Conductivity, Thermal Mass, and surface finish affect a mold's performance.
09.0	Demonstrate the ability to perform precision assembly. The student will be able to:
	09.01 Use a print to assemble a composite part.
	09.02 Perform common fastener assembly and repair techniques with an emphasis on joint design.
10.0	Perform final inspection and compare part to specified standard. The student will be able to:
	10.01 Conduct cosmetic inspection.
	10.02 Apply filler material to achieve specified part finish.
	10.03 Demonstrate the ability to perform composites repair.
	10.04 Perform part polishing and buffing.
	10.05 Determine the quality of a completed assembly based on industry specifications.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Electrical and Instrumentation Technology 1**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J110100	
CIP Number	0615040401	
Grade Level	30, 31	
Program Length	1000 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 11	Communications (Reading and Language Arts): 10

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, and the technical training to support professional personnel in the engineering, design, development and evaluation of electrical and instrument systems.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of three occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EEV0650	Electrician (Construction)	ELECTRONIC @7 7G TEC ELEC @7 7G	350 hours
B	EEV0652	Instrument Mechanic		350 hours
C	EEV0654	Electrician Maintenance		300 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate knowledge of National Electrical Codes (NEC).
02.0 Install and troubleshoot facility electrical circuits from service entrance to convenience outlets.
03.0 Demonstrate knowledge of using basic electrical drawings.
04.0 Demonstrate basic electrical construction skills.
05.0 Demonstrate understanding of DC power sources.
06.0 Demonstrate understanding of AC power sources.
07.0 Demonstrate knowledge of DC motors.
08.0 Demonstrate knowledge of AC motors.
09.0 Demonstrate knowledge of motor controls.
10.0 Demonstrate knowledge of transformers.
11.0 Demonstrate knowledge of over current protection and grounding.
12.0 Demonstrate knowledge of an industrial power distribution system.
13.0 Perform preventive and corrective maintenance on basic electrical power and control components.
14.0 Demonstrate knowledge of electrical test equipment.
15.0 Demonstrate knowledge of hydraulic and pneumatic systems.
16.0 Identify the basic principles and terminology of process control.
17.0 Identify the primary components of a process control system.
18.0 Demonstrate knowledge of using instrumentation drawings.
19.0 Demonstrate knowledge of using instrumentation test instruments.
20.0 Demonstrate knowledge of instrumentation installation techniques.
21.0 Demonstrate knowledge of programmable logic controllers (PLC).

Florida Department of Education
Student Performance Standards

Program Title: **Electrical and Instrumentation Technology 1**
Career Certificate Program Number: **J110100**

Course Description: The Electrician (Construction) course prepares students for entry into the Electrical and Instrumentation Technology industry. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Content emphasizes beginning skills key to the success of working in the Electrical and Instrumentation industry. Students study the National Electrical Code, installation and troubleshooting of facility wiring circuits, basic electrical drawings, electrical construction skills, DC and AC power systems, DC and AC motors, motor controls, transformers, over-current and grounding, industrial power distribution systems, preventative and corrective maintenance, electrical testing equipment, and hydraulic and pneumatic systems.

Course Number: EEV0650 **Occupational Completion Point: A** **Electrician (Construction) – 350 Hours**	
01.0	Demonstrate knowledge of the National Electrical Code (NEC). The student will be able to:
01.01	Relate the NEC to general wiring practices.
01.02	Relate the NEC to wire, conduit and box sizing.
01.03	Relate the NEC to outlets, lighting, appliances and building services.
01.04	Relate the NEC to services and service calculations.
01.05	Relate the NEC to grounding and bonding requirements.
01.06	Relate the NEC to over current protection.
01.07	Relate the NEC to motor circuit wiring.
01.08	Relate the NEC to transformers.
01.09	Relate the NEC to hazardous location wiring.
01.10	Relate the NEC to emergency and alternate power systems.
01.11	Relate the NEC to industrial electrical.
02.0	Install and troubleshoot facility wiring circuits from service entrance to convenience outlets. The student will be able to:
02.01	Demonstrate the knowledge power requirements, distribution, and construction considerations to meet the needs for a safe and functional electrical system for residential, commercial, or industrial facilities.
02.02	Determine the size of service entrance equipment, components and conductors.
02.03	Demonstrate proper methods to install service entrance, lighting circuits and equipment branch circuits.

	02.04 Demonstrate knowledge of NEC local codes, utility regulations, special ordinances and installation instructions.
	02.05 Demonstrate knowledge of optional electrical safety devices, special fixtures (explosion proof, waterproof), communications and alarm systems, timers and controllers.
	02.06 Demonstrate knowledge of the needs for, and the proper methods of facility grounding systems.
	02.07 Demonstrate the ability to troubleshoot faults in control and power circuits.
	02.08 Choose the correct test equipment to service electrical systems.
03.0	Demonstrate knowledge of using basic electrical drawings. The student will be able to:
	03.01 Demonstrate the knowledge to describe, identify and use electrical symbols and abbreviations.
	03.02 Demonstrate the knowledge to use floor plans, lighting layouts and building service drawings.
	03.03 Demonstrate the knowledge to use single line power distribution drawings.
	03.04 Demonstrate the knowledge to use elementary drawings.
	03.05 Demonstrate the knowledge to use process logic drawings.
	03.06 Demonstrate the knowledge to convert English system and metric system measurements.
	03.07 Demonstrate the knowledge to use measuring scales to take accurate system measurements.
	03.08 Demonstrate the knowledge to produce accurate electrical drawings.
	03.09 Demonstrate the knowledge to prepare an equipment and material list.
	03.10 Demonstrate the knowledge to troubleshoot using the different electrical diagrams and drawings.
04.0	Demonstrate basic electrical construction skills. The student will be able to:
	04.01 Use blueprints and associated documents to identify materials and equipment which will be needed to perform construction or maintenance task.
	04.02 Use the proper equipment to make correct and accurate bends in various types of electrical conduits.
	04.03 Use the proper equipment to thread electrical conduit.
	04.04 Make appropriate electrical terminations.
	04.05 Apply correct wiring methods to motors and motor control circuits.
	04.06 Apply correct wiring methods to transformers.
	04.07 Install non-metallic sheathed cable.
	04.08 Correctly install lighting fixtures and perform preventive and corrective maintenance.
	04.09 Correctly install switching and outlet devices.
	04.10 Correctly use power tools.

05.0	Demonstrate an understanding of DC power sources. The student will be able to:
05.01	Describe safe procedures for handling, storing, charging and installing storage batteries.
05.02	Describe electrical characteristics of lead-acid storage batteries, dry cell and NiCd.
05.03	Demonstrate knowledge of low voltage electronic power supplies.
05.04	Demonstrate knowledge of DC generator theory and construction for DC generators.
05.05	Perform troubleshooting and preventive maintenance on DC power sources.
06.0	Demonstrate and understanding of AC power sources. The student will be able to:
06.01	Calculate and explain power factor.
06.02	Calculate and explain power factor corrections.
06.03	Demonstrate knowledge of the theory and physical and electrical characteristics of three phase alternators.
06.04	Demonstrate knowledge of the theory and application for engine driven generating sets, including types of prime movers and transfer switches.
06.05	Demonstrate knowledge of paralleling, synchronizing, testing three phase alternators.
06.06	Demonstrate knowledge of selecting, troubleshooting, connecting and maintaining 3-phase alternators.
06.07	Demonstrate knowledge of uninterruptible power supplies (UPS).
07.0	Demonstrate knowledge of DC motors. The student will be able to:
07.01	Demonstrate knowledge of DC motor theory and construction including series, shunt and compound motors.
07.02	Demonstrate knowledge of DC motor torque effectively speed regulation, loading and starting.
07.03	Demonstrate knowledge of performing maintenance procedures for and installation of DC motors.
07.04	Demonstrate knowledge of correctly apply testing and monitoring equipment to DC motors and machines.
07.05	Select and apply DC motor controls.
08.0	Demonstrate knowledge of AC motors. The student will be able to:
08.01	Demonstrate knowledge of single-phase AC motors.
08.02	Demonstrate the ability to select connect and troubleshoot single phase AC motors.
08.03	Demonstrate knowledge of 3-phase AC motors.
08.04	Demonstrate the ability to select, connect, troubleshoot and maintain 3-phase AC motors.
08.05	Demonstrate the ability to correctly apply testing and monitoring equipment to AC 3-phase motors.
08.06	Select and apply AC motor controls.

	08.07 Disassemble and assemble a single-phase motor.
	08.08 Disassemble and assemble a 3-phase motor.
	08.09 Perform preventative maintenance for AC motors.
09.0	Demonstrate knowledge of motor controls. The student will be able to:
	09.01 Use schematics and drawings to troubleshoot electrical failures.
	09.02 Demonstrate knowledge of motor starters.
	09.03 Design, install, operate, and troubleshoot 2-wire control.
	09.04 Design, install, operate, and troubleshoot 3-wire control.
	09.05 Design, install, operate, and troubleshoot motor control circuits that use timers.
	09.06 Design, install, operate, and troubleshoot motor control circuits that use relays.
	09.07 Design, install, operate, and troubleshoot motor control circuits that use sequences.
	09.08 Demonstrate the ability to install and troubleshoot limit switches, proximity switches and other sensors in control circuits.
	09.09 Demonstrate knowledge of variable frequency drives (VFC's).
	09.10 Demonstrate knowledge of DC motor circuits.
10.0	Demonstrate knowledge of transformers. The student will be able to:
	10.01 Demonstrate knowledge of transformer theory and application.
	10.02 Demonstrate knowledge of single-phase transformer theory and application.
	10.03 Demonstrate knowledge of theory and application of a single-phase 3-wire secondary system.
	10.04 Demonstrate knowledge of theory and application for single-phase transformers connected in 3-phase systems.
	10.05 Apply testing and monitoring equipment to transformers and their associated circuits.
	10.06 Install transformers to primary service and main switch metering equipment and secondary switching.
	10.07 Install transformer over current protection.
11.0	Demonstrate knowledge of over current protection and grounding. The student will be able to:
	11.01 List and identify types, classes and ratings of fuses and circuit breakers.
	11.02 Describe operation of fuses and breakers.
	11.03 Install fuses and breakers.
	11.04 Select and apply branch-circuit protection for appliances.

	11.05 Select and apply branch-circuit and overload protection for motors.
	11.06 Relate the NEC to the selection and installation of over current protection devices.
	11.07 Explain the purpose of equipment grounding.
	11.08 Relate the NEC to the sizing and installation of grounding systems and conductors.
	11.09 Perform preventative maintenance on grounding systems.
12.0	Demonstrate knowledge of an industrial power distribution system. The student will be able to:
	12.01 Demonstrate knowledge of a utility generation and distribution system.
	12.02 Demonstrate knowledge of a typical industrial generation and distribution system.
	12.03 Demonstrate knowledge of co-generation applications.
	12.04 Demonstrate knowledge of protective relay applications.
	12.05 Demonstrate knowledge of amperage, voltage control and power factor control techniques.
	12.06 Demonstrate knowledge of breaker controls and computer load shed considerations.
	12.07 Demonstrate knowledge of high voltage, distribution equipment, ground fault protection methods.
	12.08 Demonstrate knowledge of safety procedures including identification of equipment used for testing high voltage.
	12.09 Demonstrate knowledge of pole line isolation switches.
	12.10 Demonstrate knowledge of current transformers (CT's) and potential transformers (PT's).
13.0	Perform preventative and corrective maintenance on basic electrical power and control components. The student will be able to:
	13.01 Use technical data and manuals to perform preventative maintenance.
	13.02 Demonstrate ability to select and apply appropriate tools and testing equipment.
	13.03 Perform corrective preventative maintenance and certify completion.
	13.04 Determine the need for corrective maintenance by applying troubleshooting and analysis techniques.
	13.05 Replace parts and calibrate or adjust as necessary to bring equipment, systems, components, or machines to specifications.
	13.06 Prepare forms and reports of preventive and corrective maintenance.
14.0	Demonstrate knowledge of electrical test equipment. The student will be able to:
	14.01 Demonstrate the ability to use an analog multi-meter.
	14.02 Demonstrate the ability to use a digital multi-meter.
	14.03 Demonstrate the ability to use a "wiggy" voltmeter.

	14.04 Demonstrate the ability to use a clamp-on ammeter.
	14.05 Demonstrate the ability to use a megohmmeter.
	14.06 Demonstrate the ability to use an oscilloscope.
	14.07 Demonstrate the ability to use a high voltage tester.
	14.08 Use test equipment to systematically troubleshoot a defective system.
15.0	Demonstrate knowledge of hydraulic and pneumatic systems. The student will be able to:
	15.01 Identify principles and practical applications of hydraulic and pneumatic power.
	15.02 Identify control valves in a hydraulic and pneumatic system.
	15.03 Identify pressure and safety relief valves and vacuum breakers.
	15.04 Identify cylinders and motors.
	15.05 Remove and replace hydraulic and pneumatic systems and components.
	15.06 Identify strainers and filters in hydraulic and pneumatic systems.
	15.07 Identify reservoirs and accumulators in hydraulic and pneumatic systems.
	15.08 Identify hydraulic and pneumatic pimps on a system.
	15.09 Identify piping, tubing, and fittings on a hydraulic pneumatic system.
	15.10 Identify system interfaces.
	15.11 Identify the procedures for pneumatic and hydraulic system maintenance.
	15.12 Locate control valve failures.
	15.13 Demonstrate knowledge of regulators, volume boosters, relays and repeaters.
	15.14 Identify the components to produce instrument air.
	15.15 Demonstrate knowledge of current-to-pressure and pressure-to-current transducers.

Course Description: The Instrumentation Mechanics course is designed to build on the skills and knowledge students learned in the Electrician (Construction) course for entry into the Electrical and Instrumentation Technology industry. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Content emphasizes beginning skills key to the success of working in the Electrical and Instrumentation industry. Students study basic principles, terminology, and components of process control, instrumentation drawings, testing equipment, and installation techniques.

Course Number: EEV0652 Occupational Completion Point: B Instrument Mechanics – 350 Hours	
16.0	Identify the basic principles and terminology of process control. The student will be able to:
16.01	Identify the purpose of automatic control systems.
16.02	Identify the elements of process control.
16.03	Identify measured and manipulated variables in a control loop.
16.04	Demonstrate knowledge of proportional control.
16.05	Demonstrate knowledge of on/off control.
16.06	Determine the effects of gain, reset and derivative in a proportional control scheme.
16.07	Demonstrate knowledge of the basic laws of physics pertaining to instrumentation.
16.08	Demonstrate knowledge of the terminology associated with instrumentation and process control.
17.0	Identify the primary components of a process control system. The student will be able to:
17.01	Identify primary control elements in process loops.
17.02	Identify final control elements in process loops.
17.03	Identify electronic, pneumatic, and digital transmitters in process loops.
17.04	Identify controllers in process loops.
17.05	Identify control loop applications (level, flow, temp, pressure, or analytical).
17.06	Define the static and dynamic characteristics of instruments.
17.07	Demonstrate knowledge necessary to interface individual process loops into microprocessor-based control schemes.
18.0	Demonstrate knowledge of using instrumentation drawings. The student will be able to:
18.01	Demonstrate ability to use loop sheets.
18.02	Demonstrate ability to use flow sheets/P&IDs.
18.03	Demonstrate ability to use process logic diagrams.
18.04	Demonstrate ability to use installation drawings.
18.05	Demonstrate ability to use building layout or location drawings.
18.06	Troubleshoot using drawings.
18.07	Identify process safety devices and explain their purpose.

19.0	Demonstrate knowledge of using instrumentation test instruments. The student will be able to:
19.01	Operate basic hydraulic measuring instruments.
19.02	Operate dead weight testers.
19.03	Operate manometers.
19.04	Operate basic pneumatic measuring instruments.
19.05	Operate vacuum pumps.
19.06	Operate pressure and vacuum gauges.
19.07	Operate basic thermal measuring instruments.
19.08	Operate temperature baths.
19.09	Operate electronic calibration instruments.
19.10	Operate thermometers.
19.11	Calibrate instruments using test instruments.
19.12	Operate instrument standards.
20.0	Demonstrate knowledge of instrumentation installation techniques. The student will be able to:
20.01	Apply proper OSHA safety standards.
20.02	Make electrical connections for instrument equipment.
20.03	Identify and use hand tools properly.
20.04	Identify and use power tools properly.
20.05	Demonstrate acceptable tubing bending and installation techniques.
20.06	Identify the proper method for instrument wire installation in a cable tray.
20.07	Demonstrate the ability to properly install various instrumentation devices.
20.08	Demonstrate knowledge of “clean design” for instrument installations.

Course Description: The Electrician Maintenance course is designed to build on the skills and knowledge students learned in the Instrumentation Mechanics course for entry into the Electrical and Instrumentation Technology industry. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Content emphasizes beginning skills key to the success of working in the Electrical and Instrumentation industry. Students study programmable logic controllers (PLC).

Course Number: EEV0654 **Occupational Completion Point: C** **Electrician Maintenance – 300 Hours**	
21.0	Demonstrate knowledge of programmable logic controllers (PLC). The student will be able to:
21.01	Demonstrate knowledge of the terminology and operating components of PLC systems.
21.02	Demonstrate knowledge of the addressing schemes used in various PLC systems.
21.03	Understand and use ladder logic for various PLC systems.
21.04	Program basic relay logic in ladder logic.
21.05	Program timers and counters in ladder logic.
21.06	Program shift registers and other data manipulation routines.
21.07	Program for message displays and other output devices.
21.08	Interface PLS's to perform communications.
21.09	Load and save files on storage media.
21.10	Prepare and update documentation.
21.11	Perform local/remote interfacing.
21.12	Troubleshoot defective PLC systems.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Electrical and Instrumentation Technology 2**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J110200	
CIP Number	0615040402	
Grade Level	30, 31	
Program Length	800 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 11	Communications (Reading and Language Arts): 10

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, and the technical training to support professional personnel in the engineering, design, development and evaluation of electrical and instrument systems.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

The standard length of this program is 800 hours. **Electrical and Instrumentation Technology 1** is a core program. It is recommended that students complete **Electrical and Instrumentation Technology 1** or demonstrate mastery of the outcomes in that program prior to enrollment in **Electrical and Instrumentation Technology 2.**

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EEV0656	Instrument Technician	ELECTRONIC @7 7G TEC ELEC @7 7G	400 hours
B	EEV0658	Operating Engineer Assistant Stationary		400 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate knowledge of operating, troubleshooting and maintaining distributed control systems (DCS).
02.0 Demonstrate knowledge of operating, troubleshooting and maintaining level measurement and control devices.
03.0 Demonstrate knowledge of operating, troubleshooting and maintaining pressure measurement and control devices.
04.0 Demonstrate knowledge of operating, troubleshooting and maintaining temperature measurement and control devices.
05.0 Demonstrate knowledge of operating, troubleshooting and maintaining flow measurement and control devices.
06.0 Demonstrate knowledge of operating, troubleshooting and maintaining physical property measurement and control devices.
07.0 Demonstrate knowledge of operating, troubleshooting and maintaining chemical property measurement and control devices.
08.0 Demonstrate process operation skills.
09.0 Demonstrate knowledge of technical reporting.

Florida Department of Education
Student Performance Standards

Program Title: **Electrical and Instrumentation Technology 2**
Career Certificate Program Number: **J110200**

Course Description: The Instrument Technician course is designed to build on the skills and knowledge students learned in the Electrician Maintenance course for entry into the Electrical and Instrumentation Technology industry. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Content emphasizes beginning skills key to the success of working in the Electrical and Instrumentation industry. Students study distributed control systems (DCS); level, pressure, temperature, flow, physical property, and chemical property measurement and control devices.

Course Number: EEV0656 **Occupational Completion Point: A** **Instrument Technician – 400 Hours**	
01.0	Demonstrate knowledge of operating, troubleshooting and maintaining distributed control systems (DCS). The student will be able to:
01.01	Describe the principles and purpose of a DCS system.
01.02	Describe the architecture and components of a DCS system.
01.03	Configure control points on a DCS system.
01.04	Perform data storage routines on a DCS system.
01.05	Print graphs of control point responses from a DCS system.
01.06	Perform data communications through PLC or discrete input/output interface units.
01.07	Perform preventive maintenance and calibrate on DCS system devices.
01.08	Troubleshoot and repair faults in DCS systems.
02.0	Demonstrate knowledge of operating, troubleshooting and maintaining level measurement and control device. The student will be able to:
02.01	Demonstrate knowledge of the terminology, physics, methods and principles of level measurement and control.
02.02	Identify level measurement purpose and requirements.
02.03	Identify level measurement instruments.
02.04	Identify solid level measuring systems.
02.05	Identify instrument calibration standards.
02.06	Identify safe standards, installation techniques and maintenance practices as applicable to level measurement.
02.07	Identify common causes of level measurement instrument and sensor failures.

	02.08 Troubleshoot and repair level measurement and control system failures.
	02.09 Identify ultrasonic level devices.
	02.10 Identify principles of operation for radiation type, level control devices.
	02.11 Determine correct applications for direct level measurement devices: floats, displacers, conductivity probes, etc.
	02.12 Determine correct applications for indirect level measurement devices: hydraulic pressure, bubble tubes, radioactive emitters and detectors, etc.
	02.13 Design and operate a level control loop.
	02.14 Calibrate level elements, transmitters and controllers.
	02.15 Demonstrate knowledge of final control elements and applications for level loops.
03.0	Demonstrate knowledge of operating, troubleshooting and maintaining pressure measurement and control devices. The student will be able to:
	03.01 Demonstrate knowledge of the terminology, physics, methods and principles of pressure measurement and control.
	03.02 Identify pressure measurement instruments.
	03.03 Identify pressure measurement purpose and requirements.
	03.04 Identify applications of vacuum/pressure measuring methods.
	03.05 Identify the elements of vacuum/pressure measurement systems.
	03.06 Identify safety standards, installation techniques and maintenance practices as applicable to vacuum/pressure measurement.
	03.07 Identify instrument calibration standards.
	03.08 Identify common vacuum/pressure, measuring instrument and sensor failures.
	03.09 Troubleshoot and repair vacuum/pressure measurement and control system failures.
	03.10 Demonstrate knowledge of elastic deformation elements.
	03.11 Design and operate pressure loop.
	03.12 Calibrate pressure elements, transmitters and controllers.
	03.13 Demonstrate knowledge of differential pressure elements, principles, and applications.
	03.14 Demonstrate knowledge of applications and requirements of vacuum breakers and pressure relief devices.
	03.15 Demonstrate knowledge of final control elements and applications for vacuum/pressure loops.
04.0	Demonstrate knowledge of operating, troubleshooting and maintaining temperature measurement and control devices. The student will be able to:
	04.01 Demonstrate knowledge of the terminology, physics, methods and principles of temperature measurement and control.

	04.02 Identify temperature measurement purpose and requirements.
	04.03 Identify temperature measurement instruments.
	04.04 Identify bimetallic and fluid-filled temperature measuring instruments.
	04.05 Identify thermocouple and RTD temperature measuring instruments.
	04.06 Identify and operate pyrometers and thermometers.
	04.07 Identify safety standards, installation techniques and maintenance practices as applicable to temperature measurement.
	04.08 Identify instrument calibration standards.
	04.09 Identify common temperature measuring instrument and sensor failures.
	04.10 Troubleshoot and repair temperature measurement and control system failure.
	04.11 Design and operate a temperature control loop.
	04.12 Calibrate temperature elements, transmitters and controllers.
	04.13 Demonstrate knowledge of final control elements and applications for temperature loops.
05.0	Demonstrate knowledge of operating, troubleshooting and maintaining flow measurement and control devices. The student will be able to:
	05.01 Demonstrate knowledge of the terminology, physics, methods and principles of fluid flow measurement and control.
	05.02 Identify flow measurement purpose and requirement.
	05.03 Identify secondary measurement devices for fluid flow.
	05.04 Identify applications for variable area instruments.
	05.05 Identify open channel flow devices.
	05.06 Identify applications for positive displacement metering.
	05.07 Identify flow displacement measurement methods.
	05.08 Identify applications for magnetic flow meters.
	05.09 Identify applications for ultrasonic flow metering methods.
	05.10 Identify safety standards, installation techniques and maintenance practices as applicable to flow measurement.
	05.11 Troubleshoot and repair flow measurement and control system failure.
	05.12 Demonstrate knowledge of Venturi tubes, flow nozzles, orifice plates and pilot tubes to measure flow.
	05.13 Demonstrate knowledge of mass flow measurement techniques.
	05.14 Demonstrate knowledge of final control elements and applications for flow loops.

	05.15 Calibrate flow elements, transmitters and controllers.
	05.16 Design and operate a flow control loop.
06.0	Demonstrate knowledge of operating, troubleshooting and maintaining physical property measurement and control devices. The student will be able to:
	06.01 Identify weight and mass measuring units.
	06.02 Identify methods for weighing materials in motion.
	06.03 Identify weight displacement measurement methods.
	06.04 Troubleshoot and repair weight instruments.
	06.05 Perform operating systems checks, preventative maintenance and make adjustments to weight measurement loops.
	06.06 Calibrate weight elements, transmitters and controllers.
	06.07 Understand the principles of operation for consistency measuring instruments.
07.0	Demonstrate knowledge of operating, troubleshooting and maintaining chemical property measurement and control devices. The student will be able to:
	07.01 Troubleshoot and repair pH measuring instruments.
	07.02 Perform operating systems checks and make minor adjustments to pH measuring instruments.
	07.03 Troubleshoot and repair liquid conductivity measuring instruments.
	07.04 Understand basic principles of operation and the application for gas analyzer measuring instruments.
	07.05 Demonstrate knowledge of measuring instruments used to enhance a safe work environment.

Course Description: The Operating Engineer Assistant Stationary course is designed to build on the skills and knowledge students learned in the Instrument Technician course. Students explore career opportunities and requirements of a professional electrical and instrumentation technician. Students study process operation, and technical reporting.

Course Number: EEV0658 Occupational Completion Point: B Operating Engineer Assistant Stationary – 400 Hours	
08.0	Demonstrate process operation skills. The student will be able to:
	08.01 Use PLC’s to troubleshoot process systems.
	08.02 Identify safety isolation procedures for removing a device from a process.
	08.03 Perform operating system checks, preventive maintenance and make minor adjustments to level control loops.
	08.04 Perform operating system checks, preventive maintenance and make minor adjustments to vacuum/pressure control loops.

08.05	Perform operating system checks, preventive maintenance and make minor adjustments to temperature control loops.
08.06	Perform operating system checks, preventive maintenance and make minor adjustments to flow measuring instruments.
08.07	Perform operating system checks, preventive maintenance and make minor adjustments to consistency measuring instruments.
08.08	Perform operating system checks, preventive maintenance and make minor adjustments to liquid conductivity measuring instruments.
08.09	Perform operating system checks to pneumatic and hydraulic systems.
08.10	Operate control points on a DCS system.
09.0	Demonstrate knowledge of technical reporting. The student will be able to:
09.01	Draw and interpret schematics.
09.02	Record data and prepare charts and graphs.
09.03	Write reports and make oral presentations.
09.04	Make equipment - failure reports.
09.05	Specify and requisition simple components.
09.06	Compose technical letters and memoranda.
09.07	Draw preventive maintenance and calibration procedures.
09.08	Write and use maintenance work orders.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Machining Technologies**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J200100	
CIP Number	0648050305	
Grade Level	30, 31	
Program Length	1500 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 8

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in machining positions.

The content includes but is not limited to broad, transferable skills, stresses the understanding of all aspects of the machining industry, and demonstrates such elements of the industry as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	PMT0020	Machinist Helper	MACH SHOP @7 7G METAL WORK 7G TOOL DIE %7G	300 hours
B	PMT0022	Machinist Operator		300 hours
C	PMT0024	Machinist Setup Operator		600 hours
D	PMT0025	Machinist		300 hours

National Standards

Programs identified as having Industry or National Standards corresponding to the standards and/or benchmarks for the Machining Technologies program can be found using the following link: https://www.nims-skills.org/web/nims/home

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of workplace safety and workplace organization.
02.0 Solve basic job-related math problems**.**
03.0 Interpret basic blueprint information.
04.0 Perform basic measuring operations.
05.0 Perform benchwork skills.
06.0 Demonstrate basic knowledge of manufacturing history and primary manufacturing processes.
07.0 Demonstrate basic knowledge of secondary manufacturing processes and manufacturing systems.
08.0 Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings.
09.0 Perform basic precision measuring operations.
10.0 Sharpen machining tools.
11.0 Set up and operate power saws.
12.0 Set up and operate pedestal grinders.
13.0 Set up and operate drill presses.
14.0 Explain the importance of employability and entrepreneurship skills.
15.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
16.0 Solve problems using critical thinking skills, creativity and innovation.
17.0 Solve advanced job-related math problems.
18.0 Demonstrate inspection methods.
19.0 Plan lathe machining operations.
20.0 Interpret and apply blueprint for lathe machine operations.
21.0 Operate lathes.
22.0 Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for lathe operations.
23.0 Set up and operate a computerized-numerical-control (CNC) machine for lathe operations.
24.0 Plan milling machining operations.
25.0 Interpret and apply blueprint for milling machine operations.
26.0 Operate milling machines.
27.0 Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for milling operations.
28.0 Set up and operate a computerized-numerical-control (CNC) machine for milling operations.
29.0 Perform advanced milling operations.
30.0 Perform advanced lathe operations.
31.0 Use advance techniques to operate a computerized-numerical-control (CNC) machine.
32.0 Perform advanced set up and operation of a computerized-numerical-control (CNC) machine.
33.0 Operate grinding machines.
34.0 Operate and set up electrical discharge machine (EDM).
35.0 Set up and operate heat-treating furnaces.
36.0 Perform advanced grinding operations.

Florida Department of Education
Student Performance Standards

Program Title: Machining Technologies
Career Certificate Program Number: J200100

Course Description: The Machinist Helper course prepares students for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes beginning skills key to the success of working in the machining industry. Students study workplace safety and organization, job-related mathematics, basic blueprint information, basic measuring operations, benchwork skills, the history of manufacturing, manufacturing processes and systems, generating and interpreting computer-aided design drawings, basic precision measurement, sharpening tools, operating power saws, pedestal grinders, drill presses, and understanding the importance of employability and entrepreneurship skills.

Course Number: PMT0020 **Occupational Completion Point: A** **Machinist Helper – 300 Hours**	
01.0	Demonstrate an understanding of workplace safety and workplace organization. The student will be able to:
01.01	Identify safety requirements for manual, electrical-powered and pneumatic tools.
01.02	Demonstrate, apply, and provide evidence of safely using manual, electrical-powered and pneumatic tools.
01.03	Identify safety requirements for operation of automated machines and equipment.
01.04	Demonstrate, apply, and provide evidence of safely operating automated machines and equipment.
01.05	Demonstrate, apply, and provide evidence of properly storing equipment and tools.
01.06	Demonstrate, apply, and provide evidence of properly storing precision measuring tools.
01.07	Identify, demonstrate, apply, and provide evidence of understanding of shop safety rules on an ongoing basis.
01.08	Research and characterize class A, B and C type fires.
01.09	Demonstrate and apply the proper procedures for extinguishing class A, B and C type fires.
01.10	Identify various workplace injuries related to the machining industry.
01.11	Demonstrate and practice knowledge of first aid and first response procedures appropriate for this course.
01.12	Identify and apply safety procedures in case of smoke or chemical inhalation.
01.13	Demonstrate and apply material handling techniques to safely move materials.
01.14	Demonstrate and apply proper techniques for lifting loads.
01.15	Research Occupational Safety Health Administration (OSHA) safety standards.

01.16	Demonstrate, apply, and provide evidence of understanding Occupational Safety Health Administration (OSHA) safety standards.
01.17	Locate Safety Data Sheets (SDS).
01.18	Demonstrate understanding and knowledge of using and applying the information located on Safety Data Sheets (SDS).
01.19	Proactively respond to a safety concern and then document occurrences.
01.20	Demonstrate knowledge of emergency exits and signage.
01.21	Develop safety checklists.
01.22	Identify and report unsafe conditions.
01.23	Determine the appropriate corrective action after an unsafe condition is identified.
01.24	Demonstrate knowledge of various emergency alarms and procedures.
01.25	Perform emergency drills and participate in emergency teams.
01.26	Demonstrate knowledge and apply clean-up procedures for spills.
01.27	Explain Lock Out/Tag Out requirements and procedures.
01.28	Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.
01.29	Identify and apply procedures for handling hazardous material.
01.30	Perform safety and environmental inspections.
01.31	Perform leak checks to determine if toxic or hazardous material is escaping from a piece of equipment.
01.32	Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists, and regulations.
01.33	Demonstrate and apply proper equipment shutdown procedures.
01.34	Identify safety related maintenance procedures.
01.35	Select lubricants for machining operations.
01.36	Lubricate equipment parts.
01.37	Inspect and maintain machine cutting fluids.
01.38	Inspect drive pulleys and belts; perform necessary action.
01.39	Properly dispose of scrap-metal chips, shavings, trash and waste.
01.40	Identify, select and use personal protective equipment (PPE).
01.41	Explain the safety benefits of 6S work environment.
01.42	Identify, demonstrate and apply ergonomic work techniques.

	01.43 Train other students to use and apply safety skills outlined in this standard.
02.0	Solve basic job-related math problems. The student will be able to:
	02.01 Solve job-related problems by adding, subtracting, multiplying, and dividing whole numbers, decimals and common fractions.
	02.02 Calculate the amount of material that should be removed to obtain correct limits for secondary operations.
	02.03 Solve job-related problems using mathematical handbooks, charts and tables.
	02.04 Calculate machine speed and feed by using appropriate formulas.
	02.05 Calculate chip load per tooth on milling operations.
03.0	Interpret basic blueprint information. The student will be able to:
	03.01 Interpret view concepts.
	03.02 Interpret lines.
	03.03 Read and interpret title blocks.
	03.04 Read and interpret change orders on working and assembly prints.
	03.05 Read and interpret abbreviations.
	03.06 Identify basic geometrical dimensioning & tolerancing (GD&T) terminology.
04.0	Perform basic measuring operations. The student will be able to:
	04.01 Comply with safe and efficient work practices.
	04.02 Measure a workpiece and compare measurements with blueprint specifications, including tolerances.
	04.03 Read and measure with rules and calipers.
	04.04 Read and measure with micrometers.
	04.05 Read and measure with vernier tools.
	04.06 Use surface-plate techniques.
05.0	Perform benchwork skills. The student will be able to:
	05.01 Comply with safe and efficient work practices.
	05.02 Cut materials by using appropriate hand saws.
	05.03 Cut threads by using hand taps.
	05.04 Cut threads by using dies.
	05.05 Deburr workpiece.

	05.06 Demonstrate or identify filing techniques.
06.0	Demonstrate basic knowledge of manufacturing history and primary manufacturing processes. The student will be able to:
	06.01 Demonstrate knowledge of how manufacturing processes have evolved throughout history.
	06.02 Demonstrate knowledge of obtaining raw materials through harvesting and extracting.
	06.03 Explain the difference between primary and secondary manufacturing processes.
	06.04 Demonstrate knowledge of primary processes (e.g., thermal, chemical, mechanical, etc.)
07.0	Demonstrate basic knowledge of secondary manufacturing processes and manufacturing systems. The student will be able to:
	07.01 Demonstrate knowledge of secondary processes. (e.g., casting and molding, separating, forming, conditioning, assembling and finishing)
	07.02 Demonstrate knowledge of the various materials used in manufacturing. (e.g., metallic, polymeric, ceramic, composite)
	07.03 Demonstrate knowledge of the various material properties. (e.g., physical, mechanical, chemical, thermal, acoustic, optical, electrical and magnetic)
	07.04 Demonstrate knowledge of the technological or universal systems model. (inputs, process, outputs, feedback)
	07.05 Demonstrate knowledge of the various manufacturing/production systems. (e.g., custom, intermittent, continuous, flexible, automated)
	07.06 Demonstrate knowledge of the use of current manufacturing processes.
	07.07 Demonstrate knowledge of quality assurance.
08.0	Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings. The student will be able to:
	08.01 Create a sketch of an object.
	08.02 Select the front view of an object.
	08.03 Use a CAD System to open and change the views of CAD drawings.
	08.04 Use standard CAD commands (such as Grid, Snap, Array, Erase, Trim Break) in the editing of a drawing.
	08.05 Use CAD software to create a single view drawing.
	08.06 Use CAD software to create a multi-view drawing.
	08.07 Use CAD software to dimension a drawing.
	08.08 Use the UCS command to create a custom 3D coordinate system orientation.
	08.09 Create a 3D object using 3D drawing commands.
	08.10 Open and change the view of a solid model.
09.0	Perform basic precision measuring operations. The student will be able to:

	09.01 Use appropriate measurement tools. (e.g., machinist's rule, tape measure, calipers, micrometers, vernier and dial indicator.
	09.02 Convert between common fraction inches and decimal inches.
	09.03 Calibrate a dial caliper.
	09.04 Master a dial indicator.
	09.05 Read and interpret gage blocks and adjustable gages.
	09.06 Implement appropriate testing regimes.
	09.07 Use appropriate safety monitoring and testing equipment.
	09.08 Use multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.
	09.09 Research measurement tools for non-mechanical systems and products. (i.e., pH, °Brix)
10.0	Sharpen machining tools. The student will be able to:
	10.01 Comply with safe and efficient work practices.
	10.02 Hand sharpens cutting tools by using abrasive stones.
	10.03 Grind lathe tools to required angles.
	10.04 Sharpen drills.
11.0	Set up and operate power saws. The student will be able to:
	11.01 Comply with safe and efficient work practices.
	11.02 Remove and replace saw blades.
	11.03 Select appropriate blades to perform given sawing operations.
	11.04 Select and set speeds and feeds for given sawing operations.
	11.05 Measure and cut material using a power saw.
	11.06 Saw to scribed lines by using a metal band saw.
	11.07 Cut and weld band-saw blades for contour sawing. (Optional)
	11.08 Set up and operate saws for angular cutting.
12.0	Set up and operate pedestal grinders. The student will be able to:
	12.01 Comply with safe and efficient work practices.
	12.02 Identify the parts of the machine and explain their uses.
	12.03 Set up support rests.

	12.04 Dress grinding wheels.
13.0	Set up and operate drill presses. The student will be able to:
	13.01 Identify the parts of a drill press and explain their uses.
	13.02 Identify and set the machine controls.
	13.03 Comply with safe and efficient work practices.
	13.04 Select the proper tooling.
	13.05 Set up and operate drill press for hole work, center drill, drill, ream, countersink and counterbore.
	13.06 Set drill presses for proper feed and speed for specified operations.
14.0	Explain the importance of employability and entrepreneurship skills. The students will be able to:
	14.01 Identify and demonstrate positive work behaviors needed to be employable.
	14.02 Develop personal career plan that includes goals, objectives and strategies.
	14.03 Examine licensing, certification, and industry credentialing requirements.
	14.04 Maintain a career portfolio to document knowledge, skills and experience.
	14.05 Evaluate and compare employment opportunities that match career goals.
	14.06 Identify and exhibit traits for retaining employment.
	14.07 Identify opportunities and research requirements for career advancement.
	14.08 Research the benefits of ongoing professional development.
	14.09 Examine and describe entrepreneurship opportunities as a career planning option.

Course Description: The Machining Operator course is designed to build on the skills and knowledge students learned in the Machinist Helper course for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes knowledge of working in the machining industry. Students study the skills necessary to work in teams, using critical thinking skill to solve complex problems, advance mathematics, quality control and inspection methods, plan machining operations using a lathe and mill, use CAD/CAM processes for lathe and milling operations, and set-up and program a CNC machine for lathe and milling operations.

Course Number: PMT0022 Occupational Completion Point: B Machinist Operator – 300 Hours	
15.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The students will be able to:
	15.01 Employ leadership skills to accomplish organizational goals and objectives.

	15.02 Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
	15.03 Conduct and participate in meetings to accomplish work tasks.
	15.04 Employ mentoring skills to inspire and teach others.
16.0	Solve problems using critical thinking skills, creativity and innovation. The students will be able to:
	16.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
	16.02 Employ critical thinking and interpersonal skills to resolve conflicts.
	16.03 Identify and document workplace performance goals and monitor progress toward those goal.
	16.04 Conduct technical research to gather information necessary for decision-making.
17.0	Solve advanced job-related math problems. The student will be able to:
	17.01 Solve job-related problems using basic formulas, geometry and trigonometry.
	17.02 Convert measurements from English to metric and from metric to English units.
18.0	Demonstrate inspection methods. The student will be able to:
	18.01 Comply with safe and efficient work practices.
	18.02 Measure with sine bars.
	18.03 Take readings with hardness testers.
	18.04 Explain the purpose of statistical process control (SPC).
19.0	Plan lathe machining operations. The student will be able to:
	19.01 Comply with safe and efficient work practices.
	19.02 Perform layout for precision machine work by using layout instruments.
	19.03 Describe the importance of quality assurance.
20.0	Interpret and apply blueprint for lathe machine operations. The student will be able to:
	20.01 Create shop sketches.
	20.02 Read and interpret blueprints that include geometric tolerances.
	20.03 Determine and interpret reference information used in performing machine work.
	20.04 Comply with safe and efficient work practices.
	20.05 Inspect, remove, and replace manufactured parts that need repair or machine work.
	20.06 Select the most productive tool and tooling for a given operation.

	20.07 Identify the costs involved in product production.
21.0	Operate lathes. The student will be able to:
	21.01 Identify the parts of a lathe and explain their uses.
	21.02 Comply with safe and efficient work practices.
	21.03 Inspect tooling prior to operations.
	21.04 Set up an engine lathe.
	21.05 Secure tools, tool holders, and fixtures or attachments.
	21.06 Select and set feeds and speeds.
	21.07 Set up lathes and face workpieces held in chucks.
	21.08 Rough cut and finish cut with lathes.
	21.09 Perform lathe filing to deburr parts.
	21.10 Drill holes with lathes.
	21.11 Countersink holes with lathes.
	21.12 Ream holes with lathes.
	21.13 Tap threads with lathes.
	21.14 Die cut threads with lathes.
	21.15 Counterbore holes with lathes.
	21.16 Align lathe centers using accurate methods.
	21.17 Bore holes with lathes.
	21.18 Knurl parts with lathes.
	21.19 Cut external threads with lathes.
	21.20 Perform contour, angular or radii cuts with lathes.
	21.21 Set up the faceplate and dog.
22.0	Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for lathe operations. The student will be able to:
	22.01 Identify parts of the machine and explain their uses.
	22.02 Identify CAD/CAM processes.
	22.03 Comply with safe and efficient work practices.

	22.04 Create a multidimensional geometry of parts.
	22.05 Create a CNC code from parts geometry.
	22.06 Identify the basic classification of CNC tooling.
	22.07 Set up and manufacture parts.
23.0	Set up and operate a computerized-numerical-control (CNC) machine for lathe operations. The student will be able to:
	23.01 Comply with safe and efficient work practices.
	23.02 Set up work holding devices.
	23.03 Select proper cutting tools.
	23.04 Write a basic program and apply basic programming skills.
	23.05 Adjust appropriate cutting tools and tool offsets.
	23.06 Machine and create parts to blueprint tolerances.
24.0	Plan milling machining operations. The student will be able to:
	24.01 Comply with safe and efficient work practices.
	24.02 Perform layout for precision machine work by using layout instruments.
	24.03 Describe the importance of quality assurance.
25.0	Interpret and apply blueprint for milling machine operations. The student will be able to:
	25.01 Create shop sketches.
	25.02 Read and interpret blueprints that include geometric tolerances.
	25.03 Determine and interpret reference information used in performing machine work.
	25.04 Comply with safe and efficient work practices.
	25.05 Lay out radial and bolt hole circles.
	25.06 Inspect, remove, and replace manufactured parts that need repair or machine work.
	25.07 Select the most productive tool and tooling for a given operation.
	25.08 Identify the costs involved in product production.
26.0	Operate milling machines. The student will be able to:
	26.01 Identify the parts of a vertical milling machine and explain their uses.
	26.02 Comply with safe and efficient work practices.

	26.03 Inspect tooling prior to operations.
	26.04 True up the head and align milling fixtures.
	26.05 Select and set feeds and speeds for milling work.
	26.06 Square up workpieces with a table vise.
	26.07 Perform end milling.
	26.08 Perform fly-cutting operations.
	26.09 Drill holes with milling machines.
	26.10 Perform reaming operations.
	26.11 Perform form milling.
	26.12 Mill an external radius.
	26.13 Mill an angle.
	26.14 Use an edge finder and wiggler.
	26.15 Identify the parts of vertical and horizontal milling machines and explain their uses.
	26.16 Select the correct set up and operation for different milling machines.
	26.17 Cut external keyways.
	26.18 Bore holes with boring head.
	26.19 Mill cylindrical work.
	26.20 Set up and perform slab mill operations.
	26.21 Use digital readouts.
	26.22 Set up and operate power tapping head.
27.0	Use computer-aided design/computer-aided manufacturing (CAD/CAM) processes for milling operations. The student will be able to:
	27.01 Identify parts of the machine and explain their uses.
	27.02 Identify CAD/CAM processes.
	27.03 Comply with safe and efficient work practices.
	27.04 Create a multidimensional geometry of parts.
	27.05 Create a CNC code from parts geometry.
	27.06 Identify the basic classification of CNC tooling.

	27.07 Set up and manufacture parts.
28.0	Set up and operate a computerized-numerical-control (CNC) machine for milling operations. The student will be able to:
	28.01 Comply with safe and efficient work practices.
	28.02 Set up work holding devices.
	28.03 Select proper cutting tools.
	28.04 Write a basic program and apply basic programming skills.
	28.05 Adjust appropriate cutting tools and tool offsets.
	28.06 Machine and create parts to blueprint tolerances.

Course Description: The Machine Setup Operator course is designed to build on the skills and knowledge students learned in the Machinist Helper and Machine Operator courses for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes knowledge of working in the machining industry. Students study the skills necessary to perform advanced lathe, milling, and CNC operations.

Course Number: PMT0024 Occupational Completion Point: C Machinist Setup Operator – 600 Hours	
29.0	Perform advanced milling operations. The student will be able to:
	29.01 Perform indexing operations using a dividing head.
	29.02 Set up and operate rotary tables.
	29.03 Design and use jigs and fixtures. (Optional)
30.0	Perform advanced lathe operations. The student will be able to:
	30.01 Rechase threads with lathes.
	30.02 Cut internal threads with lathes.
	30.03 Set up and perform taper turning with the compound rest.
	30.04 Cut internal tapered surfaces.
	30.05 Set up and use follower and steady rests.
31.0	Use advance techniques to operate a computerized-numerical-control (CNC) machine. The student will be able to:
	31.01 Identify parts of a CNC machine and explain their uses.
	31.02 Follow safe and efficient work practices, including procedures sheets.

	31.03 Identify unusual machine noises.
	31.04 Adjust machine speeds and feeds according to specifications.
	31.05 Inspect parts for correct dimensions.
32.0	Perform advanced set up and operation of a computerized-numerical-control (CNC) machine. The student will be able to:
	32.01 Comply with safe and efficient work practices.
	32.02 Set up work holding devices.
	32.03 Select proper cutting tools.
	32.04 Write an advanced program and apply basic programming skills.
	32.05 Adjust appropriate cutting tools and tool offsets.
	32.06 Machine and create parts to blueprint tolerances.

Course Description: The Machinist course is designed to build on the skills and knowledge students learned in the Machinist Helper, Machine Operator, and Machine Setup Operator courses for entry into the machining industry. Students explore career opportunities and requirements of a professional machinist. Content emphasizes knowledge of working in the machining industry. Students study the skills necessary to perform grinding operations, operating and setting up electrical discharge machines, and heat-treating furnaces.

Course Number: PMT0025 Occupational Completion Point: D Machinist – 300 Hours	
33.0	Operate grinding machines. The student will be able to:
	33.01 Identify the parts of a grinding machine and explain their uses.
	33.02 Comply with safe and efficient work practices.
	33.03 Set up and grind parallel flat surfaces.
	33.04 Select the proper wheel.
	33.05 Inspect, balance, dress, and true grinding wheels.
	33.06 Attach and align workpieces for grinding operations.
	33.07 Set up and grind four sides square.
	33.08 Select and set feeds and speeds of power-feed grinding machines.
	33.09 Cut or part workpieces with grinding machines.
	33.10 Set up and use angle plates.

	33.11 Grind to a shoulder.
	33.12 Grind a taper.
34.0	Operate and set up electrical discharge machine (EDM). The student will be able to:
	34.01 Identify parts of the machine and explain their uses.
	34.02 Comply with safe and efficient work practices.
	34.03 Follow procedure sheets.
	34.04 Set up and adjust machine controls according to specifications.
	34.05 Select and manufacture electrode.
	34.06 Select flushing techniques.
	34.07 Create part according to specifications. (Optional)
	34.08 Perform EDM programming.
35.0	Set up and operate heat-treating furnaces. The student will be able to:
	35.01 Identify the parts of the machine and explain their uses. (Optional)
	35.02 Identify and select proper machine controls. (Optional)
	35.03 Comply with safe and efficient work practices. (Optional)
	35.04 Select and identify proper heat-treatment processes. (Optional)
	35.05 Perform a basic heat-treatment process to blueprint specifications. (Optional)
36.0	Perform advanced grinding operations. The student will be able to:
	36.01 Explain up grinders to run workpieces between centers. (Optional)
	36.02 Explain up and use radius dressers. (Optional)
	36.03 Explain cylindrical grinders. (Optional)
	36.04 Explain operate inside diameter (ID) grinders. (Optional)

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Mechatronics Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J200200	
CIP Number	0615049901	
Grade Level	30, 31	
Program Length	1550 Hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 10	Communications (Reading and Language Arts):10

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

Mechatronics is the combination of Mechanical, Electronic, Computer, Software, Control, and Systems Design engineering in order to design and manufacture useful products. Mechatronics is a multidisciplinary field of engineering,

The program is designed to provide graduates with a high-tech skill set and knowledge in electronic, mechanical, fluid power/pneumatic systems, electrical, Program Logic Controller applications (PLC) programming, computer technology for maintenance and repair of PLC/computer controlled, automated machines and robotic systems.

The content includes but is not limited to Direct current (DC) circuits, alternating current (AC) circuits and analog circuits; solid state and digital devices; microprocessors; use of circuit diagrams, blueprints and schematics; soldering and chassis assembly techniques; laboratory practices, technical recording and reporting. The operation, maintenance and repair of electrical equipment and control systems, hydraulic/pneumatic

systems, and mechanical systems: gears, drives, linkage and lever systems, computers, Programmable Logic Controller (PLC) programming, process control systems, automated control and integrated robotic systems.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3) (b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the Career Certificate Program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EEV0010	Electronics Assembler	AUTO PROD 7G AVIONICS @7 7G ELECTRONIC @7 7G ENG 7G IND ENGR 7G RADIO TV %7 %G TEC ELEC @7 7G TV PROD TEC @7 7G ROBOTICS 7G	250 hours
B	EEV0100	Electronics Tester		400 hours
C	EEV0752	Electromechanical Assembler	AUTO PROD 7G AVIONICS @7 7G ELECTRONIC @7 7G ENG 7G IND ENGR 7G ROBOTICS 7G	500 hours
D	EEV0753	Mechatronic Technician		400 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describes the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in soldering and basic laboratory practices.
02.0 Demonstrate proficiency in basic DC circuits.
03.0 Demonstrate proficiency in advanced DC circuits.
04.0 Demonstrate proficiency in AC circuits.
05.0 Demonstrate proficiency in solid state devices.
06.0 Demonstrate proficiency in motors and motor control circuits.
07.0 Demonstrate proficiency in hydraulic and pneumatic systems.
08.0 Demonstrate proficiency in mechanical power transmission systems.
09.0 Demonstrate proficiency in mechanisms, linkages, and levers.
10.0 Demonstrate proficiency in automatic controls, robotics and PLC programming.

Florida Department of Education
Curriculum Framework

Program Title: **Mechatronics Technology**
Career Certificate Program Number: **J200200**

Course Description: The Electronics Assembler course prepares students for entry into the mechatronics technology industry. Students explore career opportunities and requirements of a professional mechatronics technician. Content emphasizes beginning skills key to the success of working in the mechatronics industry. Students study basic soldering lab practices and basic DC circuitry.

Course Number: EEV0010 **Occupational Completion Point: A** **Electronics Assembler – 250 Hours**	
01.0	Demonstrate proficiency in soldering basic laboratory practices. The student will be able to:
01.01	Apply proper Occupational Safety Health Administration (OSHA) safety standards.
01.02	Make electrical connections.
01.03	Identify and use hand tools properly.
01.04	Identify and use power tools properly.
01.05	Apply recognized industry accepted standard soldering techniques.
01.06	Apply recognized industry accepted standard desoldering techniques.
01.07	Apply recognized industry accepted standard electrostatic discharge (ESD) safety procedures.
01.08	Design and/or construct printed circuit boards (PCB's) to industry accepted standards.
01.09	Explain the theoretical concepts of industry accepted soldering techniques.
01.10	Apply recognized industry accepted standard techniques for rework and repair.
02.0	Demonstrate proficiency in basic DC circuits. The student will be able to:
02.01	Demonstrate proficiency in basic DC circuits.
02.02	Solve problems in electronic units utilizing metric prefixes.
02.03	Identify sources of electricity.
02.04	Define voltage, current, resistance, power and energy.
02.05	Apply Ohm's law and power formulas.
02.06	Read and interpret color codes and symbols to identify electrical components and values.

02.07	Measure properties of a circuit using a digital multi-meter (DMM).
02.08	Compute conductance and compute and measure resistance of conductors and insulators.
02.09	Apply Ohm's law to series circuits.
02.10	Construct and verify operation of series circuits.
02.11	Analyze and troubleshoot series circuits.
02.12	Apply Ohm's law to parallel circuits.
02.13	Construct and verify the operation of parallel circuits.
02.14	Analyze and troubleshoot parallel circuits.

Course Description: The Electronics Tester course is designed to build on the skills and knowledge students learned in the Electronics Assembler course for entry into the mechatronics technology industry. Students explore career opportunities and requirements of a professional mechatronics technician. Content emphasizes knowledge of working in the mechatronics industry. Students study advanced DC circuitry, AC circuitry and solid state devices.

Course Number: EEV0100 Occupational Completion Point: B Electronics Tester – 400 Hours	
03.0	Demonstrate proficiency in advanced DC circuits. The student will be able to:
03.01	Solve algebraic problems to include exponentials to DC.
03.02	Describe the relationship of DC electricity to the nature of matter.
03.03	Apply Ohm’s law to series-parallel and parallel-series circuits.
03.04	Construct and verify the operation of series-parallel and parallel-series and bridge circuits.
03.05	Troubleshoot series-parallel and parallel-series and bridge circuits.
03.06	Identify and define voltage divider circuits (loaded and unloaded).
03.07	Construct and verify the operation of voltage divider circuits (loaded and unloaded).
03.08	Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
03.09	Apply maximum power transfer theorem.
03.10	Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
03.11	Describe magnetic properties of circuits and devices.
03.12	Determine the physical and electrical characteristics of capacitors and inductors.

	03.13 Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
	03.14 Set up and operate power supplies for DC circuits.
	03.15 Explain the theory of DC motor operation.
	03.16 Identify the practical applications for the use of a DC motor.
04.0	Demonstrate proficiency in AC circuits. The student will be able to:
	04.01 Solve basic trigonometric problem as applicable to electronics.
	04.02 Define the characteristics of AC capacitive circuits.
	04.03 Construct and verify the operation of AC capacitive circuits.
	04.04 Analyze and troubleshoot AC capacitive circuits.
	04.05 Define the characteristics of AC inductive circuits.
	04.06 Construct and verify the operation of AC inductive circuits.
	04.07 Analyze and troubleshoot AC inductive circuits.
	04.08 Define and apply the principles of transformers to AC circuits.
	04.09 Construct and verify the operation of AC circuits utilizing transformers.
	04.10 Analyze and troubleshoot AC circuits utilizing transformers.
	04.11 Construct and verify the operation of differentiators and integrators to determine R-C and R-L time constraints.
	04.12 Analyze and troubleshoot differentiator and integrator circuits.
	04.13 Define the characteristics of Resistive, Inductive and Capacitive (RLC) circuits (series, parallel and complex).
	04.14 Construct and verify the operation of series and parallel resonant circuits.
	04.15 Define the characteristics of series and parallel resonant circuits.
	04.16 Construct and verify the operation of series and parallel resonant circuits.
	04.17 Analyze and troubleshoot R-C, R-L and RLC circuits.
	04.18 Define the characteristics of frequency selective filter circuits.
	04.19 Construct and verify the operation of frequency selective filter circuits.
	04.20 Analyze and troubleshoot frequency selective filter circuits.
	04.21 Define the characteristics of poly phase circuits.
	04.22 Define basic motor theory and operation.

04.23	Define basic generator theory and operation.
04.24	Set up and operate power supplies for AC circuits.
04.25	Set up and operate oscilloscopes for AC circuits.
04.26	Set up and operate function generators for AC circuits.
04.27	Analyze and measure power in AC circuits.
04.28	Set up and operate capacitor and inductor analyzers for AC circuits.
04.29	Explain the theory of AC motor operation.
04.30	Identify the practical applications for the use of an AC motor.
05.0	Demonstrate proficiency in solid state devices. The student will be able to:
05.01	Identify and define properties of semiconductor materials.
05.02	Identify and define operating characteristics and applications of junction diodes.
05.03	Identify and define operating characteristics and applications of special diodes, e.g., Zener diodes.
05.04	Construct diode circuits.
05.05	Analyze and troubleshoot diode circuits.
05.06	Identify and define operating characteristics and applications of bipolar transistors,
05.07	Identify and define operating characteristics and applications of field effect transistors.
05.08	Identify and define operating characteristics and applications of single-stage amplifiers.
05.09	Construct single-stage amplifiers.
05.10	Analyze and troubleshoot single-stage amplifiers.
05.11	Construct thyristor circuitry.
05.12	Analyze and troubleshoot thyristor circuitry.
05.13	Set up and operate power supplies for solid-state devices.
05.14	Set up and operate oscilloscopes for solid-state devices.
05.15	Set up and operate function generators for solid-state devices.
05.16	Set up and operate capacitor and inductor analyzers for solid-state devices.
05.17	Set up and operate curve tracers.
05.18	Set up and operate transistor testers.

Course Description: The Electromechanical Assembler course is designed to build on the skills and knowledge students learned in the Electronics Assembler, and Electronics Tester courses for entry into the mechatronics technology industry. Students study Industrial 3 phase electricity/Motor controls, Mechanisms: Gears/Drives, Linkages/Levers, and Fluid Power: Hydraulics/Pneumatics.

Course Number: EEV0752 **Occupational Completion Point: C** **Electromechanical Assembler – 500Hours**	
06.0	Demonstrate proficiency in industrial 3 phase electricity, motors, and motor control circuits. The students will be able to:
06.01	Identify and locate reference documents for the National Electric Code and other electrical standards.
06.02	Identify types of relays and describe their operations and applications.
06.03	Identify types of electric motors and describe their operation and applications of protection circuits.
06.04	Identify types of transformers and describe their operation and applications.
06.05	Identify types of motor controllers and describe their operation and applications.
06.06	Write and interpret relay ladder logic diagrams and digital logic, Gales truth tables and Boolean algebraic expressions.
06.07	Construct and troubleshoot manual motor starting and reversing circuits.
06.08	Construct and troubleshoot magnetic motor starting and reversing circuits.
06.09	Construct and troubleshoot relay logic circuits.
06.10	Identify the elements of solid state motor controls and variable speed drives.
06.11	Analyze and construct complex control configurations.
06.12	Analyze and troubleshoot variable frequency and variable speed AC and DC drives.
06.13	Design, construct and troubleshoot timing control circuits.
06.14	Analyze and troubleshoot industrial power distribution systems including power factor and harmonic power management issues
06.15	Analyze, construct and troubleshoot photoelectric, proximity sensor circuits and transducer circuits.
06.16	Analyze programmable logic controller (PLC) equipment fundamentals.
07.0	Demonstrate proficiency in hydraulic and pneumatic systems. The students will be able to:
07.01	Identify the components of hydraulic systems and describe their functions.
07.02	Construct and troubleshoot basic hydraulic circuits.
07.03	Identify hydraulic symbols, components and types of fluids.
07.04	Construct and troubleshoot hydraulic circuits using flow control valves, pressure valves and sequence valves.

07.05	Construct and troubleshoot hydraulic circuits using directional and speed/pressure control valves.
07.06	Analyze, construct and troubleshoot hydraulic circuits that utilize actuator speed control and counterbalance devices.
07.07	Construct and troubleshoot hydraulic circuits using reducing and unloading valves.
07.08	Construct and troubleshoot hydraulic circuits using accumulators.
07.09	Construct and troubleshoot a regenerative hydraulic circuit and a hydraulic circuit using remote control.
07.10	Construct and troubleshoot hydraulic circuits for deceleration and braking.
07.11	Identify the components of pneumatic logic systems and describe their functions.
07.12	Troubleshoot and repair pneumatic valves, compressors, pumps and regulators.
07.13	Analyze and define gas pressure storage and force in basic pneumatic circuits.
07.14	Construct and troubleshoot pneumatic circuits and systems.
08.0	Demonstrate proficiency in mechanical power transmission systems. The students will be able to:
08.01	Utilize precision measuring instruments.
08.02	Construct and align mechanisms to demonstrate displacement, velocity and torque ratios.
08.03	Identify, analyze, and construct simple, compound and reverted gear trains.
08.04	Identify, analyze, and construct internal and planetary gear trains.
08.05	Identify, analyze, and construct helical and bevel gear trains.
08.06	Identify, analyze, and construct rack and pinion, worm and wheel and block and screw mechanisms.
08.07	Identify, analyze, and construct counter rotating mechanisms and differentials.
08.08	Identify, analyze, and construct spring mechanisms, pulley blocks and differentials hoists.
08.09	Identify, analyze, and construct chain, belt and disc drives and universal joints.
08.10	Identify, analyze, and construct clutch and coupling mechanisms.
08.11	Identify, analyze, and construct bushings and cam mechanisms.
08.12	Apply proper lubrication to mechanical system components, using appropriately rated lubricants.
09.0	Demonstrate proficiency in mechanisms, linkages, and levers. The students will be able to:
09.01	Identify, analyze, and repair clutch and brake mechanisms.
09.02	Identify, analyze, and repair class one, two, three and compound levers.
09.03	Identify, analyze, and repair rocker arm and bell crank linkages and combined mechanisms.

09.04	Identify, analyze and repair four-bar mechanisms (crank, rocker, and double rocker).
09.05	Identify, analyze and repair drag link and intermediate mechanisms.
09.06	Identify, analyze and repair four-bar variations.
09.07	Identify, analyze, and repair cam mechanisms.
09.08	Identify, analyze and repair pivoted follower mechanisms.
09.09	Identify, analyze, and repair toggle, quick return and ratchet mechanisms.
09.10	Identify, analyze, and repair harmonic drives.
09.11	Identify, analyze, and repair Geneva mechanisms.

Course Description: This course of instruction is a continuation of the Mechatronics Technology program with a principle focus on logical troubleshooting of industrial machines and equipment, PLC (Programmable Logic Controllers) programming, automated work cell programming and operation, servo precision robot operation and programming, integrated manufacturing work cell troubleshooting and maintenance.

Course Number: EE0753 Occupational Completion Point: D Mechatronics Technician – 400 Hours	
10.0	Demonstrate proficiency in automatic controls and robotics. The students will be able to:
10.01	Utilize complex motor control circuits including variable frequency (speed) drives.
10.02	Analyze, design, interpret and draw complex ladder diagrams.
10.03	Analyze and program the operation of programmable controllers in automated systems.
10.04	Develop programs for programmable controllers in integrated automated work cells and manufacturing and process control applications.
10.05	Specify and utilize various sensor and transducer devices.
10.06	Analyze and program the operation of robotic work cells and support equipment.
10.07	Analyze and troubleshoot specific robot mechanisms and systems.
10.08	Analyze and implement robotic software programs and explain and demonstrate pendant programming and robot operations.
10.09	Interface robotic systems with other automated systems.
10.10	Troubleshoot and repair automated control and PLC systems.
10.11	Identify, analyze and repair various robotic servo and control systems.
10.12	Demonstrate proficiency in PLC application and programming.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **CNC Production Specialist**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J200300	
CIP Number	0648050307	
Grade Level	30, 31	
Program Length	600 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 10	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to limited to broad, transferable skills, stresses the understanding of all aspects of the computer numeric control as it relates to the machining industry, and demonstrates such elements of the industry as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3) (b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	PMT0026	CNC Production Technician I	ENG 7G MACH SHOP @7 7G METAL WORK 7G	300 hours
B	PMT0027	CNC Production Technician II		300 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding of workplace safety and workplace organization.
02.0 Demonstrate an understanding of manufacturing methodology principles.
03.0 Solve basic job-related math problems**.**
04.0 Interpret basic blueprint information.
05.0 Perform basic metrology.
06.0 Demonstrate basic knowledge of manufacturing history and primary as well as secondary manufacturing processes.
07.0 Demonstrate basic understanding of geometric dimension and tolerance (GD&T)
08.0 Set up and operate drill presses.
09.0 Demonstrate the use of a CNC control panel.
10.0 Demonstrate an understanding of CNC machine systems.
11.0 Set up and operate a computerized-numerical-control (CNC) machine for lathe operations.
12.0 Set up and operate a computerized-numerical-control (CNC) machine for milling operations.
13.0 Demonstrate appropriate computerized-numerical-control (CNC) maintenance and troubleshooting.
14.0 Explain the importance of employability and entrepreneurship skills.
15.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
16.0 Solve problems using critical thinking skills, creativity, and innovation.
17.0 Demonstrate first article inspection methods.
18.0 Demonstrate the technique of CNC milling.
19.0 Perform advanced set up and operation of a computerized-numeric-control (CNC) mill machine.
20.0 Demonstrate the technique of CNC turning.
21.0 Perform advanced set up and operation of a computerized-numeric-control (CNC) lathe machine.
22.0 Demonstrate basic computer-aided design/computer-aided manufacturing (CAD/CAM) processes.

Florida Department of Education
Student Performance Standards

Program Title: **CNC Production Specialist**
Career Certificate Program Number: **J200300**

Course Description: CNC Production Technician 1 prepares students for entry into the CNC machining industry. Students explore career opportunities and requirements of a CNC production specialist. Content emphasizes beginning skills key to the success of working in the CNC machining industry. Students study workplace safety and organization, job-related mathematics, basic blueprint information, metrology, the history of manufacturing and primary and secondary manufacturing processes, geometric dimension and tolerance, set up and operation of drill presses, CNC control panels, CNC machine systems, CNC lathe and mill operations, and maintenance and troubleshooting.

Course Number: PMT0026 **Occupational Completion Point: A** **CNC Production Technician I – 300 Hours**	
01.0	Demonstrate an understanding of workplace safety and workplace organization. The student will be able to:
01.01	Identify safety requirements for manual, electrical-powered, and pneumatic tools.
01.02	Demonstrate, apply, and provide evidence of safely using manual, electrical-powered, and pneumatic tools
01.03	Identify safety requirements for operation of automated machines and equipment.
01.04	Demonstrate, apply, and provide evidence of safely operating automated machines and equipment.
01.05	Demonstrate, apply, and provide evidence of properly storing equipment and tools.
01.06	Demonstrate, apply, and provide evidence of properly storing precision measuring tools.
01.07	Identify, demonstrate, apply, and provide evidence of understanding of shop safety rules on an ongoing basis.
01.08	Research and characterize class A, B, and C type fires.
01.09	Demonstrate and apply the proper procedures for extinguishing class A, B, and C type fires.
01.10	Identify various workplace injuries related to the manufacturing industry.
01.11	Identify and apply safety procedures in case of smoke or chemical inhalation.
01.12	Identify and apply safety procedures in case of smoke or chemical inhalation.
01.13	Demonstrate and apply material handling and lifting techniques to safely move materials.
01.14	Research Occupational Safety Health Administration (OSHA) safety standards as it pertains to the manufacturing industry.
01.15	Locate Safety Data Sheets (SDS).
01.16	Understand the Globally Harmonized System of Classification and Labeling of Chemicals.

01.17	Proactively respond to a safety concern and then document occurrences.
01.18	Demonstrate knowledge of emergency exits and signage.
01.19	Identify and report unsafe conditions.
01.20	Demonstrate knowledge of various emergency alarms and procedures.
01.21	Perform emergency drills and participate in emergency teams.
01.22	Demonstrate knowledge and apply clean-up procedures for spills.
01.23	Explain Lock Out/Tag Out requirements and procedures.
01.24	Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.
01.25	Identify and apply procedures for handling hazardous material.
01.26	Perform safety and environmental inspections.
01.27	Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists, and regulations.
01.28	Demonstrate and apply proper equipment shutdown procedures.
01.29	Identify safety related maintenance procedures.
01.30	Select lubricants for machining operations.
01.31	Lubricate equipment parts.
01.32	Inspect and maintain machine cutting fluids.
01.33	Properly dispose of scrap-metal chips, shavings, trash, and waste.
01.34	Identify, select, and use personal protective equipment (PPE).
01.35	Identify, demonstrate, and apply ergonomic work techniques.
01.36	Identify, demonstrate, and apply pinch points.
02.0	Demonstrate an understanding of the manufacturing methodology principles. The student will be able to:
02.01	Identify and understand an ISO process environment.
02.02	Identify and understanding documentation requirements in an ISO environment.
02.03	Understand their role in an ISO audit.
02.04	Identify and understand 5S terminology.
02.05	Apply 5S principles in workplace.
02.06	Identify and understand lean manufacturing principles and terminology.

	02.07 Identify waste in the workplace.
	02.08 Identify “management by eye: (visual cues).
	02.09 Identify and understand six sigma principles and terminology.
	02.10 Identify the DMAIC process.
	02.11 Explain the purpose of statistical process control (SPC).
03.0	Solve basic job- related math problems. The student will be able to:
	03.01 Solve job-related math problems by adding, subtracting, multiplying, and dividing whole numbers, decimals, and common fractions.
	03.02 Understand and apply the order of operations and rounding.
	03.03 Solve job-related math problems using positive and negative numbers.
	03.04 Solve job-related math problems using different measurement systems (American and metric).
	03.05 Measure a workpiece and compare measurements with blueprint specifications and tolerances.
	03.06 Solve job-related problems using mathematical charts, tables, and calculators.
	03.07 Calculate machine speed and feed by suing appropriate formulas.
04.0	Interpret basic blueprint information. The student will be able to:
	04.01 Interpret view concepts (drawing views and projections)
	04.02 Read and interpret dimensioning.
	04.03 Read and interpret tolerances.
	04.04 Interpret lines.
	04.05 Read and interpret tile blocks.
	04.06 Read and interpret 1st and 3rd angles.
	04.07 Read and interpret change orders on working and assembly prints.
	04.08 Read and interpret abbreviations, symbols, and terminology.
	04.09 Read and interpret thread callouts.
05.0	Perform basic metrology. The student will be able to:
	05.01 Identify and understands the proper use of functional measuring tools.
	05.02 Read and measure with scales and calipers.
	05.03 Read and measure with micrometers (American and Metric).

	05.04 Read, calculate, and measure with sine tool.
	05.05 Demonstrate proper use of gage blocks.
06.0	Demonstrate basic knowledge of manufacturing history and primary as well as secondary manufacturing processes. The student will be able to:
	06.01 Demonstrate knowledge of how manufacturing processes have evolved throughout history.
	06.02 Identify different types of raw materials used in manufacturing.
	06.03 Explain the difference between primary and secondary manufacturing processes.
	06.04 Demonstrate knowledge of primary processes (milling, turning, assembly).
	06.05 Demonstrate knowledge of secondary processes including painting, plating, coating, and heat treating)
	06.06 Demonstrate knowledge of the use of current manufacturing processes.
	06.07 Demonstrate knowledge of quality assurance.
07.0	Demonstrate a basic understanding of geometric dimension and tolerance (GD&T). The student will be able to:
	07.01 Identify the datum reference frame.
	07.02 Identify datum's and datum symbols.
	07.03 Identify geometric characteristic symbols.
	07.04 Understand material condition modifiers.
	07.05 Identify feature control frame.
08.0	Set up and operate drill presses. The student will be able to:
	08.01 Identify the parts of a drill press and explain their uses.
	08.02 Identify and set the machine controls.
	08.03 Comply with safe and efficient work practices.
	08.04 Select the proper tooling.
	08.05 Identify the parts of a drill press and explain their uses.
	08.06 Set up and operate drill press for secondary operations.
	08.07 Set drill presses for proper feed and speed for specified operations.
09.0	Demonstrate the use of a CNC control panel. The student will be able to:
	09.01 Apply power off and power on procedures.
	09.02 Identify and apply modes of operation and overrides.

	09.03 Identify and use emergency stops.
	09.04 Identify and use movement controls.
	09.05 Identify and use switching functions.
10.0	Demonstrate the understanding of CNC machine systems. The student will be able to:
	10.01 Identify and use construction of machine tools.
	10.02 Identify controllable feed and rotation axis.
	10.03 Identify feed and main drives and their characteristics.
	10.04 Identify workpiece clamping device types.
	10.05 Identify and use switching functions.
11.0	Set up and operate a computerized numerical-control (CNC) machine for lathe operations. The student will be able to:
	11.01 Comply with safe and efficient work practices.
	11.02 Set up work holding devices.
	11.03 Select proper cutting tools.
	11.04 Select appropriate raw materials.
	11.05 Write and transfer basic program from computer to machine.
	11.06 Adjust appropriate cutting tools and tool offsets.
	11.07 Machine and create parts to blueprint tolerances.
	11.08 Perform first piece inspection.
12.0	Set up and operate a computerized numerical-control (CNC) machine for milling operations. The student will be able to:
	12.01 Comply with safe and efficient work practices.
	12.02 Set up work holding devices.
	12.03 Select proper cutting tools.
	12.04 Select appropriate raw materials.
	12.05 Write and transfer basic program from computer to machine.
	12.06 Adjust appropriate cutting tools and tool offsets.
	12.07 Machine and create parts to blueprint tolerances.
	12.08 Perform first piece inspection.

13.0	Demonstrate appropriate CNC maintenance and troubleshooting. The student will be able to:
	13.01 Maintain lubrication levels.
	13.02 Maintain coolant levels.
	13.03 Perform basic housekeeping tasks.

Course Description: CNC Production Technician 2 is designed to build on the skills and knowledge students learned in the CNC Production Technician 1 for entry into the machining industry. Students explore the importance of employability and entrepreneurship skills, leadership and teamwork skills; solve problems using critical thinking, creativity and innovation; demonstrate inspection methods, the techniques of CNC milling, perform advanced set up and operation of a CNC mill and lathe machine, and demonstrate basic computer-aided design/computer-aided manufacturing processes.

Course Number: PMT0027 Occupational Completion Point: B CNC Production Technician II – 300 Hours	
14.0	Explain the importance of employability and entrepreneurships skills. The student will be able to:
	14.01 Identify and demonstrate positive work behaviors needed to be employable.
	14.02 Develop personal career plan that includes goals, objectives, and strategies.
	14.03 Examine licensing, certification, and industry credentialing requirements.
	14.04 Maintain a career portfolio to document knowledge, skills, and experience.
	14.05 Evaluate and compare employment opportunities that match career goals.
	14.06 Identify and exhibit traits for retaining employment.
	14.07 Identify opportunities and research requirements for career advancement.
	14.08 Research the benefits of ongoing professional development.
	14.09 Examine and describe entrepreneurship opportunities as a career planning option.
15.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. The students will be able to:
	15.01 Employ leadership skills to accomplish organizational goals and objectives.
	15.02 Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
	15.03 Conduct and participate in meetings to accomplish work tasks.
	15.04 Employ mentoring skills to inspire and teach others.
16.0	Solve problems using critical thinking skills, creativity, and innovation. The students will be able to:

	16.01 Employ critical thinking skills independently and in teams to solve problems and make decisions.
	16.02 Employ critical thinking and interpersonal skills to resolve conflicts.
	16.03 Identify and document workplace performance goals and monitor progress toward those goal.
	16.04 Conduct technical research to gather information necessary for decision-making.
17.0	Demonstrate first article inspection methods. The student will be able to:
	17.01 Comply with safe and efficient work practices.
	17.02 Inspect equipment for safety.
18.0	Demonstrate the technique of CNC milling. The student will be able to:
	18.01 Use and apply program structure – address letters
	18.02 Use and apply geometric & technological basics
	18.03 Use and apply linear interpolation
	18.04 Use and apply circular interpolation
	18.05 Use and apply point machining cycle calls
	18.06 Use and apply programming milling cycles (3 Digit)
19.0	Perform advanced set up and operation of a computerized-numerical-control (CNC) mill machine. The student will be able to:
	19.01 Identify parts of a CNC machine and explain their uses.
	19.02 Follow safe and efficient work practices, including procedure sheets.
	19.03 Identify unusual machine noises.
	19.04 Inspect parts for correct dimensions.
20.0	Demonstrate the technique of CNC turning. The student will be able to:
	20.01 Use and apply program structure – address letters
	20.02 Use and apply geometric & technological basics
	20.03 Use and apply linear interpolation
	20.04 Use and apply circular interpolation
	20.05 Use and apply Turning Canned Cycles
21.0	Perform advanced set up and operation of a computerized-numerical-control (CNC) lathe machine. The student will be able to:
	21.01 Comply with safe and efficient work practices.

	21.02 Set up work holding devices.
	21.03 Select proper cutting tools.
	21.04 Select appropriate advanced program and make necessary edits.
	21.05 Adjust appropriate cutting tools and tool offsets.
	21.06 Machine and create parts to blueprint tolerances.
	21.07 Inspect parts for correct dimensions.
22.0	Demonstrate basic computer-aided design/computer-aided manufacturing (CAD/CAM) processes. The student will be able to:
	22.01 Identify and use computer-aided design (CAD) software
	22.02 Use computer-aided design (CAD) software to create sketches
	22.03 Use computer-aided design (CAD) software to create extrudes and cuts
	22.04 Use computer-aided design (CAD) software to create a model for sample part machining
	22.05 Use computer-aided manufacturing (CAM) to generate features of a sample part
	22.06 Use computer-aided manufacturing (CAM) generate operations of a sample part
	22.07 Use computer-aided manufacturing (CAM) verify operations of a sample part
	22.08 Use computer-aided manufacturing (CAM) to execute post process operation of a sample part

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Certified Production Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program	
Program Number	J200400
CIP Number	0615049905
Grade Level	30, 31
Program Length	300 Hours
Teacher Certification	Refer to the **Program Structure** section.
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml
Basic Skills Level	N/A

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Manufacturing career cluster.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 face-to-face lab clock hours and 240 hours of online instruction.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section1001.44(3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EEV0210	Certified Production Technician	AUTO PROD 7G ELECTRONIC @7 7GENG 7G TECH ED 1 @2 ENG&TEC ED1@2	300 hours

National Standards (NS)

Programs identified as having Industry or National Standards have been cross walked with the corresponding standards and/or benchmarks. Industry or National Standards for the MSSC Certified Production Technician program can be found using the following link: http://www.msscusa.org

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusiveto a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will have demonstrated mastery the following student learning outcomes:

01.0 Demonstrate an understanding of technology.
02.0 Demonstrate an understanding of workplace safety and workplace organization.
03.0 Demonstrate an understanding of workplace communication skills and teamwork.
04.0 Demonstrate the ability to read and accurately interpret blueprints and schematics.
05.0 Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings.
06.0 Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods.
07.0 Demonstrate an understanding of and be able to select production processes.
08.0 Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control.
09.0 Demonstrate an understanding of industrial tools and processes inclusive of: Basic Machine Tools, CNC machines, and Welding technology.
10.0 CNC Mill Programming and Operation.
11.0 Welding. (Optional when welding equipment is NOT available to students)
12.0 Demonstrate an understanding of mechanisms.
13.0 Pulley Systems and Gear Drives.
14.0 Demonstrate a fundamental understanding of AC/DC electrical and electrical control.
15.0 Demonstrate a fundamental understanding of Programmable Logic Control.
16.0 Demonstrate an understanding of fluid power.
17.0 Demonstrate the abilities to use and maintain technological products and systems.
18.0 Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies.

Florida Department of Education
Student Performance Standards

Program Title: **Certified Production Technology**
Career Certificate Program Number: **J200400**

Course Description: The purpose of the Certified Production Technician (CPT) ® 4.0 certification program is to recognize through certification, individuals who demonstrate mastery of the foundational, core competencies of advanced manufacturing production at the entry-level to front-line supervisor through successful completion of the certification assessments. The goal of the CPT 4.0 certification program is to raise the level of performance of production technicians to help employers ensure their workforce increases the company's productivity and competitiveness. The CPT 4.0 program consists of four individual certificate assessments: **Safety; Quality Practices and Measurement; Manufacturing Processes and Production; and Maintenance Awareness.**

Course Number: EEV0210 **Occupational Completion Point: A** **Certified Production Technician – 300 Hours**	
01.0	Demonstrate an understanding of technology. The student will be able to
01.01	Define and understand the concept of "Technology".
01.02	Explain "Technological Literacy" and what it means to be "Technologically Literate".
01.03	Classify the resources of technology.
01.04	Illustrate the nature and development of technological knowledge and processes.
01.05	Identify and describe technological systems. (ex. open-loop, closed-loop, system, subsystem)
01.06	Compare and contrast current and past technological systems.
02.0	Demonstrate an understanding of workplace safety and workplace organization. The student will be able to:
02.01	Wear appropriate Personal Protective Equipment (PPE).
02.02	Follow appropriate safety procedures.
02.03	Follow applicable safety and environmental laws and regulations.
02.04	Maintain a clean and safe work environment.
02.05	Maintain personal protection equipment.
02.06	Report unsafe conditions and practices.
02.07	Locate emergency equipment, exits, and alarms.
02.08	Comply with established safety practices.

	02.09 Explain appropriate fire extinguishing procedures.
	02.10 Explain when a machine or a process should be stopped to investigate an unsafe condition.
	02.11 Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
03.0	Demonstrate an understanding of workplace communication skills and teamwork. The student will be able to:
	03.01 Write logical and understandable statements, or phrases, to accurately complete forms commonly used in business and industry.
	03.02 Demonstrate an understanding of appropriate use of productivity tools. (e.g., software, computers, networks, etc.)
	03.03 Read and understand graphs, charts, diagrams, and common table formats.
	03.04 Read and follow written instructions.
	03.05 Demonstrate knowledge of technical language and technical acronyms.
	03.06 Demonstrate an understanding of; and ability to follow oral instructions.
	03.07 Answer and ask questions coherently and concisely
	03.08 Interact with co-workers using communication tools appropriately.
	03.09 Define member roles of a high-performance team.
	03.10 Explain the importance of setting goals both personally and as a team.
04.0	Demonstrate the ability to read and accurately interpret blueprints and schematics. The student will be able to:
	04.01 Define basic blueprint terminology used in manufacturing.
	04.02 Differentiate between dimensions of location and size.
	04.03 Interpret Linear, Circular, and Angular dimension features on a print.
	04.04 Identify general note symbols and their applications within a manufacturing environment.
	04.05 Locate notes on a print using industry standards.
	04.06 Interpret commonly used abbreviations and terminology used on prints in the manufacturing environment.
	04.07 Identify types of lines within a drawing.
	04.08 Interpret and understand information from a blueprint title block.
	04.09 Check for revisions.
	04.10 Interpret the meaning of the revision block symbols and notations.
	04.11 Identify orthographic views.
	04.12 Recognize the three basic orthographic views which may be represented on a drawing; front, top, right side.

	04.13 Identify positions of views: top, front, side, auxiliary, and section of an orthographic drawing.
	04.14 Calculate appropriate scale of view or section based on the title block information, physical scaling of view, and standard drawing scale
05.0	Demonstrate an understanding of graphic design by generating and interpreting computer-aided drawings. The student will be able to:
	05.01 Apply current industrial design software computer aided-drawing practices.
	05.02 Apply standard dimensioning and tolerance rules.
	05.03 Import and export various file types.
	05.04 Use industrial design software to open and change the views of CAD drawings.
	05.05 Use standard industrial design software commands in the editing of a drawing.
	05.06 Use industrial design software to create a single view drawing.
	05.07 Use industrial design software to create a multi-view drawing.
	05.08 Use industrial design software to dimension a drawing.
	05.09 Use industrial design software to create a full sectional view for an object.
	05.10 Use industrial design software to create a bent sectional view for an object.
	05.11 Use industrial design software to create an offset sectional view for an object.
	05.12 Use industrial design software to draw a thread representation.
	05.13 Create a custom 3D coordinate system orientation.
	05.14 Create a 3D object using 3D drawing commands.
06.0	Demonstrate proficiency in using measurement tools, instruments and testing devices related to proper quality assurance methods. The student will be able to:
	06.01 Use measurement tools appropriately.
	06.02 Maintain and store inspection tools appropriately.
	06.03 Determine accuracy and precision when using inspection tools, measuring equipment, and procedures.
	06.04 Use and convert both U.S. measurement and Standard International (S.I.) metric systems.
	06.05 Demonstrate knowledge of inspection equipment, calibration standards, and requirements.
	06.06 Verify calibration of inspection equipment.
	06.07 Demonstrate knowledge of appropriate automated inspection systems.
	06.08 Use appropriate safety monitoring and testing equipment.
	06.09 Implement appropriate testing regimens.

	06.10 Use multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.
	06.11 Research measurement tools for non-mechanical systems and products. (e.g., pH, °Brix)
	06.12 Describe and explain the use of the 6S's, (sort, set in order, shine, standardize, sustain, safety).
07.0	Demonstrate an understanding of and be able to select production processes. The student will be able to:
	07.01 Identify customer needs.
	07.02 Determine available and needed resources for the production process.
	07.03 Make job assignments and coordinate workflow.
	07.04 Communicate production and material requirements to meet product specifications.
	07.05 Establish set-up and operation procedures are available and up to date.
	07.06 Read and interpret a production schedule and manufacturing work order.
	07.07 Demonstrate knowledge of production processes, including flow and bottlenecks.
	07.08 Document product and process compliance with customer requirements.
	07.09 Compare and contrast various production processes. (e.g., push, pull, just-in-time, work cell, batch, etc.)
08.0	Demonstrate an understanding of computer aided manufacturing and flexible manufacturing planning and control. The student will be able to:
	08.01 Identify manufacturing process variables that must be controlled for quality and reliability.
	08.02 Identify the process for making job assignments and coordinating workflow.
	08.03 Identify and explain Enterprise Resource Planning (ERP) and Material Resource Planning (MRP).
	08.04 Understand and predict lead-time required for a production plan.
	08.05 Read and interpret bills of materials and routing sheets.
	08.06 Identify methods of productivity measurement and improvement.
	08.07 Apply principles and practice of various production processes such as just-in-time (JIT) inventory control in performing a physical inventory.
09.0	Demonstrate an understanding of industrial tools and processes inclusive of: Basic Machine Tools, CNC machines, and Welding technology. The student will be able to:
	09.01 Operate manual controls on a milling machine.
	09.02 Use a milling machine micrometer collar to measure table movement.
	09.03 Face a piece of stock to length.
	09.04 Mill a step using the micrometer collars on the milling machine.

	09.05 Mill a step on a part using layout lines.
	09.06 Mill a slot to a specific depth.
	09.07 Mill a part.
10.0	CNC Mill Programming and Operation. The student will be able:
	10.01 Operate a CNC Mill.
	10.02 Determine CNC program coordinates based on a dimensioned part drawing.
	10.03 Select tooling for a CNC operation.
	10.04 Determine the spindle speed for various machining operations.
	10.05 Locate the PRZ (Program Reference Zero) of a part in a CNC mill using an edge-finder.
	10.06 Create a precision part using PRZ (Program Reference Zero) and tool offset measurements.
11.0	Welding. The student will be able to: **(Optional when welding equipment is NOT available to students)**
	11.01 Identify a specified weld using a welding symbol.
	11.02 Draw and identify welding symbols.
	11.03 Demonstrate an understanding of the steps necessary to create a project from a welding drawing.
	11.04 Prepare metal for welding. Set up welder controls correctly
	11.05 Demonstrate an understanding of weld quality analysis using various testing procedures. (i.e., dye penetrant, guided bend)
12.0	Demonstrate an understanding of mechanisms. The student will be able to:
	12.01 Use a spring scale to measure the weight of an object and the force on an object.
	12.02 Calculate torque.
	12.03 Understand the mechanical advantage of an inclined plane
	12.04 Understand the operation of a slider crank linkage.
	12.05 Understand the operation of a double rocker linkage.
	12.06 Understand the operation of a crank rocker linkage.
	12.07 Understand the velocity, rise, dwell, and fall of a cam.
	12.08 Calculate and measure the mechanical advantage of a first-class, second-class, and third-class lever.
	12.09 Use a spirit level to determine orientation of a surface.
	12.10 Level an electric motor.

	12.11 Measure the actual size of a key and key seat.
	12.12 Use a digital tachometer to measure motor speed.
13.0	Pulley Systems and Gear Drives. The student will be able to:
	13.01 Calculate pulley ratio.
	13.02 Measure the mechanical advantage of a fixed pulley.
	13.03 Calculate sprocket ratio.
	13.04 Determine allowable chain sag for a given application.
	13.05 Use a rule and a straight edge to measure chain sag.
14.0	Demonstrate a fundamental understanding of AC/DC electrical and electrical control. The student will be able to:
	14.01 Demonstrate knowledge of AC/DC theory.
	14.02 Check electrical components for UL and CSA approval.
	14.03 Understand how to use an AC tester to check for electricity.
	14.04 Use a Digital Multi-Meter (DMM) to properly measure voltage, current, resistance, and continuity.
	14.05 Test a capacitor with a DMM.
	14.06 Operate a circuit using a fuse, test and replace a fuse.
	14.07 Operate a circuit using a circuit breaker, test and reset a circuit breaker.
15.0	Demonstrate a fundamental understanding of Programmable Logic Control. The student will be able to:
	15.01 Read and interpret the operation of a circuit given a ladder diagram.
	15.02 Connect and operate a logic circuit given a ladder diagram.
	15.03 Design a ladder diagram using one or more logic elements.
	15.04 Design, connect, and operate a control circuit to operate a solenoid valve.
	15.05 Connect and operate an event sequencing circuit given a ladder diagram.
	15.06 Design a control circuit to perform time-driven sequencing.
16.0	Demonstrate an understanding of fluid power. The student will be able to:
Pneumatic Circuits and Power Systems	
	16.01 Identify pneumatic symbols.
	16.02 Read a pneumatic pressure gage and flow meter.

	16.03 Connect equipment and perform basic pneumatic operations.
	16.04 Connect a pneumatic circuit given a schematic.
	16.05 Connect and operate pneumatic Directional Control Valve (DCV) applications.
	16.06 Design a pneumatic circuit to sequence two cylinders.
Hydraulic Circuits and Power Systems	
	16.07 Read a hydraulic pressure gage, flow meter and the liquid level and temperature in the reservoir
	16.08 Operate a hydraulic power unit.
	16.09 Connect equipment and perform basic hydraulic operations.
	16.10 Connect and operate hydraulic Directional Control Valve (DCV) applications.
	16.11 Design and connect hydraulic speed control circuits.
17.0	Demonstrate the abilities to use and maintain technological products and systems. The student will be able to:
Overall Maintenance Process	
	17.01 Discuss preventive and predictive maintenance methods for manufacturing environments.
	17.02 Demonstrate knowledge of principles of Total Productive Maintenance (TPM).
	17.03 Recognize potential maintenance issues with basic production systems and determine when to inform maintenance personnel about issues.
	17.04 Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.
	17.05 Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.
	17.06 Describe root cause analysis methods.
	17.07 Use materials management to know what is recyclable and what is not.
18.0	Demonstrate an understanding of employability skills and career opportunities in the fields of advanced manufacturing and engineering technologies. The student will be able to:
	18.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
	18.02 Discuss motivation and human behavior.
	18.03 Demonstrate knowledge of ways to improve reading, listening and writing skills.
	18.04 Demonstrate knowledge of techniques for making effective presentations to internal and external customers.
	18.05 Provide effective feedback and make suggestions.
	18.06 Demonstrate appropriate customer service skills and techniques.

18.07	Demonstrate knowledge of roles and responsibilities of production team members.
18.08	Explain the characteristics of a high-performance team and how to assess team member personality types.
18.09	Align team goals (that are specific, documented, measurable and achievable) to customer and business production needs.
18.10	Communicate production and process information to team members.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology andspecial communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Biomedical Equipment Repair Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J400100	
CIP Number	0615040106	
Grade Level	30, 31	
Program Length	1140 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 10	Communications (Reading and Language Arts): 10

Purpose

The purpose of this program is to prepare students for employment as biomedical equipment repair technicians. This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Manufacturing career cluster.

The course content includes, but is not limited to, hydraulics, pneumatics, optics and mechanics to troubleshoot, service and repair equipment commonly used for treatment, diagnosis and monitoring of patients in a medical environment.

The course content should also include training in communication, leadership, human relations and employability skills; and safe, efficient work practices.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the **Equipment Repair** industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	AVS0095	Basic Electronics Troubleshooter	BIOMED EQ 7G ELECTRONIC @7 7G MED EQUIP TEC 7G	150 hours
B	EER0006	Electronics Equipment Repairer		150 hours
C	EER0090 EER0091	Biomedical Electronics Troubleshooter 1 Biomedical Electronics Repair Technician		150 hours 150 hours
D	EER0092 EER0093	Biomedical Imaging Equipment 1 Biomedical Imaging Equipment Technician		270 hours 270 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in soldering and basic laboratory practices.
02.0 Demonstrate proficiency in basic DC circuits.
03.0 Demonstrate employability skills.
04.0 Demonstrate an understanding of entrepreneurship.
05.0 Demonstrate proficiency in knowledge of basic computer usage.
06.0 Demonstrate proficiency in advanced DC circuits.
07.0 Demonstrate proficiency in AC circuits.
08.0 Demonstrate proficiency in analog circuits.
09.0 Demonstrate proficiency in solid state devices.
10.0 Demonstrate proficiency in digital circuits.
11.0 Demonstrate proficiency in fundamental microprocessors.
12.0 Demonstrate appropriate understanding of basic math skills.
13.0 Demonstrate an understanding of basic science skills.
14.0 Demonstrate skills in technical recording.
15.0 Demonstrate appropriate communication skills.
16.0 Demonstrate proficiency with Transistor Pulse Amplifiers.
17.0 Demonstrate proficiency with Trigger Device Circuits.
18.0 Demonstrate proficiency with Operational Amplifiers.
19.0 Demonstrate proficiency in knowledge of Electromagnetics.
20.0 Demonstrate proficiency with Fiber Optic Applications.
21.0 Demonstrate proficiency in DC Motor Systems.
22.0 Demonstrate proficiency with Motor Control Systems.
23.0 Demonstrate an understanding of safety concepts and best practices.
24.0 Demonstrate appropriate understanding of “The Human Machine”.
25.0 Demonstrate an understanding of Monitoring Systems.
26.0 Demonstrate proficiency with Basic Monitoring Equipment.
27.0 Demonstrate proficiency with Medical Support Equipment.
28.0 Demonstrate proficiency with Motors.
29.0 Demonstrate proficiency with Power Systems.
30.0 Demonstrate proficiency with Laboratory Equipment.
31.0 Demonstrate proficiency with Sterilization Equipment.
32.0 Demonstrate an understanding of Biomedical Imaging Systems.
33.0 Demonstrate proficiency with Radiographic Imaging Systems.
34.0 Demonstrate proficiency with Magnetic Resonance Imaging Systems.
35.0 Demonstrate proficiency with Impedance Tomography Systems.
36.0 Demonstrate proficiency with Life Support Systems.

37.0 Demonstrate proficiency with Respiratory Systems.
38.0 Demonstrate proficiency with Cardio Systems.
39.0 Demonstrate proficiency with Renal Systems.
40.0 Demonstrate proficiency with Incubators.
41.0 Demonstrate proficiency with Biomedical Optic Systems.
42.0 Demonstrate proficiency with Surgical Support Tools.
43.0 Demonstrate proficiency using Biomedical Information Systems.
44.0 Graphically illustrate an understanding of anatomy.
45.0 Reinforce knowledge of Medical Terminology.
46.0 Demonstrate proficiency in Computer Communication.
47.0 Demonstrate understanding and knowledge of Electro/Mechanical Safety.
48.0 Demonstrate understanding of Picture Archive Communication Systems.
49.0 Demonstrate understanding and knowledge of Diagnostic Ultrasound Equipment.
50.0 Demonstrate proficiency in Building Wiring.
51.0 Demonstrate proficiency in Basic Radiographic Equipment.
52.0 Demonstrate proficiency in Film Processing.
53.0 Demonstrate proficiency in Test Equipment.
54.0 Demonstrate an understanding of Magnetic Resonance Imaging.
55.0 Demonstrate understanding and knowledge of Computed Tomography.
56.0 Demonstrate an understanding of Nuclear Medicine.
57.0 Demonstrate an understanding of Codes and Regulations Applications.
58.0 Demonstrate proficiency in Troubleshooting.
59.0 Demonstrate proper application of Radiation Safety.
60.0 Demonstrate an understanding and knowledge of Radiation Physics.
61.0 Demonstrate proficiency in Linear Accelerators**.**

Florida Department of Education
Student Performance Standards

Program Title: **Biomedical Equipment Repair Technology**
Career Certificate Program Number: **J400100**

Course Description: This course teaches basic DC and AC electricity and electronics fundamentals. It emphasizes troubleshooting techniques and it brings elements that help to develop fine motor skills. This course defines techniques, requirements and expectations for those seeking to enter the job market as employees or small business owners**.**

Course Number: AVS0095 **Occupational Completion Point: A** **Basic Electronics Troubleshooter – 150 Hours**	
01.0	Demonstrate proficiency in soldering basic laboratory practices. The student will be able to:
01.01	Apply proper Occupational Safety Health Administration (OSHA) safety standards.
01.02	Make electrical connections.
01.03	Identify and use hand tools properly.
01.04	Identify and use power tools properly.
01.05	Demonstrate acceptable soldering techniques.
01.06	Demonstrate acceptable de-soldering techniques.
01.07	Demonstrate electrostatic discharge (ESD) safety procedures.
01.08	Describe the construction of printed circuit boards (PCB's).
01.09	Explain the theoretical concepts of soldering.
01.10	Demonstrate rework and repair techniques.
02.0	Demonstrate proficiency in basic direct current (DC) circuits. The student will be able to:
02.01	Demonstrate proficiency in basic DC circuits.
02.02	Solve problems in electronic units utilizing metric prefixes.
02.03	Identify sources of electricity.
02.04	Define voltage, current, resistance, power and energy.
02.05	Apply Ohm's law and power formulas.
02.06	Read and interpret color codes and symbols to identify electrical components and values.

	02.07 Measure properties of a circuit using volt-ohm meter (VOM) and digital volt-ohm meter (DVM) and oscilloscopes.
	02.08 Compute conductance and compute and measure resistance of conductors and insulators.
	02.09 Apply Ohm's law to series circuits.
	02.10 Analyze and troubleshoot series circuits.
	02.11 Apply Ohm's law to parallel circuits.
	02.12 Analyze and troubleshoot parallel circuits.
03.0	Demonstrate employability skills. The student will be able to:
	03.01 Discuss elements of a job search.
	03.02 Develop sources of information about a job.
	03.03 Identify documents that may be required when applying for a job.
	03.04 Complete a job application form correctly.
	03.05 Demonstrate competence in job interview techniques.
	03.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other persons.
	03.07 Identify acceptable work habits.
	03.08 Demonstrate knowledge of how to make appropriate job changes.
	03.09 Demonstrate acceptable employee health habits.
	03.10 Demonstrate knowledge of the Federal Law as recorded in (29 CFR-1910.1200).
	03.11 Resume writing.
04.0	Demonstrate an understanding of entrepreneurship. The student will be able to:
	04.01 Define entrepreneurship.
	04.02 Describe the importance of entrepreneurship to the American economy.
	04.03 List the advantages and disadvantages of business ownership.
	04.04 Identify the risks involved in ownership of a business.
	04.05 Identify the necessary personal characteristics of a successful entrepreneur.
	04.06 Identify the business skills needed to operate a small business efficiently and effectively.
	04.07 Corporate structure “S”,”C”, Sole Proprietor, “LLC”
05.0	Demonstrate proficiency in knowledge of basic computer usage. The student will be able to:

	05.01 Demonstrate proficiency in the knowledge of basic computer use.
	05.02 Demonstrate the use of computer application programs (i.e., word processing, data base, Excel).
06.0	Demonstrate proficiency in advanced DC circuits. The student will be able to:
	06.01 Solve algebraic problems to include exponentials to DC.
	06.02 Relate electricity to the nature of matter.
	06.03 Apply Ohm's law to series-parallel and parallel-series circuits.
	06.04 Construct and verify the operation of series-parallel and parallel-series and bridge circuits.
	06.05 Troubleshoot series-parallel and parallel-series and bridge circuits.
	06.06 Identify and define voltage divider circuits (loaded and unloaded).
	06.07 Construct and verify the operation of voltage divider circuits (loaded and unloaded).
	06.08 Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
	06.09 Describe magnetic properties of circuits and devices.
	06.10 Determine the physical and electrical characteristics of capacitors and inductors.
	06.11 Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants.
	06.12 Set up and operate power supplies for DC circuits.
07.0	Demonstrate proficiency in AC circuits. The student will be able to:
	07.01 Solve basic trigonometric problem as applicable to electronics.
	07.02 Define the characteristics of AC capacitive circuits.
	07.03 Analyze and troubleshoot AC capacitive circuits.
	07.04 Define the characteristics of AC inductive circuits.
	07.05 Analyze and troubleshoot AC inductive circuits.
	07.06 Define and apply the principles of transformers to AC circuits.
	07.07 Analyze and troubleshoot AC circuits utilizing transformers.
	07.08 Analyze and troubleshoot differentiator and integrator circuits.
	07.09 Define the characteristics of resistive, Inductive, and Capacitive (RLC) circuits (series, parallel and complex).
	07.10 Define the characteristics of series and parallel resonant circuits.
	07.11 Analyze and troubleshoot R-C, R-L, and RLC circuits.

07.12	Define the characteristics of frequency selective filter circuits.
07.13	Analyze and troubleshoot frequency selective filter circuits.
07.14	Define the characteristics of poly-phase circuits.
07.15	Define basic motor theory and operation.
07.16	Define basic generator theory and operation.
07.17	Set up and operate power supplies for AC circuits.
07.18	Analyze and measure power in AC circuits.

Course Description: This course develops skills and understanding of basic electronics, Analog, Digital, and Microprocessor functions. Students will learn or refresh practical and applied math and science skills.

Course Number: EER0006 Occupational Completion Point: B Electronics Equipment Repairer – 150 Hours	
08.0	Demonstrate proficiency in analog circuits. The student will be able to:
08.01	Identify and define operational characteristics and applications of multistage amplifiers.
08.02	Analyze and troubleshoot multistage amplifiers.
08.03	Identify and define operating characteristics and applications of linear integrated circuits.
08.04	Identify and define operating characteristics and applications of basic power supplies and filters.
08.05	Identify and define operating characteristics and applications of differential and operational amplifiers.
08.06	Analyze and troubleshoot differential and operational amplifier circuits.
08.07	Identify and define operating characteristics of audio power amplifiers.
08.08	Analyze and troubleshoot audio power amplifiers.
08.09	Identify and define operating characteristics and applications of power supply regulator circuits.
08.10	Analyze and troubleshoot power supply regulator circuits.
08.11	Identify and define operating characteristics and applications of active filters.
08.12	Analyze and troubleshoot active filter circuits.
08.13	Identify and define operating characteristics and applications of sinusoidal and non-sinusoidal oscillator circuits.
08.14	Analyze and troubleshoot oscillator circuits.

	08.15 Identify and define operating characteristics and applications of cathode ray tubes and optoelectronic devices.
	08.16 Set up and operate measuring instruments for analog circuits.
09.0	Demonstrate proficiency in solid state devices. The student will be able to:
	09.01 Identify and define properties of semiconductor materials.
	09.02 Identify and define operating characteristics and applications of junction and special diodes.
	09.03 Analyze and troubleshoot diode circuits.
	09.04 Identify and define operating characteristics and applications of bipolar and field effect transistors,
	09.05 Identify and define operating characteristics and applications of single-stage amplifiers.
	09.06 Analyze and troubleshoot single-stage amplifiers.
	09.07 Analyze and troubleshoot thyristor circuitry.
	09.08 Set up and operate; DVM, power supplies, oscilloscopes, and function generators for solid-state devices.
	09.09 Demonstrate transistor testing techniques.
10.0	Demonstrate proficiency in digital circuits. The student will be able to:
	10.01 Define and apply numbering systems to codes and arithmetic operations.
	10.02 Analyze and minimize logic circuits using Boolean operations.
	10.03 Set up and operate; logic probes, pulsers, oscilloscopes, logic analyzers, and pulse generators for digital circuits.
	10.04 Set up and operate power supplies for digital circuits and solve power distribution and noise problems.
	10.05 Identify types of logic gates and their truth tables.
	10.06 Construct combinational logic circuits using integrated circuits.
	10.07 Troubleshoot logic circuits.
	10.08 Analyze types of flip-flops and their truth tables.
	10.09 Troubleshoot flip-flops.
	10.10 Identify, define and measure characteristics of integrated circuit (IC) logic families.
	10.11 Identify types of registers and counters.
	10.12 Troubleshoot registers and counters.
	10.13 Analyze clock and timing circuits.
	10.14 Troubleshoot clock and timing circuits.

	10.15 Identify types of arithmetic-logic circuits.
	10.16 Troubleshoot arithmetic-logic circuits.
	10.17 Identify types of encoding and decoding devices.
	10.18 Troubleshoot encoders and decoders.
	10.19 Identify types of multiplexer and de-multiplexer circuits.
	10.20 Troubleshoot multiplexer and de-multiplexer circuits.
	10.21 Identify types of memory circuits.
	10.22 Relate the uses of digital-to-analog and analog-to-digital conversions.
	10.23 Troubleshoot digital-to-analog and analog-to-digital circuits.
	10.24 Identify types of digital displays.
	10.25 Troubleshoot digital display circuits.
11.0	Demonstrate proficiency in fundamental microprocessors. The student will be able to:
	11.01 Identify central processing unit (CPU) building blocks and their uses (architecture).
	11.02 Analyze bus concepts.
	11.03 Analyze various memory schemes.
	11.04 Use memory devices in circuits.
	11.05 Set up and operate oscilloscopes for microprocessor systems.
	11.06 Identify types of input and output devices and peripherals.
	11.07 Interface input and output ports to peripherals.
	11.08 Analyze and troubleshoot input and output ports.
12.0	Demonstrate appropriate understanding of basic math skills. The student will be able to:
	12.01 Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares, and cylinders.
	12.02 Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet, and inches.
	12.03 Add, subtract, multiply and divide using fractions, decimals, and whole numbers.
	12.04 Determine the correct purchase price, to include sales tax for a materials list containing a minimum of six items.
	12.05 Demonstrate and understanding of federal, state, and local taxes and their computation.
13.0	Demonstrate an understanding of basic science skills. The student will be able to:

13.01	Understand molecular action as a result of temperature extremes, chemical reaction, and moisture content.
13.02	Draw conclusions or make interferences from data.
13.03	Identify health-related problems, which may result from exposure to work related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
13.04	Understand pressure measurement in terms of P.S.I., inches of mercury, and K.P.A.
14.0	Demonstrate skills in technical recording. The student will be able to:
14.01	Draw and interpret electronic schematics.
14.02	Write reports and make oral presentations.
14.03	Maintain test logs.
14.04	Make equipment failure reports.
14.05	Specify and requisition simple electronic components.
14.06	Compose technical letters and memoranda.
14.07	Write formal reports of laboratory experiences.
14.08	Draft preventive maintenance procedures.
15.0	Demonstrate appropriate communication skills. The student will be able to:
15.01	Write logical and understandable statements, or phrases, to accurately fill out forms/invoices commonly used in business and industry.
15.02	Read and understand graphs, charts, diagrams, and tables commonly used in this industry/occupation area.
15.03	Read and follow written instructions.
15.04	Answer and ask questions coherently and concisely.
15.05	Read critically by recognizing assumptions and implications and by evaluating ideas.
15.06	Demonstrate appropriate telephone/communication skills.

Course Description: This course develops skills and understanding of advanced electronics circuits; semiconductor devices, fiber optics, and basic motor applications.

Course Number: EER0090 **Occupational Completion Point: C (1 of 2)** **Biomedical Electronics Troubleshooter 1 – 150 Hours**	
16.0	Demonstrate proficiency with Transistor Pulse Amplifiers. The student will be able to:
16.01	Observe and study Schmitt Trigger operation.

	16.02 Troubleshoot Schmitt Trigger circuits.
17.0	Demonstrate proficiency with Trigger Device Circuits. The student will be able to:
	17.01 Understand trigger devices.
	17.02 Explain unijunction transistor oscillator operation.
	17.03 Validate SCR trigger circuit operation.
	17.04 Explain SCR power control operation.
	17.05 Troubleshoot SCR circuit circuits.
	17.06 Differentiate between DIAC, TRIAC, and 4-layer diodes.
	17.07 Classify programmable unijunction transistors.
18.0	Demonstrate proficiency with Operational Amplifiers. The student will be able to:
	18.01 Examine operational amplifiers functionality.
	18.02 Troubleshoot operational amplifiers.
19.0	Demonstrate proficiency in knowledge of Electromagnetics. The student will be able to:
	19.01 State magnetism and electromagnetic principles.
	19.02 Extrapolate magnetic calculations.
20.0	Demonstrate proficiency with Fiber Optic Applications. The student will be able to:
	20.01 Understand fiber optics.
	20.02 Apply fiber optics concepts to communications protocols.
	20.03 Understand lasers.
	20.04 Construct fiber optic cable connections.
	20.05 Troubleshoot fiber optic system devices.
21.0	Demonstrate proficiency in DC Motor Systems. The student will be able to:
	21.01 Explain the concepts and principles of DC series field motors.
	21.02 Label brushless DC motor components.
	21.03 Troubleshoot AC motor systems.
	21.04 Describe pulse width modulation and amplification functionality.
	21.05 Troubleshoot open loop motor system.

22.0	Demonstrate proficiency with Motor Control Systems. The student will be able to:
22.01	Investigate the functionality of motion detection.
22.02	Recognize error detection and feedback protocols.
22.03	Troubleshoot closed loop system.
22.04	Investigate the functionality of position detection.
22.05	Extrapolate Proportional-Integral-Derivative (PID) control system output functions.
22.06	Troubleshoot Proportional-Integral-Derivative (PID) control systems.
22.07	Distinguish the differences between motion detection and position detection.
23.0	Demonstrate an understanding of safety concepts and best practices. The student will be able to:
23.01	Evaluate personal and workplace safety concerns.
23.02	Justify medical ethics.
23.03	Create an Electrical Shock and Safety Public Service Announcement (PSA).
23.04	Design a “Best Practices” plan for tool safety.
23.05	Apply National Electric Code (NEC) Standards to medical facilities.
23.06	Compare and contrast Biomedical Equipment specifications and installation requirements.
23.07	Diagram a Systems Thinking model.
24.0	Demonstrate appropriate understanding of “The Human Machine”. The student will be able to:
24.01	Define medical terminology words and terms.
24.02	Communicate an understanding of cells and body fluid.
24.03	Reconstruct the skeletal and muscle system as they apply to biomechanics.
24.04	Recognize and document the gastrointestinal system.
24.05	Explain the functionality of the nervous and endocrine systems.
24.06	List the functions of the circulatory and pulmonary systems.
24.07	Outline the proper procedures for handling bio-hazardous materials.
25.0	Demonstrate an understanding of Monitoring Systems. The student will be able to:
25.01	Collect and confirm biomedical measurements.
25.02	Align the proper electrodes, sensors, and transducer to a biomedical measurement.

	25.03 Provide examples of signal processing techniques.
	25.04 Identify data recording systems.
26.0	Compile and Compare Data through the Usage of Basic Monitoring Equipment. The student will be able to:
	26.01 Recognize vital signs.
	26.02 Compare blood pressure measurements from various sources.
	26.03 Chart blood oxygen level measurements over multiple time periods.
	26.04 Plot temperature measurements and explain how temperature sensors react to various skin conditions.
	26.05 Apply electro-cardio measurement devices and determine normal outcomes.
	26.06 Estimate pulse and respiratory measurements and compare to actual scales.
27.0	Demonstrate proficiency with Medical Support Equipment. The student will be able to:
	27.01 Understand the fundamental concepts and principles of biomedical pumps.
	27.02 Explain displacement pumps functionality.
	27.03 List the applications of centrifugal and gravity pumps.
	27.04 Detail the effects of electromagnetic and impedance on pumps
	27.05 Observe the operation of vacuum and pneumatic pumps.
28.0	Demonstrate proficiency with Motors. The student will be able to:
	28.01 Understand motion control as it applies to biomedical motors.
	28.02 Analyze and troubleshoot stepper, linear, PCB, and pneumatic motors.
29.0	Demonstrate proficiency with Power Systems. The student will be able to:
	29.01 Formulate a plan for managing AC power in a medical environment.
	29.02 Differentiate between batteries and their application to medical equipment.
	29.03 Evaluate battery backup systems for rated capacity and life expectancy.
	29.04 Summarize the characteristics of various dental compressor systems.
30.0	Demonstrate proficiency with Laboratory Equipment. The student will be able to:
	30.01 Compare and contrast biological and chemical testing systems
	30.02 Categorize manipulation, prep, and storage systems to their laboratory application.
31.0	Demonstrate proficiency with Sterilization Equipment. The student will be able to:

31.01	Understand the need and describe the process of sterilization.
31.02	List the types of sterilization equipment.
31.03	Analyze and troubleshoot ultrasonic and ultraviolet sterilization systems.

Course Number: EER0091 Occupational Completion Point: C (2 of 2) Biomedical Electronics Repair Technician – 150 Hours	
32.0	Demonstrate an understanding of Sound Imaging Systems. The student will be able to:
32.01	Explain the characteristics of sound waves.
32.02	Describe the Doppler Effect and list the medical uses of Doppler.
32.03	Determine how sonography and ultrasonography equipment capture images of the body's internal functions.
32.04	Explain how echocardiography creates an image of the heart muscle and identify information that is captured and displayed by echocardiograph equipment.
32.05	Develop a preventative maintenance plan for a given sound imaging system (ultrasound, echocardiograph).
33.0	Demonstrate proficiency with Radiographic Imaging Systems. The student will be able to:
33.01	Prepare a 20-minute presentation on the types, operation, and safety precautions of a given Radiographic Imaging System (x-ray, fluoroscopic).
33.02	Differentiate between an x-ray and a fluoroscopic imaging system and define the limitations of each.
33.03	Analyze and troubleshoot faulted radiographic imaging systems.
34.0	Demonstrate proficiency with Nuclear Imaging Systems. The student will be able to:
34.01	Identify the main components of MRI, CT, and PET imaging systems and describe the information provided by these systems.
34.02	Develop an operational procedures step-action table from the observation of the operation of MRI, CT, and PET imaging systems.
34.03	Evaluate a faulted Magnetic Resonance Imaging System and create a troubleshooting procedure for determining the cause of the fault.
35.0	Demonstrate proficiency with Impedance Tomography Systems. The student will be able to:
35.01	Diagram the process of nerve impulses across synapses and at neuromuscular junctions.
35.02	Draw a block diagram of the key elements of an EMG, EEG, and ECG system.
35.03	Recognize the operational differences between EMG, EEG, and ECG systems.
35.04	List the common failures associated with EMG, EEG, and ECG systems and recommend interventions for returning the equipment to an operational condition.

36.0	Demonstrate proficiency with Life Support Systems. The student will be able to:
36.01	Categorize biomedical needs as basic, advance, or long-term life support.
36.02	Explain the purpose and operation of various life support systems and link their use with the appropriate level of life support.
36.03	Choose the best infusion device (intravenous, subcutaneous, respiratory) to provide life support to a given medical condition.
36.04	Write a troubleshooting plan to correct malfunctions on specific life support systems.
37.0	Demonstrate proficiency with Respiratory Systems. The student will be able to:
37.01	Identify the types and explain the operation of different types of Resuscitator Systems.
37.02	List the critical elements to verify when maintaining respiratory equipment, ventilators, and nebulizers.
38.0	Demonstrate proficiency with Cardio Systems. The student will be able to:
38.01	Describe the purpose and operation of various types of Cardio Systems.
38.02	Explain the safety precautions when using and working with Defibrillators.
38.03	Report on the history, purpose, and technical requirements of pacemakers.
39.0	Demonstrate proficiency with Renal Systems. The student will be able to:
39.01	Recognize the types of renal dysfunctions.
39.02	Draw a flow diagram of Renal System Equipment with their interfaces to the human renal system.
39.03	Determine the corrective action for common Dialysis Equipment failures.
40.0	Demonstrate proficiency with Incubators. The student will be able to:
40.01	Correlate the fetal biomedical functions to the elements an incubator provides (ambient temperature, skin temperature, humidity, oxygen, sound, and lighting) and explain the purpose and operation of each element.
40.02	Explain the purpose and components of an MR-Compatible Neonatal Incubator.
40.03	Describe the process of monitoring fetal heart, temperature, and respiratory parameters and determine the life-sustaining ranges of each.
40.04	Create a preventative maintenance plan for Incubators.
41.0	Demonstrate proficiency with Biomedical Optic Systems. The student will be able to:
41.01	Practice the protocols associated with working in the operating room environment (dress code, sterilization, equipment handling).
41.02	Define the characteristics of fiber optics and calculate reflective and refraction errors in a fiber optic cable.
41.03	Select a type of operating room optic system (laser, optical microscope, endoscopy, etc.) and prepare a15-minutee lesson that describes the purpose, use, operation, and precautions associated with the system.
42.0	Demonstrate proficiency with Surgical Support Systems. The student will be able to:

	42.01 Explain the use and operation of the different types of Surgical Support Systems (electrosurgical generators, cauterization, lighting, suction, robotics, adjustable patient platforms, and cooling).
	42.02 Analyze malfunctions in surgical support systems and develop a troubleshooting process plan.
43.0	Demonstrate Proficiency using Biomedical Information Systems. The student will be able to:
	43.01 Research the meaning and provide examples of health-care informatics.
	43.02 Conduct a survey of local medical facilities and determine the types of Facility Information Systems used in the biomedical industry.
	43.03 Draw a block diagram of a typical health-care facility Central Monitoring System.

Course Description: This course develops skills and understanding of electronic circuits; medical terminology, and advance imaging techniques.

Course Number: EER0092 Occupational Completion Point: D (1 of 2) Medical Imaging Equipment 1 – 270 Hours	
44.0	Graphically illustrate an understanding of anatomy. The student will be able to:
	44.01 State the Purposes of the Skeletal System.
	44.02 Describe Appendicular Skeletal System.
	44.03 Describe Axial Skeletal System.
	44.04 Identify Bone vs. Cartilage and list the differences between them.
	44.05 Identify Ligament vs. Tendon and Explain the Difference.
	44.06 Identify Major Nerves.
	44.07 Identify Major Veins.
	44.08 Identify Major Bones.
45.0	Reinforce knowledge of Medical Terminology. The student will be able to:
	45.01 Describe the anatomical position.
	45.02 State positional terms.
	45.03 State directional terms
	45.04 Identify anatomical planes.
	45.05 Describe supine and compare the term with prone.
	45.06 Identify major suffixes, roots and prefixes used in medical terminology.

	45.07 State radiographic positional terms.
46.0	Demonstrate proficiency in Computer Communication. The student will be able to:
	46.01 Demonstrate the ability to install RJ45/48 connectors and fittings.
	46.02 Explain the difference between single twisted pair and CAT-5 wiring.
	46.03 Define network control points.
	46.04 Define and construct a database.
	46.05 Demonstrate ability to “ping” hardware along the network.
47.0	Demonstrate understanding and knowledge of Electro/Mechanical Safety. The student will be able to:
	47.01 Define electrical safety.
	47.02 Relate how preventive maintenance reduces electrical hazards.
	47.03 Define corrective maintenance.
	47.04 Define scheduled maintenance.
	47.05 Explain lock out/tag out procedures.
	47.06 Define leakage current.
	47.07 Define required grounding for imaging equipment (portable and fixed).
	47.08 Administer electrical safety tests on equipment.
	47.09 Explain universal precautions.
	47.10 State the ground resistances for existing portable medical equipment in patient-care areas.
	47.11 State the ground resistances for new portable medical equipment in patient-care areas.
	47.12 State the chassis leakage current for portable medical equipment in patient-care areas.
	47.13 State the lead leakage current for portable medical equipment in patient-care areas.
	47.14 State the lead leakage current for x-ray equipment in patient-care areas.
48.0	Demonstrate understanding of Picture Archive Communication Systems. The student will be able to:
	48.01 Explain electrical surge potentials.
	48.02 List ways of preventing damage from electrical surges.
	48.03 Describe the internet and its application to imaging modalities.
	48.04 Explain TCP/IP duties and protocols.

	48.05 Describe security problems with the internet.
	48.06 Describe tele-radiology.
	48.07 Describe picture archive communication system.
	48.08 List major components of picture archive communication system.
	48.09 Explain basic computer/network maintenance procedures.
49.0	Demonstrate understanding and knowledge of Diagnostic Ultrasound Equipment. The student will be able to:
	49.01 List the functions of the five basic components of a diagnostic medical ultrasound machine.
	49.02 Identify the unique characteristics for each of the types of transducer scan heads used in real-time ultrasound.
	49.03 Describe current ultrasound image display formats (pie-shaped, rectangular, trapezoidal, circular).
	49.04 Describe the different ultrasound image recording formats (polaroid film, single emulsion film, thermal paper, magnetic tape, magnetic disks, optical disks).
	49.05 Describe A-mode, B-mode, and M-mode.
50.0	Demonstrate proficiency in Building Wiring. The student will be able to:
	50.01 List standards used in the electrical wiring of medical buildings.
	50.02 Explain methods of pre-wiring and ways to wire existing buildings.
	50.03 Explain NEC or other safety rules pertaining to building wiring and grounding.
51.0	Demonstrate proficiency in Basic Radiographic Equipment. The student will be able to:
	51.01 List the main function of an X-ray machine.
	51.02 State the different types of X-ray machines (fluoroscope, cine, chest, dental).
	51.03 Sketch a circuit diagram of an X-ray machine and X-ray tube.
	51.04 Describe the “heel effect”.
	51.05 Describe the focal spot.
	51.06 Explain the purpose of grids.
	51.07 Explain the purpose of the “bucky”.
	51.08 Identify dental and portable X-ray machine components.
	51.09 Identify general “rad-room” components.
	51.10 Identify “cath-lab” components.
52.0	Demonstrate proficiency in Film Processing. The student will be able to:

52.01	Describe wet processing.
52.02	Identify chemicals and functions.
52.03	Describe dry processing.
52.04	Identify and describe laser imaging process.
52.05	Describe function and makeup of X-ray cassettes.
52.06	Describe and identify X-ray film types.
52.07	State dark-room procedures.
52.08	Describe film duplication process.
52.09	Demonstrate proper cassette loading techniques.

Course Description: This course develops skills and understanding of advanced electronics circuits; medical terminology, and advance imaging techniques.

Course Number: EER0093 Occupational Completion Point: D (2 of 2) Biomedical Imaging Equipment Technician – 270 Hours	
53.0	Demonstrate proficiency in Test Equipment. The student will be able to:
53.01	Explain the purpose of a dosimeter.
53.02	Demonstrate proper operation of a DVM and an Oscilloscope.
53.03	Demonstrate proper operation of a milliamp-meter.
53.04	Explain the application of an ion chamber.
53.05	Explain the application of the half-value layer.
54.0	Demonstrate an understanding of Magnetic Resonance Imaging. The student will be able to:
54.01	Identify magnet types.
54.02	Describe the Fourier process.
54.03	Identify cryogens.
54.04	Describe T1 and T2.
54.05	State purpose of gradients.
54.06	Identify coils.

	54.07 State purpose of auxiliary coils.
	54.08 Identify RF leakage.
	54.09 Identify image produced with metal in bore.
55.0	Demonstrate understanding and knowledge of Computed Tomography. The student will be able to:
	55.01 Define computed tomography.
	55.02 Identify the components of computed tomography (gantry – tube/detectors – generator – couch – computers – applications – reconstruction – display).
	55.03 Describe the formation of the image.
	55.04 Describe computed tomography dose index (CTDI).
	55.05 Describe multiple scan average dose (MSDA).
	55.06 Describe beam geometry.
	55.07 Describe measuring dose.
	55.08 Describe protocol selection options (kvp, mAs, slice thickness, feed, matrix, algorithm).
56.0	Demonstrate an understanding of Nuclear Medicine. The student will be able to:
	56.01 Identify the major components of a scintillation camera.
	56.02 List the function of scintillation camera collimators.
	56.03 Identify the material of which scintillation camera collimators are made.
	56.04 Identify the chemical composition of a scintillation crystal and its physical characteristics.
	56.05 List the environmental factors that can adversely affect a scintillation crystal.
	56.06 Identify the purpose of a photo multiplier tube in a scintillation detector system.
	56.07 Describe the function of a pulse height analyzer in a scintillation detector system.
	56.08 Differentiate between planar, SPECT, and PET.
57.0	Demonstrate an understanding of Codes and Regulations Applications. The student will be able to:
	57.01 State pertinent NFPA 99 chapters.
	57.02 Explain ACR regulations.
	57.03 List the labeling criteria per 21CFR.
	57.04 List the safety indicators required per 21CFR.
	57.05 Enumerate fluoroscopic time limits.

	57.06 State required accuracy of mA and kVp measurements.
	57.07 State required accuracy of timer and light field.
	57.08 State the three major organizations involved in setting the safe limits of radiation dosage.
58.0	Demonstrate proficiency in Troubleshooting. The student will be able to:
	58.01 Demonstrate proper usage of test equipment.
	58.02 Describe “last good, first bad” method of troubleshooting.
	58.03 Describe “divide and conquer” method of troubleshooting.
	58.04 Demonstrate how to use static-arresting test procedures.
	58.05 Demonstrate diagnosis and repair of defective electronic imaging equipment.
59.0	Demonstrate proper application of Radiation Safety. The student will be able to:
	59.01 State the importance of exposure time, shielding, and distance from source in regard to safety.
	59.02 Describe the safe handling of isotopes and cryogens.
	59.03 Describe the reasons for non-ferrous tools in the MRI suite.
	59.04 Describe the “Thomson Effect”.
	59.05 Describe the purpose of a film badge.
	59.06 State the inverse square law.
	59.07 State the potential lethal dose of x-radiation for humans.
60.0	Demonstrate an understanding and knowledge of Radiation Physics. The student will be able to:
	60.01 Define ionizing radiation.
	60.02 State the diagnostic (measurement) function of an X-ray machine.
	60.03 Explain how X-Rays are produced.
	60.04 Explain decay rate.
	60.05 Describe hard and soft radiation.
61.0	Demonstrate proficiency in Linear Accelerators. The student will be able to:
	61.01 Describe a cyclotron.
	61.02 Explain how a cyclotron may be utilized for treatment.
	61.03 Discuss how a neutron beam is generated.

61.04	Describe the betatron.
61.05	Discuss the major differences between a cyclotron and betatron.
61.06	Name the types of isotope treatment units.
61.07	State the function of a linear accelerator treatment unit.
61.08	Name the types of beams produced by a linear accelerator and state their uses.
61.09	List types of linear accelerator designs utilized to accelerate electrons.
61.10	List the functions of the major block diagram components and auxiliary systems of a medical linear accelerator.
61.11	Name the common types of external beams utilized in radiotherapy.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Welding Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J400400	
CIP Number	0648050805	
Grade Level	30, 31	
Program Length	1050 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in the welding industry.

The content includes but is not limited to planning, management, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of three occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	PMT0070 PMT0071	Welder Assistant 1 Welder Assistant 2	METAL WORK 7G WELDING @7 7G	150 hours 150 hours
B	PMT0072 PMT0073	Welder, SMAW 1 Welder, SMAW 2		150 hours 150 hours
C	PMT0074	Welder		450 hours

National Standards

Industry or National Standards corresponding to the standards and/or benchmarks for the Welding Technology program can be found using the following link: https://www.aws.org/certification/page/home

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding and apply workplace safety and workplace organization skills.
02.0 Demonstrate basic knowledge of industrial and manufacturing processes.
03.0 Describe and identify metals and their properties accurately.
04.0 Demonstrate and apply basic knowledge of drawing and interpreting AWS welding symbols.
05.0 Apply basic oxy-fuel gas cutting principles and practices.
06.0 Create a product using basic oxy-fuel gas cutting principles and practices.
07.0 Apply intermediate oxy-fuel gas cutting principles and practices.
08.0 Demonstrate plasma arc cutting principles and practices.
09.0 Demonstrate a basic understanding of shielded metal arc welding (SMAW).
10.0 Create a product using basic shielded metal arc welding (SMAW) principles and practices.
11.0 Apply basic shielded metal arc welding (SMAW) skills.
12.0 Demonstrate and apply Carbon Arc Gouging (GAC) principles and practices.
13.0 Apply visual examination skills.
14.0 Create a product using Carbon Arc Gouging and basic shielded metal arc welding (SMAW) principles and practices.
15.0 Demonstrate an understanding of employability skills and career opportunities related to the welding industry.
16.0 Apply intermediate shielded metal arc welding (SMAW) skills.
17.0 Create a product using intermediate shielded metal arc welding (SMAW) principles and practices.
18.0 Apply basic gas metal arc welding (GMAW) skills.
19.0 Apply intermediate gas metal arc welding (GMAW) skills.
20.0 Apply basic flux-core arc welding (FCAW) skills.
21.0 Apply intermediate flux-core arc welding (FCAW) skills.
22.0 Apply basic gas tungsten arc welding (GTAW) skills.
23.0 Apply intermediate gas tungsten arc welding (GTAW) skills.
24.0 Demonstrate and apply basic pipe welding principles and practices.

Florida Department of Education
Student Performance Standards

Program Title: **Welding Technology**
Career Certificate Program Number: **J400400**

Course Description: The Welder Assistant 1 course prepares students for entry into the welding industry. Students explore career opportunities and requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study workplace safety and organization, basic manufacturing processes, metals identification, basic interpretation of welding symbols and oxyfuel gas cutting practices.

Course Number: PMT0070 **Occupational Completion Point: A (1 of 2)** **Welder Assistant 1 – 150 Hours**	
01.0	Demonstrate an understanding and apply workplace safety and workplace organization. The student will be able to:
01.01	Locate and use Safety Data Sheets (SDS).
01.02	Demonstrate knowledge of first aid or first response procedures.
01.03	Identify safety procedures in case of smoke or chemical inhalation.
01.04	Demonstrate knowledge of material handling techniques to safely move materials.
01.05	Demonstrate the proper techniques for lifting.
01.06	Proactively respond to a safety concern and notify the instructor.
01.07	Demonstrate knowledge of emergency exits and signage.
01.08	Demonstrate knowledge of various emergency alarms and procedures
01.09	Perform emergency drills and participate in emergency teams.
01.10	Demonstrate knowledge of clean-up procedures.
01.11	Explain Lock Out/Tag Out requirements procedures, including confined space awareness.
01.12	Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.
01.13	Identify procedures for handling hazardous material.
01.14	Develop safety checklists.
01.15	Determine the appropriate corrective action after an unsafe condition is identified.
01.16	Demonstrate knowledge of safety requirements for manual, electrical-powered and pneumatic tools.
01.17	Demonstrate knowledge of safety requirements for operation of automated machines.

01.18	Perform safety and environmental inspections.
01.19	Demonstrate skill in performing leak checks to determine if toxic or hazardous material is escaping from a piece of equipment.
01.20	Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists and regulations.
01.21	Demonstrate knowledge of equipment shutdown procedures.
01.22	Identify-safety related maintenance procedures.
01.23	Selecting and use of personal protective equipment (PPE) correctly.
01.24	Demonstrate knowledge of ergonomic impact of work techniques.
01.25	Demonstrate knowledge of and follow applicable safety laws, regulations and the environment (e.g., Occupational Safety and Health Administration (OSHA)).
01.26	Apply Occupational Safety Health Administration (OSHA) safety standards properly.
01.27	Research and identify class A, B, and C type fires.
01.28	Demonstrate and apply the proper procedures for extinguishing class A, B and C type fires.
01.29	Demonstrate knowledge of National Institute of Occupational Safety and Health (NIOSH), Environmental Protection Agency (EPA) and other regulatory agencies recommendations, guidelines and best practices.
01.30	Describe "Right-to-Know" Law as recorded in (29 CFR-1910.1200)
02.0	Demonstrate basic knowledge of industrial and manufacturing processes. The student will be able to:
02.01	Demonstrate knowledge of the use of current manufacturing processes as related to the welding industry.
02.02	Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment.
02.03	Understand the processes of separating, forming, conditioning, fabricating and finishing of materials.
02.04	Explain the difference between primary and secondary manufacturing processes.
03.0	Describe and identify metals and their properties accurately. The student will be able to:
03.01	Describe and understand the steel making process.
03.02	Describe and understand the differences between ferrous and nonferrous metals.
03.03	Describe and understand casting, alloys and forging.
03.04	Identify and understand metallurgical processes related to metals such as galvanized iron and steel, aluminum stainless steel, sheet metal, copper and brass.
03.05	Identify, understand and describe thermal properties of metals.
03.06	Identify and describe common gages, shapes and dimensions of metals.
04.0	Demonstrate and apply basic knowledge of drawing and interpreting AWS welding symbols. The student will be able to:

	04.01 Interpret, understand and apply elements of a drawing or sketch.
	04.02 Interpret, understand, and apply welding symbol information.
	04.03 Design and create a drawing using welding symbology.
	04.04 Identify a specified weld using a welding symbol.
	04.05 Draw welding symbols using given variables.
	04.06 Use and apply appropriate mathematical practices to the design and creation of drawings using welding symbols.
05.0	Apply basic oxy-fuel gas cutting principles and practices. The student will be able to:
	05.01 Perform external inspections of equipment and accessories.
	05.02 Make minor repairs to equipment and accessories.
	05.03 Set up manual OFC operations for plain carbon steel.
	05.04 Operate manual oxyfuel cutting equipment.
	05.05 Perform straight cutting operations using manual oxyfuel cutting process on plain carbon steel.
06.0	Create a product using basic oxy-fuel gas cutting principles and practices. The student will be able to:
	06.01 Design and create a basic work of art or project utilizing material and skills developed.
	06.02 Produce a product using drawings with tolerances and specifications.
	06.03 Create and deliver a presentation to communicate project results.

Course Description: The Welder Assistant 2 course is designed to build on the skills and knowledge students learned in Welder Assistant 1 for entry into the welding industry. Students explore career opportunities and requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study drawings and welding symbols, intermediate oxyfuel gas cutting practices, plasma arc cutting principles and basic shielded metal arc welding (SMAW).

Course Number: PMT0071 Occupational Completion Point: A (2 of 2) Welder Assistant 2 – 150 Hours	
07.0	Apply intermediate oxy-fuel gas cutting principles and practices. The student will be able to:
	07.01 Apply intermediate manual oxy-fuel gas cutting skills.
	07.02 Perform shape cutting operations on plain carbon steel.
	07.03 Perform bevel cutting operations on plain carbon steel.
	07.04 Remove weld metal on plain carbon steel using weld washing techniques.

	07.05 Apply machine oxy-fuel gas cutting (track burner) skills.
	07.06 Perform safety inspections of equipment and accessories.
	07.07 Make minor external repairs to equipment and accessories.
	07.08 Set up for plain carbon steel machine OFC (track burner) operations.
	07.09 Operate machine oxy-fuel gas cutting (track burner) equipment.
	07.10 Perform straight cutting operations on plain carbon steel.
08.0	Demonstrate plasma arc cutting principles and practices. The student will be able to:
	08.01 Perform safety inspections of equipment and accessories.
	08.02 Make minor external repairs to equipment and accessories.
	08.03 Perform metal removal operations.
	08.04 Make minor repairs to equipment and accessories.
	08.05 Set up for using plasma arc cutting operations.
	08.06 Operate manual plasma arc cutting equipment.
	08.07 Perform shape cutting operations using plasma arc cutting process.
09.0	Demonstrate a basic understanding of shielded metal arc welding (SMAW). The student will be able to:
	09.01 Perform external inspections of SMAW equipment and accessories.
	09.02 Make minor repairs to SMAW equipment and accessories.
	09.03 Set up shielded metal arc welding operations on plain carbon steel.
	09.04 Operate shielded metal arc welding equipment.
	09.05 Make pad welds, all positions, on plain carbon steel.
10.0	Create a product using oxy-fuel gas cutting and introductory shielded metal arc welding (SMAW) principles and practices. The student will be able to:
	10.01 Design and create a work of art or project utilizing material and skills learned.
	10.02 Create a working drawing or blueprint using welding symbols.
	10.03 Design a product from a working drawing or blueprint created.
	10.04 Fabricate a product using the skills learned related to oxy-fuel gas cutting and introductory shielded metal arc welding (SMAW).
	10.05 Create and deliver a presentation to communicate project results.

Course Description: The Welder SMAW 1 course prepares students for entry into the welding industry as a basic Shielded Metal Arc Welder. Students explore career opportunities and requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study basic shielded metal arc welding (SMAW), Carbon Arc Gouging (GAC) principles, and visual examination skills.

Course Number: PMT0072 **Occupational Completion Point: B (1 of 2)** **Welder, SMAW 1 – 150 Hours**	
11.0	Demonstrate and apply basic shielded metal arc welding (SMAW) skills. The student will be able to:
11.01	Perform external inspections of SMAW equipment and accessories.
11.02	Make minor repairs to SMAW equipment and accessories.
11.03	Set up shielded metal arc welding operations on plain carbon steel.
11.04	Operate shielded metal arc welding equipment.
11.05	Make pad welds, all positions, on plain carbon steel.
11.06	Make fillet welds, all positions, on plain carbon steel.
11.07	Make groove welds, all positions, on plain carbon steel.
12.0	Demonstrate and apply Carbon Arc Gouging (GAC) principles and practices. The student will be able to:
12.01	Perform safety inspections of equipment and accessories.
12.02	Repair unacceptable weld profiles.
12.03	Properly set up equipment, accessories, and machine for Carbon Arc Gouging (GAC)
12.04	Apply Manual Air (Carbon Arc Gouging) and Cutting (CAC-A) skills.
12.05	Set up manual air carbon arc gouging and cutting operations.
12.06	Operate manual air carbon arc cutting equipment.
12.07	Apply manual Arc Gouging and Arc Cutting (AC) skills.
13.0	Apply visual examination skills. The student will be able to:
13.01	Examine cut surfaces and edges of prepared base metal parts.
13.02	Examine tack, intermediate pass and cover pass.
14.0	Create a product using Carbon Arc Gouging and basic shielded metal arc welding (SMAW) principles and practices. The student will be able to:
14.01	Design and create a work of art or project utilizing material and skills learned.

14.02	Create a working drawing or blueprint using welding symbols.
14.03	Design a product from a working drawing or blueprint created.
14.04	Fabricate a product using the skills learned related to Carbon Arc Gouging and basic shielded metal arc welding (SMAW).
14.05	Create and deliver a presentation to communicate project results.

Course Description: The Welder SMAW 2 course is designed to build on the skills and knowledge students learned in Welder SMAW 1 for entry into the welding industry as a basic Shielded Metal Arc Welder. Students explore career opportunities and requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study employability and welding careers, and intermediate shielded metal arc welding (SMAW).

Course Number: PMT0073 **Occupational Completion Point: B (2 of 2)** **Welder, SMAW 2 – 150 Hours**	
15.0	Demonstrate an understanding of employability skills and career opportunities related to the welding industry. The student will be able to:
15.01	Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
15.02	Discuss motivation and human behavior.
15.03	Develop a personal stress management plan.
15.04	Demonstrate knowledge of ways to improve reading, listening and writing skills.
15.05	Demonstrate knowledge of techniques for making effective presentations.
15.06	Use different forms of technology communication.
15.07	Provide effective feedback and make suggestions.
15.08	Demonstrate appropriate customer service skills and techniques.
15.09	Demonstrate knowledge of roles and responsibilities of team members.
15.10	Align team goals (that are specific, documented, measurable and achievable) to customer and business production needs.
15.11	Effectively communicate production and process information.
15.12	Develop personal career plan that includes goals, objectives, and strategies.
15.13	Examine licensing, certification, and industry credentialing requirements.
15.14	Evaluate and compare employment opportunities that match career goals.
15.15	Identify and exhibit traits for retaining employment.

	15.16 Identify opportunities and research requirements for career advancement.
	15.17 Research the benefits of ongoing professional development.
	15.18 Examine and describe entrepreneurship opportunities as a career planning option.
16.0	Apply intermediate shielded metal arc welding (SMAW) skills. The student will be able to:
	16.01 Make single "V" groove welds, all positions (visual inspection criteria, using current and applicable welding industry codes) on plain carbon steel with backing.
	16.02 Perform 1G - 4G limited thickness qualification (bend) tests on plain carbon steel plate (using current and applicable welding industry codes).
	16.03 Perform destructive root and face bend specimens (using current and applicable welding industry codes).
	16.04 Determine and understand WPS and PQR.
17.0	Create a product using intermediate shielded metal arc welding (SMAW) principles and practices. The student will be able to:
	17.01 Design and create a work of art or project utilizing material and skills learned.
	17.02 Create a working drawing or blueprint using welding symbols learned.
	17.03 Design a product from a working drawing or blueprint created.
	17.04 Fabricate a product using the skills learned related to intermediate shielded metal arc welding (SMAW).
	17.05 Repair products of ferrous and non-ferrous metals.
	17.06 Create and deliver a presentation to communicate project results.

Course Description: The Welder course builds on the skills and knowledge students learned in the Welder Assistant and Welder SMAW courses. Students explore career opportunities and requirements of a professional welder. Content emphasizes skills key to the success of working in the welding industry. Students study basic and intermediate Gas Metal Arc Welding (GMAW), basic and intermediate Flux-Core Arc Welding (FCAW), basic and intermediate Gas Tungsten Arc Welding (GTAW), and a basic understanding of pipe welding.

Course Number: PMT0074 Occupational Completion Point: C Welder – 450 Hours	
18.0	Apply basic gas metal arc welding (GMAW) skills. The student will be able to:
	18.01 Perform external inspections of GMAW equipment and accessories.
	18.02 Make minor repairs to GMAW equipment and accessories.
	18.03 Set up gas metal arc welding operations for plain carbon steel.
	18.04 Operate gas metal arc welding equipment.

	18.05 Make short-circuiting transfer fillet welds, all positions, on plain carbon steel.
	18.06 Make Pad welds, all positions, on plain carbon steel.
19.0	Apply intermediate gas metal arc welding (GMAW) skills. The student will be able to:
	19.01 Make Fillet Spray transfer welds, in flat and horizontal positions, on plain carbon steel.
	19.02 Make 1G Groove Spray transfer welds on plain carbon steel.
	19.03 Set up (GMAW) gas metal arc welding equipment for aluminum, stainless steel.
	19.04 Make groove welds 1G Groove position on aluminum.
	19.05 Make fillet welds 1F position on stainless.
	19.06 Make groove welds 1G position on stainless.
20.0	Apply basic flux-cored arc welding (FCAW) skills. The student will be able to:
	20.01 Perform safety inspections of equipment and accessories.
	20.02 Make minor repairs to equipment and accessories.
	20.03 Set up for plain carbon steel FCAW operations.
	20.04 Operate flux cored arc welding equipment, gas shielded process.
	20.05 Make Pad welds, all positions, on plain carbon steel.
21.0	Apply Intermediate flux-core arc welding (FCAW) skills. The student will be able to:
	21.01 Make fillet welds and groove welds in all positions on plain carbon steel.
	21.02 Operate flux core arc welding equipment, gas-shielded process, to make fillet welds, all positions, on plain carbon steel.
	21.03 Operate flux core arc welding equipment to make groove welds all positions, on plain carbon steel.
22.0	Apply basic gas tungsten arc welding (GTAW) skills. The student will be able to:
	22.01 Perform external inspections of GTAW equipment and accessories.
	22.02 Make minor repairs to GTAW equipment and accessories.
	22.03 Set up for plain carbon steel, aluminum, and stainless steel GTAW operations.
	22.04 Operate gas tungsten arc welding equipment.
	22.05 Make fillet welds, all position, on plain carbon steel.
23.0	Apply intermediate gas tungsten arc welding (GTAW) skills. The student will be able to:
	23.01 Make 1G - 2G Groove welds on plain carbon steel.

	23.02 Make 1F - 3F Fillet welds on aluminum.
	23.03 Make 1G Groove welds on aluminum.
	23.04 Make 1F - 3F Fillet welds on stainless steel.
	23.05 Make 1G - 2G Groove welds on stainless steel.
24.0	Demonstrate and understanding of pipe welding principles and practices. The student will be able to:
	24.01 Research and understand employability opportunities associated with advanced welding skills such as careers in pipe welding.
	24.02 Set up welding equipment for shielded metal arc welding (SMAW) processes for pipe welding on carbon steel pipe.
	24.03 Tack and weld carbon steel in the 1G position.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Welding Technology - Advanced**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J400410	
CIP Number	0648050806	
Grade Level	30, 31	
Program Length	750 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in the welding industry.

The content includes but is not limited to planning, management, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

The standard length of this program is 750 hours. **Welding Technology** is a core program. It is recommended that students successfully complete **Welding Technology** or demonstrate mastery of the outcomes in that program prior to enrollment in the **Welding Technology - Advanced** program**.**

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	PMT0075	Advanced Welder 1	METAL WORK 7G WELDING @7 7G	600 hours
B	PMT0076	Advanced Welder 2		150 hours

National Standards

Industry or National Standards corresponding to the standards and/or benchmarks for the Welding Technology - Advanced program can be found using the following link: https://www.aws.org/certification/page/home

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply intermediate shielded metal arc welding (SMAW) pipe welding (Class-B Pipe Welder) skills.
02.0 Apply and understand fabrication techniques using pipe fitting techniques.
03.0 Apply advanced gas-tungsten arc welding (GTAW) pipe skills.
04.0 Apply advanced gas-tungsten arc welding (GTAW) and shielded metal arc welding (SMAW) heavy-wall pipe skills.
05.0 Apply emerging welding technologies.

Florida Department of Education
Student Performance Standards

Program Title: **Welding Technology - Advanced**
Career Certificate Program Number: **J400410**

Course Description: The Advanced Welder 1 course prepares students for entry into the welding industry. Students explore career opportunities and requirements of a professional welder. Content emphasizes advanced skills key to the success of working in the welding industry. Students study intermediate and advanced Shielded Metal Arc Welding (SMAW) Class-B Pipe Welder, pipe fitting fabrication techniques and advanced Gas Tungsten Arc Welding (GTAW) skills.

Course Number: PMT0075 **Occupational Completion Point: A** **Advanced Welder 1 – 600 Hours**	
01.0	Apply intermediate shielded metal arc welding (SMAW) pipe welding (Class-B Pipe Welder) skills. The student will be able to:
01.01	Make SMAW equipment ready for open-root V-groove pipe welds.
01.02	Identify and explain open-root V-grove pipe welding techniques with SMAW equipment.
01.03	Perform open-root V-groove pipe welds in the following positions using SMAW equipment. 1-GR, 2-G, 5-G, 6-G.
02.0	Apply and understand fabrication techniques using pipe fitting techniques. The student will be able to:
02.01	Apply and understand pipe fitting take-outs / take-offs for pipe fittings.
02.02	Identify and explain the different types of pipe fittings and their usage.
02.03	Identify and explain welding symbols and a standard legend on mechanical drawings.
02.04	Identify elevations and directions on a set of mechanical drawings.
03.0	Apply advanced gas-tungsten arc welding (GTAW) pipe skills. The student will be able to:
03.01	Prepare GTAW equipment to create welds with low alloy (Carbon Steel), stainless steel pipe and filler metal.
03.02	Identify and explain open-root V-groove pipe welding techniques with GTAW equipment.
03.03	Perform open-root V-groove welds on low alloy (carbon steel) and stainless-steel pipe in the following positions using GTAW equipment. 1-GR, 2-G, 5-G, 6-G.
04.0	Apply advanced gas-tungsten arc welding (GTAW) and shielded metal arc welding (SMAW) heavy-wall pipe skills. The student will be able to:
04.01	Identify and explain open-root V-groove pipe welding techniques on heavy wall pipe with GTAW/SMAW equipment.
04.02	Identify and explain Pre and Post weld heat treatment on the different types of alloy metals.
04.03	Make open-root V-groove welds on heavy wall carbon steel pipe root and hot pass using different techniques and filler metals such as, Key holing, washing or soaking, back feeding in the 1-G, 2-G,5-G, 6-G positions with GTAW equipment.

04.04	Make V-groove multi-pass welds on heavy wall pipe using the GTAW/SMAW welding processes in the 2-G, 5-G, 6-G positions.

Course Description: The Advanced Welder 2 course is designed to prepare advanced welders for entry into emerging welding industries. Students explore career opportunities and requirements of a professional welder. Content emphasizes advance skills key to the success of working in the welding industry. Students study emerging technologies directly related to geographically relevant welding needs of business and industry.

Course Number: PMT0076 Occupational Completion Point: B Advanced Welder 2 – 150 Hours	
05.0	Apply emerging welding technologies. The student will be able to:
05.01	Research and identify careers and workforce needs that employ emerging welding technologies.
05.02	Identify the skills required to work within careers that use emerging welding technologies.
05.03	Apply skills and competencies needed to successfully use emerging welding technologies such as, but not limited to: Pulse Welding, Robotics, Submerged Welding, Adaptive Welding, Hybrid Laser-Arc Welding (HLAW), etc.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Jewelry Design and Repair 1**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J450600	
CIP Number	0647040808	
Grade Level	30, 31	
Program Length	900 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment and/or specialized training in jewelry occupations.

The Jewelry Design and Repair program prepares students for employment as Jewelers and Precious Stone and Metal Workers.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Jewelry Repair industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	PMT0620	Jewelry Technician Assistant	JWLY MFGR 7G METAL WORK 7G	450 hours
B	PMT0630	Jewelry Designer		450 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate the safe use of basic tools and equipment.
02.0 Perform sawing, piercing, filing skills.
03.0 Perform polishing techniques.
04.0 Solder metals.
05.0 Roll metal and wire.
06.0 Perform shop management, business, and employability skills.

Florida Department of Education
Student Performance Standards

Program Title: **Jewelry Design and Repair 1**
Career Certificate Program Number: **J450600**

Course Description: The Jewelry Technician Assistant course prepares students for entry into the Jewelry Making and Repair industry. Students learn beginning level trade skills such as; tool and equipment safety, sawing and piercing, filing and finishing, polishing, and silver soldering.

Course Number: PMT0620 **Occupational Completion Point: A** **Jewelry Technician Assistant – 450 Hours**	
01.0	Demonstrate the safe use of basic tools and equipment. The student will be able to:
	01.01 Organize and maintain tools.
	01.02 Identify safety skills.
	01.03 Select tools and equipment.
	01.04 Identify and handle tools and equipment safely.
	01.05 Develop measuring and weighing skills.
02.0	Roll metal and wire. The student will be able to:
	02.01 Melt precious metals into ingots.
	02.02 Roll ingots into sheet metal.
	02.03 Roll ingots into wire stock.
03.0	Perform sawing, piercing, filing skills. The student will be able to:
	03.01 Use sawing technique.
	03.02 Use piercing technique.
	03.03 Use filing technique.

Course Description: The Jewelry Designer course is designed to build on the skills and knowledge students developed in the Jewelry Technician course. Students learn the process of alloying, surface embellishment, forming and fabrication techniques, and shop management skills.

Course Number: PMT0630 **Occupational Completion Point: B** **Jewelry Designer – 450 Hours**	
04.0	Perform polishing techniques. The student will be able to:
04.01	Identify abrasives used to sand metals.
04.02	Identify compounds used for polishing metals.
04.03	Operate the flexible shaft.
04.04	Operate the polishing machine.
04.05	Operate the ultrasonic and steam cleaning machine.
05.0	Solder metals. The student will be able to:
05.01	Explain the process of soldering and the effects of heat on metals.
05.02	Select soldering equipment and hand tools.
05.03	Select appropriate solder and flux.
05.04	Design and fabricate jewelry using metal wire.
05.05	Design and fabricate jewelry using sheet metal.
05.06	Design and fabricate jewelry using both sheet and wire stock.
06.0	Perform shop management, business, and employability skills. The student will be able to:
06.01	Maintain a shop production schedule.
06.02	Prepare cost estimates and work orders.
06.03	Maintain inventory.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Jewelry Design and Repair 2**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J450700	
CIP Number	0647040809	
Grade Level	30, 31	
Program Length	750 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communication (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment and/or specialized training in jewelry occupations.

The Jewelry Design and Repair program prepares students for employment as Jewelers and Precious Stone and Metal Workers.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Jewelry Repair industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

The standard length of this program is 750 hours. **Jewelry Design and Repair 1** is a core program. It is recommended students complete **Jewelry Design and Repair 1,** or demonstrate mastery of the outcomes in that program, prior to enrollment in **Jewelry Design and Repair 2.**

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	PMT0643	Casting/Rubber Molding	JWLY MFGR 7G METAL WORK 7G	150 hours
B	PMT0642	Jewelry Repair		150 hours
C	PMT0632	Stone Setter		150 hours
D	PMT0635	CAD/CAM Jewelry Designer		300 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Cast jewelry.
02.0 Perform general repairs.
03.0 Stone Setting.
04.0 CAD/CAM Designing.

Florida Department of Education
Student Performance Standards

Program Title: Jewelry Design and Repair 2
Career Certificate Program Number: J450700

Course Description: The Casting/ Rubber molding course is designed to build on the skills and knowledge learned in the Jewelry Designer course for entry into the Jewelry Making and Repair industry. This course will focus on the Lost Wax Casting process using specific wax carving and molding techniques to create rings, pendants, earrings, and jewelry components.

Course Number: PMT0643 **Occupational Completion Point: A** **Casting/Rubber Molding – 150 Hours**	
01.0	Cast jewelry. The student will be able to:
	01.01 Understand and perform the process of lost wax casting.
	01.02 Use the centrifugal casting machine.
	01.03 Use the vacuum casting table.
	01.04 Understand and perform the process of rubber molding.

Course Description: The Jewelry Repairer course is designed to build on the skills and knowledge students learned in the Wax Molder/Casting course for entry into the Jewelry Making and Repair industry. Content emphasizes beginning skills and concepts as a recommended requisite. Students study general repair techniques.

Course Number: PMT0642 **Occupational Completion Point: B** **Jewelry Repair – 150 Hours**	
02.0	Perform general repairs. The student will be able to:
	02.01 Perform chain link repairs.
	02.02 Size a ring up and down.
	02.03 Repair a prong setting.
	02.04 Replace missing or broken stone.
	02.05 Replace findings.

Course Description: The Stone Setter course is designed to build on the skills and knowledge students learned in the Jewelry Repairer course for entry into the Jewelry Making and Repair industry. Student will learn fabricating techniques to create calibrated setting for round, oval, square, heart, emerald cut, marquise, and pear shaped stones.

Course Number: PMT0632 Occupational Completion Point: C Stone Setter – 150 Hours	
03.0	Stone setting. The student will be able to:
03.01	Fabricate a bezel setting for cabochon stones.
03.02	Fabricate a prong setting for oval, round, princess cut, and pear shaped faceted stones.
03.03	Set faceted stones in a pave' setting.
03.04	Fabricate a channel setting for princess cut and round faceted stones.
03.05	Restring pearls and stone beads.

Course Description: The CAD/CAM Designer course is designed to build on the skills and knowledge students learned in the Stone Setter course for entry into the Jewelry Making and Repair industry. Students will learn the process of designing jewelry using the 3Design CAD/CAM program as a designing tool.

Course Number: PMT0635 Occupational Completion Point: D CAD/CAM Designer – 300 Hours	
04.0	CAD/CAM designing. The student will be able to:
04.01	Understand the concept and purpose for the use of the Matrix Gold CAD/CAM program.
04.02	Design a signet ring.
04.03	Design a solitaire ring.
04.04	Design a three stone bezel set ring.
04.05	Design a three stone prong set ring with a split shank.
04.06	Design a ring with an under carriage.
04.07	Design an eternity band.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Electronic Technology 1**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J540100	
CIP Number	0615030315	
Grade Level	30, 31	
Program Length	650 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 10	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to Direct current (DC) circuits, alternating current (AC) circuits and analog circuits; solid state and digital devices; microprocessors; use of circuit diagrams and schematics; soldering and chassis assembly techniques; laboratory practices; and technical recording and reporting.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EEV0010	Electronics Assembler	AUTO PROD 7G AVIONICS @7 7G ELECTRONIC @7 7G ENG 7G IND ENGR 7G RADIO TV %7 %G TEC ELEC @7 7G TV PROD TEC @7 7G ROBOTICS 7G	250 hours
B	EEV0100	Electronics Tester		400 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in soldering and basic laboratory practices.
02.0 Demonstrate proficiency in basic DC circuits.
03.0 Demonstrate proficiency in advanced DC circuits.
04.0 Demonstrate proficiency in AC circuits.
05.0 Demonstrate proficiency in solid state devices.

Florida Department of Education
Student Performance Standards

Program Title: **Electronic Technology 1**
Career Certificate Program Number: **J540100**

Course Description: The Electronics Assembler course prepares students for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Content emphasizes beginning skills key to the success of working in the Electronics industry. Students study basic soldering lab practices, and basic DC circuitry.

Course Number: EEV0010 **Occupational Completion Point: A** **Electronics Assembler – 250 Hours**	
01.0	Demonstrate proficiency in soldering basic laboratory practices. The student will be able to:
01.01	Apply proper Occupational Safety Health Administration (OSHA) safety standards.
01.02	Make electrical connections.
01.03	Identify and use hand tools properly.
01.04	Identify and use power tools properly.
01.05	Apply recognized industry accepted standard soldering techniques.
01.06	Apply recognized industry accepted standard desoldering techniques.
01.07	Apply recognized industry accepted standard electrostatic discharge (ESD) safety procedures.
01.08	Design and/or construct printed circuit boards (PCB's) to industry accepted standards.
01.09	Explain the theoretical concepts of industry accepted soldering techniques.
01.10	Apply recognized industry accepted standard techniques for rework and repair.
02.0	Demonstrate proficiency in basic DC circuits. The student will be able to:
02.01	Demonstrate proficiency in basic DC circuits.
02.02	Solve problems in electronic units utilizing metric prefixes.
02.03	Identify sources of electricity.
02.04	Define voltage, current, resistance, power and energy.
02.05	Apply Ohm's law and power formulas.
02.06	Read and interpret color codes and symbols to identify electrical components and values.

02.07	Measure properties of a circuit using a digital multi-meter (DMM).
02.08	Compute conductance and compute and measure resistance of conductors and insulators.
02.09	Apply Ohm's law to series circuits.
02.10	Construct and verify operation of series circuits.
02.11	Analyze and troubleshoot series circuits.
02.12	Apply Ohm's law to parallel circuits.
02.13	Construct and verify the operation of parallel circuits.
02.14	Analyze and troubleshoot parallel circuits.

Course Description: The Electronics Tester course is designed to build on the skills and knowledge students learned in the Electronics Assembler course for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Content emphasizes knowledge of working in the electronics industry. Students study advanced DC circuitry, AC circuitry, and solid state devices.

Course Number: EEV0100 Occupational Completion Point: B Electronics Tester – 400 Hours	
03.0	Demonstrate proficiency in advanced DC circuits. The student will be able to:
03.01	Solve algebraic problems to include exponentials to DC.
03.02	Describe the relationship of DC electricity to the nature of matter.
03.03	Apply Ohm’s law to series-parallel and parallel-series circuits.
03.04	Construct and verify the operation of series-parallel and parallel-series and bridge circuits.
03.05	Troubleshoot series-parallel and parallel-series and bridge circuits.
03.06	Identify and define voltage divider circuits (loaded and unloaded).
03.07	Construct and verify the operation of voltage divider circuits (loaded and unloaded).
03.08	Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
03.09	Apply maximum power transfer theorem.
03.10	Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
03.11	Describe magnetic properties of circuits and devices.
03.12	Determine the physical and electrical characteristics of capacitors and inductors.

	03.13 Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
	03.14 Set up and operate power supplies for DC circuits.
	03.15 Explain the theory of DC motor operation.
	03.16 Identify the practical applications for the use of a DC motor.
04.0	Demonstrate proficiency in AC circuits. The student will be able to:
	04.01 Solve basic trigonometric problem as applicable to electronics.
	04.02 Define the characteristics of AC capacitive circuits.
	04.03 Construct and verify the operation of AC capacitive circuits.
	04.04 Analyze and troubleshoot AC capacitive circuits.
	04.05 Define the characteristics of AC inductive circuits.
	04.06 Construct and verify the operation of AC inductive circuits.
	04.07 Analyze and troubleshoot AC inductive circuits.
	04.08 Define and apply the principles of transformers to AC circuits.
	04.09 Construct and verify the operation of AC circuits utilizing transformers.
	04.10 Analyze and troubleshoot AC circuits utilizing transformers.
	04.11 Construct and verify the operation of differentiators and integrators to determine R-C and R-L time constraints.
	04.12 Analyze and troubleshoot differentiator and integrator circuits.
	04.13 Define the characteristics of Resistive, Inductive, and Capacitive (RLC) circuits (series, parallel and complex).
	04.14 Construct and verify the operation of series and parallel resonant circuits.
	04.15 Define the characteristics of series and parallel resonant circuits.
	04.16 Construct and verify the operation of series and parallel resonant circuits.
	04.17 Analyze and troubleshoot R-C, R-L, and RLC circuits.
	04.18 Define the characteristics of frequency selective filter circuits.
	04.19 Construct and verify the operation of frequency selective filter circuits.
	04.20 Analyze and troubleshoot frequency selective filter circuits.
	04.21 Define the characteristics of poly-phase circuits.
	04.22 Define basic motor theory and operation.

04.23	Define basic generator theory and operation.
04.24	Set up and operate power supplies for AC circuits.
04.25	Set up and operate oscilloscopes for AC circuits.
04.26	Set up and operate function generators for AC circuits.
04.27	Analyze and measure power in AC circuits.
04.28	Set up and operate capacitor and inductor analyzers for AC circuits.
04.29	Explain the theory of AC motor operation.
04.30	Identify the practical applications for the use of an AC motor.
05.0	Demonstrate proficiency in solid state devices. The student will be able to:
05.01	Identify and define properties of semiconductor materials.
05.02	Identify and define operating characteristics and applications of junction diodes.
05.03	Identify and define operating characteristics and applications of special diodes, ex. Zener diodes.
05.04	Construct diode circuits.
05.05	Analyze and troubleshoot diode circuits.
05.06	Identify and define operating characteristics and applications of bipolar transistors,
05.07	Identify and define operating characteristics and applications of field effect transistors.
05.08	Identify and define operating characteristics and applications of single-stage amplifiers.
05.09	Construct single-stage amplifiers.
05.10	Analyze and troubleshoot single-stage amplifiers.
05.11	Construct thyristor circuitry.
05.12	Analyze and troubleshoot thyristor circuitry.
05.13	Set up and operate power supplies for solid-state devices.
05.14	Set up and operate oscilloscopes for solid-state devices.
05.15	Set up and operate function generators for solid-state devices.
05.16	Set up and operate capacitor and inductor analyzers for solid-state devices.
05.17	Set up and operate curve tracers.
05.18	Set up and operate transistor testers.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Electronic Technology 2**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J540200	
CIP Number	0615030316	
Grade Level	30, 31	
Program Length	750 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 10	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster.

The content includes but is not limited to Direct current (DC) circuits, alternating current (AC) circuits and analog circuits; solid state and digital devices; microprocessors; use of circuit diagrams and schematics; soldering and chassis assembly techniques; laboratory practices; and technical recording and reporting.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

The standard length for this program is 750 hours. **Electronic Technology 1** is a core program. It is recommended that students complete **Electronic Technology 1** or demonstrate mastery of the outcomes in that program prior to enrollment in **Electronic Technology 2.**

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EEV0500	Electronics Equipment Repairer	AVIONICS @7 7G ELECTRONIC @7 7G RADIO TV %7 %G TEC ELEC @7 7G TV PROD TEC @7 7G	375 hours
B	EEV0616	Electronics Technician		375 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in digital circuits.
02.0 Demonstrate proficiency in fundamental microprocessors.
03.0 Demonstrate skills in technical recording utilizing industry recognized computer application software.
04.0 Demonstrate proficiency in analog circuits.

Florida Department of Education
Student Performance Standards

Program Title: **Electronic Technology 2**
Career Certificate Program Number: **J540200**

Course Description: The Electronic Equipment Repairer course is designed to build on the skills and knowledge students learned in the Electronics Tester course for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Content emphasizes knowledge of working in the electronics industry. Students study digital circuitry, and fundamental microprocessor theory.

Course Number: EEV0500 **Occupational Completion Point: A** **Electronic Equipment Repairer – 375 Hours**	
01.0	Demonstrate proficiency in digital circuits. The student will be able to:
01.01	Define and apply numbering systems to codes and arithmetic operations.
01.02	Analyze and minimize logic circuits using Boolean operations.
01.03	Set up and operate logic probes for digital circuits.
01.04	Set up and operate power supplies for digital circuits and solve power distribution and noise problems.
01.05	Set up and operate pulsers for digital circuits.
01.06	Set up and operate oscilloscopes for digital circuits.
01.07	Set up and operate logic analyzers for digital circuits.
01.08	Set up and operate pulse generators for digital circuits.
01.09	Identify types of logic gates and their truth tables.
01.10	Construct combinational logic circuits using integrated circuits.
01.11	Troubleshoot logic circuits.
01.12	Analyze types of flip-flops and their truth tables.
01.13	Construct flip-flops using integrated circuits.
01.14	Troubleshoot flip-flops.
01.15	Identify, define and measure characteristics of integrated circuit (IC) logic families.
01.16	Identify types of registers and counters.
01.17	Construct registers and counters using flip-flops and logic gates.

	01.18 Troubleshoot registers and counters.
	01.19 Analyze clock and timing circuits.
	01.20 Construct clock and timing circuits.
	01.21 Troubleshoot clock and timing circuits.
	01.22 Identify types of arithmetic-logic circuits.
	01.23 Construct arithmetic-logic circuits.
	01.24 Troubleshoot arithmetic-logic circuits.
	01.25 Identify types of encoding and decoding devices.
	01.26 Construct encoders and decoders.
	01.27 Troubleshoot encoders and decoders.
	01.28 Identify types of multiplexer and de-multiplexer circuits.
	01.29 Construct multiplexer and de-multiplexer circuits using integrated circuits.
	01.30 Troubleshoot multiplexer and de-multiplexer circuits.
	01.31 Identify types of memory circuits.
	01.32 Relate the uses of digital-to-analog and analog-to-digital conversions.
	01.33 Construct digital-to-analog and analog-to-digital circuits.
	01.34 Troubleshoot digital-to-analog and analog-to-digital circuits.
	01.35 Identify types of digital displays.
	01.36 Construct digital display circuits.
	01.37 Troubleshoot digital display circuits.
02.0	Demonstrate proficiency in fundamental microprocessors. The student will be able to:
	02.01 Identify central processing unit (CPU) building blocks and their uses (architecture).
	02.02 Safely install and remove a CPU without damaging.
	02.03 Analyze bus concepts.
	02.04 Analyze various memory schemes.
	02.05 Use memory devices in circuits.
	02.06 Troubleshoot memory device circuits.

02.07	Set up and operate oscilloscopes for microprocessor systems.
02.08	Set up and operate logic-data analyzers to troubleshoot microprocessor systems.
02.09	Identify types of input and output devices and peripherals.
02.10	Interface input and output ports to peripherals.
02.11	Analyze and troubleshoot input and output ports.
02.12	Compare and contrast macro processor programming language types.
02.13	Diagram the macro processor programming sequence using a flow chart.

Course Description: The Electronics Technician course is designed to build on the skills and knowledge students learned in the Electronic Equipment Repairer course for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Content emphasizes knowledge of working in the Electronics industry. Students study technical writing and computer software skills, and analog circuitry.

Course Number: EEV0616 Occupational Completion Point: B Electronics Technician – 375 Hours	
03.0	Demonstrate skills in technical recording utilizing industry recognized computer application software. The student will be able to:
03.01	Draw and interpret electronic schematics.
03.02	Record data and design curves and graphs.
03.03	Write reports and make oral presentations.
03.04	Maintain test logs.
03.05	Make equipment failure reports.
03.06	Specify and requisition simple electronic components.
03.07	Compose technical letters and memoranda.
03.08	Write formal reports of laboratory experiences.
03.09	Draft preventive maintenance and calibration procedures.
04.0	Demonstrate proficiency in analog circuits. The student will be able to:
04.01	Identify and define operational characteristics and applications of multistage amplifiers.
04.02	Construct multistage amplifiers.
04.03	Analyze and troubleshoot multistage amplifiers.

04.04	Identify and define operating characteristics and applications of linear integrated circuits.
04.05	Identify and define operating characteristics and applications of basic power supplies and filters.
04.06	Construct basic power supplies and filters.
04.07	Identify and define operating characteristics and applications of differential and operational amplifiers.
04.08	Construct differential and operational amplifier circuits.
04.09	Analyze and troubleshoot differential and operational amplifier circuits.
04.10	Identify and define operating characteristics of audio power amplifiers.
04.11	Construct audio power amplifiers.
04.12	Analyze and troubleshoot audio power amplifiers.
04.13	Identify and define operating characteristics and applications of power supply regulator circuits.
04.14	Construct power supply regulator circuits.
04.15	Analyze and troubleshoot power supply regulator circuits.
04.16	Identify and define operating characteristics and applications of active filters.
04.17	Construct active filter circuits.
04.18	Analyze and troubleshoot active filter circuits.
04.19	Identify and define operating characteristics and applications of sinusoidal and non-sinusoidal oscillator circuits.
04.20	Construct oscillator circuits.
04.21	Analyze and troubleshoot oscillator circuits.
04.22	Identify and define operating characteristics and applications of Liquid Crystal Display (LCD), Light Emitting Diode (LED), and Three Dimensional (3D) technologies.
04.23	Identify and define operating characteristics and applications of optoelectronic devices.
04.24	Set up and operate measuring instruments for analog circuits.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Electronic Systems Technician**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J540300	
CIP Number	0615030332	
Grade Level	30, 31	
Program Length	900 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 10	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in electronic support services positions.

The content includes but is not limited to direct current (DC) circuits, alternating current (AC) circuits and analog circuits; solid state and digital devices; microprocessors; use of circuit diagrams and schematics; soldering and chassis assembly techniques; laboratory practices; and technical recording and reporting.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of five occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EEV0012	Electronic Assembler and DC Technician	AVIONICS @7 7G ELECTRONIC @7 7G RADIO TV %7 %G TEC ELEC @7 7G TV PROD TEC @7 7G	150 hours
B	EEV0820	Electronic Digital and Microprocessor Technician		150 hours
C	EEV0130	Electronic AC Technician		150 hours
D	EEV0824	Electronic Solid-State and Analog Technician		150 hours
E	EEV0825	Electronic Systems and Equipment Technician		300 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate proficiency in electronics assembly, soldering, and basic laboratory practices.
02.0 Demonstrate proficiency in basic DC circuits.
03.0 Demonstrate proficiency in advanced DC circuits.
04.0 Demonstrate proficiency in digital circuits.
05.0 Demonstrate proficiency in fundamental microprocessors.
06.0 Demonstrate skills in technical recording utilizing industry recognized computer application software.
07.0 Demonstrate proficiency in AC circuits.
08.0 Demonstrate proficiency in solid state devices.
09.0 Demonstrate proficiency in analog circuits.
10.0 Demonstrate proficiency in basic systems troubleshooting.
11.0 Demonstrate proficiency in fiber optic circuits.
12.0 Explain the importance of employability and entrepreneurship skills.
13.0 Demonstrate an understanding of emerging electronic technologies.

Florida Department of Education
Student Performance Standards

Program Title: **Electronic Systems Technician**
Career Certificate Program Number: **J540300**

Course Description: The Electronic Assembler and DC Technician course prepares students for entry into the electronics technology industry. Students explore career opportunities and requirements of a professional electronics technician. Students study basic soldering lab practices, Basic DC and Advanced DC circuitry.

Course Number: EEV0012 **Occupational Completion Point: A** **Electronic Assembler and DC Technician – 150 Hours**	
01.0	Demonstrate proficiency in electronics assembly, soldering, and basic laboratory practices. The student will be able to:
01.01	Apply proper Occupational Safety Health Administration (OSHA) safety standards.
01.02	Identify and use hand tools and power tools properly.
01.03	Draw and interpret electronic schematics.
01.04	Apply recognized industry accepted standard electrostatic discharge (ESD) safety procedures.
01.05	Make electrical connections.
01.06	Specify and request simple electronic components.
01.07	Properly place and solder components on a basic printed circuit board (PCB) to industry accepted standards.
01.08	Apply recognized industry standard soldering and De soldering techniques to include surface mount and thru-hole techniques.
01.09	Apply recognized industry accepted standard techniques for rework and repair.
01.10	Understand the purpose for writing reports and properly communicating results.
01.11	Understand the purpose for recording data.
01.12	Understand the purpose for designing curves and graphs.
01.13	Understand the purpose for writing formal laboratory experience reports.
01.14	Understand the process for generating equipment failure reports.
01.15	Understand the process for maintaining test logs.
01.16	Understand preventive maintenance and calibration procedures and related documentation.
02.0	Demonstrate proficiency in basic DC circuits. The student will be able to:

02.01	Solve problems in electronic units utilizing metric prefixes.
02.02	Describe the relationship of DC electricity to the nature of matter.
02.03	Identify sources of electricity.
02.04	Define voltage, current, resistance, power and energy.
02.05	Apply Ohm's law and power formulas to series circuits.
02.06	Read and interpret color codes, surface mount codes, and symbols to identify electrical components and values.
02.07	Measure properties of a circuit using appropriate test equipment.
02.08	Compute conductance and compute and measure resistance of conductors and insulators.
02.09	Verify, analyze, and troubleshoot the operation of series circuits.
02.10	Apply Ohm's law to parallel circuits.
02.11	Verify, analyze, and troubleshoot the operation of parallel circuits.
03.0	Demonstrate proficiency in advanced DC circuits. The student will be able to:
03.01	Solve algebraic problems to include exponentials to DC.
03.02	Apply Ohm’s law to series-parallel and parallel-series circuits.
03.03	Verify, analyze, and troubleshoot the operation of series-parallel, parallel-series, and bridge circuits.
03.04	Verify, analyze, and troubleshoot and the operation of voltage divider circuits (loaded and unloaded).
03.05	Apply and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
03.06	Describe magnetic properties of circuits and devices.
03.07	Determine the physical and electrical characteristics of capacitors and inductors.
03.08	Define resistor-capacitor (R-C) and resistor-inductor (R-L) time constants and classify the output of differentiators and integrators.
03.09	Verify the operation of power supplies for DC circuits.
03.10	Identify and explain the theory of DC motors and their practical applications.

Course Description: The Electronic Digital and Microprocessor Technician course is designed to build on the skills and knowledge students learned in the Electronics Assembler and DC Technician course for entry into the electronics technology industry. Students study digital circuitry, fundamental micro-processor theory, and technical recording.

Course Number: EEV0820 **Occupational Completion Point: B** **Electronic Digital and Microprocessor Technician – 150 Hours**	
04.0	Demonstrate proficiency in digital circuits. The student will be able to:
04.01	Define and apply numbering systems to codes and arithmetic operations.
04.02	Analyze and minimize logic circuits using Boolean operations.
04.03	Verify the operation of digital devices and circuits using appropriate test equipment.
04.04	Verify, analyze and troubleshoot the operation of combinational logic circuits and sequential logic gates.
04.05	Verify, analyze, and troubleshoot the operation of flip-flops using integrated circuits and their truth tables.
04.06	Identify, define and measure characteristics of integrated circuit (IC) logic families.
04.07	Verify, analyze, and troubleshoot the operation of registers and counters.
04.08	Verify, analyze, and troubleshoot the operation of timing circuits.
04.09	Verify, analyze, and troubleshoot the operation of arithmetic-logic circuits.
04.10	Verify, analyze and troubleshoot the operation of encoding and decoding devices.
04.11	Verify, analyze and troubleshoot the operation of multiplexer and demultiplexer circuits.
04.12	Identify types of memory circuits.
04.13	Verify, analyze and troubleshoot the operation of digital-to-analog and analog-to-digital circuits.
04.14	Verify, analyze and troubleshoot the operation of digital display circuits.
05.0	Demonstrate proficiency in fundamental microprocessors. The student will be able to:
05.01	Identify central processing unit (CPU) building blocks and their uses (architecture).
05.02	Safely install and remove a CPU without damaging.
05.03	Analyze bus concepts.
05.04	Analyze various memory schemes.
05.05	Define and identify the types of memory devices and circuits.
05.06	Define and identify the functions of a microprocessor.
05.07	Analyze and troubleshoot a microprocessor system.
05.08	Define and identify microprocessor peripheral devices.
05.09	Demonstrate the proper handling of a microprocessor.

	05.10 Compare and contrast micro types and programming language types.
06.0	Demonstrate skills in technical recording utilizing industry recognized computer application software. The student will be able to:
	06.01 Draw and interpret electronic schematics.
	06.02 Record data and design curves and graphs.
	06.03 Write reports and make oral presentations.
	06.04 Maintain test logs.
	06.05 Make equipment failure reports.
	06.06 Specify and requisition simple electronic components.
	06.07 Compose technical letters and memoranda with issue and solutions.
	06.08 Write formal reports of laboratory experiences.
	06.09 Understand preventive maintenance and calibration procedures and related documentation.

Course Description: The Electronic AC Technician course is designed to build on the skills and knowledge students learned in the Electronic Digital and Microprocessor Technician course for entry into the electronics technology industry. Students study AC circuitry, and technical recording.

Course Number: EEV0130 Occupational Completion Point: C Electronic AC Technician – 150 Hours	
07.0	Demonstrate proficiency in AC circuits. The student will be able to:
	07.01 Solve basic trigonometric problem as applicable to electronics.
	07.02 Verify, analyze, and troubleshoot the operation of AC capacitive circuits and their characteristics.
	07.03 Verify, analyze, and troubleshoot the operation of AC inductive circuits and their characteristics.
	07.04 Verify, analyze, and troubleshoot the operation of AC circuits utilizing transformers and their principles of transformers to AC circuits.
	07.05 Verify, analyze, and troubleshoot the operation of differentiators and integrators to determine R-C and R-L time constraints.
	07.06 Define, analyze, and troubleshoot the characteristics of Resistive, Inductive, and Capacitive (RLC) circuits, R-C & R-L circuits.
	07.07 Verify, analyze, and troubleshoot the operation of series and parallel resonant circuits and their characteristics
	07.08 Verify, analyze, and troubleshoot operations of frequency selective filter circuits and their characteristics
	07.09 Define the characteristics of poly-phase circuits.
	07.10 Define basic AC motor theory, operation, and practical applications.

07.11	Define basic generator theory, operation, and practical applications.
07.12	Operate power supplies for AC circuits.
07.13	Set up and operate oscilloscopes for AC circuits.
07.14	Set up and operate function generators for AC circuits.
06.0	Demonstrate skills in technical recording utilizing industry recognized computer application software. The student will be able to:
06.01	Draw and interpret electronic schematics.
06.02	Record data and design curves and graphs.
06.03	Write reports and make oral presentations.
06.04	Maintain test logs.
06.05	Make equipment failure reports.
06.06	Specify and requisition simple electronic components.
06.07	Compose technical letters and memoranda with issue and solutions.
06.08	Write formal reports of laboratory experiences.
06.09	Understand preventive maintenance and calibration procedures and related documentation.

Course Description: The Electronic Solid-State and Analog Technician course is designed to build on the skills and knowledge students learned in the Electronic AC Technician course for entry into the electronics technology industry. Students study solid state devices, analog circuitry, and technical recording.

Course Number: EEV0824 Occupational Completion Point: D Electronic Solid-State and Analog Technician – 150 Hours	
08.0	Demonstrate proficiency in solid state devices. The student will be able to:
08.01	Identify and define properties of semiconductor materials.
08.02	Identify and define operating characteristics and applications of junction diodes.
08.03	Identify and define operating characteristics and applications of special diodes, for example Zener diodes.
08.04	Verify, analyze, and troubleshoot the proper operation of diode circuits.
08.05	Identify and define operating characteristics and applications of bipolar transistors,
08.06	Identify and define operating characteristics and applications of field effect transistors.
08.07	Identify and define operating characteristics and applications of single-stage amplifiers.

	08.08 Verify, analyze, and troubleshoot the operation of single-stage amplifiers.
	08.09 Understand the principles and application of thyristor circuity.
	08.10 Set up and operate power supplies, oscilloscopes and function generators for solid-state devices.
	08.11 Verify the proper operation of transistors.
	08.12 Analyze and troubleshoot transistor circuits.
09.0	Demonstrate proficiency in analog circuits. The student will be able to:
	09.01 Verify, analyze, and troubleshoot the operational characteristics and applications of multistage amplifiers.
	09.02 Identify and define operating characteristics and applications of linear integrated circuits.
	09.03 Verify, analyze, and troubleshoot the operating characteristics and applications of basic power supplies and filters.
	09.04 Verify, analyze, and troubleshoot the operating characteristics and applications of differential and operational amplifiers.
	09.05 Verify, analyze, and troubleshoot the operating characteristics and applications of audio power amplifiers.
	09.06 Verify, analyze, and troubleshoot the operating characteristics and applications of power supply regulator circuits.
	09.07 Verify, analyze, and troubleshoot the operating characteristics and applications of active filter circuits.
	09.08 Verify, analyze, and troubleshoot the operating characteristics and applications of sinusoidal and non-sinusoidal oscillator circuits.
	09.09 Verify, analyze, and troubleshoot the operating characteristics and applications of Optoelectronic Devices including: Liquid Crystal Display (LCD), Light Emitting Diode (LED), and Three Dimensional (3D) technologies.
06.0	Demonstrate skills in technical recording utilizing industry recognized computer application software. The student will be able to:
	06.01 Draw and interpret electronic schematics.
	06.02 Record data and design curves and graphs.
	06.03 Write reports and make oral presentations.
	06.04 Maintain test logs.
	06.05 Make equipment failure reports.
	06.06 Specify and requisition simple electronic components.
	06.07 Compose technical letters and memoranda with issue and solutions.
	06.08 Write formal reports of laboratory experiences.
	06.09 Understand preventive maintenance and calibration procedures and related documentation.

Course Description: The Electronic Systems and Equipment Technician course is designed to build on the skills and knowledge students learned in the Electronic Solid-State and Analog Technician course for entry into the electronics technology industry. Students study basic systems troubleshooting, fiber optic circuitry, employability and entrepreneurship skills, and emerging electronic technologies.

Course Number: EEV0825 **Occupational Completion Point: F** **Electronic Systems and Equipment Technician – 300 Hours**	
10.0	Demonstrate proficiency in basic systems troubleshooting. The student will be able to:
10.01	Identify basic components of systems.
10.02	Interpret basic flow charts, block diagrams, schematics, and technical documentation.
10.03	Isolate a system malfunction to a specific subsystem or field replaceable unit.
11.0	Demonstrate proficiency in fiber optic circuits. The student will be able to:
11.01	Describe the nature of light propagation.
11.02	Identify and define optical transmitters, receivers, and fibers.
11.03	Recognize a fiber optic cable connection that complies too industry standards.
11.04	Determine reflectivity, refractivity, and losses within a fiber optic system.
12.0	Explain the importance of employability and entrepreneurship skills. The students will be able to:
12.01	Identify and demonstrate positive work behaviors needed to be employable.
12.02	Develop personal career plan that includes goals, objectives, and strategies.
12.03	Research licensing, certification, and industry credentialing requirements.
12.04	Maintain a career portfolio to document knowledge, skills, and experience.
12.05	Evaluate and compare employment opportunities that match career goals.
12.06	Identify and exhibit traits for retaining employment.
12.07	Identify opportunities and research requirements for career advancement.
12.08	Research the benefits of ongoing professional development.
12.09	Examine and describe entrepreneurship opportunities as a career planning option.
13.0	Demonstrate an understanding of emerging electronic technologies. The student will be able to:
13.01	Research and identify careers and workforce needs that employ emerging electronic technologies.
13.02	Identify the skills required to work within careers that use emerging electronic technologies.

13.03	Apply learned skills and competencies related to various electronic technology industry sectors. (e.g., communications, telecommunications, computer networking, consumer electronics, medical electronics, avionics, mechatronics, etc.)

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Industrial Machinery Maintenance 1**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J590100	
CIP Number	0647030303	
Grade Level	30, 31	
Program Length	750 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please se the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in industrial-machinery maintenance positions.

The content includes but is not limited to understanding all aspects of the industrial-machinery maintenance-technology industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0450	Industrial Machinery Maintenance Assistant	BLDG CONST @7 7G IND ENGR 7G MACH SHOP @7 7G MILLWRIGHT 7G TEC CONSTR @7 7G	450 hours
B	ETI0456	Machinery Maintenance Mechanic		300 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply safety rules and procedures.
02.0 Explain basic electricity and electronics.
03.0 Perform mathematical calculations.
04.0 Use and maintain hand tools.
05.0 Use and maintain portable power tools.
06.0 Read plans and drawings.
07.0 Perform measuring and layout operations.
08.0 Demonstrate basic knowledge of industrial and manufacturing processes.
09.0 Perform benchwork skills.
10.0 Troubleshoot electrical circuits.
11.0 Identify common troubles and basic troubleshooting techniques.
12.0 Handle and apply lubricants.
13.0 Perform rigging functions.
14.0 Explain the basic elements of physics as related to industrial machinery maintenance and repair.
15.0 Install and maintain drive components.
16.0 Maintain and troubleshoot pneumatic systems.
17.0 Maintain and troubleshoot fluid-drive systems.
18.0 Maintain reciprocating, positive-displacement, and rotary air compressors.
19.0 Perform gas and electric welding and cutting operations.
20.0 Install and remove machinery.
21.0 Demonstrate conveyor-maintenance techniques.
22.0 Perform gas- and arc-welding procedures.
23.0 Perform machine-shop operations.
24.0 Maintain piping and tubing systems.
25.0 Perform pump maintenance and repair.
26.0 Identify various types of industrial-pollution control systems.
27.0 Identify boilers.
28.0 Understand internal combustion engines.

Florida Department of Education
Student Performance Standards

Program Title: **Industrial Machinery Maintenance/Installation Technician**
Career Certificate Program Number: **J590100**

Course Description: The Industrial Machinery Maintenance Assistant course prepares students for entry into the Industrial Machinery Maintenance and Repair industry. Content emphasizes beginning skills and concepts as a recommended requisite. Students study workplace safety and organization, basics of electricity and electronics, mathematical calculations, proper use of hand and power tools, read and interpret plans and drawings, perform measuring and layout operations, industrial and manufacturing processes, benchwork skills, troubleshooting skills and techniques, lubrication processes, rigging, basic elements of physics, installation of drive components, troubleshoot pneumatic and fluid-drive systems, and maintaining air compressors.

Course Number: ETI0450 **Occupational Completion Point: A** **Industrial Machinery Maintenance Assistant – 450 Hours**	
01.0	Apply safety rules and procedures. The student will be able to:
01.01	Practice shop safety rules and procedures.
01.02	Practice personal safety rules and procedures, including the use of personal protective equipment (PPE).
01.03	Practice fire safety rules and procedures.
01.04	Practice electrical safety rules and procedures.
01.05	Practice tool safety rules and procedures.
01.06	Practice ladder and scaffolding safety rules and procedures.
01.07	Maintain a clean work and shop area.
01.08	Perform tag lockout procedures.
01.09	Identify Occupational Safety and Health Administration (OSHA) requirements and procedures.
01.10	Use Safety Data Sheets (SDS).
02.0	Explain basic electricity and electronics. The student will be able to:
02.01	Define electrical/electronic terms.
02.02	Describe direct current (DC) and alternating current (AC) circuits.
02.03	Identify the advantages and disadvantages of alternating current (AC) and direct current (DC) motors for various applications.
03.0	Perform mathematical calculations. The student will be able to:

03.01	Make job-related decimal and fraction calculations.
03.02	Solve job-related problems by adding, subtracting, multiplying, and dividing numbers.
03.03	Solve job-related problems using a hand-held calculator.
03.04	Solve job-related problems using basic formulas.
03.05	Solve job-related problems using basic geometry.
03.06	Measure a work piece and compare the measurements with blueprint specifications.
03.07	Solve job-related problems using mathematical handbooks, charts, and tables.
03.08	Convert measurements from English to metric and from metric to English units.
03.09	Solve job-related problems using proportions.
03.10	Solve job-related problems using statistics.
04.0	Use and maintain hand tools. The student will be able to:
04.01	Demonstrate the safe use of hand tools such as screwdrivers, hammers, wrenches, pliers, hacksaws, punches, chisels, drills, files, tin snips, taps, and dies.
04.02	Use measuring devices.
04.03	Use wrenches and screwdrivers.
04.04	Use pipefitting tools.
04.05	Use sheet-metal tools.
04.06	Safely use ropes, slings, pulleys, and block and tackle.
04.07	Select the proper tool for each job application.
04.08	Select correct tools for metric and standard fasteners.
04.09	Identify state-of-the-art innovations and explore their uses.
04.10	Identify and select fasteners for various applications, considering the effects of corrosion on each, including threaded fasteners, nuts, washers, rivets, locking pins, keys, self-tapping screws, locking-nut fasteners, and self-retaining nuts.
04.11	Describe the techniques and liability issues regarding retrofitting fasteners for ease of removal.
05.0	Use and maintain portable power tools. The student will be able to:
05.01	Demonstrate the safe use of portable power tools, drills, belt and disc sanders, grinders, circular saws, saber saws, metal shears, electric and pneumatic impact wrenches, rotary and pneumatic chipping hammers, drill presses, and bench grinders.
05.02	Use and maintain light- and heavy-duty drills.
05.03	Use and maintain electric hammers.

	05.04 Use and maintain pneumatic drills and hammers.
	05.05 Use and maintain power screwdrivers and nut runners.
	05.06 Use and maintain linear motion saws.
	05.07 Use and maintain circular saws.
	05.08 Use and maintain belt, pad, and disc sanders.
	05.09 Use and maintain grinders and shears.
06.0	Read plans and drawings. The student will be able to:
	06.01 Identify various types of plans and drawings (e.g., architectural, mechanical, electrical, etc.).
	06.02 Identify dimensions.
	06.03 Identify lists of materials and specifications.
	06.04 Identify section and detail views.
	06.05 Sketch and dimension a part.
	06.06 Disassemble and assemble parts using an exploded-view drawing.
	06.07 Interpret blueprint abbreviations.
	06.08 Identify dimensioning of radii, round holes, fillets, and chamfers.
	06.09 Identify screw threads and bolt types.
	06.10 Apply dimensional tolerances.
	06.11 Identify the metal-fabrication symbols used in blueprints.
07.0	Perform measuring and layout operations. The student will be able to:
	07.01 Perform basic geometric-construction operations.
	07.02 Safely use marking gauges, center punches, scribes, surface gauges, squares, dividers, dial indicators, protractors, surface plates, depth gauges, and circumference rules.
	07.03 Develop patterns using parallel lines, radial lines, and triangulation.
	07.04 Make metal-fabrication sketches.
	07.05 Read and measure with steel rules.
	07.06 Read and measure with micrometers.
	07.07 Read and measure with vernier tools.
	07.08 Read and measure with dial and digital calipers.

	07.09 Read and measure with dial and digital indicators.
08.0	Demonstrate basic knowledge of industrial and manufacturing processes. The student will be able to:
	08.01 Demonstrate knowledge of the use of current manufacturing processes.
	08.02 Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment.
	08.03 Understand the processes of separating, forming, conditioning, fabricating, and finishing of materials.
09.0	Perform benchwork skills. The student will be able to:
	09.01 Identify safety and shop rules.
	09.02 Cut materials by using hand hacksaws.
	09.03 Cut threads by using hand taps.
	09.04 Cut threads by using dies.
	09.05 Repair threads by chasing and thread inserts.
	09.06 Install dowel pins using tapered and straight reamers.
	09.07 Ream holes by using tapered and straight reamers.
	09.08 Hand-sharpen cutting tools by using abrasive stones.
	09.09 Hone and lap surfaces.
	09.10 Remove damaged screws and other hardware.
	09.11 Deburr workpieces.
	09.12 Demonstrate accurate dis-assembly and re-assembly of machinery components.
10.0	Troubleshoot electrical circuits. The student will be able to:
	10.01 Describe the safety requirements and precautions for troubleshooting electrical circuits.
	10.02 Disconnect and reconnect electric motors.
	10.03 Identify the parts and function of an electrical system.
	10.04 Explain how to troubleshoot a sequence of events.
	10.05 Properly use electrical test equipment for troubleshooting.
11.0	Identify common troubles and basic troubleshooting techniques. The student will be able to:
	11.01 Analyze the possible causes of common troubles in industrial machinery performance.
	11.02 Identify basic troubleshooting techniques for bearings.

	11.03 Identify basic troubleshooting techniques for pumps.
	11.04 Identify basic troubleshooting techniques for drive systems.
	11.05 Identify basic troubleshooting techniques for hydraulics.
	11.06 Identify basic troubleshooting techniques for pneumatics.
12.0	Handle and apply lubricants. The student will be able to:
	12.01 Explain the functions of lubrication.
	12.02 Explain the properties of oil lubricants.
	12.03 Identify the types, advantages, and functions of lubricant additives.
	12.04 Explain the types of circulating oils and their purposes.
	12.05 Identify grease application.
	12.06 Identify lubricating systems and methods.
	12.07 Explain lubricant storage and handling methods.
	12.08 Explain the types of oil filters and their uses.
	12.09 Lubricate a piece of industrial equipment.
	12.10 Define the role of preventive maintenance in total equipment maintenance.
	12.11 Describe the major tasks of preventive maintenance: cleaning, inspection, lubrication, minor repair, and information feedback.
	12.12 Review a typical maintenance program.
13.0	Perform rigging functions. The student will be able to:
	13.01 Demonstrate the safety procedures for performing rigging and lifting operations.
	13.02 Identify and inspect fiber and wire rope.
	13.03 Tie knots and hitches.
	13.04 Identify and use the components of rigging hardware.
	13.05 Perform rigging and lifting operations.
14.0	Explain the basic elements of physics as related to industrial machinery maintenance and repair. The student will be able to:
	14.01 Explain the standards of measurement and the impact of action and working forces, including tension, compression, torque, and shear.
	14.02 Identify the principles and laws of motion and explain how they affect acceleration and deceleration.
	14.03 Explain the relationship of work, power, and energy to the types of collisions and conservation of momentum.

14.04	Explain the operation of simple machines, including the lever, inclined plane, screw, wedge, wheel and axle, pulley, and jacking screws.
14.05	Identify the ways of producing power for mechanical efficiency, in terms of gear ratios, work forces, and the types of work done by a crane hook, forklift truck, and screw or bolt.
14.06	Use linear, liquid, and weight units of measurement to measure areas, areas within areas, and volume.
14.07	Describe the mechanical and chemical properties of materials commonly used in industry.
14.08	Explain the laws and conditions governing static and kinetic friction, the problems caused by friction, and the effects of the angle of repose.
14.09	Explain molecular action as a result of temperature extremes, chemical reaction, and moisture content.
14.10	Draw conclusions or make inferences from data.
14.11	Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
15.0	Install and maintain drive components. The student will be able to:
15.01	Demonstrate safety procedures for installing and maintaining drive components.
15.02	Identify the types of bearings, their cross-referencing, and their uses.
15.03	Remove, inspect, and/or replace bearings.
15.04	Remove and replace seals.
15.05	Perform shaft alignment.
15.06	Identify the types of belts.
15.07	Identify the types of chains.
15.08	Perform tension adjustments and alignment on belt and chain drives.
15.09	Troubleshoot belt and chain drives.
15.10	Identify the types of gears.
15.11	Remove, replace, and align gears, sprockets, and couplings.
15.12	Remove, replace, or repair V-joints and jack shafts.
15.13	Adjust gear backlash.
15.14	Troubleshoot gear drives.
15.15	Disassemble, inspect, reassemble, and adjust clutches.
15.16	Identify the types of variable-speed drives.
15.17	Troubleshoot variable-speed drives.

	15.18 Identify the types of cams and link mechanisms.
	15.19 Troubleshoot cam-and-link mechanism problems.
16.0	Maintain and troubleshoot pneumatic systems. The student will be able to:
	16.01 Explain the safety procedures for troubleshooting pneumatic systems.
	16.02 Diagram an air supply system.
	16.03 Install system components.
	16.04 Demonstrate system-maintenance techniques.
	16.05 Explain proper troubleshooting procedures.
	16.06 Troubleshoot air compressors.
	16.07 Troubleshoot, repair, and install control valves.
	16.08 Troubleshoot air motors.
17.0	Maintain and troubleshoot fluid-drive systems. The student will be able to:
	17.01 Explain the safety procedures for maintaining and troubleshooting fluid-drive systems.
	17.02 Install adjustable-speed drives.
	17.03 Troubleshoot adjustable-speed drives.
	17.04 Explain the operation of fluid couplings.
	17.05 Install fluid couplings.
	17.06 Install torque converters.
	17.07 Perform preventive maintenance.
	17.08 Apply a "dynamic" magnetic/mechanical braking device to a motor.
	17.09 Mount the equipment.
18.0	Maintain reciprocating, positive-displacement, and rotary air compressors. The student will be able to:
	18.01 Relate scientific principles to a pneumatic system.
	18.02 Demonstrate the safety procedures for maintaining and operating reciprocating, positive-displacement, and rotary air compressors.
	18.03 Identify the systems of reciprocating, positive-displacement, and rotary air compressors.
	18.04 Check oil level.
	18.05 Change oil.

18.06	Drain water from tank.
18.07	Test for efficiency of compressor.
18.08	Inspect storage tank for quality.
18.09	Test pressure control switch.

Course Description: The Machinery Maintenance Mechanic course is designed for entry into the Industrial Machinery Maintenance and Repair industry. Students study welding and cutting operations, machinery installation and removal, conveyor maintenance, machine shop operations, piping and tubing systems, pump maintenance and repair, industrial pollution control systems, boilers, and internal combustion engines.

Course Number: ETI0456 Occupational Completion Point: B Machinery Maintenance Mechanic – 300 Hours	
19.0	Perform gas and electric welding and cutting operations. The student will be able to:
19.01	Identify the properties of the most commonly used metals and alloys, including hardness and malleability.
19.02	Identify welding cylinders, regulators, hoses, pressure gauges, and torches.
19.03	Describe welding-equipment safety procedures.
19.04	Demonstrate proper flame settings.
19.05	Demonstrate basic gas-welding skills.
19.06	Demonstrate procedures for adjusting and operating the oxyacetylene cutting torch.
19.07	Demonstrate freehand and guide cutting of various metal thicknesses.
19.08	Perform basic electric arc welding procedures.
20.0	Install and remove machinery. The student will be able to:
20.01	Identify the safety procedures for installing and removing machinery.
20.02	Identify the equipment required for machine installation and removal.
20.03	Prepare an area for machine installation per the manufacturer's specifications.
20.04	Rig, lift, and transport machinery to the installation site.
20.05	Install electrical hookups to machinery.
20.06	Install air hydraulic hookups to machinery.
20.07	Perform an assigned machine retrofit per the manufacturer's specifications.
20.08	Perform an assigned machine removal and transport per specification requirements.

	20.09 Explain the importance of vibration detection.
21.0	Demonstrate conveyor-maintenance techniques. The student will be able to:
	21.01 Identify various types of conveyors.
	21.02 Identify the safety requirements and precautions for conveyor-maintenance operations.
	21.03 Adjust the tracking of a belt.
	21.04 Check a belt for wear.
	21.05 Identify the types of splices.
	21.06 Identify splicing equipment and procedures.
	21.07 Identify conveyor-maintenance techniques, including making splices with splicing equipment.
22.0	Perform gas- and arc-welding procedures. The student will be able to:
	22.01 Demonstrate the safety procedures for performing gas and arc welding and for transporting equipment.
	22.02 Identify the components of an oxyfuel rig.
	22.03 Set up and shut down an oxyfuel rig.
	22.04 Weld beads in a flat position.
	22.05 Weld an outside corner joint using a filler rod.
	22.06 Cut metal of various thicknesses.
	22.07 Weld beads in a flat position using E-6010 and E-7018 electrodes.
	22.08 Weld beads in horizontal and in vertical positions using E-6010 and E-7018 electrodes.
	22.09 Weld beads in an overhead position using E-6010 and E-7018 electrodes.
	22.10 Weld beads using a MIG welder.
	22.11 Weld beads using a TIG welder.
	22.12 Solder and braze metals.
	22.13 Cut stainless steel and aluminum with a plasma-arc rig.
23.0	Perform machine-shop operations. The student will be able to:
	23.01 Demonstrate safety in performing machine-shop operations.
	23.02 Identify the types of cutting tools.
	23.03 Bore a hole to a specified size.

	23.04 Cut an external V-thread.
	23.05 Identify the different types of work-holding devices.
	23.06 Prepare metal for finishing.
	23.07 Set up, use, and adjust an arbor press.
	23.08 Set up, use, and adjust a hydraulic press.
	23.09 Cut keyways with an end mill.
24.0	Maintain piping and tubing systems. The student will be able to:
	24.01 Identify the components of a piping system.
	24.02 Explain the maintenance considerations of metallic and nonmetallic piping systems.
	24.03 Describe the safety requirements for working with piping and tubing systems.
	24.04 Join copper tubing.
	24.05 Join common fittings.
	24.06 Join metallic pipe.
	24.07 Join plastic pipe.
	24.08 Explain valve operation and maintenance.
	24.09 Explain the importance of strainers, filters, and traps in piping systems.
	24.10 Bend back-to-back, stub-ups, and doglegs in electrical metallic tubing (EMT).
25.0	Perform pump maintenance and repair. The student will be able to:
	25.01 Demonstrate the safety procedures for performing pump maintenance.
	25.02 Determine pump capacity and system requirements.
	25.03 Perform pump maintenance.
	25.04 Identify packing and seal requirements.
	25.05 Explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating, diaphragm, positive placement, and vacuum pumps.
	25.06 Disassemble and reassemble a pump.
26.0	Identify various types of industrial-pollution control systems.
27.0	Identify boilers. The student will be able to:
	27.01 Identify the various types and components of heat exchangers.

	27.02 Identify the various types and components of boilers.
	27.03 Identify the various types and components of fractioning columns.
	27.04 Identify the uses of steam.
28.0	Understand internal combustion engines. The student will be able to:
	28.01 Explain the basic principles of the two-stroke-cycle combustion engine.
	28.02 Identify the types of engines, engine assemblies, and systems.
	28.03 Perform routine maintenance on engine operating systems.
	28.04 Troubleshoot and evaluate engine performance.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Industrial Machinery Maintenance 2**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J590200	
CIP Number	0647030304	
Grade Level	30, 31	
Program Length	600 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in industrial-machinery maintenance positions.

The content includes but is not limited to understanding all aspects of the industrial-machinery maintenance-technology industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

The standard length for this program is 600 hours. **Industrial Machinery Maintenance 1** is a core program. It is recommended students complete **Industrial Machinery Maintenance 1,** or demonstrate mastery of the outcomes in that program, prior to enrollment in **Industrial Machinery Maintenance 2.**

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0457	Machinery Maintenance Technician	BLDG CONST @7 7G IND ENGR 7G MACH SHOP @7 7G MILLWRIGHT 7G TEC CONSTR @7 7G	150 hours
B	ETI0458	Industrial Maintenance Specialist		450 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Plan an elementary predictive-preventive-maintenance (PPM) schedule.
02.0 Maintain and repair hydraulic-system components.
03.0 Troubleshoot hydraulic systems.
04.0 Maintain and troubleshoot robotic systems.
05.0 Demonstrate an understanding of employability skills and career opportunities.

Industrial Maintenance Specialist
06.0 Prepare for machinery startup.
07.0 Apply vibration-analysis skills.
08.0 Perform machinery balancing.
09.0 Demonstrate predictive-preventive-maintenance (PPM) technologies.
10.0 Use computer-maintenance-management systems (CMMS).
11.0 Perform failure analysis (FA).
12.0 Improve rotating equipment performance.
13.0 Generate machine improvements and maintenance management.

Florida Department of Education
Student Performance Standards

Program Title: **Industrial Machinery Maintenance 2**
Career Certificate Program Number: **J590200**

Course Description: The Machinery Maintenance Technician course prepares students for entry into the Industrial Machinery Maintenance and Repair industry. Content emphasizes beginning skills and concepts as a recommended requisite. Students study elementary predictive-preventive-maintenance planning, maintain and troubleshoot hydraulic and robotic systems, and understanding employability skills.

Course Number: ETI0457 **Occupational Completion Point: A** **Machinery Maintenance Technician – 150 Hours**	
01.0	Plan an elementary predictive-preventive-maintenance (PPM) schedule. The student will be able to:
01.01	List the types of predictive-preventive maintenance.
01.02	Describe the purpose of preventive-maintenance schedules.
01.03	Create a preventive-maintenance schedule form using a machine manual or the manufacturer recommendations.
01.04	Identify troubles caused by the lack of preventive maintenance.
01.05	Create a maintenance log and make entries for a machine or equipment.
01.06	Create a preventive-maintenance schedule from a maintenance-failures log.
02.0	Maintain and repair hydraulic-system components. The student will be able to:
02.01	Explain the safety procedures for installing hydraulic lines.
02.02	Explain how heat and pressure relate to power and transmission.
02.03	Describe the physical and chemical properties of a fluid.
02.04	Install and maintain a contaminant-removal system.
02.05	Determine reservoir requirements.
02.06	Classify and select pumps for specific applications.
02.07	Compute hose requirements.
02.08	Select and install control valves.
03.0	Troubleshoot hydraulic systems. The student will be able to:
03.01	Explain the safety procedures for troubleshooting hydraulic systems.

	03.02 Read a hydraulic schematic.
	03.03 Install hydraulic components.
	03.04 Connect electrically controlled valves.
	03.05 Explain hydraulic system troubleshooting techniques.
	03.06 Repair and replace valves.
	03.07 Repair and replace cylinders.
	03.08 Repair and replace pumps and motors.
04.0	Maintain and troubleshoot robotic systems. The student will be able to:
	04.01 Identify uses of robotics in industry.
	04.02 Identify safety procedures related to robotic systems.
	04.03 Identify mechanical, hydraulic, pneumatic, and electric/electronic components of robotic systems.
05.0	Demonstrate an understanding of employability skills and career opportunities. The student will be able to:
	05.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
	05.02 Discuss motivation and human behavior.
	05.03 Demonstrate knowledge of ways to improve reading, listening, and writing skills.
	05.04 Provide effective feedback and make suggestions.
	05.05 Demonstrate knowledge of roles and responsibilities of team members.
	05.06 Effectively communicate production and process information to internal and external customers.
	05.07 Develop personal career plan that includes goals, objectives, and strategies.
	05.08 Examine licensing, certification, and industry credentialing requirements.
	05.09 Evaluate and compare employment opportunities that match career goals.
	05.10 Identify and exhibit traits for retaining employment.
	05.11 Identify opportunities and research requirements for career advancement.
	05.12 Research the benefits of ongoing professional development.

Course Description: The Industrial Maintenance Specialist course is designed to build on the skills and knowledge students learned in the Machinery Maintenance Technician course for entry into the Industrial Machinery Maintenance and Repair industry. Students explore career opportunities and requirements of a professional industrial machinery mechanic. Students study machinery startup, vibration analysis, machinery

balancing, predictive-preventative maintenance, computer maintenance management systems, failure analysis, rotating equipment, and machine improvement.

Course Number: ETI0458 Occupational Completion Point: B Industrial Maintenance Specialist – 450 Hours	
06.0	Prepare for machinery startup. The student will be able to:
06.01	Describe the requirements and precautions for machinery startup.
06.02	Align machinery using wire line, transit, dial indicators, a computer, and laser-alignment devices.
06.03	Position and secure machinery on a foundation.
06.04	Level machinery and install balance-vibration dampeners.
06.05	Identify pipe-stress standards for machine-maintenance applications.
06.06	Perform finish alignment and check for pipe stresses in machinery- maintenance applications.
07.0	Apply vibration-analysis skills. The student will be able to:
07.01	Collect vibration data.
07.02	Interpret vibration data.
07.03	Determine velocity, acceleration, spike energy, frequency, amplitude, and other vibration sources.
07.04	Describe the safety requirements and precautions for vibration analysis.
07.05	Operate and use vibration software.
07.06	Predict and verify the condition of machinery in an industrial setting using vibration tools.
07.07	Explain the approximately 25 sources of vibration.
07.08	Explain the bearing frequency (BIFO) formulas.
07.09	Demonstrate proficiency in vibration detection.
08.0	Perform machinery balancing. The student will be able to:
08.01	Describe the safety requirements and precautions for balancing procedures and equipment.
08.02	Identify the principles of static balancing.
08.03	Perform a vector balance in the classroom.
08.04	Identify balancing standards, ISO 1940 or equal.
08.05	Perform a stand balance in a shop.

	08.06 Perform a field balance in an industrial setting.
	08.07 Use portable or stationary balancing equipment.
09.0	Demonstrate predictive-preventive-maintenance (PPM) technologies. The student will be able to:
	09.01 Explain the use of infrared thermography.
	09.02 Explain the use of ultrasound technology.
	09.03 Explain the use of advanced alignment techniques (optical and Essinger bars).
	09.04 Explain the use of oil ferrography and the types of oil sampling.
	09.05 Explain the use of shock pulse equipment.
	09.06 Describe the safety requirements for PPM technologies.
	09.07 Demonstrate the use of one of the above predictive-maintenance procedures.
	09.08 Plan an advanced PPM schedule.
10.0	Use computer-maintenance-management systems (CMMS). The student will be able to:
	10.01 Operate CMMS software.
	10.02 Enter and close a maintenance work order with CMMS.
	10.03 Schedule a series of maintenance tasks.
	10.04 Write a detailed maintenance job plan.
	10.05 Order parts and supplies for a maintenance work order.
	10.06 Determine the personnel resources needed for a maintenance job.
11.0	Perform failure analysis (FA). The student will be able to:
	11.01 Conduct/lead a failure analysis meeting to determine the root cause of a failure.
	11.02 Create a failure-analysis form and write a minimum of two different types of failure-analysis reports.
	11.03 Explain the types of bearing failures.
	11.04 Explain the types of shaft fatigues and failures.
	11.05 Explain the types of lubrication breakdowns.
	11.06 Estimate the cost and the impact on production of a specific failure.
12.0	Improve rotating-equipment performance. The student will be able to:
	12.01 Calculate shaft-deflection ratios and use the results to improve shaft design.

12.02	Draw or sketch equipment bases and supports of sturdy construction.
12.03	Demonstrate and install advanced labyrinth-sealing devices.
12.04	Demonstrate and install advanced mechanical-sealing devices.
12.05	Run the Gates Belts or another interactive belt-design-and- tensioning computer program applied to various drives.
12.06	Explain the benefits of synthetic oils and greases.
12.07	Explain MTBF (mean time between equipment failure) and its cost impact when machinery life is extended.
12.08	List seven specific machinery-improvement ideas in detail.
13.0	Generate machine improvements and maintenance management. The student will be able to:
13.01	Review and critique machinery and base design for improvement before the equipment is placed on order.
13.02	Identify the essential elements of effective maintenance management:
	• Reward system
	• Predictive-preventive maintenance
	• Planning
	• Work-order systems
	• Organizations
	• Goals and tracking
	• Facilities
	• Storerooms
	• Contractors
	• Shutdowns
13.03	Write a report on the design and effective use of at least two of the essential elements of management.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Millwright 1**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J590400	
CIP Number	0647030305	
Grade Level	30, 31	
Program Length	750 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in industrial-machinery maintenance positions.

The content includes but is not limited to understanding all aspects of the industrial-machinery maintenance-technology industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.
To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0450	Industrial Machinery Maintenance Assistant	BLDG CONST @7 7G IND ENGR 7G MACH SHOP @7 7G MILLWRIGHT 7G TEC CONSTR @7 7G	450 hours
B	ETI0456	Machinery Maintenance Mechanic		300 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply safety rules and procedures.
02.0 Explain basic electricity and electronics.
03.0 Perform mathematical calculations.
04.0 Use and maintain hand tools.
05.0 Use and maintain portable power tools.
06.0 Read plans and drawings.
07.0 Perform measuring and layout operations.
08.0 Demonstrate basic knowledge of industrial and manufacturing processes.
09.0 Perform benchwork skills.
10.0 Identify common troubles and basic troubleshooting techniques.
11.0 Handle and apply lubricants.
12.0 Perform rigging functions.
13.0 Explain the basic elements of physics as related to industrial machinery maintenance and repair.
14.0 Install and maintain drive components.
15.0 Maintain and troubleshoot pneumatic systems.
16.0 Maintain and troubleshoot fluid-drive systems.
17.0 Maintain reciprocating, positive-displacement, and rotary air compressors.
18.0 Perform gas and electric welding and cutting operations.
19.0 Install and remove machinery.
20.0 Demonstrate conveyor-maintenance techniques.
21.0 Perform gas- and arc-welding procedures.
22.0 Perform machine-shop operations.
23.0 Maintain piping and tubing systems.
24.0 Perform pump maintenance and repair.
25.0 Identify various types of industrial-pollution control systems.
26.0 Identify boilers.
27.0 Understand internal combustion engines.

Florida Department of Education
Student Performance Standards

Program Title: **Millwright 1**
Career Certificate Program Number: **J590400**

Course Description: The Industrial Machinery Maintenance Assistant course prepares students for entry into the Millwright industry. Content emphasizes beginning skills and concepts as a recommended requisite for entry into Machinery Maintenance Technician. Students study workplace safety and organization, basics of electricity and electronics, mathematical calculations, proper use of hand and power tools, read and interpret plans and drawings, perform measuring and layout operations, industrial and manufacturing processes, benchwork skills, troubleshooting skills and techniques, lubrication processes, rigging, basic elements of physics, installation of drive components, troubleshoot pneumatic and fluid-drive systems, and maintaining air compressors.

Course Number: ETI0450 **Occupational Completion Point: A** **Industrial Machinery Maintenance Assistant – 450 Hours**	
01.0	Apply safety rules and procedures. The student will be able to:
01.01	Practice shop safety rules and procedures.
01.02	Practice personal safety rules and procedures, including the use of personal protective equipment (PPE).
01.03	Practice fire safety rules and procedures.
01.04	Practice electrical safety rules and procedures.
01.05	Practice tool safety rules and procedures.
01.06	Practice ladder and scaffolding safety rules and procedures.
01.07	Maintain a clean work and shop area.
01.08	Perform tag lockout procedures.
01.09	Identify Occupational Safety and Health Administration (OSHA) requirements and procedures.
01.10	Use Safety Data Sheets (SDS).
02.0	Explain basic electricity and electronics. The student will be able to:
02.01	Define electrical/electronic terms.
02.02	Describe direct current (DC) and alternating current (AC) circuits.
02.03	Identify the advantages and disadvantages of alternating current (AC) and direct current (DC) motors for various applications.
03.0	Perform mathematical calculations. The student will be able to:

	03.01 Make job-related decimal and fraction calculations.
	03.02 Solve job-related problems by adding, subtracting, multiplying, and dividing numbers.
	03.03 Solve job-related problems using a hand-held calculator.
	03.04 Solve job-related problems using basic formulas.
	03.05 Solve job-related problems using basic geometry.
	03.06 Measure a work piece and compare the measurements with blueprint specifications.
	03.07 Solve job-related problems using mathematical handbooks, charts, and tables.
	03.08 Convert measurements from English to metric and from metric to English units.
	03.09 Solve job-related problems using proportions.
	03.10 Solve job-related problems using statistics.
04.0	Use and maintain hand tools. The student will be able to:
	04.01 Demonstrate the safe use of hand tools such as screwdrivers, hammers, wrenches, pliers, hacksaws, punches, chisels, drills, files, tin snips, taps, and dies.
	04.02 Use measuring devices.
	04.03 Use wrenches and screwdrivers.
	04.04 Use pipefitting tools.
	04.05 Use sheet-metal tools.
	04.06 Safely use ropes, slings, pulleys, and block and tackle.
	04.07 Select the proper tool for each job application.
	04.08 Select correct tools for metric and standard fasteners.
	04.09 Identify state-of-the-art innovations and explore their uses.
	04.10 Identify and select fasteners for various applications, taking into account the effects of corrosion on each, including threaded fasteners, nuts, washers, rivets, locking pins, keys, self-tapping screws, locking-nut fasteners, and self-retaining nuts.
	04.11 Describe the techniques and liability issues regarding retrofitting fasteners for ease of removal.
05.0	Use and maintain portable power tools. The student will be able to:
	05.01 Demonstrate the safe use of portable power tools, drills, belt and disc sanders, grinders, circular saws, saber saws, metal shears, electric and pneumatic impact wrenches, rotary and pneumatic chipping hammers, drill presses, and bench grinders.
	05.02 Use and maintain light- and heavy-duty drills.
	05.03 Use and maintain electric hammers.

	05.04 Use and maintain pneumatic drills and hammers.
	05.05 Use and maintain power screwdrivers and nut runners.
	05.06 Use and maintain linear motion saws.
	05.07 Use and maintain circular saws.
	05.08 Use and maintain belt, pad, and disc sanders.
	05.09 Use and maintain grinders and shears.
06.0	Read plans and drawings. The student will be able to:
	06.01 Identify various types of plans and drawings. (e.g., architectural, mechanical, electrical, etc.)
	06.02 Identify dimensions.
	06.03 Identify lists of materials and specifications.
	06.04 Identify section and detail views.
	06.05 Sketch and dimension a part.
	06.06 Disassemble and assemble parts using an exploded-view drawing.
	06.07 Interpret blueprint abbreviations.
	06.08 Identify dimensioning of radii, round holes, fillets, and chamfers.
	06.09 Identify screw threads and bolt types.
	06.10 Apply dimensional tolerances.
	06.11 Identify the metal-fabrication symbols used in blueprints.
07.0	Perform measuring and layout operations. The student will be able to:
	07.01 Perform basic geometric-construction operations.
	07.02 Safely use marking gauges, center punches, scribes, surface gauges, squares, dividers, dial indicators, protractors, surface plates, depth gauges, and circumference rules.
	07.03 Develop patterns using parallel lines, radial lines, and triangulation.
	07.04 Make metal-fabrication sketches.
	07.05 Read and measure with steel rules.
	07.06 Read and measure with micrometers.
	07.07 Read and measure with vernier tools.
	07.08 Read and measure with dial and digital calipers.

	07.09 Read and measure with dial and digital indicators.
08.0	Demonstrate basic knowledge of industrial and manufacturing processes. The student will be able to:
	08.01 Demonstrate knowledge of the use of current manufacturing processes.
	08.02 Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment.
	08.03 Understand the processes of separating, forming, conditioning, fabricating, and finishing of materials.
09.0	Perform benchwork skills. The student will be able to:
	09.01 Identify safety and shop rules.
	09.02 Cut materials by using hand hacksaws.
	09.03 Cut threads by using hand taps.
	09.04 Cut threads by using dies.
	09.05 Repair threads by chasing and thread inserts.
	09.06 Install dowel pins using tapered and straight reamers.
	09.07 Ream holes by using tapered and straight reamers.
	09.08 Hand-sharpen cutting tools by using abrasive stones.
	09.09 Hone and lap surfaces.
	09.10 Remove damaged screws and other hardware.
	09.11 Deburr workpieces.
	09.12 Demonstrate accurate dis-assembly and re-assembly of machinery components.
10.0	Identify common troubles and basic troubleshooting techniques. The student will be able to:
	10.01 Analyze the possible causes of common troubles in industrial machinery performance.
	10.02 Identify basic troubleshooting techniques for bearings.
	10.03 Identify basic troubleshooting techniques for pumps.
	10.04 Identify basic troubleshooting techniques for drive systems.
	10.05 Identify basic troubleshooting techniques for hydraulics.
	10.06 Identify basic troubleshooting techniques for pneumatics.
11.0	Handle and apply lubricants. The student will be able to:
	11.01 Explain the functions of lubrication.

11.02	Explain the properties of oil lubricants.
11.03	Identify the types, advantages, and functions of lubricant additives.
11.04	Explain the types of circulating oils and their purposes.
11.05	Identify grease application.
11.06	Identify lubricating systems and methods.
11.07	Explain lubricant storage and handling methods.
11.08	Explain the types of oil filters and their uses.
11.09	Lubricate a piece of industrial equipment.
11.10	Define the role of preventive maintenance in total equipment maintenance.
11.11	Describe the major tasks of preventive maintenance: cleaning, inspection, lubrication, minor repair, and information feedback.
11.12	Review a typical maintenance program.
12.0	Perform rigging functions. The student will be able to:
12.01	Demonstrate the safety procedures for performing rigging and lifting operations.
12.02	Identify and inspect fiber and wire rope.
12.03	Tie knots and hitches.
12.04	Identify and use the components of rigging hardware.
12.05	Perform rigging and lifting operations.
13.0	Explain the basic elements of physics as related to industrial machinery maintenance and repair. The student will be able to:
13.01	Explain the standards of measurement and the impact of action and working forces, including tension, compression, torque, and shear.
13.02	Identify the principles and laws of motion and explain how they affect acceleration and deceleration.
13.03	Explain the relationship of work, power, and energy to the types of collisions and conservation of momentum.
13.04	Explain the operation of simple machines, including the lever, inclined plane, screw, wedge, wheel and axle, pulley, and jacking screws.
13.05	Identify the ways of producing power for mechanical efficiency, in terms of gear ratios, work forces, and the types of work done by a crane hook, forklift truck, and screw or bolt.
13.06	Use linear, liquid, and weight units of measurement to measure areas, areas within areas, and volume.
13.07	Describe the mechanical and chemical properties of materials commonly used in industry.
13.08	Explain the laws and conditions governing static and kinetic friction, the problems caused by friction, and the effects of the angle of repose.

	13.09 Explain molecular action as a result of temperature extremes, chemical reaction, and moisture content.
	13.10 Draw conclusions or make inferences from data.
	13.11 Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
14.0	Install and maintain drive components. The student will be able to:
	14.01 Demonstrate safety procedures for installing and maintaining drive components.
	14.02 Identify the types of bearings, their cross-referencing, and their uses.
	14.03 Remove, inspect, and/or replace bearings.
	14.04 Remove and replace seals.
	14.05 Perform shaft alignment.
	14.06 Identify the types of belts.
	14.07 Identify the types of chains.
	14.08 Perform tension adjustments and alignment on belt and chain drives.
	14.09 Troubleshoot belt and chain drives.
	14.10 Identify the types of gears.
	14.11 Remove, replace, and align gears, sprockets, and couplings.
	14.12 Remove, replace, or repair V-joints and jack shafts.
	14.13 Adjust gear backlash.
	14.14 Troubleshoot gear drives.
	14.15 Disassemble, inspect, reassemble, and adjust clutches.
	14.16 Identify the types of variable-speed drives.
	14.17 Troubleshoot variable-speed drives.
	14.18 Identify the types of cams and link mechanisms.
	14.19 Troubleshoot cam-and-link mechanism problems.
15.0	Maintain and troubleshoot pneumatic systems. The student will be able to:
	15.01 Explain the safety procedures for troubleshooting pneumatic systems.
	15.02 Diagram an air supply system.
	15.03 Install system components.

	15.04 Demonstrate system-maintenance techniques.
	15.05 Explain proper troubleshooting procedures.
	15.06 Troubleshoot air compressors.
	15.07 Troubleshoot, repair, and install control valves.
	15.08 Troubleshoot air motors.
16.0	Maintain and troubleshoot fluid-drive systems. The student will be able to:
	16.01 Explain the safety procedures for maintaining and troubleshooting fluid-drive systems.
	16.02 Install adjustable-speed drives.
	16.03 Troubleshoot adjustable-speed drives.
	16.04 Explain the operation of fluid couplings.
	16.05 Install fluid couplings.
	16.06 Install torque converters.
	16.07 Perform preventive maintenance.
	16.08 Apply a "dynamic" magnetic/mechanical braking device to a motor.
	16.09 Mount the equipment.
17.0	Maintain reciprocating, positive-displacement, and rotary air compressors. The student will be able to:
	17.01 Relate scientific principles to a pneumatic system.
	17.02 Demonstrate the safety procedures for maintaining and operating reciprocating, positive-displacement, and rotary air compressors.
	17.03 Identify the systems of reciprocating, positive-displacement, and rotary air compressors.
	17.04 Check oil level.
	17.05 Change oil.
	17.06 Drain water from tank.
	17.07 Test for efficiency of compressor.
	17.08 Inspect storage tank for quality.
	17.09 Test pressure control switch.

Course Description: The Machinery Maintenance Mechanic course is designed for entry into the Industrial Machinery Maintenance and Repair industry. Students study welding and cutting operations, machinery installation and removal, conveyor maintenance, machine shop operations, piping and tubing systems, pump maintenance and repair, industrial pollution control systems, boilers, and internal combustion engines.

Course Number: ETI0456 **Occupational Completion Point: B** **Machinery Maintenance Mechanic – 300 Hours**	
18.0	Perform gas and electric welding and cutting operations. The student will be able to:
18.01	Identify the properties of the most commonly used metals and alloys, including hardness and malleability.
18.02	Identify welding cylinders, regulators, hoses, pressure gauges, and torches.
18.03	Describe welding-equipment safety procedures.
18.04	Demonstrate proper flame settings.
18.05	Demonstrate basic gas-welding skills.
18.06	Demonstrate procedures for adjusting and operating the oxyacetylene cutting torch.
18.07	Demonstrate freehand and guide cutting of various metal thicknesses.
18.08	Perform basic electric arc welding procedures.
19.0	Install and remove machinery. The student will be able to:
19.01	Identify the safety procedures for installing and removing machinery.
19.02	Identify the equipment required for machine installation and removal.
19.03	Prepare an area for machine installation per the manufacturer's specifications.
19.04	Rig, lift, and transport machinery to the installation site.
19.05	Install electrical hookups to machinery.
19.06	Install air hydraulic hookups to machinery.
19.07	Perform an assigned machine retrofit per the manufacturer's specifications.
19.08	Perform an assigned machine removal and transport per specification requirements.
19.09	Explain the importance of vibration detection.
20.0	Demonstrate conveyor-maintenance techniques. The student will be able to:
20.01	Identify various types of conveyors.
20.02	Identify the safety requirements and precautions for conveyor-maintenance operations.

	20.03 Adjust the tracking of a belt.
	20.04 Check a belt for wear.
	20.05 Identify the types of splices.
	20.06 Identify splicing equipment and procedures.
	20.07 Identify conveyor-maintenance techniques, including making splices with splicing equipment.
21.0	Perform gas- and arc-welding procedures. The student will be able to:
	21.01 Demonstrate the safety procedures for performing gas and arc welding and for transporting equipment.
	21.02 Identify the components of an oxy-fuel rig.
	21.03 Set up and shut down an oxy-fuel rig.
	21.04 Weld beads in a flat position.
	21.05 Weld an outside corner joint using a filler rod.
	21.06 Cut metal of various thicknesses.
	21.07 Weld beads in a flat position using E-6010 and E-7018 electrodes.
	21.08 Weld beads in horizontal and in vertical positions using E-6010 and E-7018 electrodes.
	21.09 Weld beads in an overhead position using E-6010 and E-7018 electrodes.
	21.10 Weld beads using a MIG welder.
	21.11 Weld beads using a TIG welder.
	21.12 Solder and braze metals.
	21.13 Cut stainless steel and aluminum with a plasma-arc rig.
22.0	Perform machine-shop operations. The student will be able to:
	22.01 Demonstrate safety in performing machine-shop operations.
	22.02 Identify the types of cutting tools.
	22.03 Bore a hole to a specified size.
	22.04 Cut an external V-thread.
	22.05 Identify the different types of work-holding devices.
	22.06 Prepare metal for finishing.
	22.07 Set up, use, and adjust an arbor press.

	22.08 Set up, use, and adjust a hydraulic press.
	22.09 Cut keyways with an end mill.
23.0	Maintain piping and tubing systems. The student will be able to:
	23.01 Identify the components of a piping system.
	23.02 Explain the maintenance considerations of metallic and nonmetallic piping systems.
	23.03 Describe the safety requirements for working with piping and tubing systems.
	23.04 Join copper tubing.
	23.05 Join common fittings.
	23.06 Join metallic pipe.
	23.07 Join plastic pipe.
	23.08 Explain valve operation and maintenance.
	23.09 Explain the importance of strainers, filters, and traps in piping systems.
	23.10 Bend back-to-back, stub-ups, and doglegs in electrical metallic tubing (EMT).
24.0	Perform pump maintenance and repair. The student will be able to:
	24.01 Demonstrate the safety procedures for performing pump maintenance.
	24.02 Determine pump capacity and system requirements.
	24.03 Perform pump maintenance.
	24.04 Identify packing and seal requirements.
	24.05 Explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating, diaphragm, positive placement, and vacuum pumps.
	24.06 Disassemble and reassemble a pump.
25.0	Identify various types of industrial-pollution control systems.
26.0	Identify boilers. The student will be able to:
	26.01 Identify the various types and components of heat exchangers.
	26.02 Identify the various types and components of boilers.
	26.03 Identify the various types and components of fractioning columns.
	26.04 Identify the uses of steam.
27.0	Understand internal combustion engines. The student will be able to:

27.01	Explain the basic principles of the two-stroke-cycle combustion engine.
27.02	Identify the types of engines, engine assemblies, and systems.
27.03	Perform routine maintenance on engine operating systems.
27.04	Troubleshoot and evaluate engine performance.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Millwright 2**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J590500	
CIP Number	0647030306	
Grade Level	30, 31	
Program Length	600 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in industrial-machinery maintenance positions.

The content includes but is not limited to understanding all aspects of the industrial-machinery maintenance-technology industry, and demonstrates elements of the industry such as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

The standard length for this program is 600 hours. **Millwright 1** is a core program. It is recommended students complete **Millwright 1,** or demonstrate mastery of the outcomes in that program, prior to enrollment in **Millwright 2**.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	ETI0457	Machinery Maintenance Technician	BLDG CONST @7 7G IND ENGR 7G MACH SHOP @7 7G MILLWRIGHT 7G TEC CONSTR @7 7G	150 hours
B	ETI0459	Millwright		450 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Plan an elementary predictive-preventive-maintenance (PPM) schedule.
02.0 Maintain and repair hydraulic-system components.
03.0 Troubleshoot hydraulic systems.
04.0 Maintain and troubleshoot robotic systems.
05.0 Demonstrate an understanding of employability skills and career opportunities.

Millwright
06.0 Perform metal fabrication.
07.0 Perform precision layout.
08.0 Perform advanced rigging.
09.0 Install, remove, and align machinery.

Florida Department of Education
Student Performance Standards

Program Title: **Millwright 2**
Career Certificate Program Number: **J590500**

Course Description: The Machinery Maintenance Technician course is designed for entry into the Industrial Machinery Maintenance and Repair industry. Students explore career opportunities and requirements of a professional industrial machinery mechanic. Students study elementary predictive-preventive-maintenance planning, maintain and troubleshoot hydraulic and robotic systems, and understanding employability skills.

Course Number: ETI0457 **Occupational Completion Point: A** **Machinery Maintenance Technician – 150 Hours**	
01.0	Plan an elementary predictive-preventive-maintenance (PPM) schedule. The student will be able to:
01.01	List the types of predictive-preventive maintenance.
01.02	Describe the purpose of preventive-maintenance schedules.
01.03	Create a preventive-maintenance schedule form using a machine manual or the manufacturer recommendations.
01.04	Identify troubles caused by the lack of preventive maintenance.
01.05	Create a maintenance log and make entries for a machine or equipment.
01.06	Create a preventive-maintenance schedule from a maintenance-failures log.
02.0	Maintain and repair hydraulic-system components. The student will be able to:
02.01	Explain the safety procedures for installing hydraulic lines.
02.02	Explain how heat and pressure relate to power and transmission.
02.03	Describe the physical and chemical properties of a fluid.
02.04	Install and maintain a contaminant-removal system.
02.05	Determine reservoir requirements.
02.06	Classify and select pumps for specific applications.
02.07	Compute hose requirements.
02.08	Select and install control valves.
03.0	Troubleshoot hydraulic systems. The student will be able to:
03.01	Explain the safety procedures for troubleshooting hydraulic systems.

	03.02 Read a hydraulic schematic.
	03.03 Install hydraulic components.
	03.04 Explain hydraulic system troubleshooting techniques.
	03.05 Repair and replace valves.
	03.06 Repair and replace cylinders.
	03.07 Repair and replace pumps and motors.
04.0	Maintain and troubleshoot robotic systems. The student will be able to:
	04.01 Identify uses of robotics in industry.
	04.02 Identify safety procedures related to robotic systems.
	04.03 Identify mechanical, hydraulic, pneumatic, and electric/electronic components of robotic systems.
05.0	Demonstrate an understanding of employability skills and career opportunities. The student will be able to:
	05.01 Demonstrate knowledge of good workplace behavior and how to address improper workplace behavior.
	05.02 Discuss motivation and human behavior.
	05.03 Demonstrate knowledge of ways to improve reading, listening, and writing skills.
	05.04 Provide effective feedback and make suggestions.
	05.05 Demonstrate knowledge of roles and responsibilities of team members.
	05.06 Effectively communicate production and process information to internal and external customers.
	05.07 Develop personal career plan that includes goals, objectives, and strategies.
	05.08 Examine licensing, certification, and industry credentialing requirements.
	05.09 Evaluate and compare employment opportunities that match career goals.
	05.10 Identify and exhibit traits for retaining employment.
	05.11 Identify opportunities and research requirements for career advancement.
	05.12 Research the benefits of ongoing professional development.

Course Description: The Millwright course is designed to build on the skills and knowledge students learned in the Industrial Machinery Maintenance Assistant, Machinery Maintenance Technician, and Machinery Maintenance Mechanic courses for entry into the Millwright industry. Students explore career opportunities and requirements of a professional millwright. Students study metal fabrication, precision layout, advanced rigging, and installation, alignment, and removal of machinery.

Course Number: ETI0459 **Occupational Completion Point: B** **Millwright – 450 Hours**	
06.0	Perform metal fabrication. The student will be able to:
06.01	Field sketch equipment supports for applications in the millwright industry.
06.02	Read and interpret requirements in an OSHA 1910.211-219 and ANSI B15.1.
06.03	Create, design, draw, fabricate, and paint an OSHA-approved guard.
06.04	Use a Cut-A-Matic to make precision cuts.
07.0	Perform precision layout. The student will be able to:
07.01	Locate an existing benchmark and transfer it to various positions around a work area or site.
07.02	Use the triangle procedure to check established benchmarks with an optical level and a transit.
07.03	Identify and establish centerlines of equipment related to building columns.
08.0	Perform advanced rigging. The student will be able to:
08.01	Perform and interpret all rigging hand signals.
08.02	Interpret and apply load charts for slings, chokers, and cables.
08.03	Determine the weight of a load.
08.04	Determine the method of lifting.
08.05	Identify crane capacity, including the boom angle and load-swing radius.
08.06	Identify and take the necessary precautions to accommodate weather conditions, load capacity, equipment, and safety factors.
08.07	Balance different types of loads.
09.0	Install, remove, and align machinery. The student will be able to:
09.01	Identify the equipment required for machine installation and removal in millwright applications.
09.02	Operate levers, inclined planes, screws, wedges, wheel and axle assemblies, pulleys, and jacking screws.
09.03	Perform site-clearance operations and demolition and salvage procedures.
09.04	Explain the principles of machine alignment.
09.05	Explain the principles of shaft alignment.
09.06	Explain the relationship of structural problems to misalignment.
09.07	Explain the use of thermal growth by calculation and field-growth techniques such as Essinger bars.

09.08	Align machinery using wire line, transit, dial indicators, a computer, and laser-alignment devices.
09.09	Perform laser horizontal and vertical alignment.
09.10	Perform the train alignment of three or more machines and graph the results.
09.11	Prepare an area for machine installation according to the manufacturer’s specifications for selected applications.
09.12	Position and secure machinery on a foundation.
09.13	Level machinery and install balance-vibration dampeners.
09.14	Identify pipe-stress standards for millwright applications.
09.15	Perform finish alignment and check for pipe stresses in millwright applications.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is thew co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Major Appliance and Refrigeration Technician**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program		
Program Number	J620300	
CIP Number	0647010604	
Grade Level	30, 31	
Program Length	1200 hours	
Teacher Certification	Refer to the **Program Structure** section	
CTSO	SkillsUSA	
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading and Language Arts): 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the manufacturing career cluster. This program offers a broad foundation of knowledge and skills to prepare students for employment in machining positions.

The content includes but is not limited to broad, transferable skills, stresses the understanding of all aspects of the machining industry, and demonstrates such elements of the industry as planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues, and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
A	EER0391	Appliance Installation Helper	APPLI REPR @7 7G GAS FITTER 7G	200 hours
B	EER0315	Laundry Technician		300 hours
C	EER0392	Cooking Appliance Technician		350 hours
D	ACR0084	Cooling Appliance Technician		350 hours

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social, and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership, and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Apply proper laboratory practices.
02.0 Apply electrical fundamentals.
03.0 Apply gas fundamentals.
04.0 Install, troubleshoot and repair electric and gas clothes dryers.
05.0 Install, troubleshoot, and repair clothes washers.
06.0 Install, troubleshoot, and repair electric and gas ranges.
07.0 Install, troubleshoot, and repair microwave ovens.
08.0 Install, troubleshoot, and repair dishwashers.
09.0 Utilize fundamentals of refrigeration.
10.0 Work with tubing and fittings.
11.0 Install, troubleshoot, and repair refrigerators, icemakers, and freezers.
12.0 Install, troubleshoot, and repair window air conditioners.

Florida Department of Education
Student Performance Standards

Program Title: **Major Appliance and Refrigeration Technician**
Career Certificate Program Number: **J620300**

Course Description: The Appliance Installation Helper course is designed to provide instruction for entry into the major appliance and refrigeration repair industry. Students explore career opportunities and requirements of a professional appliance repairman. Students study laboratory practices, electrical fundamentals, and gas fundamentals.

Course Number: EER0391 **Occupational Completion Point: A** **Appliance Installation Helper – 200 Hours**	
01.0	Apply proper laboratory practices. The student will be able to:
01.01	Use industry accepted safety practices.
01.02	Explain appropriate first aid for electrical shock and potential shop accidents.
01.03	Perform appropriate record keeping functions.
01.04	Explain and demonstrate the proper use and care of hand tools.
01.05	Explain and demonstrate the proper use and care of meters and test equipment.
01.06	Explain and demonstrate the proper use and care of power tools.
02.0	Apply electrical fundamentals. The student will be able to:
02.01	Explain electron theory.
02.02	Identify circuits from schematics and diagrams using commonly accepted symbols.
02.03	Explain Ohm's Law.
02.04	Measure resistance.
02.05	Measure voltage.
02.06	Measure amperage.
02.07	Measure wattage.
02.08	Explain and construct series circuits.
02.09	Explain and construct parallel circuits.
02.10	Explain and construct combination circuits.

02.11	Explain inductance and magnetism and their relationship to electric motors.
02.12	Describe how electric motors function.
02.13	Explain the function of capacitors and how to troubleshoot them.
02.14	Explain the function of relay and switches and how to troubleshoot them.
02.15	Explain the function of capacitors and transformers in major appliances.
02.16	Explain the concept and rationale of motor protection.
02.17	Describe how a compressor functions.
02.18	Perform electronic diagnostic tests.
02.19	Identify and understand error codes and troubleshooting procedures.

Course Description: The Laundry Technician course is designed to provide instruction for entry into the major appliance and refrigeration repair industry. Students explore career opportunities and requirements of a professional appliance repairman. Students study installing, troubleshooting and repairing electric and gas clothes dryers, and clothes washers.

Course Number: EER0315 Occupational Completion Point: B Laundry Technician – 300 Hours	
03.0	Apply gas fundamentals. The student will be able to:
03.01	Explain common use terms.
03.02	Explain different types of gas.
03.03	Explain specific gravity.
03.04	Diagram and explain basic components of a gas burner.
03.05	Explain requirements for burning.
03.06	Perform pressure tests on gas systems.
03.07	Identify gas fitting and connections
03.08	Identify and test procedures for leak testing
03.09	Identify procedures for converting appliances between different gases.
04.0	Install, troubleshoot, and repair electric and gas clothes dryer. The student will be able to:
04.01	Install an electric dryer.
04.02	Install a gas dryer.

04.03	Read and interpret schematics and diagrams.
04.04	Describe the operation and application of components and their function.
04.05	Troubleshoot timers, electronic controls, and components.
04.06	Remove and replace timers, electronic controls, or components.
04.07	Troubleshoot drive motors and components.
04.08	Remove and replace drive motors or components.
04.09	Troubleshoot heating elements and components. (electric)
04.10	Remove and replace the element or component. (electric)
04.11	Troubleshoot gas burner. (gas)
04.12	Remove and replace the gas burner. (gas)
04.13	Troubleshoot thermostats.
04.14	Remove and replace the thermostats.
04.15	Troubleshoot gas valves. (gas)
04.16	Remove and replace gas valves. (gas)
04.17	Troubleshoot thermocouples. (gas)
04.18	Remove and replace thermocouples. (gas)
04.19	Troubleshoot flame switch. (gas)
04.20	Remove and replace the flame switch. (gas)
04.21	Troubleshoot bearings and components.
04.22	Remove and replace bearings or components.
04.23	Troubleshoot belts and pulleys.
04.24	Remove and replace belts or pulleys.
04.25	Troubleshoot rollers and glides.
04.26	Remove and replace rollers or glides.
04.27	Troubleshoot filters.
04.28	Remove and replace filters.
04.29	Troubleshoot seals.

	04.30 Remove and replace seals.
	04.31 Troubleshoot push-to-start switch. (electric)
	04.32 Remove and replace push-to-start switch. (electric)
	04.33 Troubleshoot electric ignition components. (gas)
	04.34 Remove and replace electric ignition components. (gas)
	04.35 Troubleshoot door switches.
	04.36 Remove and replace door switches.
	04.37 Troubleshoot selector switches.
	04.38 Remove and replace selector switches.
	04.39 Troubleshoot motor switches. (gas)
	04.40 Remove and replace motor switches. (gas)
	04.41 Troubleshoot sensor and electronic control. (electric)
	04.42 Remove and replace sensor and electronic control. (electric)
	04.43 Perform operational check.
	04.44 Instruct consumer on use and care.
	04.45 Perform electronic diagnostic tests.
	04.46 Identify and understand error codes and troubleshooting procedures.
05.0	Install, troubleshoot, and repair clothes washers. The student will be able to:
	05.01 Install a clothes washer.
	05.02 Identify components and their function.
	05.03 Read and interpret schematics and diagrams.
	05.04 Troubleshoot timers, electronic controls and components.
	05.05 Remove and replace timers, electronic controls or components.
	05.06 Troubleshoot selector switches.
	05.07 Remove and replace selector switches.
	05.08 Troubleshoot water level switches and components.
	05.09 Remove and replace water level switches or components.

05.10 Troubleshoot water inlet valves and components.
05.11 Remove and replace water inlet valves or components.
05.12 Troubleshoot hoses.
05.13 Remove and replace hoses.
05.14 Troubleshoot water pumps and components.
05.15 Remove and replace water pumps or components.
05.16 Troubleshoot filters to include front load washers.
05.17 Remove and replace filters to include front load washers
05.18 Troubleshoot drive motors and components.
05.19 Remove and replace drive motors or components.
05.20 Troubleshoot belts and pulleys.
05.21 Remove and replace belts or pulleys.
05.22 Troubleshoot transmissions and components.
05.23 Remove and replace transmissions or components.
05.24 Troubleshoot bearings.
05.25 Remove and replace bearings.
05.26 Troubleshoot water and oil seals.
05.27 Remove and replace water and oil seals.
05.28 Troubleshoot clutches.
05.29 Remove and replace clutches.
05.30 Troubleshoot brakes.
05.31 Remove and replace brakes.
05.32 Troubleshoot lid switches and components.
05.33 Remove and replace lid switches or components.
05.34 Perform operational check.
05.35 Instruct consumer on use and care.
05.36 Perform electronic diagnostic tests.

05.37	Identify and understand error codes and troubleshooting procedures.

Course Description: The Cooking Appliance Technician course is designed to provide instruction for entry into the major appliance and refrigeration repair industry. Students explore career opportunities and requirements of a professional appliance repairman. Students study installing, troubleshooting and repairing electric ranges, gas ranges, microwave ovens, and dishwashers.

Course Number: EER0392 Occupational Completion Point: C Cooking Appliance Technician – 350 Hours	
06.0	Install, troubleshoot, and repair electric and gas ranges. The student will be able to:
06.01	Install an electric range.
06.02	Describe the operation and application of components and their function.
06.03	Read and interpret schematics and diagrams.
06.04	Troubleshoot clocks, timers, and electronic controls.
06.05	Remove and replace clocks, timers, or electronic controls.
06.06	Troubleshoot surface unit switches and components. (electric)
06.07	Remove and replace surface switches or components. (electric)
06.08	Troubleshoot oven thermostats and components.
06.09	Remove and replace oven thermostats or components.
06.10	Troubleshoot self-clean relays. (gas)
06.11	Remove and replace self-clean relays. (gas)
06.12	Troubleshoot surface units and components including induction cook-tops and ranges. (electric)
06.13	Remove and replace surface units or components including induction cook-tops and ranges. (electric)
06.14	Troubleshoot bake and broil elements. (electric)
06.15	Remove and replace bake and broil elements. (electric)
06.16	Troubleshoot gas valves for surface burners. (gas)
06.17	Remove and replace gas valves for surface burners. (gas)
06.18	Troubleshoot gas valve for oven. (gas)
06.19	Remove and replace gas valve for oven. (gas)
06.20	Troubleshoot electric igniters. (gas)

	06.21 Remove and replace electric igniters. (gas)
	06.22 Troubleshoot safety valves. (gas)
	06.23 Remove and replace safety valves. (gas)
	06.24 Troubleshoot pressure regulators. (gas)
	06.25 Remove and replace pressure regulators. (gas)
	06.26 Troubleshoot oven sensors and components.
	06.27 Remove and replace oven sensors or components.
	06.28 Troubleshoot door locks and components.
	06.29 Remove and replace door locks or components.
	06.30 Troubleshoot fans.
	06.31 Remove and replace fan.
	06.32 Troubleshoot gaskets and seals.
	06.33 Remove and replace gaskets or seals.
	06.34 Perform temperature test and calibration on electric and gas ranges.
	06.35 Perform operational check.
	06.36 Instruct consumer on use and care.
	06.37 Perform electronic diagnostic tests.
	06.38 Identify and understand error codes and troubleshooting procedures.
07.0	Install, troubleshoot, and repair microwave ovens. The student will be able to:
	07.01 Install a microwave oven.
	07.02 Describe the operation and application of components and their function.
	07.03 Read and interpret schematics and diagrams.
	07.04 Troubleshoot clocks, timers, and electronic controls.
	07.05 Remove and replace clocks, timers, or electronic controls.
	07.06 Troubleshoot door switches.
	07.07 Remove and replace door switches.
	07.08 Troubleshoot relays.

	07.09 Remove and replace relays.
	07.10 Troubleshoot thermal protectors.
	07.11 Remove and replace thermal protectors.
	07.12 Troubleshoot power transformer.
	07.13 Remove and replace power transformer.
	07.14 Troubleshoot high voltage diode.
	07.15 Remove and replace high voltage diode.
	07.16 Troubleshoot capacitor.
	07.17 Remove and replace capacitor.
	07.18 Troubleshoot magnetron.
	07.19 Remove and replace magnetron.
	07.20 Troubleshoot fans.
	07.21 Remove and replace fans.
	07.22 Troubleshoot stirrer blade and motor.
	07.23 Remove and replace stirrer blade and motor.
	07.24 Troubleshoot turntable motor.
	07.25 Remove and replace turntable motor.
	07.26 Troubleshoot inverter board.
	07.27 Remove and replace inverter board.
	07.28 Perform operational check.
	07.29 Instruct consumer on use and care.
	07.30 Perform electronic diagnostic tests.
	07.31 Identify and understand error codes and troubleshooting procedures.
08.0	Install, troubleshoot, and repair dishwashers. The student will be able to:
	08.01 Install a dishwasher.
	08.02 Describe the operation and application of components and their function.
	08.03 Read and interpret schematics and diagrams.

08.04	Troubleshoot timers, electronic controls, and components.
08.05	Remove and replace timers, electronic controls, or component.
08.06	Troubleshoot selector switches.
08.07	Remove and replace selector switches.
08.08	Troubleshoot float switches.
08.09	Remove and replace float switches.
08.10	Troubleshoot door switches.
08.11	Remove and replace door switches.
08.12	Troubleshoot motors and components.
08.13	Remove and replace motor and components.
08.14	Troubleshoot heating elements.
08.15	Remove and replace heating elements.
08.16	Troubleshoot relays.
08.17	Remove and replace relays.
08.18	Troubleshoot water valves and components.
08.19	Remove and replace water valves or components.
08.20	Troubleshoot hoses.
08.21	Remove and replace hoses.
08.22	Troubleshoot pumps and components.
08.23	Remove and replace pumps or components.
08.24	Troubleshoot seals.
08.25	Remove and replace seals.
08.26	Troubleshoot dispensers and components.
08.27	Remove and replace dispensers or components.
08.28	Troubleshoot spray arms.
08.29	Remove and replace spray arms.
08.30	Troubleshoot blower motors.
08.31	Remove and replace blower motors.
08.32	Troubleshoot thermostats.

08.33	Remove and replace thermostats.
08.34	Perform operational check.
08.35	Instruct consumer on use and care.
08.36	Perform electronic diagnostic tests.
08.37	Identify and understand error codes and troubleshooting procedures.

Course Description: The Cooling Appliance Technician course is designed to provide instruction for entry into the major appliance and refrigeration repair industry. Students explore career opportunities and requirements of a professional appliance repairman. Students study installing, troubleshooting and repairing basic refrigeration, icemakers and freezers, and window air conditioners.

Course Number: ACR0084 Occupational Completion Point: D Cooling Appliance Technician – 350 Hours	
09.0	Utilize the fundamentals of refrigeration. The student will be able to:
09.01	Explain commonly used terms.
09.02	Perform heat transfer, measuring and temperature conversions.
09.03	Perform pressure measuring and conversion calculations.
09.04	Explain the concept of state of matter.
09.05	Explain the differences in refrigerants and their uses.
09.06	Diagram and explain the functions of the components of basic refrigeration systems.
09.07	Identify purpose and importance of CFC recover/recycling.
09.08	Identify operation of recovery system components.
09.09	Recover and recycle refrigerants.
10.0	Work with tubing and fittings. The student will be able to:
10.01	Identify types and uses of solders and brazing alloys.
10.02	Identify types and sizes of tubing and fittings.
10.03	Measure, cut, flare, swage, and bend tubing.
10.04	Soft solder with acetylene.
10.05	Braze with acetylene and oxyacetylene.
10.06	Fabricate replacement sections of tubing for appliances.

11.0	Install, troubleshoot, and repair refrigeration icemakers and freezers. The student will be able to:
11.01	Install a refrigerator and a freezer.
11.02	Identify components, electronic controls, variable speed compressors and their functions.
11.03	Read and interpret schematics and diagrams.
11.04	Troubleshoot gaskets and seals.
11.05	Remove and replace gaskets and seals.
11.06	Troubleshoot light and fan switches.
11.07	Remove and replace light and fan switches.
11.08	Troubleshoot fans.
11.09	Remove and replace fans.
11.10	Troubleshoot manual and electronic adaptive controls defrost timers.
11.11	Remove and replace manual and electronic adaptive control defrost timers.
11.12	Troubleshoot defrost thermostats and thermistors.
11.13	Remove and replace defrost thermostats and thermistors.
11.14	Troubleshoot defrost heater.
11.15	Remove and replace defrost heater.
11.16	Troubleshoot cold control.
11.17	Remove and replace cold control.
11.18	Troubleshoot icemakers.
11.19	Remove and repair icemakers.
11.20	Use test equipment to determine operating conditions of a refrigeration system.
11.21	Troubleshoot refrigeration system.
11.22	Remove and replace compressors.
11.23	Remove and replace condensers, evaporators, metering devices and dryers.
11.24	Perform operational check.
11.25	Instruct consumers on use and care.
12.0	Install, troubleshoot, and repair window air conditioners. The student will be able to:

12.01	Install a window air conditioner.
12.02	Identify components and their functions to include multi-split systems and electronic controls.
12.03	Read and interpret schematics and diagrams.
12.04	Troubleshoot selector switches.
12.05	Remove and replace selector switches.
12.06	Troubleshoot thermostats.
12.07	Remove and replace thermostats.
12.08	Troubleshoot capacitors.
12.09	Remove and replace capacitors.
12.10	Troubleshoot fan motor.
12.11	Remove and replace fan motor.
12.12	Troubleshoot heater.
12.13	Remove and replace heater.
12.14	Troubleshoot deicer.
12.15	Remove and replace deicer.
12.16	Troubleshoot reversing valve.
12.17	Remove and replace reversing valve.
12.18	Troubleshoot compressor.
12.19	Remove and replace compressor.
12.20	Use test equipment to determine operating conditions of refrigeration systems.
12.21	Perform operational check.
12.22	Instruct consumer on use and care.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools, and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate, and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the co-curricular career and technical student organization(s) providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Basic Skills

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Computation (Mathematics) and Communications (Reading and Language Arts). These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02, Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91, F.S.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education
Curriculum Framework

Program Title: **Aluminum Welding and Fabrication**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

Career Certificate Program	
Program Number	J400500
CIP Number	0648050808
Grade Level	30, 31
Program Length	360 hours
Teacher Certification	Refer to the **Program Structure** section.
CTSO	SkillsUSA
SOC Codes (all applicable)	Please see the CIP to SOC Crosswalk located at the link below.
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml
Basic Skills Level	N/A

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Manufacturing career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Manufacturing career cluster.

The content includes but is not limited to planning, management, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of one occupational completion point.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section (s.) 1007.24 (1), Florida Statutes (F.S). Career and Technical credit shall be awarded to the student on a transcript in accordance with s.1001.44(3)(b), F.S.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length
	PMT0710	Aluminum Welding and Fabrication 1	METAL WORK 7G WELDING @7 7G	150 hours
A	PMT0711	Aluminum Welder and Fabrication 2		210 hours

National Standards (NS)

Industry or National Standards corresponding to the standards and/or benchmarks for the Welding Technology program can be found using the following link: https://www.aws.org/certification/page/home

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate an understanding and apply workplace safety and workplace organization skills.
02.0 Demonstrate basic knowledge of industrial and manufacturing processes.
03.0 Describe and identify aluminum properties accurately.
04.0 Demonstrate and apply basic knowledge of drawings.
05.0 Apply basic aluminum shearing/cutting principles and practices.
06.0 Create a product using basic aluminum fabrication principles and practices.
07.0 Demonstrate aluminum shearing/cutting principles and practices.
08.0 Demonstrate a basic understanding of and apply gas tungsten arc welding (GTAW) skills.
09.0 Create a product using gas tungsten arc welding (GTAW) principles and practices.
10.0 Apply visual examination skills.

Florida Department of Education
Student Performance Standards

Program Title: **Aluminum Welding and Fabrication**
Career Certificate Program Number: **J400500**

Course Description: The Aluminum Welding and Fabrication 1 course prepares students for entry into the aluminum welding industry. Students explore career opportunities and requirements of a professional aluminum welder and fabricator. Content emphasizes beginning skills key to the success of working in the aluminum welding industry. Students study workplace safety and organization, basic manufacturing processes, metals identification, basic interpretation of welding symbols, and aluminum shearing/cutting practices.

Course Number: PMT0710 **Occupational Completion Point: A (1 of 2)** **Aluminum Welding and Fabrication 1 – 150 Hours**	
01.0	Demonstrate an understanding and apply workplace safety and workplace organization. The student will be able to:
01.01	Locate and use Safety Data Sheets (SDS).
01.02	Demonstrate knowledge of first aid or first response procedures.
01.03	Identify safety procedures in case of smoke or chemical inhalation.
01.04	Demonstrate knowledge of material handling techniques to safely move materials.
01.05	Demonstrate the proper techniques for lifting.
01.06	Proactively respond to a safety concern and notify the instructor.
01.07	Demonstrate knowledge of emergency exits and signage.
01.08	Demonstrate knowledge of various emergency alarms and procedures
01.09	Perform emergency drills and participate in emergency teams.
01.10	Demonstrate knowledge of clean-up procedures.
01.11	Explain Lock Out/Tag Out requirements procedures, including confined space awareness.
01.12	Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.
01.13	Identify procedures for handling hazardous material.
01.14	Develop safety checklists.
01.15	Determine the appropriate corrective action after an unsafe condition is identified.
01.16	Demonstrate knowledge of safety requirements for manual, electrical-powered, and pneumatic tools.
01.17	Demonstrate knowledge of safety requirements for operation of automated machines.

	01.18	Perform safety and environmental inspections.
	01.19	Demonstrate skill in performing leak checks to determine if toxic or hazardous material is escaping from a piece of equipment.
	01.20	Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists and regulations.
	01.21	Demonstrate knowledge of equipment shutdown procedures.
	01.22	Identify-safety related maintenance procedures.
	01.23	Selecting and use of personal protective equipment (PPE) correctly.
	01.24	Demonstrate knowledge of ergonomic impact of work techniques.
	01.25	Demonstrate knowledge of, and follow applicable safety laws, regulations and the environment (e.g., Occupational Safety and Health Administration (OSHA)).
	01.26	Apply OSHA safety standards properly.
	01.27	Research and identify class A, B and C type fires.
	01.28	Demonstrate and apply the proper procedures for extinguishing class A, B and C type fires.
	01.29	Demonstrate knowledge of National Institute of Occupational Safety and Health (NIOSH), Environmental Protection Agency (EPA) and other regulatory agencies recommendations, guidelines and best practices.
	01.30	Describe "Right-to-Know" Law as recorded in (29 CFR-1910.1200).
02.0	Demonstrate basic knowledge of industrial and manufacturing processes. The student will be able to:	
	02.01	Demonstrate knowledge of the use of current manufacturing processes as related to the welding industry.
	02.02	Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment.
	02.03	Understand the processes of separating, forming, conditioning, fabricating and finishing of materials.
	02.04	Explain the difference between primary and secondary manufacturing processes.
03.0	Describe and identify aluminum and it’s properties accurately. The student will be able to:	
	03.01	Describe and understand the aluminum making process.
	03.02	Describe and understand the differences between ferrous and nonferrous metals.
	03.03	Describe and understand casting, alloys and forging.
	03.04	Identify and understand metallurgical processes related to metals such as galvanized iron and steel, aluminum, stainless steel, sheet metal, copper and brass.
	03.05	Identify, understand, and describe thermal properties of metals.
	03.06	Identify and describe common gages, shapes and dimensions of metals.
04.0	Demonstrate and apply basic knowledge of drawings. The student will be able to:	

	04.01 Interpret, understand, and apply elements of a drawing or sketch.
	04.02 Design and create a drawing.
	04.03 Use and apply appropriate mathematical practices to the design and creation of drawings.
05.0	Apply basic aluminum shearing/cutting principles and practices. The student will be able to:
	05.01 Perform external inspections of equipment and accessories.
	05.02 Make minor external repairs to equipment and accessories.
	05.03 Set up manual shearing/cutting equipment for aluminum.
	05.04 Operate manual shearing/cutting equipment for aluminum.
	05.05 Perform straight shearing/cutting operations on aluminum.
06.0	Create a product using basic aluminum fabrication principles and practices. The student will be able to:
	06.01 Design and create a basic work of art or project utilizing material and skills developed.
	06.02 Produce a product using drawings with tolerances and specifications.
	06.03 Create and deliver a presentation to communicate project results.

Course Description: The Aluminum Welder and Fabricator 2 course is designed to build on the skills and knowledge students learned in Aluminum Welder and Fabricator 1 for entry into the aluminum welding industry. Students explore career opportunities and requirements of a professional aluminum welder. Content emphasizes beginning skills key to the success of working in the aluminum welding industry. Students study drawings, intermediate shearing/cutting practices and basic gas tungsten arc welding (GTAW) skills.

Course Number: PMT0711 **Occupational Completion Point: A (2 of2)** **Aluminum Welder and Fabricator 2 – 210 Hours**	
07.0	Demonstrate aluminum shearing/cutting principles and practices. The student will be able to:
	07.01 Perform safety inspections of equipment and accessories.
	07.02 Make minor repairs to shearing/cutting equipment and accessories.
	07.03 Perform metal removal operations.
	07.04 Set up for shearing/cutting operations.
	07.05 Perform aluminum shape shearing/cutting operations.
08.0	Demonstrate a basic understanding of and apply gas tungsten arc welding (GTAW) skills. The student will be able to:
	08.01 Perform external inspections of GTAW equipment and accessories.

	08.02 Make minor repairs to GTAW equipment and accessories.
	08.03 Set up gas tungsten arc welding (GTAW) welding operations on aluminum.
	08.04 Operate gas tungsten arc welding (GTAW) equipment.
	08.05 Make pad welds, all positions, on aluminum.
09.0	Create a product using aluminum shearing/cutting practices and gas tungsten arc welding (GTAW) skills principles and practices. The student will be able to:
	09.01 Design and create a work of art or project utilizing material and skills learned.
	09.02 Create a working drawing or blueprint.
	09.03 Design a product from a working drawing or blueprint created.
	09.04 Fabricate a product using the skills learned related to aluminum shearing/cutting and introductory gas tungsten arc welding (GTAW).
	09.05 Create and deliver a presentation to communicate project results.
10.0	Apply visual examination skills. The student will be able to:
	10.01 Examine cut surfaces and edges of prepared base metal parts.
	10.02 Examine tack, intermediate pass and cover pass.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

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