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
Standard Length	3 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA, FL-TSA
SOC Codes (all applicable)	19-4021 – Biological Technicians

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 occupational completion points. 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:

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

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Academic Alignment Table

Academic alignment is an ongoing, collaborative effort of professional educators specializing in the fields of science, mathematics, English/language arts, and Career and Technical Education (CTE). This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses. Career and Technical Education courses that have been aligned to the Next Generation Sunshine State Standards for Science and the Florida Standards for Mathematics and English/Language Arts will show the following data: the quantity of academic standards in the CTE course; the total number of standards contained in the academic course; and the percentage of alignment to the CTE course.

Courses	Anatomy/ Physiology Honors	Astronomy Solar/Galactic Honors	Biology 1	Chemistry 1	Earth-Space Science	Environmental Science	Genetics	Integrated Science	Marine Science 1 Honors	Physical Science	Physics 1
3027010	12/87 14%	21/80 26%	35/83 42%	23/69 33%	10/67 15%	19/70 27%	30/69 43%	28/82 34%	20/66 30%	24/74 32%	16/72 22%
3027020	11/87 13%	11/80 14%	24/83 29%	14/69 20%	6/67 9%	17/70 24%	17/69 25%	18/82 22%	17/66 26%	11/74 15%	8/72 11%
8736030	16/87 18%	27/80 34%	35/83 42%	26/69 38%	13/67 19%	24/70 34%	29/69 42%	27/82 33%	24/66 36%	27/74 36%	21/72 29%

*** Alignment pending review* *# Alignment attempted, but no correlation to academic course*

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
3027010	8/67 1%	3/75 4%	2/54 4%	13/46 28%	13/45 29%	#	#
3027020	10/67 15%	4/75 5%	2/54 4%	11/46 24%	11/45 24%	#	#
8736030	6/67 9%	4/75 5%	#	#	#	8/45 18%	8/45 18%

*** Alignment pending review* *# Alignment attempted, but no correlation to academic course*

Florida Standards for Technical Subjects

Florida Standards (FS) for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects are the critical reading and writing literacy standards designed for grade 6 and above. These standards are predicated on teachers of history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. The FS for Mathematical Practices are designed for grades K-12 and describe varieties of expertise that educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

Instructors must incorporate the Florida Standards for Technical Subjects and Mathematical Practices throughout instruction of this CTE program.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

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.

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 the interdependence of organisms, humans, and the environment.
08.0 Demonstrate an understanding of genetic diversity, selection, adaptations, and changes through time.
09.0 Demonstrate an understanding of the legal and ethical responsibilities associated with working with biological specimens for research or industry, bioethics.
10.0 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 <u>strongly recommended</u> 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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
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.	LAFS.910.RI.3.8	
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.	LAFS.910.SL.1.1	
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.	LAFS.910.SL.1.1	
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.	LAFS.910.L.3.6	
02.0	Demonstrate understanding of the roles of matter, energy, in the chemical processes of cells, organisms.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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	LAFS.910.L.3.6	
02.07	Identify the usefulness of the periodic table and identify properties of specific groups.		
02.08	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).	LAFS.910.W.1.1	
02.09	Understand that there is conservation of mass and energy when matter is transformed.		
02.10	Understand that biological systems obey the same laws of conservation as physical systems.		
02.11	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:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
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:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
05.01	Understand the mechanism of asexual and sexual reproduction and knows 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:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
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 the interdependence of organisms, humans, and the environment.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
07.01	Understand the interdependence exists between both the biotic and abiotic components of any system.	LAFS.910.SL.1.1	
07.02	Understand of the great diversity and interdependence of living things.		
07.03	Understand that changes in a component of an ecosystem will have unpredictable and predictable effects on the entire system, but that the components of the system tend to react in a way that will restore the ecosystem to its original condition.		
08.0	Demonstrate an understanding of genetic diversity, selection, adaptations, and changes through time.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14,

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
			16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
08.01	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.	MAFS.912.S-CP.1.2	
08.02	Understand the great diversity and interdependence of living things.		
08.03	Understands how genetic variation of offspring contributes to natural selection.	MAFS.912.S-ID.1.1; 2.5	
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:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
09.01	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.		
09.02	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.		
09.03	Understand that performance testing is often conducted using small-scale models, computer simulations, or analogous systems to reduce the chance of system failure.		
09.04	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.		
09.05	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 obtaining familial consent.	LAFS.910.SL.1.1	
09.06	Understand the purpose of clinical trials.		
09.07	Understand the purpose of Good Laboratory Practices (GLP) as related to product testing and approval.		
10.0	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:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5,

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
		6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
10.01 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.		
10.02 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.		
10.03 Provide examples of industry trends related to Biotechnology.		
CTE Performance Standards:		
11.0 Demonstrate knowledge of the history, career fields, and benefits of biotechnology.-The student will be able to:		SC.912.N.4.2
11.01 Describe major historic developments in biotechnology fields such as pharmaceuticals, biopharmaceuticals, agriculture, diagnostics, industrial products, devices, instrumentation, and research and development.	LAFS.910.SL.2.4	
11.02 Identify several products obtained through recombinant DNA technology and other biotechnology advances.		
11.03 Describe the major steps in a product's move through a company's product pipeline.	LAFS.910.RI.1.2	
11.04 Explain how companies decide on the research and development targets and potential products.		
11.05 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.	LAFS.910.SL.2.4	
11.06 Illustrate examples of how biotechnology has led to benefits and risks to society and how biotechnical advances affect human lives on a personal level.	LAFS.910.W.1.2 LAFS.910.RI.1.1	
12.0 Recognize and practice safety procedures.-The student will be able to:		
12.01 Identify safety symbols and signs.		
12.02 Identify appropriate safety procedures and guidelines.		
12.03 Demonstrate an understanding of the emergency procedures in case of fire, burn, chemical spill or other hazardous situations.	LAFS.910.W.1.2	
12.04 Recognize laboratory safety hazards and avoid them.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
12.05	Locate and identify emergency equipment, including first aid.		
12.06	Use laboratory apparatus, materials, and technology in an appropriate and safe manner.		
12.07	Locate a Safety Data Sheet (SDS) and use the information to operate in a safe manner.		
12.08	Demonstrate knowledge of universal precautions for blood-borne pathogens.	LAFS.910.W.1.2	
13.0	Recognize and follows quality control procedures and regulatory guidelines.-The student will be able to:		
13.01	Identify the need for and function of regulatory agencies such as those in government, industry, and society.	LAFS.910.RI.1.1	
13.02	Describe appropriate attire for different biotechnology workplaces including the office, laboratory and cleanroom environments.		
13.03	Monitor, use, store and dispose of hazardous materials properly.		
13.04	Clean, organize, and sterilize materials and equipment.		
13.05	Understand the role of the employer to provide a safe and healthful workplace. (OSHA regulations)		
14.0	Demonstrate the ability to communicate and use interpersonal skills effectively.-The student will be able to:		
14.01	Follow all oral and written instructions.	LAFS.910.SL.1.1 LAFS.910.W.1.2	
14.02	Demonstrate good listening, writing, and verbal communication skills and procedures.		
14.03	Appropriately use and respond to verbal and non-verbal cues.	LAFS.910.W.2.4	
14.04	Use correct spelling, grammar, and format in all written communication.	LAFS.910.L.3.6	
14.05	Use appropriate scientific terminology and abbreviations.		
14.06	Recognize the importance of courtesy and respect and maintain good interpersonal relationships.	LAFS.910.RI.1.1 LAFS.910.SL1.1	
14.07	Read and discuss technical material.	LAFS.910.W.1.2	
14.08	Read and present a scientific paper for discussion, including an overview of the objective, experimental methods, results, and conclusions.	LAFS.910.SL.1.1 LAFS.910.W.1.2	
15.0	Apply basic skills in scientific inquiry, calculations, and analysis.-The student will be able to:	MAFS.912.S-IC.2	SC.912.N.1.1, 2
15.01	Demonstrate knowledge of the scientific method.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
15.02	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.	LAFS.910.W.3.7	
15.03	Use the scientific method to conduct a valid experiment, including hypothesis formation, data collection, and data analysis including results and discussion, and conclusion.	LAFS.910.W.2.4 LAFS.910.SL.1.1 MAFS.912.S-ID.1.1, 2, 3	
15.04	Maintain a scientific notebook per industry best practices (objectives, procedures, data, materials, sources of error, and conclusions).		
15.05	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.	LAFS.910.W.2.4	
15.06	Make and use measurements in both traditional and metric units.	MAFS.912.N-Q.1.3	
15.07	Measure time, temperature, distance, capacity and mass/weight.	MAFS.912.N-Q.1.3	
15.08	Describe the relationship between 12 and 24 hour time and be able to convert between the two.		
15.09	Make estimates and approximations in order to test the reasonableness of the result.	MAFS.912.N-Q.1.3	
15.10	Evaluate the validity of results obtained during experimentation and product development.	MAFS.912.S-ID.1.1, 2, 3	
15.11	Interpret and use graphs, charts and tables used to collect and analyze data.	MAFS.912.S-ID.1.1, 2, 3	
15.12	Interpret quantitative and qualitative data.	LAFS.910.W.1.2 MAFS.912.S-ID.1.1, 2, 3	
15.13	Demonstrate ability to evaluate and draw conclusions.	LAFS.910.W.1.2	
15.14	Follow guidelines to prepare a scientific report.	LAFS.910.W.1.2	
16.0	Demonstrate knowledge of organism structure and function.-The student will be able to:		SC.912.L.14.1, 2 , 3; 15.6, 15; 16.1, 2, 3, 4, 5, 6, 7, 9, 14, 16, 17; 18.1, 7, 8, 9
16.01	Recognize and distinguish between the following based upon the hierarchy of organization of organisms: atom, molecule, cells, tissue, organs, organ system, and organism.	LAFS.910.L.3.6	
16.02	Outline the life cycle and characteristics of certain model organisms used in the biotechnology industry, including bacterial, yeast, and mammalian cells, and viruses.	LAFS.910.RI.1.3	
16.03	Differentiate between prokaryotic and eukaryotic cells.	LAFS.910.RI.1.2	

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
16.04	Describe the cell (both prokaryotes and eukaryotes) as the basic unit of life.	LAFS.910.RI.1.2	
16.05	Analyze the difference between plant and animal cells.	LAFS.910.SL.1.1 LAFS.910.RI.1.2	
16.06	Describe cell structure and function.	LAFS.910.L.3.6 LAFS.910.SL.1.1	
16.07	Differentiate between mitosis and meiosis.	LAFS.910.L.3.6	
16.08	Describe the role of DNA, RNA, and ribosomes in protein synthesis.	LAFS.910.W.1.2	
17.0	Utilize materials processing and standard laboratory operating procedures for biotechnology.-The student will be able to:		SC.912.L.14.6 SC.912.N.1.1
17.01	Maintain a clean and organized work area.		
17.02	Follow written protocols and oral directions to perform a variety of laboratory and technical tasks.		
17.03	Determine appropriate equipment and units of measurement for a given task.	MAFS.912.N-Q.1.3	
17.04	Discuss and perform disinfection and sterilization techniques.	LAFS.910.SL.1.1	
18.0	Apply biotechnical materials analysis skills.-The student will be able to:		SC.912.L.14.3 SC.912.L.16.11, 12 SC.912.L.17.13, 20
18.01	Isolate DNA from a variety of cells.		
18.02	Explain the principles' involved in agarose gel electrophoresis.	LAFS.910.W.1.2	
18.03	Prepare, load, run, visualize, and analyze DNA samples on an agarose gel.		
18.04	Describe the meaning in differences in DNA and peptide bands seen on agarose gels.	LAFS.910.W.1.2	
18.05	Explain the difference between analyzing PCR products on conventional gels vs. using a Realtime PCR system.		
18.06	Discuss sources of environmental contamination and methods of detection in controlled environments.	LAFS.910.SL.1.1	
19.0	Demonstrates knowledge of basic chemistry as applied to biotechnology procedures.-The student will be able to:		SC.912.N.3.5 SC.912.P.8.4, 5, 6, 7, 8, 9; 12.12
19.01	Recognize and provide labels for models of neutral atoms, ions, and isotopes.		
19.02	Differentiate between atoms, elements, molecules, compounds, mixtures and solutions.	LAFS.910.L.3.6	
19.03	Compare and contrast homogenous and heterogeneous solutions and suspensions.	LAFS.910.L.3.6	

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
19.04	Determine chemical characteristics and reactivity based on electron configuration.		
19.05	Demonstrate that the rate of chemical reactions depend on reactant concentration or temperature, or the presence of a catalyst.	MAFS.912.S-ID.1.1, 2; 3.7	
19.06	Explain how the electron configuration determines covalent and ionic bonds.		
19.07	Compare and contrast the variety of forces that hold matter together.	LAFS.910.L.3.6	
20.0	Utilizes basic knowledge of microbiology and blood-borne diseases, including AIDS.-The student will be able to:		SC.912.L.14.3, 6 SC.912.L.15.5, 6
20.01	Differentiate between aerobic vs. anaerobic bacteria, viruses, bacteriophage, and mycoplasma.	LAFS.910.RI.1.1	
20.02	Discuss microbial taxonomy and classification.	LAFS.910.RI.1.1	
20.03	Practice aseptic techniques as required.		
20.04	Discuss sterilization and isolation techniques.		
20.05	Discuss techniques of inoculation and transfer of cultures.		
20.06	Describe conditions that promote cell growth under aseptic conditions in the laboratory and workplace.		
20.07	Identify "at risk" behaviors which promote the spread of diseases caused by blood borne pathogens.	LAFS.910.W.3.7	
20.08	Discuss differences between sterilization, decontamination, and disinfection.	LAFS.910.RI.1.1	
20.09	Demonstrate proper protocol for the disposal of biohazardous waste and microorganisms.		
21.0	Demonstrate knowledge of legal and ethical responsibilities.-The student will be able to:		SC.912.L.16.10
21.01	Discuss ethical, legal and social issues raised by biotechnology.	LAFS.910.W.3.7	
22.0	Demonstrate literacy and computer skills applicable to the biotechnology industry.-The student will be able to:		
22.01	Define terms and demonstrate basic computer skills.		
22.02	Describe the uses of computers in the biotechnology industry.		
22.03	Use the Internet to gather and share scientific and regulatory information.	LAFS.910.W.2.6	
22.04	Use spreadsheet software to calculate and analyze data.	MAFS.912.S-ID.1.1, 2, 3, 4	
23.0	Demonstrate employability skills.-The student will be able to:		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
23.01 Demonstrate appropriate responses to criticism and coaching from employer, supervisor, or other persons.	LAFS.910.W.2.5	
23.02 Demonstrate appropriate methods for asking questions, and providing constructive criticism and feedback.		
23.03 Use several resources including the internet to gather information about job opportunities in the biotechnology field.	LAFS.910.W.3.7	
23.04 Outline the opportunities for careers in biotechnology in health, industry, medicine, genetics, agriculture, etc.	LAFS.910.RI.1.2	
23.05 Identify and demonstrate acceptable work habits and health habits.		
23.06 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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
24.01 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.		
24.02 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.		
24.03 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.	LAFS.910.SL.1.1	
24.04 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.	LAFS.910.RI.3.8	
24.05 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.	LAFS.910.SL.1.1	
24.06 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.	LAFS.910.SL.1.1	
24.07 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.		
25.0 Demonstrate understanding of the chemical processes in biotechnology, pH, solutions, dilutions, molarity.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
25.01 Experiments and determines that the rates of reaction among atoms and molecules depend on the concentration, pressure, and temperature of the reactants and the	MAFS.912.S-ID1.1, 2; 3.7	

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	presence of absence of catalysts.		
25.02	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).	LAFS.910.W.1.1	
25.03	Understand that there is conservation of mass and energy when matter is transformed.		
25.04	Understands that membranes are sites for chemical synthesis and essential energy conversions.		
25.05	Understands that biological systems obey the same laws of conservation as physical systems.		
26.0	Demonstrate an understanding of cell propagation, growth and cultures for biotechnology.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
26.01	Understand the mechanisms of asexual and sexual reproduction and know the different genetic advantages and disadvantages of asexual and sexual reproduction.		
27.0	Demonstrate an understanding of the fundamentals of biochemistry including protein synthesis, recombinants, and reproduction, analysis, western blot.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
27.01	Define monoclonal antibodies and hybridoma technology.	LAFS.910.L.3.6	
27.02	Understand the complex interactions among the different kinds of molecules in the cell cause distinct cycles of activity governed by proteins.	LAFS.910.RI.1.1	
27.03	Understand that cell behavior can be affected by molecules from other parts of the organism or even from other organisms.	LAFS.910.RI.1.1	
28.0	Demonstrate an understanding of genetics and biotechnology, gene selection, transformation, analysis, PCR, northern and southern blot.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
			SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
28.01	Understand that the chemical elements that make up the molecules of living things are combined and recombined in different ways.	LAFS.910.RI.1.1	
28.02	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.	LAFS.910.RI.1.1	
29.0	Demonstrate a knowledge of the structure and function and reproduction of various organisms used as genetic models.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
29.01	Understand that body structures are uniquely designed and adapted for their function.	LAFS.910.RI.1.1	
29.02	Describe animal models used in research, and the types of studies they are optimally used for.	LAFS.910.RI.1.2	
30.0	Demonstrate an understanding of the interdependence of organisms, humans, and the environment.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
30.01	Understand the interdependence exists between both the biotic and abiotic components of any system.	LAFS.910.SL.1.1	
30.02	Understand that changes in a component of an ecosystem will have unpredictable effects on the entire system, but that the components of the system tend to react in a way that will restore the ecosystem to its original condition.		
31.0	Demonstrate an understanding of genetic diversity, natural and genetic selection.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
31.01	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.	MAFS.912.S-CP.1.2	

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
31.02	Understand of the great diversity and interdependence of living things, and the value of biodiversity.		
31.03	Understands how genetic variation of offspring contributes to natural selection.	MAFS.912.S-ID.1.1; 2.5	
32.0	Demonstrate an understanding of bioethics.-The student will be able to:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
32.01	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.		
32.02	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.		
32.03	Understand that performance testing is often conducted using small-scale models, computer simulations, or analogous systems to reduce the chance of system failure.		
32.04	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.		
33.0	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:	MAFS.912.S-IC.2	SC.912.L.14.1,2,3; 16.3,5,8,9,10,11,14, 16,17; 17.14; 18.1,11 SC.912.N.1.1,2,3,4,5, 6,7; 2.1,2,5; 3.4,5; 4.1,2 SC.912.P.8.6,7
33.01	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.	LAFS.910.RI.1.1	
33.02	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.		
33.03	Discuss how scientists contribute to and promote science-based policy in US government.	LAFS.910.SL.1.1	
33.04	Discuss the correlation between scientific discovery and product development, based on societal benefit vs. financial benefit to a company.	LAFS.910.SL.1.1	

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
CTE Performance Standards:			
34.0	Demonstrate knowledge of the history, career fields, and benefits of biotechnology.-The student will be able to:		SC.912.E.6.6 SC.912.L.16.10; 17.11 SC.912.N.2.5
34.01	Understand that technologies used in biotechnology continue to be developed and improved, with respect to advances in discoveries, applications, and demand for increased efficiency.	LAFS.910.RI.1.1	
34.02	Compare the developments in two biotechnology fields and make predictions for future developments in those areas.	LAFS.910.W.3.7	
34.03	Identify several local biotechnology companies specializing in the production of pharmaceuticals, agricultural products, industrial products, and research instruments and reagents.	LAFS.910.W.3.7	
34.04	Compare the benefits of products derived from biotechnological advances (including DNA technology), to an environment devoid of biotechnological products or applications.	LAFS.910.RI.1.2	
34.05	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.	LAFS.910.W.3.7	
35.0	Recognize and practice safety procedures.-The student will be able to:		SC.912.L.14.6 SC.912.N.1.1
35.01	Define Biological Safety Levels 1 through 4 and their differences.	LAFS.910.RI.1.1	
35.02	Describe appropriate attire for Biological Safety Levels 1 through 4.	LAFS.910.RI.1.1	
35.03	Identify potential biohazards and relate how to deal with a variety of biohazards.	LAFS.910.RI.1.1	
35.04	Use appropriate safety procedures and guidelines and demonstrate knowledge of emergency procedures.	LAFS.910.RI.1.1	
35.05	Maintain equipment and material logs for all apparatus, materials, and technology.		
35.06	Maintain Safety Data Sheet (SDS) notebook and appropriately reference for each activity.		
35.07	Follow approved protocols for all activities which may cause exposure to blood-borne pathogens.		
35.08	Describe strategies used in a cleanroom to minimize the introduction of contaminating microorganisms or particulates.	LAFS.910.RI.1.1	
36.0	Recognize and follows quality control procedures and regulatory guidelines.-The student will be able to:		SC.912.L.17.13, 14
36.01	Describe the need for and function of regulatory agencies such as those in	LAFS.910.RI.1.1	

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	government, industry, and society.		
36.02	Discuss quality control and assurance with respect to documentation.	LAFS.910.RI.1.1	
36.03	Discuss quality control in relation to inspection results and specifications, procedures, testing methods, process control, regulatory specifications and documentation, and internal audits.	LAFS.910.RI.1.1	
36.04	Utilize quality control methods in relation to hazardous and non-hazardous materials.		
37.0	Demonstrate the ability to communicate and use interpersonal skills effectively.-The student will be able to:		SC.912.N.1.1
37.01	Demonstrate ability to give and follow oral and written directions.		
37.02	Recognize potential errors in protocol and address them with colleagues and the appropriate supervisor.	LAFS.910.SL.1.1	
37.03	Maintain thorough documentation of tasks and procedures.	LAFS.910.W.2.4	
37.04	Work effectively in a research, manufacturing, quality control, or quality assurance team with a defined responsibility.		
37.05	Incorporate appropriate scientific terminology and abbreviations into all technical documents.	LAFS.910.L.3.6	
37.06	Prepare, analyze, and discuss technical material.	LAFS.910.RI.1.1	
38.0	Apply basic skills in scientific inquiry, calculations, and analysis.-The student will be able to:		SC.912.N.1.1, 3, 4
38.01	Develop scientific questions, hypotheses, and experimental plans.	LAFS.910.RI.1.2 LAFS.910.W.2.4	
38.02	Properly and safely operate scientific equipment including mixers, analytical balances, stirrers, shakers, conductivity meters, and a hemocytometer.		
38.03	Calculate ratios used for making chemical dilutions or plate counting.		
38.04	Compose a thorough concluding statement outlining the results of an experiment with evidence, explanations, error analysis, and practical applications.	LAFS.910.W.1.2	
38.05	Evaluate scientific reports with well-supported, clearly presented opinions.	LAFS.910.W.1.1 LAFS.910.RI.1.1	
38.06	Consistently analyze and properly uses a variety of valid literature resources.	LAFS.910.W.3.7	
38.07	Set-up and maintain a legal scientific notebook that includes an account of all laboratory procedures, data, conclusions, and appropriate signatures.	LAFS.910.W.2.4	
38.08	Measure time, temperature, distance, capacity, mass/weight, flow rates and growth rates.	MAFS.912.N-Q.1.3	
38.09	Use 24 hour time in all documents.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
38.10	Create graphs, charts and tables used to record, analyze, and convey scientific data.	MAFS.912.S-ID.1.1, 2, 3	
38.11	Critically analyze quantitative and qualitative data.	MAFS.912.S-ID.1.1, 2, 3	
38.12	Organize and communicate clear, concise written and oral reports of scientific findings.	LAFS.910.W.1.2	
39.0	Demonstrate knowledge of organism structure and function.-The student will be able to:		SC.912.L.15.15; 16.19; 18.1, 4 SC.912.N.1.1
39.01	Discuss the makeup of chromosomes.	LAFS.910.RI.1.1	
39.02	Describe the processes of nucleic acid transfer.	LAFS.910.RI.1.1	
39.03	Describe the relationship of cellular science and biotechnology.	LAFS.910.RI.1.1	
39.04	Describe how enzymes regulate all aspects of protein synthesis.	LAFS.910.RI.1.1	
39.05	Explain how the structure of nucleic acid affects its isolation from cells and solutions.	LAFS.910.RI.1.1	
39.06	Describe how cells are engineered to express recombinant proteins.	LAFS.910.RI.1.1	
39.07	Identify groups of proteins based on their functions, citing specific examples of proteins in each group.	LAFS.910.RI.1.1	
39.08	Use the Internet to find information about the structure and function of specific proteins.	LAFS.910.W.3.7	
40.0	Utilize materials processing and standard laboratory operating procedures for biotechnology.-The student will be able to:		SC.912.L.14.3, 6 SC.912.N.1.1
40.01	Maintain a professional laboratory space following standard operating procedures.		
40.02	Perform a variety of biological tests and chemical assays, collect data, perform calculations and statistical analysis.	MAFS.912.S-ID.1.1, 2, 3	
40.03	Discuss classification, composition and preparation of culture media.		
40.04	Discuss collection and handling of specimens for fungal, bacterial, mammalian cells and viral specimens, and parasites.	LAFS.910.RI.1.1	
40.05	Prepare and examine specimens, and identify ova and parasites as indicated.		
41.0	Apply biotechnical materials analysis skills.-The student will be able to:		SC.912.L.14.3; 15.15; 16.3, 5, 9, 11, 12, 14; 17.13 SC.912.N.1.1 SC.912.P.8.11
41.01	Outline the steps in cell culture, aseptic technique and media preparation.	LAFS.1112.RI.1.1	

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
41.02	Isolate DNA from cells and analyze its purity and concentration.		
41.03	Outline the steps in production, product testing, and delivery of a product made through recombinant DNA technology.	LAFS.910.RI.1.1	
41.04	Explain the principles involved in polyacrylamide and agarose gel electrophoresis.		
41.05	Prepare, load, run, visualize, and analyze protein samples on a polyacrylamide or agarose gel.		
41.06	Prepare protein solutions and dilutions at specific concentrations and pH.	MAFS.912.A-CED.1.4	
41.07	Use protein indicator solutions to identify the presence and concentration of protein in solution.		
41.08	Describe the meaning in differences in DNA and peptide bands seen on polyacrylamide or agarose gels.	LAFS.910.W.1.2	
41.09	Prepare and maintain plate and broth cultures of bacteria. Explain how polyacrylamide gel electrophoresis (PAGE) is used with column chromatography to monitor protein product.	LAFS.910.RI.1.1 LAFS.910.SL.1.1	
41.10	Describe the steps in harvesting protein product from fermentation cell culture.	LAFS.910.RI.1.1	
41.11	Outline the steps of using a visible light spectrophotometer.	LAFS.910.RI.1.1	
41.12	Prepare a serial dilution of protein and measure absorbance at a given wavelength.		
41.13	Use a standard curve to determine the concentration of an unknown protein solution.	MAFS.912.S-ID.1.2, 3	
41.14	Explain the protocol and application for isolating plasmids.	LAFS.910.SL.2.4	
41.15	Explain the process and application of inserting genes that code for antibiotic resistance into a plasmid.	LAFS.910.RI.1.1	
41.16	Demonstrate the ability to culture, propagate, and harvest bacteria.		
41.17	Understand the bacterial growth stages in culture.	LAFS.910.RI.1.1	
41.18	Understand components of growth media such as energy source, and antibiotics, and incubation parameters: time, temp, atmospheric concentration.	LAFS.910.RI.1.1	
41.19	Explain the process of utilizing restriction enzymes and DNA ligase to insert a new gene into a plasmid.	LAFS.910.RI.1.1	
41.20	Explain the process of replicating plasmids.	LAFS.910.RI.1.1	
41.21	Practice environmental monitoring using agar plates.		
42.0	Demonstrates knowledge of basic chemistry as applied to biotechnology procedures.-The student will be able to:		SC.912.P.8.4, 5, 7, 9, 11

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
42.01	Use the periodic table to predict valence electron configuration, and physical and chemical characteristics of elements.		
42.02	Use the periodic table to calculate molarity.		
42.03	Balance equations to show that there is a conservation of matter. Explain hydrogen and polar bonding.	MAFS.912.A-CED.1.1	
42.04	Discuss and use techniques that identify and separate components of a homogenous mixture.	LAFS.910.SL.1.1	
42.05	Explain and use the function of pH in the preservation, purification, and functioning of proteins.	LAFS.910.W.1.2	
42.06	Use pH paper or pH meter to measure and adjust pH.		
42.07	Calculate how to prepare solutions based on % mass/volume.		
42.08	Calculate how to prepare solutions based on molar concentrations.		
42.09	Use stoichiometry and molarity to prepare solutions of any volume and concentration.	MAFS.912.A-CED.1.4	
42.10	Prepare dilutions of concentrated solutions.	MAFS.912.A-CED.1.4	
43.0	Utilizes basic knowledge of microbiology and blood-borne diseases, including AIDS.-The student will be able to:		SC.912.L.14.3,4,6,16 52; 15.5, 6; 16.9,10; 17.1, 2, 4, 5
43.01	Discuss bacterial metabolism, reproduction, cell structures and their functions.	LAFS.910.RI.1.1	
43.02	Perform microbiology techniques in controlled environments.		
43.03	Demonstrate techniques of microscope use related to oil immersion and slide preparation.		
43.04	Discuss uses for different microscopy methods, including light, fluorescent, phase-contrast, and electron.	LAFS.910.RI.1.1	
43.05	Demonstrate the preparation and interpretation of Gram stains.		
43.06	Perform various preparation and staining techniques.		
43.07	Perform disinfection and aseptic techniques.		
43.08	Perform sterilization and isolation techniques.		
43.09	Prepare artificial culture media.		
43.10	Perform techniques of inoculation and transfer of cultures.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
43.11	Use various methods to monitor the growth of cell cultures.		
43.12	Discuss the immune system and the normal immune response.	LAFS.910.RI.1.1	
43.13	Perform antigen and antibody testing.		
43.14	Discuss methods that utilize the antigen/antibody complex as tools for research, diagnosis, and testing.	LAFS.910.RI.1.1	
43.15	Discuss the ABO, Rh and other blood group systems.	LAFS.910.RI.1.1	
43.16	Distinguish between fact and fallacy about the transmission and treatment of diseases caused by blood borne pathogens including Hepatitis B.		
43.17	Identify community resources and services available to the individuals with diseases caused by blood borne pathogens.		
43.18	Demonstrate knowledge of the legal aspects of AIDS, including testing.		
43.19	Describe how blood-borne pathogens are avoided in manufacturing.		
44.0	Demonstrate knowledge of legal and ethical responsibilities.-The student will be able to:		SC.912.L.16.10 SC.912.L.17.18
44.01	Recognize ethical issues of the biotechnology workplace such as employee privacy, employee safety, animal testing, etc.		
44.02	List the local, regional, state and federal agencies who oversee safety, ethics, and manufacturing.		
44.03	Provide examples of the appropriate professional traits of a worker in biotechnology.		
44.04	Outline the proper protocol for reporting unsafe or unethical behavior.		
45.0	Demonstrate literacy and computer skills applicable to the biotechnology industry.-The student will be able to:		
45.01	Use the Internet to gather and share scientific and regulatory information.	LAFS.910.W.2.6	
45.02	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.	LAFS.910.W.3.7	
45.03	Use a computer spreadsheet, word processing, and presentation programs to collect, analyze and report information or data.	MAFS.912.S-ID.1.1, 2, 3, 4	
46.0	Demonstrate employability skills.-The student will be able to:		
46.01	Conduct a job search.		
46.02	Develop a portfolio that demonstrates proficiency in specific biotechnology workplace	LAFS.910.W.2.4	

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	tasks including writing samples and performance-based lab and computer skills.		
46.03	Describe the opportunities for careers in biotechnology in health, industry, medicine, genetics, agriculture, etc.		
46.04	Identify or demonstrate appropriate responses to criticism from employer, supervisor, or other persons.		
46.05	Analyze the impact that work and health habits play in the biotechnology industry.		
46.06	Recognize appropriate professional behavior.		
46.07	Explain the roles of different departments and the employees within each department at an industry site.		
46.08	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 <u>strongly recommended</u> that the following scope, sequence, and course recommendations be followed.

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

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: National Standards

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
<u>CTE Performance Standards:</u>		
47.0 History, career fields, and benefits of biotechnology.-The student will be able to:		SC.912.L.17.15 SC.912.N.1.1,4,5; 2.2, 5
47.01 Identify a recent advancement in a biotechnological tool or method, and compare it to its predecessor.	LAFS.1112.W.3.7	
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.	LAFS.1112.W.1.2 LAFS.1112.RI.1.1	
47.05 Graph a history timeline with medical advances due to technology advances.		
47.06 Research and analyze career opportunities available in biotechnology and select the	LAFS.1112.W.3.7	

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	career pathway best suited to your interests, abilities, and objectives.		
47.07	Discuss medical, agricultural, forensic, and environmental applications of biotechnology.	LAFS.1112.RI.1.1	
48.0	Safety procedures.-The student will be able to:		SC.912.L.14.6; 16.10; 17.16, 20 SC.912.N.1.1, 2; 4.2
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:		SC.912.L.17.13, 20 SC.912.N.1.1, 2; 2.2
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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:		SC.912.L.17.13 SC.912.N.1.1, 3, 7; 2.1, 2, 4, 5; 3.1
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.	LAFS.1112.W.2.4 LAFS.1112.SL.1.1	
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.	LAFS.1112.W.2.4 LAFS.1112.SL.1.1	
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.	LAFS.1112.L.1.2	
50.11	Use appropriate scientific terminology and abbreviations.	LAFS.1112.L.3.6	
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.	LAFS.1112.W.1.2	
51.0	Basic skills in scientific inquiry, calculations, and analysis.-The student will be able to:		SC.912.L.14.4 SC.912.N.1.1, 2, 3,

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
			4, 5, 6, 7; 2.1, 2; 3.1, 4, 5; 4.1, 2
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.	LAFS.1112.RI.1.1	
51.04	Set-up and maintain a legal scientific notebook that includes an account of all laboratory procedures, data, conclusions, and appropriate signatures.	LAFS.1112.W.2.4	
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.		
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.	MAFS.912.N-Q.1.3	
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.	MAFS.912.N-Q.1.3	
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 in order to test the reasonableness of the result.	MAFS.912.N-Q.1.3	
51.15	Evaluate the validity of results obtained during experimentation and product development.	LAFS.1112.SL.1.1	
51.16	Interpret and create graphs, charts and tables used to collect and analyze data.	MAFS.912.S-ID.1.1, 2, 3	
51.17	Interpret and critically analyze quantitative and qualitative data.	MAFS.912.S-ID.1.1, 2, 3	
51.18	Demonstrate ability to evaluate and draw conclusions.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
51.19	Organize and communicate clear, concise written and oral reports of scientific findings.	LAFS.1112.W.1.2	
51.20	Evaluate scientific reports with well-supported, clearly presented opinions. Monitor scientific equipment by conducting and documenting preventative maintenance and calibration.	LAFS.1112.RI.1.1 LAFS.1112.SL.1.1	
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:		SC.912.L.14.2, 3; 16.3, 4, 5, 6, 7, 9, 10, 11, 12; 18.1, 4, 11
52.01	Discuss the makeup of chromosomes.	LAFS.1112.RI.1.1	
52.02	Discuss the process of nucleic acid transfer.	LAFS.1112.RI.1.1	
52.03	Describe the relationship of cellular science and biotechnology.	LAFS.1112.RI.1.1	
52.04	Explain how the structure of nucleic acid affects its isolation from cells and solutions.	LAFS.1112.RI.1.1	
52.05	Describe how cells are engineered to express recombinant proteins.	LAFS.1112.RI.1.1	
53.0	Materials processing and standard laboratory operating procedures for biotechnology.-The student will be able to:		SC.912.L.14.9; 15.4, 5, 6, 7; 18.1, 2, 3, 4 SC.912.N.1.1
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.	MAFS.912.N-Q.1.3	
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.	MAFS.912.S-ID.1.1, 2, 3	
53.06	Discuss and perform disinfection and sterilization techniques.		
53.07	Outline the steps in cell culture, aseptic technique and media preparation.	LAFS.1112.RI.1.1	
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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:		SC.912.L.14.2,6,9; 15.15; 16.2,3,5,7,10, 12; 17.13; 18.1,4,8, 11,14 SC.912.N.1.1 SC.912.P.10.1,10,18, 19,22; 12.12
54.01	Describe the characteristics of proteins that allow for their purification after cloning transformed cells.	LAFS.1112.RI.1.1	
54.02	Explain how polyacrylamide gel electrophoresis (PAGE) is used with column chromatography to monitor protein product.	LAFS.1112.RI.1.1	
54.03	Describe the steps in harvesting protein product from fermentation cell culture.	LAFS.1112.RI.1.1	
54.04	Summarize the steps in manufacturing and product testing and FDA approval for new drugs produced through genetic engineering.	LAFS.1112.RI.1.2	
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.	MAFS.912.S-ID.1.2, 3	
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.	LAFS.1112.RI.1.1	
54.11	Explain the process and application of inserting genes that code for antibiotic resistance into a plasmid.	LAFS.1112.RI.1.2	
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.	LAFS.1112.RI.1.2	
54.14	Explain the process of replicating plasmids.	LAFS.1112.RI.1.2	
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
55.0 Basic chemistry as applied to biotechnology procedures.-The student will be able to:		SC.912.N.1.1 SC.912.P.8.2,5,6,7,8, 9,11
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.	MAFS.912.A-CED. 1.1	
55.04 Explain hydrogen and polar bonding.	LAFS.1112.L.3.6	
55.05 Discuss and use techniques that identify and separate components of a homogenous mixture.	LAFS.1112.SL.1.1	
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.	MAFS.912.A-CED. 1.4	
55.11 Prepare dilutions of concentrated solutions.	MAFS.912.A-CED. 1.4	
56.0 Microbiology and blood-borne diseases, including AIDS.-The student will be able to:		SC.912.L.14.1,2,3,6, 52; 15.5; 16.10,11, 12,13,14,15,16,17,18 ;17.8 SC.912.N.1.1,4,6,7
56.01 Discuss microbial taxonomy and classification.	LAFS.1112.RI.1.1	
56.02 Perform microbiology techniques in controlled environments.		
56.03 Perform disinfection techniques.		
56.04 Practice aseptic techniques as required.	MAFS.912.S-ID.1.1, 2, 3, 4	
56.05 Perform sterilization techniques.		
56.06 Discuss isolation techniques.	LAFS.1112.RI.1.1	
56.07 Prepare artificial culture media.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
56.08	Discuss techniques of inoculation and transfer of cultures	LAFS.1112.RI.1.1	
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.	LAFS.1112.RI.1.1	
56.11	Discuss methods for the isolation, purification, and quantification of DNA and plasmid DNA.	LAFS.1112.RI.1.1	
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:		SC.912.L.16.10 SC.912.N.1.2, 5, 6, 7; 2.3, 5
57.01	Investigate an ethical, social, or legal issues facing biotechnology today and suggest an approach to solving it.	LAFS.1112.W.3.7	
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:		SC.912.N.1.1, 4; 2.3, 4; 3.5
58.01	Use the Internet to gather and share scientific and regulatory information.	LAFS.1112.W.3.7	
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
59.0	Employability skills.-The student will be able to:		SC.912.L.16.10 SC.912.N.1.1, 4, 6, 7
59.01	Conduct a job search.		
59.02	Use several resources including the Internet to gather information about job opportunities in the biotechnology field.	LAFS.1112.W.3.7	
59.03	Create an appropriate resume for use in applying for job opportunities in a biotechnology company.	LAFS.1112.W.2.4	
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.	LAFS.1112.W.1.2	
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.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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
Standard Length	5 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA, Florida Technology Student Association (FL-TSA)
SOC Codes (all applicable)	51-1011 – First-line Supervisors of Production and Operating Workers

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 occupational completion points.

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:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
A	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	
B	9200220	Advanced Manufacturing Technology 2		1 credit	51-1011	3	
C	9200230	Advanced Manufacturing Technology 3		1 credit	51-1011	3	
D	9200240	Advanced Manufacturing Technology 4		1 credit	51-1011	3	
E	9200250	Advanced Manufacturing Technology Capstone		1 credit	51-1011	3	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Academic Alignment Table

Academic alignment is an ongoing, collaborative effort of professional educators specializing in the fields of science, mathematics, English/language arts, and Career and Technical Education (CTE). This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses. Career and Technical Education courses that have been aligned to the Next Generation Sunshine State Standards for Science and the Florida Standards for Mathematics and English/Language Arts will show the following data: the quantity of academic standards in the CTE course; the total number of standards contained in the academic course; and the percentage of alignment to the CTE course.

Courses	Anatomy/ Physiology Honors	Astronomy Solar/Galactic Honors	Biology 1	Chemistry 1	Earth-Space Science	Environmental Science	Genetics	Integrated Science	Marine Science 1 Honors	Physical Science	Physics 1
9200210	**	**	**	**	**	**	**	**	**	**	**
9200220	**	**	**	**	**	**	**	**	**	**	**
9200230	**	**	**	**	**	**	**	**	**	**	**
9200240	**	**	**	**	**	**	**	**	**	**	**
9200250	**	**	**	**	**	**	**	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9200210	**	**	**	**	**	**	**
9200220	**	**	**	**	**	**	**
9200230	**	**	**	**	**	**	**
9200240	**	**	**	**	**	**	**
9200250	**	**	**	**	**	**	**

*** Alignment pending review* *# Alignment attempted, but no correlation to academic course*

Florida Standards for Technical Subjects

Florida Standards (FS) for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects are the critical reading and writing literacy standards designed for grade 6 and above. These standards are predicated on teachers of history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. The FS for Mathematical Practices are designed for grades K-12 and describe varieties of expertise that educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

Instructors must incorporate the Florida Standards for Technical Subjects and Mathematical Practices throughout instruction of this CTE program.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

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.

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.
22.0 Conceive, design, and present a project(s) that encompass all the skills learned in the Advanced Manufacturing Technology program.
23.0 Plan, organize, and carry out a project plan.
24.0 Formulate strategies to properly manage resources.
25.0 Use tools, materials, and processes in an appropriate and safe manner
26.0 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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: National Standards

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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.			
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.			

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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).			

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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 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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
04.02 Demonstrate an understanding of appropriate use of productivity tools. (ex. 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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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. (sheet, flat, round)			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.			

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: National Standards

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: National Standards

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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.)			

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci	National Standards
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 (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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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)			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.			

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: National Standards

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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 keyseat.			
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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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:			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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 and workorders).			
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.			

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci	National Standards
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.			

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
22.0	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:		
22.01	Create and produce an original working drawing using CAD/CAM software.		
22.02	Create and produce a 3-D drawing using appropriate industry recognized software.		
22.03	Create and produce a toolpath.		
22.04	Create and produce a 3-D model of the project. (if applicable)		
22.05	Compose a well written design proposal and present to instructor for approval.		
22.06	Incorporate principles and practices of manufacturing processes into the design.		
23.0	Plan, organize, and carry out a project plan.-The student will be able to:		
23.01	Determine the scope of a project.		
23.02	Organize tasks.		
23.03	Determine project priorities.		
23.04	Identify required resources.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	23.05 Record project progress in a process journal.		
	23.06 Record and account for budget expenses during the life of the project.		
	23.07 Carry out the project plan to successful completion and delivery.		
24.0	Formulate strategies to properly manage resources.-The student will be able to:		
	24.01 Identify required resources and associated costs for each stage of the project plan.		
	24.02 Create a project budget based on the identified resources.		
	24.03 Determine the methods needed to acquire needed resources.		
	24.04 Demonstrate good judgment in the use of resources.		
	24.05 Recycle and reuse resources where appropriate.		
	24.06 Demonstrate an understanding of proper legal and ethical waste disposal.		
25.0	Use tools, materials, and processes in an appropriate and safe manner.-The student will be able to:		
	25.01 Identify the proper tool for a given job.		
	25.02 Use tools and machines in a safe manner.		
	25.03 Adhere to laboratory safety rules and procedures.		
	25.04 Identify the application of processes appropriate to the task at hand.		
	25.05 Identify materials appropriate to their application.		
26.0	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:		
	26.01 Create a Design Portfolio documenting drawings and specifications.		
	26.02 Create a Bill of Material (BOM) for your project.		
	26.03 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.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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
Standard Length	Multiple credits
Teacher Certification	Refer to the **Course Structure** section
CTSO	SkillsUSA

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.

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	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

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

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.

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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.

Standards and Benchmarks
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.

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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
Standard Length	1 credit - Multiple credits
Teacher Certification	Refer to the **Course Structure** section
CTSO	SkillsUSA

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 or occupational completion point 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	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

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.

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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.

Special Notes

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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
Standard 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

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 three occupational completion points.

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:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
A	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	PA
B	9202130 9202140	Machining Technology 3 Machining Technology 4		1 credit 1 credit	51-4035	3 3	
C	9202150	Machining Technology Capstone		1 credit	51-4035	3	PA

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Academic Alignment Table

Academic alignment is an ongoing, collaborative effort of professional educators specializing in the fields of science, mathematics, English/language arts, and Career and Technical Education (CTE). This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses. Career and Technical Education courses that have been aligned to the Next Generation Sunshine State Standards for Science and the Florida Standards for Mathematics and English/Language Arts will show the following data: the quantity of academic standards in the CTE course; the total number of standards contained in the academic course; and the percentage of alignment to the CTE course.

Courses	Anatomy/ Physiology Honors	Astronomy Solar/Galactic Honors	Biology 1	Chemistry 1	Earth-Space Science	Environmental Science	Genetics	Integrated Science	Marine Science 1 Honors	Physical Science	Physics 1
9202110	#	1/80 1%	#	1/69 1%	#	1/70 1%	#	1/82 1%	1/66 2%	1/74 1%	1/72 1%
9202120	1/87 1%	5/80 6%	3/83 4%	4/69 6%	4/67 6%	4/70 6%	1/69 1%	4/82 5%	5/66 8%	5/74 7%	3/72 4%
9202130	1/87 1%	4/80 5%	2/83 2%	4/69 6%	3/67 4%	3/70 4%	1/69 1%	3/82 4%	4/66 6%	4/74 5%	3/72 4%
9202140	1/87 1%	4/80 5%	2/83 2%	4/69 6%	3/67 4%	3/70 4%	1/69 1%	3/82 4%	4/66 6%	4/74 5%	3/72 4%
9202150	**	**	**	**	**	**	**	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9202110	**	**	**	**	**	**	**

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9202120	**	**	**	**	**	**	**
9202130	**	**	**	**	**	**	**
9202140	**	**	**	**	**	**	**
9202150	**	**	**	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Florida Standards for Technical Subjects

Florida Standards (FS) for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects are the critical reading and writing literacy standards designed for grade 6 and above. These standards are predicated on teachers of history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. The FS for Mathematical Practices are designed for grades K-12 and describe varieties of expertise that educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

Instructors must incorporate the Florida Standards for Technical Subjects and Mathematical Practices throughout instruction of this CTE program.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

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.

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
01.0	Demonstrate an understanding of workplace safety and workplace organization.-The student will be able to:		SC.912.P.8.1
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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:		SC.912.L.17.16
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.)		

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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		FS-M/LA	NGSSS-Sci
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:		SC.912.N.4.1
09.01	Use appropriate measurement tools. (e.g., machinist's rule, tape measure, calipers,		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	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:		SC.912.N.1.1, 4, 7
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.		
11.08	Set up and operate saws for angular cutting.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
12.0 Set up and operate pedestal grinders.-The student will be able to:		SC.912.N.3.1
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:		SC.912.N.4.1
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.		

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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:		SC.912.N.1.1, 4, 7 SC.912.N.4.1
16.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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:		SC.912.N.1.1, 4, 7
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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:		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	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.		

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..

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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:		SC.912.N.1.1, 4, 7 SC.912.N.4.1
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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).		
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:		SC.912.N.1.1, 4, 7
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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 mill operations.-The student will be able to:		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	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 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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	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.		
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.

Special Notes

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the first 600 hrs. in the Machining Technologies (J200100) postsecondary program.

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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: **Maritime Repair/Refinishing Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

NOTE: This program has been **daggered for deletion** with 2018-2019 being the last cohort of students permitted to enroll in the program. **After 2018-2019, no new students may be enrolled** in this program. Students already enrolled in the program may, at the District's discretion, continue taking courses in the program until completion.

Secondary – Career Preparatory	
Program Number	9202200
CIP Number	0649030607
Grade Level	9 – 12
Standard Length	4 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA, FL-TSA
SOC Codes (all applicable)	47-3019 – Helpers, Construction Trades, All Other 51-2091 – Fiberglass Laminators and Fabricators

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 Maritime repair and refinishing positions.

The content includes but is not limited to communication skills, leadership skills, human relations and employability skills, safe and efficient work practices as marine painter/refinisher, marine carpenter, marine mechanical systems technician or marine welder/fabricator. A program may be structured to emphasize one of the course areas but does not have to cover all areas comprehensively.

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.

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:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
	9202210	Maritime Repair/Refinishing Technology 1		1 credit		2	
A	9202220	Maritime Repair/Refinishing Technology 2	CARPENTRY @7 7G	1 credit	47-3019	2	
	9202230	Maritime Repair/Refinishing Technology 3	SEAMANSHIP 7G	1 credit		2	
B	9202240	Maritime Repair/Refinishing Technology 4		1 credit	51-2091	2	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Academic Alignment Table

Academic alignment is an ongoing, collaborative effort of professional educators specializing in the fields of science, mathematics, English/language arts, and Career and Technical Education (CTE). This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses. Career and Technical Education courses that have been aligned to the Next Generation Sunshine State Standards for Science and the Florida Standards for Mathematics and English/Language Arts will show the following data: the quantity of academic standards in the CTE course; the total number of standards contained in the academic course; and the percentage of alignment to the CTE course.

Courses	Anatomy/ Physiology Honors	Astronomy Solar/Galactic Honors	Biology 1	Chemistry 1	Earth-Space Science	Environmental Science	Genetics	Integrated Science	Marine Science 1 Honors	Physical Science	Physics 1
9202210	**	**	**	**	**	**	**	**	**	**	**
9202220	**	**	**	**	**	**	**	**	**	**	**
9202230	**	**	**	**	**	**	**	**	**	**	**
9202240	**	**	**	**	**	**	**	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9202210	**	**	**	**	**	**	**
9202220	**	**	**	**	**	**	**
9202230	**	**	**	**	**	**	**
9202240	**	**	**	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Florida Standards for Technical Subjects

Florida Standards (FS) for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects are the critical reading and writing literacy standards designed for grade 6 and above. These standards are predicated on teachers of history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. The FS for Mathematical Practices are designed for grades K-12 and describe varieties of expertise that educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

Instructors must incorporate the Florida Standards for Technical Subjects and Mathematical Practices throughout instruction of this CTE program.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

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.

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 marine terminology.
02.0 Demonstrate proficiency in preparation of getting underway.
03.0 Demonstrate operating a boat safely.
04.0 Demonstrate understanding and knowledge related to the legal requirements of boating.
05.0 Apply concepts related to boating emergencies.
06.0 Demonstrate responsible behavior while enjoying water sports with a boat.
07.0 Demonstrate an understanding of workplace safety and workplace organization.
08.0 Demonstrate appropriate communication skills.
09.0 Demonstrate appropriate math skills.
10.0 Demonstrate appropriate understanding of science.
11.0 Describe different types of marine manufacturing industries.
12.0 Demonstrate skills in different types of marine occupations related to boat/yacht repair and refinishing trades.
13.0 Demonstrate the ability to properly handle lines and related operations in securing a marine vessel.
14.0 Demonstrate proficiency in preparing surfaces and applying marine paint finishes.
15.0 Demonstrate proficiency in preparing surfaces and refinishing fiberglass.
16.0 Demonstrate employability skills.
17.0 Demonstrate an understanding of entrepreneurship.
18.0 Demonstrate proficiency in coordinating the manufacturing, repair and refinishing operations in the marine industry.

Florida Department of Education
Student Performance Standards

Course Title: **Maritime Repair/Refinishing Technology 1**
Course Number: **9202210**
Course Credit: **1**

Course Description:
The objective of this course is designed to develop the necessary skills and competencies for first year students preparing for a career in boat/yacht repair and refinishing occupations within the marine industry. The content includes, but is not limited to: marine terminology, boating and navigation, workplace safety practices, communication skills, mathematical and scientific practices as related to the marine industry.

For students enrolled in this course, the following safety requirement MUST be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
01.0	Demonstrate proficiency in marine terminology.-The student will be able to:		
01.01	Identify and classify various parts of a boat.		
01.02	Compare and contrast various types of boat hulls.		
01.03	Calculate the length of a vessel.		
01.04	Identify and categorize the different types of boat engines and drives systems.		
01.05	Identify and classify various parts of a personal watercraft (PWC).		
01.06	Identify and classify various parts of a sailboat.		
01.07	Practice, articulate, and use correct marine terminology.		
01.08	Practice, articulate, and use correct marine technical terminology.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
02.0	Demonstrate proficiency in preparation of getting underway.-The student will be able to:		
02.01	Identify, locate, and explain a maximum capacity plate.		
02.02	Interpret Federal law related to maximum capacity.		
02.03	Calculate and estimate the number of persons a vessel 20ft. or less can safely accommodate.		
02.04	Explain the purpose of a "Float Plan."		
02.05	Complete a "Float Plan."		
02.06	Demonstrate full understanding and safety procedures related to the: before, during, and after fueling/refueling procedures of a boat and personal watercraft (PWC).		
02.07	Identify and classify various parts of a trailer.		
02.08	Calculate the trailer load capacity and vessel weight ratio.		
02.09	Predict outcomes related to improper trailer load capacity and vessel weight calculations.		
02.10	Calculate the tongue weight and combined vessel and trailer weight ratio.		
02.11	Predict outcomes related to improper tongue weight and combined vessel and trailer weight calculations.		
02.12	Explain the purpose of safety chains.		
02.13	Demonstrate understanding of securing a vessel on a trailer and properly stowing gear within a vessel.		
02.14	Inspect and maintain trailering equipment.		
02.15	Explain the proper procedures for driving a vehicle with a trailer.		
02.16	Demonstrate proper procedures for launching a vessel from a trailer.		
02.17	Demonstrate proper procedures for retrieving a vessel using a trailer.		
02.18	Explain common courtesies on a boat ramp.		
02.19	Demonstrate understanding of maintaining a vessel.		
02.20	Explain the importance of engine maintenance.		
03.0	Demonstrate operating a boat safely.-The student will be able to:		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
03.01 Demonstrate understanding of proper procedures for casting off.		
03.02 Calculate, predict, and account for wind direction, wind strength, and current prior to casting off.		
03.03 Demonstrate understanding of proper procedures for docking.		
03.04 Calculate, predict, and account for wind direction, wind strength, and current prior to docking.		
03.05 Summarize and understand navigation rules of the waterways.		
03.06 Explain the proper procedures when encountering other vessels.		
03.07 Differentiate and analyze between a Give-way Vessel and Stand-on Vessel.		
03.08 Define common terms associated with navigation rules.		
03.09 Construct arguments a vessel operator should take when encountering another vessel.		
03.10 Demonstrate proper procedures and understanding when a power-driven vessel encounters another power-driven vessel during day and night navigation.		
03.11 Demonstrate proper procedures and understanding when a sailing vessel encounters another sailing vessel during day and night navigation.		
03.12 Demonstrate proper procedures and understanding when a power-driven vessel encounters a sailing vessel during day and night navigation.		
03.13 Explain proper procedures for operating a vessel during limited or restricted visibility.		
03.14 Identify, classify, and explain navigation lights on power-driven and sailing vessels.		
03.15 Explain and identify lighting for commercial vessels towing or pushing a barge.		
03.16 Identify, interpret, and recognize various navigational sound signals related to encountering vessels.		
03.17 Classify, define, and understand the U.S. Aids to Navigation System (ATON)		
03.18 Classify, identify, and explain lateral markers.		
03.19 Interpret variations on the U.S. Aids to Navigation System (ATON)		
03.20 Define and understand the Intercoastal Waterway (ICW).		
03.21 Define and understand the Western Rivers System.		
03.22 Classify, identify, and explain non-lateral markers.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
03.23	Demonstrate ability to identify and choose an anchor that is appropriate for various boats and boating conditions.		
03.24	Demonstrate ability to prepare an anchor for setting out.		
03.25	Recall and show understanding of the steps to anchor a boat.		
03.26	Recall and show understanding of the steps to retrieving an anchor.		
03.27	Identify and demonstrate understanding of low-head and large-structure dams.		
03.28	Explain the functionality of locks.		
03.29	Demonstrate understanding of approaching a lock.		
03.30	Summarize what boaters should do when using locks.		
03.31	Understand the laws and procedures for passing under a bridge.		
03.32	Identify extra precautions sailboat operators should be aware of before and during passing under a bridge.		
03.33	Identify the challenges associated with rising tides and fluctuating water levels.		
03.34	Demonstrate knowledge of how and when to use a compass and a nautical chart.		
03.35	Identify processes and procedures for steering and stopping a personal watercraft (PWC).		
03.36	Recall and explain procedures before operating a personal watercraft (PWC).		
03.37	Demonstrate knowledge and understanding of operating a personal watercraft (PWC) with courtesy on the water.		
03.38	Explain environmental concerns when operating a personal watercraft (PWC).		
03.39	Identify and explain additional concerns, considerations, and safety awareness when operating a personal watercraft (PWC).		
03.40	Demonstrate the proper procedures for reboarding a capsized personal watercraft (PWC).		
03.41	Identify common devices used that reduce propeller strikes.		
03.42	Identify and understand the purpose of ignition safety (engine shut-off) switches.		
03.43	Explain and identify why a lanyard is attached to an operator of a personal watercraft (PWC).		
03.44	Construct logical processes and procedures for avoiding propeller strike injuries.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
04.0	Demonstrate understanding and knowledge related to the legal requirements of boating.-The student will be able to:		
04.01	Show understanding and the requirements of a vessel's certificate of registration and decal.		
04.02	Demonstrate understanding and identify other facts about titling and registering a vessel.		
04.03	Explain the purpose of the Hull Identification Number (HIN).		
04.04	Identify who may operate a vessel.		
04.05	Demonstrate understanding of the processes and procedures for acquiring a Boating Safety Education ID Card.		
04.06	Interpret the laws related to unlawfully operating a vessel.		
04.07	Explain and identify various boating regulatory zones and their related signs.		
04.08	Proficiently demonstrate knowledge of laws and the consequences related to operating a vessel under the influence of alcohol and drugs.		
04.09	Identify laws connected to an operator's responsibility associated with obstructing navigation.		
04.10	Identify laws directly related to Life Jacket (Personal Flotation Devices) (PFD).		
04.11	Classify the various types of Personal Flotation Devices (PFD), their requirements and uses.		
04.12	Explain the role of the U.S. Coast Guard related to Personal Flotation Devices (PFD).		
04.13	Compare and contrast the advantages and disadvantages associated with Inflatable Life Jackets and traditional Life Jackets.		
04.14	Identify the Federal laws linked to the Personal Floatation Devices (PFD) requirement for children.		
04.15	Identify class A, B, and C type fires.		
04.16	Demonstrate the proper procedures for extinguishing class A, B, and C type fires.		
04.17	Explain the role of the U.S. Coast Guard related to fire extinguishers.		
04.18	Explain and demonstrate knowledge of the U.S. Coast Guard standard regarding backfire flame control devices.		
04.19	Describe the importance of ventilation systems.		
04.20	Identify the laws and requirements for the use of mufflers.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
04.21	Explain and demonstrate knowledge of Visual Distress Signals (VDS).		
04.22	Classify and understand the various U.S. Coast Guard approved Visual Distress Signal (VDS) devices.		
04.23	Compare and contrast the advantages between using pyrotechnic devices versus non-pyrotechnic devices.		
04.24	Summarize the legal requirements associated with divers-down flags.		
04.25	Assess and understand laws linked to other equipment and local regulations.		
04.26	Identify the rules and regulations associated with the operation of liveries (boat/PWC rental facilities).		
04.27	Recognize and understand the laws, rules, regulations, and requirements specific to personal watercrafts (PWC).		
04.28	Demonstrate knowledge and understanding of laws related to towing a person with a vessel.		
04.29	Demonstrate expertise in understanding laws, rules, and regulations connected with waste, oil, and trash disposal in Florida and Federal waters.		
04.30	Explain the Florida's Clean Boater Program.		
04.31	Classify and differentiate the various Marine Sanitation Device (MSD) Types.		
04.32	Interpret and explain the laws, rules, and regulations related to the discharge of trash, oil, and other hazardous substances.		
04.33	Ascertain the purpose of developing a Waste Management Plan.		
04.34	Identify the causes and effects from invasive aquatic plants in Florida's waterways.		
04.35	Explain and identify what the law requires associated with boating accidents and casualties.		
04.36	Identify and define the role of the Florida Fish and Wildlife Conservation Commission (FWC) related to enforcement and penalties.		
04.37	Explain boaters responsibilities related to Homeland Security.		
05.0	Apply concepts related to boating emergencies.-The student will be able to:		
05.01	Identify and apply common risk management practices.		
05.02	Identify and explain increased risk factors associated with boating stressors and dehydration.		
05.03	Recognize the risks that can lead up to a typical boating fatality.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
05.04	Demonstrate understanding and application of rescue techniques.		
05.05	Classify and understand common boating accidents (capsizing, swamping, falling overboard, etc.).		
05.06	Explain and demonstrate knowledge on how to prevent and prepare for capsizing, swamping, or someone falling overboard.		
05.07	Explain how to avoid running aground.		
05.08	Summarize the steps to take when a vessel runs aground.		
05.09	Identify minor and major personal injuries resulting from boating accidents.		
05.10	Demonstrate knowledge of cold water immersion and hypothermia and the stages of exposure.		
05.11	Classify and recognize the symptoms of hypothermia.		
05.12	Identify preventative techniques to reduce the effects of hypothermia.		
05.13	Demonstrate knowledge of Carbon Monoxide Poisoning and the early symptoms associated with exposure.		
05.14	Classify and recognize the symptoms of Carbon Monoxide Poisoning.		
05.15	Identify preventative measures to reduce exposure to Carbon Monoxide Poisoning.		
05.16	Construct list of possible Carbon Monoxide Poisoning situations.		
05.17	Identify and understand the procedures for responding to other serious injuries such as, but not limited to: shock, bleeding, burns, broken bones, and head, neck, or spinal injuries.		
05.18	Demonstrate knowledge related to weather emergencies.		
05.19	Identify and recall daytime and nighttime weather warning display signaling systems.		
05.20	List and identify the VHF-FM frequencies used for broadcasting NOAA weather reports.		
05.21	Identify the role of the National Oceanic and Atmospheric Administration (NOAA).		
05.22	Demonstrate knowledge of how to avoid severe weather.		
05.23	Demonstrate understanding of what to do when caught in severe weather situations.		
05.24	List, explain, and identify essential devices to be carried on board to help secure assistance quickly.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
05.25	Classify and identify common VHF marine radio channels and how each is used for emergencies.		
05.26	Demonstrate proper procedure for issuing a MAYDAY call.		
06.0	Demonstrate responsible behavior while enjoying water sports with a boat.-The student will be able to:		
06.01	Fully comprehend the responsibilities associated with being a vessel operator.		
06.02	Demonstrate and apply knowledge for taking responsibility for passengers.		
06.03	Understand the responsibility and consequences of allowing others to operate you vessel or personal watercraft (PWC).		
06.04	Demonstrate and apply knowledge for showing responsibility to the environment.		
06.05	Classify and practice good environmental stewardship associated with preserving and protecting the waters, wildlife, and aquatic vegetation.		
06.06	Demonstrate and apply knowledge of the responsibility to others using the waterways.		
06.07	Define and understand the risks associated with paddlesports. (canoes, kayaks, and rafts)		
06.08	Explain and understand safety guidelines for paddlesports.		
06.09	Articulate what an operator should do before towing a person on waterskies, innertube, kneeboard, or similar device.		
06.10	Explain and demonstrate knowledge of what an operator should do and know while towing a person.		
06.11	Assess and determine what a person should do and know when in the water before and after being towed.		
06.12	Illustrate hand signals for skiers.		
06.13	Explain and demonstrate knowledge of what an operator should do and know related to scuba diving and snorkeling.		
06.14	Assess and determine what divers should do and know for their own safety.		
06.15	Understand and explain best practices for windsurfing (sailboarding), sailing, fishing, and hunting safety.		
07.0	Demonstrate an understanding of workplace safety and workplace organization.-The student will be able to:		
07.01	Identify safety requirements for manual, electrical-powered, and pneumatic tools.		
07.02	Demonstrate, apply, and provide evidence of safely using manual, electrical-powered, and pneumatic tools.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
07.03	Identify safety requirements for operation of automated machines and equipment.		
07.04	Demonstrate, apply, and provide evidence of safely operating automated machines and equipment.		
07.05	Identify the safe use of paints, chemicals, fiberglass, and compounds		
07.06	Demonstrate, apply, and provide evidence of safely using paints, chemicals, fiberglass, and compounds.		
07.07	Identify the safe use of electrical connectors and cords.		
07.08	Demonstrate, apply, and provide evidence of safely using electrical connectors and cords.		
07.09	Identify, demonstrate, apply, and provide evidence of understanding of shop safety rules on an ongoing basis.		
07.10	Research and identify class A, B, and C type fires.		
07.11	Demonstrate and apply the proper procedures for extinguishing class A, B, and C type fires.		
07.12	Identify various workplace injuries related to the marine industry.		
07.13	Demonstrate and practice knowledge of first aid and first response procedures appropriate for this course.		
07.14	Identify and apply safety procedures in case of smoke or chemical inhalation.		
07.15	Demonstrate and apply material handling techniques to safely move materials.		
07.16	Demonstrate and apply proper techniques for lifting loads.		
07.17	Research and identify Occupational Safety Health Administration (OSHA) safety standards related to the marine industry.		
07.18	Demonstrate, apply, and provide evidence of understanding Occupational Safety Health Administration (OSHA) safety standards related to the marine industry.		
07.19	Demonstrate knowledge of safety requirements for material handling equipment such as rigging, ladders, and scaffolds related to the marine industry.		
07.20	Locate Safety Data Sheets (SDS).		
07.21	Demonstrate understanding and knowledge of using and applying the information located on Safety Data Sheets (SDS).		
07.22	Proactively respond to a safety concern and then document occurrences.		
07.23	Identify and report unsafe conditions.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
07.24	Determine the appropriate corrective action after an unsafe condition is identified.		
07.25	Demonstrate knowledge of various emergency alarms and procedures.		
07.26	Demonstrate knowledge and apply clean-up procedures for spills.		
07.27	Identify and apply procedures for handling hazardous material.		
07.28	Perform safety and environmental inspections.		
07.29	Perform leak checks to determine if toxic or hazardous material is escaping from a piece of equipment.		
07.30	Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists, and regulations.		
07.31	Demonstrate and apply proper equipment shutdown procedures.		
07.32	Identify, select, and use personal protective equipment (PPE).		
07.33	Identify, demonstrate, and apply ergonomic work techniques.		
07.34	Train other students to use and apply safety skills outlined in this standard.		
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 the marine 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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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 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	Understand pressure measurement in terms of PSI, inches of mercury, and KPA.		

Florida Department of Education
Student Performance Standards

Course Title: **Maritime Repair/Refinishing Technology 2**
Course Number: **9202220**
Course Credit: **1**

Course Description:
The objective of this course is designed to develop the necessary skills and competencies for second year students preparing for a career in boat/yacht repair and refinishing occupations within the marine industry. The content includes, but is not limited to: marine manufacturing industries and the occupations related to the marine industry.

For students enrolled in this course, the following safety requirement MUST be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
11.0 Describe different types of marine manufacturing industries.-The student will be able to:		
11.01 Research and explain the process of manufacturing motor yachts.		
11.02 Research and explain the process of manufacturing sailboats.		
11.03 Research and explain the process of manufacturing small powerboats.		
11.04 Research and explain the process of manufacturing center console boats.		
11.05 Research and explain the process of manufacturing of commercial workboats.		
11.06 Research and explain the various hull shapes.		
11.07 Research and identify various sub-components used in marine manufacturing such as, but not limited to: deck accessories.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
12.0	Demonstrate skills in different types of marine occupations related to boat/yacht repair and refinishing trades.-The student will be able to:		
12.01	Describe and perform the occupational requirements of a boat finisher/painter.		
12.02	Describe and perform the occupational requirements of a marine carpenter.		
12.03	Describe and perform the occupational requirements of a marine mechanical installer.		
12.04	Describe and perform the occupational requirements of a marine welder/fabricator.		

Florida Department of Education
Student Performance Standards

Course Title: **Maritime Repair/Refinishing Technology 3**
Course Number: **9202230**
Course Credit: **1**

Course Description:
The objective of this course is designed to develop the necessary skills and competencies for third year students preparing for a career in boat/yacht repair and refinishing occupations within the marine industry. The content includes, but is not limited to: properly securing a vessel, preparing surfaces for marine finishes, and preparing fiberglass surfaces for marine finishes.

For students enrolled in this course, the following safety requirement MUST be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSS-Sci

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
13.0	Demonstrate the ability to properly handle lines and related operations in securing a marine vessel.-The student will be able to:		
13.01	Demonstrate the use of, a minimum of eight (8), correct nautical knots used in securing a marine vessel.		
13.02	Identify and use current terminology of lines.		
13.03	Successfully demonstrate slowing a vessel in dock.		
13.04	Place fenderboards to protect a vessel.		
13.05	Connect ancillary services to a moored vessel.		
13.06	Demonstrate blocking and supporting a vessel for repair in a work yard.		
13.07	Successfully demonstrate and present two common methods of splicing.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
14.0	Demonstrate proficiency in preparing surfaces and applying marine paint finishes.-The student will be able to:		
14.01	Prepare wood surfaces for painting.		
14.02	Apply paint to wood surfaces by brush.		
14.03	Apply paint to wood surfaces by spray gun.		
14.04	Prepare aluminum surfaces for painting.		
14.05	Apply paint to aluminum surfaces by brush.		
14.06	Apply paint to aluminum surfaces by spray gun.		
14.07	Prepare steel surfaces for painting.		
14.08	Apply paint to steel surfaces by brush.		
14.09	Apply paint to steel surfaces by spray gun.		
15.0	Demonstrate proficiency in preparing surfaces and refinishing fiberglass.-The student will be able to:		
15.01	Prepare raw fiberglass surfaces for painting.		
15.02	Repair and refinish fiberglass surfaces.		

Florida Department of Education
Student Performance Standards

Course Title: **Maritime Repair/Refinishing Technology 4**
Course Number: **9202240**
Course Credit: **1**

Course Description:
The objective of this course is designed to develop the necessary skills and competencies for fourth year students preparing for a career in boat/yacht repair and refinishing occupations within the marine industry. The content includes, but is not limited to: employability skills, entrepreneurship, and coordinating work processes.

For students enrolled in this course, the following safety requirement MUST be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
16.0	Demonstrate employability skills.-The student will be able to:		
16.01	Conduct a job search using periodicals and the internet.		
16.02	Secure information about a job.		
16.03	Identify documents that may be required when applying for a job interview.		
16.04	Complete a job application form correctly.		
16.05	Demonstrate competence in job interview techniques.		
16.06	Identify or demonstrate appropriate responses to criticism from employer, supervisor or other employees.		
16.07	Identify acceptable work habits.		
16.08	Demonstrate knowledge of how to make appropriate job changes.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
16.09	Demonstrate acceptable employee health habits.		
16.10	Describe Federal Law as recorded in (29 CFR-1910.1200).		
17.0	Demonstrate an understanding of entrepreneurship.-The student will be able to:		
17.01	Define entrepreneurship.		
17.02	Describe the importance of entrepreneurship to the American economy.		
17.03	List the advantages and disadvantages of business ownership.		
17.04	Identify and explain the risks involved in ownership of a business.		
17.05	Identify and explain the necessary personal characteristics of a successful entrepreneur.		
17.06	Identify and explain the business skills needed to operate a small business efficiently and effectively.		
17.07	Identify and explain the various types of business structures, e.g. sole proprietor, S-Corporation, etc.		
18.0	Demonstrate proficiency in coordinating the manufacturing, repair and refinishing operations in the marine industry.-The student will be able to:		
18.01	Identify, demonstrate, and perform different types of work and production processes.		
18.02	Identify and explain the sequential order of work and production processes.		
18.03	Demonstrate and apply the ability to coordinate work and production processes in the boatyard manufacturing or refurbishing environment.		

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

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different

competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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
Standard 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

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.

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:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
A	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	
B	9202320	Electronic Systems Technology 2		1 credit	49-2094	3	
C	9202330	Electronic Systems Technology 3		1 credit	49-2094	3	
D	9202340	Electronic Systems Technology 4		1 credit	49-2094	3	
E	9202350 9202360	Electronic Systems Technology 5 Electronic Systems Technology 6		1 credit 1 credit	17-3023 17-3023	3 3	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Academic Alignment Table

Academic alignment is an ongoing, collaborative effort of professional educators specializing in the fields of science, mathematics, English/language arts, and Career and Technical Education (CTE). This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses. Career and Technical Education courses that have been aligned to the Next Generation Sunshine State Standards for Science and the Florida Standards for Mathematics and English/Language Arts will show the following data: the quantity of academic standards in the CTE course; the total number of standards contained in the academic course; and the percentage of alignment to the CTE course.

Courses	Anatomy/ Physiology Honors	Astronomy Solar/Galactic Honors	Biology 1	Chemistry 1	Earth-Space Science	Environmental Science	Genetics	Integrated Science	Marine Science 1 Honors	Physical Science	Physics 1
9202310	0/87 0%	0/80 0%	0/83 0%	0/69 0%	0/67 0%	0/70 0%	0/69 0%	0/82 0%	0/66 0%	0/74 0%	0/72 0%
9202320	0/87 0%	0/80 0%	0/83 0%	0/69 0%	0/67 0%	0/70 0%	0/69 0%	0/82 0%	0/66 0%	0/74 0%	0/72 0%
9202330	0/87 0%	0/80 0%	0/83 0%	0/69 0%	0/67 0%	0/70 0%	0/69 0%	0/82 0%	0/66 0%	0/74 0%	0/72 0%
9202340	0/87 0%	0/80 0%	0/83 0%	0/69 0%	0/67 0%	0/70 0%	0/69 0%	0/82 0%	0/66 0%	0/74 0%	0/72 0%
9202350	0/87 0%	0/80 0%	0/83 0%	0/69 0%	0/67 0%	0/70 0%	0/69 0%	0/82 0%	0/66 0%	0/74 0%	0/72 0%
9202360	0/87 0%	0/80 0%	0/83 0%	0/69 0%	0/67 0%	0/70 0%	0/69 0%	0/82 0%	0/66 0%	0/74 0%	0/72 0%

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9202310	0/67 0%	0/75 0%	0/54 0%	0/46 0%	0/45 0%	#	#
9202320	0/67 0%	0/75 0%	0/54 0%	0/46 0%	0/45 0%	#	#
9202330	0/67 0%	0/75 0%	0/54 0%	#	#	0/45 0%	0/45 0%
9202340	0/67 0%	0/75 0%	0/54 0%	#	#	0/45 0%	0/45 0%
9202350	0/67 0%	0/75 0%	0/54 0%	**	**	**	**
9202360	0/67 0%	0/75 0%	0/54 0%	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Florida Standards for Technical Subjects

Florida Standards (FS) for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects are the critical reading and writing literacy standards designed for grade 6 and above. These standards are predicated on teachers of history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. The FS for Mathematical Practices are designed for grades K-12 and describe varieties of expertise that educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

Instructors must incorporate the Florida Standards for Technical Subjects and Mathematical Practices throughout instruction of this CTE program.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

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.

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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 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		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
documentation.		

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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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		
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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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 nonsinusoidal 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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.

Special Notes

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the Electronic Systems Technician (J540300) postsecondary program.

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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: **Biomedical Equipment Technology**
Program Type: **Career Preparatory**
Career Cluster: **Manufacturing**

NOTE: This program has been **daggered for deletion** with 2018-2019 being the last cohort of students permitted to enroll in the program. **After 2018-2019, no new students may be enrolled** in this program. Students already enrolled in the program may, at the District's discretion, continue taking courses in the program until completion. The alternative enrollment option for students is Electronic Systems Technology (9202300).

Secondary – Career Preparatory	
Program Number	9204100
CIP Number	0615040105
Grade Level	9 – 12
Standard Length	4 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA, FL-TSA
SOC Codes (all applicable)	49-9062 – Medical Equipment Repairer 49-2094 – Electrical and Electronics Repairers, Commercial and Industrial 49-9071 – Maintenance and Repair Workers, General

Purpose

The purpose of this program is to prepare students for employment in an industry related to biomedical equipment technology, such as electronics troubleshooting, electronics assemblers, etc. 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. 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 three occupational completion points.

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:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
A	9540310	Electronics Fundamentals 1	BIOMED EQ 7G ELECTRONIC @7 7G MED EQUIP TEC 7G	1 credit	49-2094	3	
B	9204110	Electronics Equipment Troubleshooter		1 credit	49-9071	3	
C	9204120 9204130	Medical Electronics 1 Biomedical Electronics Technician		1 credit 1 credit	49-9062 49-9062	3 3	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Academic Alignment Table

Academic alignment is an ongoing, collaborative effort of professional educators specializing in the fields of science, mathematics, English/language arts, and Career and Technical Education (CTE). This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses. Career and Technical Education courses that have been aligned to the Next Generation Sunshine State Standards for Science and the Florida Standards for Mathematics and English/Language Arts will show the following data: the quantity of academic standards in the CTE course; the total number of standards contained in the academic course; and the percentage of alignment to the CTE course.

Courses	Anatomy/ Physiology Honors	Astronomy Solar/Galactic Honors	Biology 1	Chemistry 1	Earth-Space Science	Environmental Science	Genetics	Integrated Science	Marine Science 1 Honors	Physical Science	Physics 1
9540310	**	**	**	**	**	**	**	**	**	**	**
9204110	**	**	**	**	**	**	**	**	**	**	**
9204120	**	**	**	**	**	**	**	**	**	**	**
9204130	**	**	**	**	**	**	**	**	**	**	**

*** Alignment pending review* *# Alignment attempted, but no correlation to academic course*

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9540310	**	**	**	**	**	**	**
9204110	**	**	**	**	**	**	**
9204120	**	**	**	**	**	**	**
9204130	**	**	**	**	**	**	**

*** Alignment pending review* *# Alignment attempted, but no correlation to academic course*

Florida Standards for Technical Subjects

Florida Standards (FS) for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects are the critical reading and writing literacy standards designed for grade 6 and above. These standards are predicated on teachers of history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. The FS for Mathematical Practices are designed for grades K-12 and describe varieties of expertise that educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

Instructors must incorporate the Florida Standards for Technical Subjects and Mathematical Practices throughout instruction of this CTE program.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

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.

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 micro-processors.
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.

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Florida Department of Education
Student Performance Standards

Course Title: **Electronics Fundamentals 1**
Course Number: **9540310**
Course Credit: **1**

Course Description:
This course teaches basic DC an 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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
07.13 Analyze and troubleshoot frequency selective filter circuits.		
07.14 Define the characteristics of polyphase 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.		

Florida Department of Education
Student Performance Standards

Course Title: **Electronics Equipment Troubleshooter**
Course Number: **9204110**
Course Credit: **1**

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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 demultiplexer circuits.		
10.20 Troubleshoot multiplexer and demultiplexer circuits.		
10.21 Identify types of memory circuits.		
10.22 Relate the uses of digital-to-analog and analog-to-digital conversions.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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 micro-processors.-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		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

Florida Department of Education
Student Performance Standards

Course Title: **Medical Electronics 1**
Course Number: **9204120**
Course Credit: **1**

Course Description:
This course develops skills and understanding of advanced electronics circuits; semiconductor devices, fiber optics, and basic motor applications.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSS-Sci

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

Florida Department of Education
Student Performance Standards

Course Title: **Biomedical Electronics Technician**
Course Number: **9204130**
Course Credit: **1**

Course Description:
This course will develop skills and understanding of basic biomedical systems.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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 a 15 minute 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.		

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

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the first 600 hrs. in the Biomedical Equipment Repair Technology (J400100) postsecondary program.

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA and Florida Technology Student Association (FL-TSA) are the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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
Standard Length	5 Credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9041 – Industrial Machinery Mechanics

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.

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:

OCP	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		3	
	9204320	Machinery Maintenance 2		1 credit		3	
A	9204330	Machinery Maintenance 3		1 credit	49-9041	3	
B	8743240	Machinery Maintenance 4		1 credit	49-9041	3	
C	9204350	Industrial Machinery Mechanic Technology Capstone		1 credit	49-9041	3	PA

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Academic Alignment Table

Academic alignment is an ongoing, collaborative effort of professional educators specializing in the fields of science, mathematics, English/language arts, and Career and Technical Education (CTE). This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses. Career and Technical Education courses that have been aligned to the Next Generation Sunshine State Standards for Science and the Florida Standards for Mathematics and English/Language Arts will show the following data: the quantity of academic standards in the CTE course; the total number of standards contained in the academic course; and the percentage of alignment to the CTE course.

Courses	Anatomy/ Physiology Honors	Astronomy Solar/Galactic Honors	Biology 1	Chemistry 1	Earth-Space Science	Environmental Science	Genetics	Integrated Science	Marine Science 1 Honors	Physical Science	Physics 1
9204310	**	**	**	**	**	**	**	**	**	**	**
9204320	**	**	**	**	**	**	**	**	**	**	**
9204330	**	**	**	**	**	**	**	**	**	**	**
8743240	**	**	**	**	**	**	**	**	**	**	**
9204350	**	**	**	**	**	**	**	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9204310	**	**	**	**	**	**	**
9204320	**	**	**	**	**	**	**
9204330	**	**	**	**	**	**	**

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
8743240	**	**	**	**	**	**	**
9204350	**	**	**	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Florida Standards for Technical Subjects

Florida Standards (FS) for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects are the critical reading and writing literacy standards designed for grade 6 and above. These standards are predicated on teachers of history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. The FS for Mathematical Practices are designed for grades K-12 and describe varieties of expertise that educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

Instructors must incorporate the Florida Standards for Technical Subjects and Mathematical Practices throughout instruction of this CTE program.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

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.

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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).		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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. (eg. 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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSS-Sci

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSS-Sci

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	20.04 Install and maintain a contaminant-removal system.		
	20.05 Determine reservoir requirements.		
	20.06 Classify and select pumps for specific applications.		
	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.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		
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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA and NGSSS-Sci.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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:		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	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.		
	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.

Special Notes

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the first 600 hrs. in the following post-secondary programs:

Industrial Machinery Maintenance and Repair (I470303)
Millwright (I470313)

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the first 450 hrs. in the following post-secondary programs:

Industrial Machinery Maintenance and Repair 1 (J590100)
Millwright 1 (J590400)

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the first 150 hrs. in the following post-secondary programs:

Industrial Machinery Maintenance and Repair 2 (J590200)
Millwright 2 (J590500)

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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
Standard 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

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.

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:

OCP	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	PA
A	9204420	Welding Technology Fundamentals 2		1 credit	51-9198	3	PA
	9204430	Welding Technology Fundamentals 3		1 credit		3	PA
B	9204440	Welding Technology Fundamentals 4		1 credit	51-4121	3	PA
C	9204450	Welding Technology Fundamentals Capstone		1 credit	51-4121	3	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Academic Alignment Table

Academic alignment is an ongoing, collaborative effort of professional educators specializing in the fields of science, mathematics, English/language arts, and Career and Technical Education (CTE). This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses. Career and Technical Education courses that have been aligned to the Next Generation Sunshine State Standards for Science and the Florida Standards for Mathematics and English/Language Arts will show the following data: the quantity of academic standards in the CTE course; the total number of standards contained in the academic course; and the percentage of alignment to the CTE course.

Courses	Anatomy/ Physiology Honors	Astronomy Solar/Galactic Honors	Biology 1	Chemistry 1	Earth-Space Science	Environmental Science	Genetics	Integrated Science	Marine Science 1 Honors	Physical Science	Physics 1
9204410	**	**	**	**	**	**	**	**	**	**	**
9204420	**	**	**	**	**	**	**	**	**	**	**
9204430	**	**	**	**	**	**	**	**	**	**	**
9204440	**	**	**	**	**	**	**	**	**	**	**
9204450	**	**	**	**	**	**	**	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9204410	**	**	**	**	**	**	**
9204420	**	**	**	**	**	**	**
9204430	**	**	**	**	**	**	**

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9204440	**	**	**	**	**	**	**
9204450	**	**	**	**	**	**	**

** *Alignment pending review* # *Alignment attempted, but no correlation to academic course*

Florida Standards for Technical Subjects

Florida Standards (FS) for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects are the critical reading and writing literacy standards designed for grade 6 and above. These standards are predicated on teachers of history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. The FS for Mathematical Practices are designed for grades K-12 and describe varieties of expertise that educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education.

Instructors must incorporate the Florida Standards for Technical Subjects and Mathematical Practices throughout instruction of this CTE program.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

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.

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 Create a product using basic oxyfuel gas cutting principles and practices.
07.0 Apply intermediate oxyfuel 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 Conceive, design, and present a welding project(s) that encompass all the skills learned in the Welding Technology program.
19.0 Plan, organize, and carry out a project plan.
20.0 Formulate strategies to properly manage resources.
21.0 Use tools, materials, and processes in an appropriate and safe manner.
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

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA, NGSSS-Sci.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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 personal protective equipment (PPE).		
01.24	Demonstrate knowledge of ergonomic impact of work techniques.		
01.25	Demonstrate knowledge of, and follow applicable safety laws and 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)		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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 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.		
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 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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	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 oxyfuel 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.		

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 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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA, NGSSS-Sci.

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	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:		
	08.01 Apply Manual Air (Carbon Arc Gouging) and Cutting (CAC-A) skills.		
	08.02 Perform safety inspections of equipment and accessories.		
	08.03 Make minor external repairs to equipment and accessories.		
	08.04 Set up manual air carbon arc gouging and cutting operations.		
	08.05 Operate manual air carbon arc cutting equipment.		
	08.06 Perform metal removal operations.		
	08.07 Apply manual Arc Gouging and Arc Cutting (AC) skills.		
	08.08 Make minor repairs to equipment and accessories.		
	08.09 Set up for using plasma arc cutting operations.		
	08.10 Operate manual plasma arc cutting equipment.		
	08.11 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 oxyfuel 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 blue print using welding symbols.		
	10.03 Design a product from a working drawing or blue print created.		

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
10.04 Fabricate a product using the skills learned related to oxyfuel gas cutting and introductory shielded metal arc welding (SMAW).		
10.05 Create and deliver a presentation to communicate project results.		

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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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA, NGSSS-Sci.

CTE Standards and Benchmarks	FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
	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)		
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 blue print using welding symbols.		
	14.03 Design a product from a working drawing or blue print 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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA, NGSSS-Sci.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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	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 blue print using welding symbols learned.		
17.03	Design a product from a working drawing or blue print 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.		

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.

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

Note: This course is pending alignment in the following categories: FS-M/LA, and NGSSS-Sci.

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		

CTE Standards and Benchmarks		FS-M/LA	NGSSS-Sci
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.		
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.

Special Notes

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the first 600 hrs. in the Welding Technology (J400400) postsecondary program.

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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 Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). 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 an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. 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)	17-3029 – Engineering Technicians, Except Drafters, All Other

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**
SOC Code(s): **17-3029**

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.
01.02	Describe the use of current manufacturing machines, operating systems and mechanisms.
01.03	Estimate manpower needs and skills needed in assembly operations.
01.04	Describe the factors considered for tool design, maintenance, procurement and handling.
01.05	Demonstrate knowledge of gages, jigs and fixtures.
01.06	Analyze process changes for impact on product.
01.07	Identify principles and practices of production timing.
01.08	Identify effect of time and motion on productivity.
01.09	Identify effect of procedural changes on productivity.
01.10	Demonstrate knowledge of raw materials properties and requirements.
01.11	Follow engineering specifications and documentation in equipment setup.
01.12	Explain the importance of routine maintenance.
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	Apply standard dimensioning and tolerance rules.
02.03	Import and export various file types.
02.04	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	Apply knowledge of AC/DC theory.
03.03	Solve circuit problems using appropriate units and notation.
03.04	Solve problems using Ohm's Law.

	03.05 Solve problems using Watt's Law.
	03.06 Solve problems involving series and parallel impedance in circuits.
	03.07 Solve problems involving capacitance in circuits.
	03.08 Solve problems involving inductance in circuits.
	03.09 Solve AC problems involving peak value, instantaneous, average value and RMS values.
04.0	Demonstrate an understanding of safety, health, and environmental requirements.-The student will be able to:
	04.01 Wear appropriate Personal Protective Equipment (PPE).
	04.02 Follow appropriate safety procedures.
	04.03 Follow applicable safety and environmental laws and regulations.
	04.04 Maintain a clean and safe work environment.
	04.05 Maintain personal protection equipment.
	04.06 Report unsafe conditions and practices.
	04.07 Locate emergency equipment, exits, and alarms.
	04.08 Comply with established safety practices.
	04.09 Explain appropriate fire extinguishing procedures.
	04.10 Explain when a machine or a process should be stopped to investigate an unsafe condition.
	04.11 Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
	04.12 Demonstrate knowledge of government and company procedures, rules and regulations concerning incident investigations.
	04.13 Use and evaluate information resources such as SDS (Safety Data Sheets).
	04.14 Describe safe identification, handling, monitoring, and measurement of hazardous materials.
	04.15 Use appropriate electrical and mechanical safety procedures.
05.0	Demonstrate proficiency in use of quality assurance methods and quality control concepts.-The student will be able to:
	05.01 Monitor processes for quality.
	05.02 Inspect product for quality.
	05.03 Document quality measurements or observations.
	05.04 Compare process measurements to standards.
	05.05 Identify root causes using standard techniques.
	05.06 Identify Corrective Action and Preventive Action.
	05.07 Describe the concept of quality assurance in increasing productivity and promoting zero defects.
	05.08 Demonstrate knowledge of how to implement quality assurance principles and methods.
	05.09 Demonstrate knowledge of industry practices regarding quality management systems. (e.g. ISO 9000)

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 Identify and use power tools properly.
	06.03 Use inspection equipment appropriately.
	06.04 Implement appropriate testing techniques and procedures.
	06.05 Use appropriate measurement tools.
	06.06 Use appropriate safety monitoring and testing equipment.
	06.07 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 the problem.
	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 Document properly all corrective actions.
	07.06 Monitor and correct parameters during tests.
	07.07 Estimate and forecast time and resources needed to correct problem.
	07.08 Interpret technical drawings.
	07.09 Explain equipment modifications per engineering specifications.
	07.10 Identify potential safety hazards related to the problem.
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 Answer and ask questions coherently and concisely.
	08.06 Read critically to identify oversights and assumptions.
	08.07 Interact with co-workers using communication tools appropriately.
	08.08 Demonstrate knowledge of technical language and technical acronyms.
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 Perform a job search.
	11.02 Respond appropriately to professional criticism.
	11.03 Identify and practice professional work habits.
	11.04 Demonstrate acceptable employee health habits.
	11.05 Explain the Federal Law as recorded in (29 CFR-1910.1200).
	11.06 Demonstrate teamwork.
	11.07 Explain appropriate interview techniques.

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 intercurricular 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: **Digital Manufacturing Specialist**
Specialization Tract: **Digital Manufacturing**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615000009
Program Type	College Credit Certificate (CCC)
Program Length	24 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	17-3019 – Drafters, All Other 17-3026 – Industrial Engineering Technicians 17-3027 – Mechanical Engineering Technicians 17-3029 – Engineering Technicians, Except Drafters, All Other 27-1029 – Designers, All Other 51-4012 – Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic 51-4061 – Model Makers, Metal and Plastic 51-9082 – Medical Appliance Technicians

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 digital engineering applications for product design.
03.0 Demonstrate proficiency in the principles, concepts and applications in digital manufacturing processes.
04.0 Demonstrate proficiency in the principles, concepts and applications in fabrication techniques.
05.0 Demonstrate proficiency in the set-up and operation of manual and CNC machining centers.
06.0 Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software.

Florida Department of Education
Student Performance Standards

Program Title: **Digital Manufacturing Specialist**
CIP Number: **0615000009**
Program Length: **24 credit hours**
SOC Code(s): **17-3019, 17-3026, 17-3027, 17-3029, 27-1029, 51-4012, 51-4061, 51-9082**

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	Implement the CAD commands for three-dimensional drawings.
01.02	Implement and apply the CAD three-dimensional coordinate system for three- dimensional objects.
01.03	Use CAD three-dimensional surface commands for 3-dimensional objects.
01.04	Implement and apply basic software utilities for arranging, detailing, and plotting views of an object.
01.05	Create basic object designs in three dimensions.
01.06	Align, rotate, and mirror three-dimensional objects.
01.07	Render a three-dimensional model.
01.08	Customize screen, toolbars, and pull down menus.
01.09	Create a new part document and 2-D sketch views of a solid object.
01.10	Apply and edit dimensions on an object.
01.11	Create the standard drawing views to document the design.
01.12	Analyze the computer model and refine the design as necessary.
01.13	Measure and calculate properties of parts.
01.14	Enter and save data for an object model/drawing.
01.15	Create an assembly model with functional sufficient mates and constraints.
01.16	Define parts of an assembly in a design tree.
01.17	Apply basic solid modeling commands.
01.18	Apply orthographic projection principles to drawing’s layouts.
01.19	Convert multiple sketches into extruded features.
01.20	Create the desired sketch to document the design feature.

01.21	Analyze the sketch procedures and refine the sketch design as necessary.
01.22	Manage multiple parts using components of a design tree.
01.23	Create and insert render parts into the sheet environment of a solid modeling drawing.
01.24	Define the type of analysis of machine elements of a part.
01.25	Apply basic drawing concepts to molded parts.
01.26	Create detailed molds or die cavities of parts and assemblies.
01.27	Perform advanced assembly mates using multiple parts or sub-assemblies.
01.28	Understand the fit between components with clearance or interference.
01.29	Understand part tolerances and dimensional precision.
02.0	Demonstrate proficiency in digital engineering design fundamentals.-The student will be able to:
02.01	Create and execute advanced templates.
02.02	Convert multiple sketches into construction lines.
02.03	Create and use multiple work planes or reference geometry for advanced functions.
02.04	Create and modify bottom up assemblies.
02.05	Create multiple configurations of an individual part.
02.06	Apply basic drawing concepts to molded parts.
02.07	Create basic sheet metal drawings.
02.08	Create two and three-dimensional drawings related to industrial design.
02.09	Define fundamental two-dimensional and three-dimensional concepts of industrial design.
02.10	Demonstrate basic design principles of visual and spatial form as applied to products.
02.11	Analyze and refine an industrial design as necessary.
02.12	Apply design features to the two and three dimensional drawings.
02.13	Describe the fundamentals of product and system design as it relates to the manufacturing and structural considerations in design.
02.14	Describe the process of product and systems design.
02.15	Solve elementary problems related to the form and function of objects and structures.
02.16	Describe the fundamentals of material selection for product and system design.
02.17	Conduct a system design identifying the major phases.
02.18	Demonstrate understanding of coordinates measuring machines.
02.19	Demonstrate understanding of optical measuring machines.

	02.20	Capture physical 3D objects, and reverse engineer accurate CAD models from 3D scans.
	02.21	Perform 1, 2 and 3D measurement routines.
	02.22	Demonstrate ability to effectively collect, consolidate, evaluate, manage and present the information coming from industrial products.
	02.23	Demonstrate ability to effectively collect, consolidate, evaluate, manage and present the information coming from manufacturing operations.
	02.24	Demonstrate the proper use of precision hand tools.
	02.25	Understand part tolerances and precision and how they impact design performance.
	02.26	Understand the impact of part tolerances on clearance of fit between components.
03.0	Demonstrate proficiency in the principles, concepts and applications in digital manufacturing fundamentals.-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	Develop a part using 3D-CAD software.
	03.04	Perform initial part-build setup on a 3D printer.
	03.05	Describe the various additive manufacturing processes.
	03.06	Define the terminology used in additive manufacturing today.
	03.07	Describe the different hardware systems used in the production of prototypes, with emphasis on the specific additive manufacturing machines used in lab activities for this course.
	03.08	Identify and discuss three main categories of additive manufacturing processes, including specific additive manufacturing machine types used in each of the three categories.
	03.09	Describe the procedures for setting up an additive manufacturing process for a part run.
	03.10	Demonstrate skill in the use of measurement tools, and dimensional analysis of additive manufacturing models.
	03.11	Apply learned skills to finish additive manufacturing model projects.
	03.12	Maintain additive manufacturing machines and support equipment in proper working order.
	03.13	Communicate and execute model post process work to meet expectations.
	03.14	Provide post-processing support for the completion of rapid prototype models.
	03.15	Model conversion to additive manufacturing compatible file with appropriate precision, scale, and orientation.
	03.16	Understand additive machine variables and impact on characteristics of finished part (model, orientation, support material, laser thickness, nozzle diameter, machine geometry, infill pattern and density, and number of shells)
	03.17	Demonstrate integration of fasteners for robust assemblies of additive manufacturing produced components.
	03.18	Demonstrate and understanding of where different additive manufacturing methods apply in the design and production lifecycle.
	03.19	Demonstrate basic troubleshooting of additive manufacturing machine and file errors.

04.0	Demonstrate proficiency in the principles, concepts and applications in metal fabrication methods.-The student will be able to:
04.01	Understand professionalism in the manufacturing environment.
04.02	Understand, use and work with precision numbers.
04.03	Interpret mechanical drawings.
04.04	Demonstrate the use of geometric dimensioning and tolerancing.
04.05	Understand materials, and machining processes.
04.06	Demonstrate the safe and proper use of and the basic adjustments and maintenance for power tools according to the manufacturer's recommendations.
04.07	Identify the use and process in part layout.
04.08	Demonstrate a working knowledge of metal forming equipment.
04.09	Demonstrate the use of precision steel rulers.
04.10	Demonstrate the use of oxy – fuel cutting.
04.11	Demonstrate acceptable methods in tungsten inert gas welding.
04.12	Demonstrate acceptable methods in gas metal arc welding.
04.13	Demonstrate acceptable methods to use a dial indicator.
04.14	Explain the use of a height gauge to measure stock.
04.15	Demonstrate acceptable methods hand cutting and forming sheet metal.
04.16	Demonstrate the use of layout sheet metal tools.
04.17	Demonstrate acceptable methods using micro-counter sinks.
04.18	Demonstrate acceptable methods of riveting solid rivets.
04.19	Demonstrate acceptable methods to use an ironworker.
04.20	Demonstrate acceptable methods using a break and shear.
04.21	Demonstrate the use of dial calipers.
04.22	Identify and characterize composite materials and commodities.
04.23	Identify uses and hazards involved in handling common composite supplies.
04.24	Demonstrate knowledge of handling composite materials, adhesives, solvents, etc.
04.25	Identify tools used in composite fabrication and repair.
04.26	Demonstrate the safe and proper use of and the basic adjustments and maintenance for dust collection equipment according to the manufacturer's recommendations.
04.27	Set up and apply the use of clamps and vices.

05.0	Demonstrate proficiency in the set-up and operation of manual and CNC machining centers.-The student will be able to:
05.01	Set up and maintain a manual lathe and mill.
05.02	Demonstrate acceptable processes using a manual lathe and mill.
05.03	Demonstrate acceptable control of machining processes
05.04	Identify and define the physics of machine cutting metals.
05.05	Demonstrate the characteristics of machining cutting tools.
05.06	Define and identify parameters of cutting tool life.
05.07	Demonstrate efficient parameters in production processes.
05.08	Demonstrate the process to drill and layout holes to a specific size.
05.09	Identify baseline machining layout.
05.10	Identify manual machining procedures used in CNC programming.
05.11	Identify grinding machining practices and processes.
05.12	Identify thread types and tooling used in machining.
05.13	Identify metal alloys and their properties in machining.
05.14	Demonstrate job planning procedures in machining.
05.15	Demonstrate procedures to calculate cutting tool speeds and feeds.
05.16	Demonstrate methods for accessing machine RPM.
05.17	Identify coordinate and primary machining axes.
05.18	Define and describe Absolute and incremental coordinates.
05.19	Identify the five CNC drive components.
05.20	Demonstrate rapid travel and interpolation.
05.21	Identify and define industrial machining and turning centers.
05.22	Identify processes for program creation and data management.
05.23	Demonstrate acceptable procedures in starting CNC machines.
05.24	Demonstrate the CNC machine controls for set up and operation.
05.25	Demonstrate acceptable procedures to set up a CNC machining center.
05.26	Demonstrate acceptable procedures to run programs using a CNC machining center.
05.27	Demonstrate acceptable procedures to generate a CNC program.
05.28	Demonstrate acceptable procedures in CNC job planning.

	05.29 Identify cutting tools collets and holding fixtures.
	05.30 Identify CNC tooling and applications.
	05.31 Define CNC programming code words and conventions.
	05.32 Define and demonstrate CNC program fixed cycles.
	05.33 Explain basic use of CAD/CAM software and processes.
06.0	Demonstrate proficiency in computer-aided drafting/computer-aided manufacturing (CAD/CAM) software.-The student will be able to:
	06.01 Create CAD/CAM geometry for tool path processing.
	06.02 Demonstrate procedures to import/export CAD/CAM files.
	06.03 Demonstrate contouring using CAM tool path commands.
	06.04 Apply pocketing using CAM tool path commands.
	06.05 Demonstrate drill cycles using CAM tool path commands.
	06.06 Demonstrate thread cycles using CAM tool path commands.
	06.07 Demonstrate engraving using CAM tool path commands.
	06.08 Construct lettering using CAM tool path commands.
	06.09 Demonstrate nesting using CAM tool path commands.
	06.10 Describe procedures for CAM post-processing.
	06.11 Apply tool path verification for a CAM program.
	06.12 Apply job set-up procedures for a CAM program.
	06.13 Demonstrate ability to save, copy, delete, and rename computer files.
	06.14 Create a CNC machining working portfolio.
	06.15 Demonstrate the use of back plotting in a CAM program.
	06.16 Demonstrate how to modify an existing tool path.

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 intercurricular 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: **Rapid Prototyping Specialist**
Specialization Tract: **Digital Manufacturing**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615000012
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	17-3013 – Mechanical Drafters 17-3019 – Drafters, All Other 17-3026 – Industrial Engineering Technicians 17-3027 – Mechanical Engineering Technicians 17-3029 – Engineering Technicians, Except Drafters, All Other 27-1029 – Designers, All Other 51-4012 – Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic 51-4061 – Model Makers, Metal and Plastic 51-9082 – Medical Appliance Technicians

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 digital engineering applications 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: **0615000012**
Program Length: **12 credit hours**
SOC Code(s): **17-3013, 17-3019, 17-3026, 17-3027, 17-3029, 27-1029, 51-4012, 51-4061, 51-9082**

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	Implement the CAD commands for three-dimensional drawings.
01.02	Implement and apply the CAD three-dimensional coordinate system for three- dimensional objects.
01.03	Use CAD three-dimensional surface commands for 3-dimensional objects.
01.04	Implement and apply basic software utilities for arranging, detailing, and plotting views of an object.
01.05	Create basic object designs in three dimensions.
01.06	Align, rotate, and mirror three-dimensional objects.
01.07	Render a three-dimensional model.
01.08	Customize screen, toolbars, and pull down menus.
01.09	Create a new part document and 2-D sketch views of a solid object.
01.10	Apply and edit dimensions on an object.
01.11	Create the standard drawing views to document the design.
01.12	Analyze the computer model and refine the design as necessary.
01.13	Measure and calculate properties of parts.
01.14	Enter and save data for an object model/drawing.
01.15	Create an assembly model with functional sufficient mates and constraints.
01.16	Define parts of an assembly in a design tree.
01.17	Apply basic solid modeling commands.
01.18	Apply orthographic projection principles to drawing’s layouts.
01.19	Convert multiple sketches into extruded features.
01.20	Create the desired sketch to document the design feature.

01.21	Analyze the sketch procedures and refine the sketch design as necessary.
01.22	Manage multiple parts using components of a design tree.
01.23	Create and insert render parts into the sheet environment of a solid modeling drawing.
01.24	Define the type of analysis of machine elements of a part.
01.25	Apply basic drawing concepts to molded parts.
01.26	Create detailed molds or die cavities of parts and assemblies.
01.27	Perform advanced assembly mates using multiple parts or sub-assemblies.
01.28	Understand the fit between components with clearance or interference.
01.29	Understand part tolerances and dimensional precision.
02.0	Demonstrate proficiency in digital engineering applications for product design.-The student will be able to:
02.01	Create and execute advanced templates.
02.02	Convert multiple sketches into construction lines.
02.03	Create and use multiple work planes or reference geometry for advanced functions.
02.04	Create and modify bottom up assemblies.
02.05	Create multiple configurations of an individual part.
02.06	Apply basic drawing concepts to molded parts.
02.07	Create basic sheet metal drawings.
02.08	Create two and three-dimensional drawings related to industrial design.
02.09	Define fundamental two-dimensional and three-dimensional concepts of industrial design.
02.10	Demonstrate basic design principles of visual and spatial form as applied to products.
02.11	Analyze and refine an industrial design as necessary.
02.12	Apply design features to the two and three dimensional drawings.
02.13	Describe the fundamentals of product and system design as it relates to the manufacturing and structural considerations in design.
02.14	Describe the process of product and systems design.
02.15	Solve elementary problems related to the form and function of objects and structures.
02.16	Describe the fundamentals of material selection for product and system design.
02.17	Conduct a system design identifying the major phases.
02.18	Demonstrate understanding of coordinates measuring machines.
02.19	Demonstrate understanding of optical measuring machines.

	02.20	Capture physical 3D objects, and reverse engineer accurate CAD models from 3D scans.
	02.21	Perform 1, 2 and 3D measurement routines.
	02.22	Demonstrate ability to effectively collect, consolidate, evaluate, manage and present the information coming from industrial products.
	02.23	Demonstrate ability to effectively collect, consolidate, evaluate, manage and present the information coming from manufacturing operations.
	02.24	Demonstrate the proper use of precision hand tools.
	02.25	Understand part tolerances and precision and how they impact design performance.
	02.26	Understand the impact of part tolerances on clearance of fit between components.
03.0	Demonstrate proficiency in the principles, concepts and applications in digital manufacturing processes.-The student will be able to:	
	12.01	Fabricate a part or an assembly using an additive manufacturing machine.
	12.02	Compare the differing properties and characteristics of common materials used for additive manufacturing models.
	12.03	Develop a part using 3D-CAD software.
	12.04	Perform initial part-build setup on a 3D printer.
	12.05	Describe the various additive manufacturing processes.
	12.06	Define the terminology used in additive manufacturing today.
	12.07	Describe the different hardware systems used in the production of prototypes, with emphasis on the specific additive manufacturing machines used in lab activities for this course.
	12.08	Identify and discuss three main categories of additive manufacturing processes, including specific additive manufacturing machine types used in each of the three categories.
	12.09	Describe the procedures for setting up an additive manufacturing process for a part run.
	12.10	Demonstrate skill in the use of measurement tools, and dimensional analysis of additive manufacturing models.
	12.11	Apply learned skills to finish additive manufacturing model projects.
	12.12	Maintain additive manufacturing machines and support equipment in proper working order.
	12.13	Communicate and execute model post process work to meet expectations.
	12.14	Provide post-processing support for the completion of rapid prototype models.
	12.15	Model conversion to additive manufacturing compatible file with appropriate precision, scale, and orientation.
	12.16	Understand additive machine variables and impact on characteristics of finished part (model, orientation, support material, laser thickness, nozzle diameter, machine geometry, infill pattern and density, and number of shells)
	12.17	Demonstrate integration of fasteners for robust assemblies of additive manufacturing produced components.
	12.18	Demonstrate and understanding of where different additive manufacturing methods apply in the design and production lifecycle.
	12.19	Demonstrate basic troubleshooting of additive manufacturing machine and file errors.

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 intercurricular 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: **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)	17-3024 – Electro-Mechanical Technicians 17-3027 – Mechanical Engineering Technicians

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 Operate industrial automation systems.
11.0 Troubleshoot industrial automation systems.
12.0 Apply the principles of robotics to automated systems.
13.0 Use proficiently human machine interfaces to operate automated systems.

Florida Department of Education
Student Performance Standards

Program Title: **Mechatronics**
CIP Number: **0615000013**
Program Length: **30 credit hours**
SOC Code(s): **17-2024, 17-3027**

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.
01.02	Describe the use of current manufacturing machines, operating systems and mechanisms.
01.03	Estimate manpower needs and skills needed in assembly operations.
01.04	Describe the factors considered for tool design, maintenance, procurement and handling.
01.05	Demonstrate knowledge of gages, jigs and fixtures.
01.06	Analyze process changes for impact on product.
01.07	Identify principles and practices of production timing.
01.08	Identify effect of time and motion on productivity.
01.09	Identify effect of procedural changes on productivity.
01.10	Demonstrate knowledge of raw materials properties and requirements.
01.11	Follow engineering specifications and documentation in equipment setup.
01.12	Explain the importance of routine maintenance.
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	Apply standard dimensioning and tolerance rules.
02.03	Import and export various file types.
02.04	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	Apply knowledge of AC/DC theory.

	03.03 Solve circuit problems using appropriate units and notation.
	03.04 Solve problems using Ohm's Law.
	03.05 Solve problems using Watt’s Law.
	03.06 Solve problems involving series and parallel impedance in circuits.
	03.07 Solve problems involving capacitance in circuits.
	03.08 Solve problems involving inductance in circuits.
	03.09 Solve AC problems involving peak value, instantaneous, average value and RMS values.
04.0	Demonstrate an understanding of safety, health, and environmental requirements.-The student will be able to:
	04.01 Wear appropriate Personal Protective Equipment (PPE).
	04.02 Follow appropriate safety procedures.
	04.03 Follow applicable safety and environmental laws and regulations.
	04.04 Maintain a clean and safe work environment.
	04.05 Maintain personal protection equipment.
	04.06 Report unsafe conditions and practices.
	04.07 Locate emergency equipment, exits, and alarms.
	04.08 Comply with established safety practices.
	04.09 Explain appropriate fire extinguishing procedures.
	04.10 Explain when a machine or a process should be stopped to investigate an unsafe condition.
	04.11 Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
	04.12 Demonstrate knowledge of government and company procedures, rules and regulations concerning incident investigations.
	04.13 Use and evaluate information resources such as SDS (Safety Data Sheets).
	04.14 Describe safe identification, handling, monitoring, and measurement of hazardous materials.
	04.15 Use appropriate electrical and mechanical safety procedures.
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 Identify and use power tools properly.
	05.03 Use inspection equipment appropriately.
	05.04 Implement appropriate testing techniques and procedures.

	05.05 Use appropriate measurement tools.
	05.06 Use appropriate safety monitoring and testing equipment.
	05.07 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 the problem.
	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 Document properly all corrective actions.
	06.06 Monitor and correct parameters during tests.
	06.07 Estimate and forecast time and resources needed to correct problem.
	06.08 Interpret technical drawings.
	06.09 Explain equipment modifications per engineering specifications.
	06.10 Identify potential safety hazards related to the problem.
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 Answer and ask questions coherently and concisely.
	07.06 Read critically to identify oversights and assumptions.
	07.07 Interact with co-workers using communication tools appropriately.
	07.08 Demonstrate knowledge of technical language and technical acronyms.
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 flow diagrams of pneumatic, hydraulic, and electromechanical systems.
	09.03 Perform basic operation maintenance of pneumatic, hydraulic and electromechanical components, devices and/or machines.
	09.04 Understand maintenance requirements.
	09.05 Troubleshoot errors, faults, and inconsistencies in pneumatic, hydraulic and electromechanical components, machines and/or systems.
	09.06 Define special applications of electromechanical, hydraulic and pneumatic machines and devices used in manufacturing and process equipment.
	09.07 Describe important limitations of electromechanical, pneumatic and hydraulic machinery.
	09.08 Operate independent pneumatic, hydraulic and electrical machines properly.
	09.09 Describe the important operating parameters of pneumatic, hydraulic and electrical machines and/systems.
	09.10 Identify and use appropriate monitoring gages for pneumatic, hydraulic, and electromechanical machines and/or systems.
	09.11 Use safe practices while operating, troubleshooting and maintaining industrial equipment.
	09.12 Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.
10.0	Operate industrial automation systems.-The student will be able to:
	10.01 Interpret schematic diagrams.
	10.02 Analyze ladder logic diagrams for industrial automation systems.
	10.03 Identify Programmable Logic Controller input and output module locations.
	10.04 Match wiring harness identification to program addresses for input and output modules.
	10.05 Identify active and passive states of each module.
	10.06 Interpret flow charts to match field device components with the real devices.
	10.07 Identify when a programmable controller is in run or program mode, or is in a fault condition.
	10.08 Integrate control systems and equipment with production and production support mechanisms.
	10.09 Establish routine operations involving maintenance schedules.
	10.10 Troubleshoot problems and perform minor repairs to industrial automation systems.
	10.11 Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.
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	Isolate systems for troubleshooting.
11.03	Develop a strategy for making system improvements based on troubleshooting activities with strong focus on fail-safe methods
11.04	Identify needed expertise to resolve complex issues.
11.05	Participate in troubleshooting and resolution teams effectively.
11.06	Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.
12.0	Apply the principles of robotics to automated systems.-The student will be able to:
12.01	Identify and describe the essential components of a robotic system.
12.02	Choose appropriate robotic equipment for specific tasks.
12.03	Describe the various axis of robotic motion.
12.04	Describe the various methods for moving robot axis’s.
12.05	Choose and implement appropriate sensors for robotic applications.
12.06	Choose and install appropriate actuators for robotic applications.
12.07	Program robotic devices for restricted movements.
12.08	Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.
13.0	Use proficiently human machine interfaces to operate automated systems.-The student will be able to:
13.01	Match computer graphic icons to real field equipment
13.02	Establish communication for data flow between computer and controlled equipment.
13.03	Identify computer input and output signals and equipment destinations.
13.04	Implement manual override appropriately.
13.05	Perform computer based system and/or machine troubleshooting.
13.06	Define the essential components of an integrated HMI system.
13.07	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)

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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: **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)	51-4012 – Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic

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**
SOC Code(s): **51-4012**

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	Apply standard dimensioning and tolerance rules.
01.03	Import and export various file types.
01.04	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	Demonstrate or identify maintenance procedures used in manual and/or CNC machining centers.
02.02	Demonstrate processes using manual and/or CNC machining centers.
02.03	Demonstrate and/or identify mill & lathe machining processes.
02.04	Demonstrate or identify the application of chip load to calculate feed rate.
02.05	Demonstrate and/or identify the characteristics of machining cutting tools used to cut various materials.
02.06	Identify cutting tool geometry and cutting tool materials used in CNC machining.
02.07	Demonstrate efficient toolpath processes used in 2D and 3D High Speed CNC machining operations.
02.08	Demonstrate and/or identify CNC code used in drill and tap toolpath operations.
02.09	Demonstrate and/or identify the proper use of semi-precision measuring tools used in layout techniques in machining.
02.10	Demonstrate and/or identify CAM toolpath operations used in CNC machining.
02.11	Identify grinding machining practices and processes.
02.12	Demonstrate and/or identify threading operations and processes used in machining.
02.13	Identify metal alloys and their properties in machining.
02.14	Demonstrate job planning procedures in machining.
02.15	Demonstrate mathematical calculations used to determine CNC cutting tool speed and feed rate.

02.16	Demonstrate and/or identify the relationship of the Cartesian coordinate system used in CNC programming.
02.17	Identify the use of absolute and incremental coordinates in CNC programming.
02.18	Identify and/or demonstrate the relationship of primary CNC machining axis's to secondary CNC machining axes.
02.19	Identify the format of rapid travel, linear and circular interpolation used in CNC programming.
02.20	Demonstrate and/or identify manual and CNC machining operations used in machining.
02.21	Demonstrate abilities in reading, editing and verifying CNC programs.
02.22	Demonstrate procedures to startup and shut down CNC machining centers.
02.23	Demonstrate and/or identify procedures used to set up tooling used in CNC machining centers.
02.24	Demonstrate and/or identify procedures used to set work offsets and tool offsets on a CNC machining centers.
02.25	Demonstrate and/or identify procedures used to verify run CNC programs on a CNC machining centers.
02.26	Demonstrate acceptable procedures to generate a CNC program.
02.27	Demonstrate acceptable procedures in CNC job planning.
02.28	Select cutting tools, collets and holding fixtures.
02.29	Identify CNC tooling and applications.
02.30	Define CNC programming code words and conventions.
02.31	Define and demonstrate CNC program fixed cycles.
02.32	Demonstrate use of CAD/CAM software and processes.
02.33	Produce student generated projects.
02.34	Explain the use of a height gauge to measure stock.
02.35	Identify the axes on a CNC mill.
02.36	Demonstrate hand jog features on a CNC mill and CNC lathe.
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 toolpath processes used in CAD/CAM software.
03.02	Demonstrate procedures to import/export CAD files into CAM software.
03.03	Demonstrate Chaining processes used to select geometry for creating toolpath in CAM software.
03.04	Demonstrate applications in pocketing toolpath operations used in CAD/CAM software.
03.05	Demonstrate applications in drill cycle toolpath operations used in CAD/CAM software.
03.06	Demonstrate thread cycles using CAM tool path commands.
03.07	Demonstrate engraving using CAM tool path commands.

03.08	Demonstrate and /or identify applications in rotary axis indexing for toolpath operations used in CAD/CAM software.
03.09	Demonstrate applications in 2D high speed toolpath operations used in CAD/CAM software.
03.10	Demonstrate processes used to post a CNC program using CAD/CAM software.
03.11	Demonstrate verification and Backplot to confirm toolpath operations in a CAD/CAM design.
03.12	Demonstrate the use of parameters in CAD/CAM software to calculate toolpath operational feeds & speeds.
03.13	Demonstrate applications in surface machining high speed toolpaths (HST) used in CAD/CAM software.
03.14	Demonstrate and/or identify processes to setup work coordinate offsets used in CAD/CAM software.
03.15	Demonstrate and/or identify processes using multi-Axis toolpath operations used in CAD/CAM software.
03.16	Modify existing geometry used in a toolpath operation.

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 intercurricular 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)	17-3023 – Electrical and Electronic Engineering Technicians

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**
SOC Code(s): **17-3023**

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 using a 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 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 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 field effect transistors (FET).
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 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 intercurricular 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)	17-3023 – Electrical and Electronic Engineering Technicians

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**
SOC Code(s): **17-3023**

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 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 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 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 intercurricular 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)	17-3023 – Electrical and Electronic Engineering Technicians

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**
SOC Code(s): **17-3023**

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	Analyze and troubleshoot R-C, R-L, and RLC circuits.
02.11	Define the characteristics of frequency selective filter circuits.
02.12	Analyze and troubleshoot frequency selective filter circuits.
02.13	Define the characteristics of polyphase circuits.
02.14	Define basic motor theory and operation.
02.15	Define basic generator theory and operation.
02.16	Set up and operate power supplies for AC circuits.
02.17	Analyze and measure power in AC circuits.
02.18	Set up and operate capacitor and inductor analyzers for AC circuits.
02.19	Apply various network theorems to AC circuits.
02.20	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 diodes.
03.04	Construct and verify the operation of diode circuits.
03.05	Analyze and troubleshoot diode circuits.
03.06	Identify and define operating characteristics and applications of bipolar transistors.
03.07	Identify and define operating characteristics and applications of field effect transistors.
03.08	Identify and define operating characteristics and applications of single-stage amplifiers.

03.09	Construct and verify the operation of single-stage amplifiers.
03.10	Analyze and troubleshoot single-stage amplifiers.
03.11	Construct and verify thyristor circuitry.
03.12	Analyze and troubleshoot thyristor circuitry.
03.13	Set up and operate DVM for solid-state devices.
03.14	Set up and operate power supplies for solid-state devices.
03.15	Set up and operate oscilloscopes for solid-state devices.
03.16	Set up and operate function generators for solid-state devices.
03.17	Set up and operate capacitor and inductor analyzers for solid-state devices.
03.18	Set up and operate curve tracers.
03.19	Set up and operate transistor testers.
03.20	Construct and analyze electronic circuits for all operating parameters.
03.21	Set up and operate measuring instruments for electronic circuit analysis.
03.22	Select substitute components in troubleshooting.
03.23	Apply appropriate solid state circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.
03.24	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	Set up and operate pulsers for digital circuits.
04.06	Set up and operate oscilloscopes for digital circuits.
04.07	Set up and operate logic analyzers for digital circuits.
04.08	Set up and operate pulse generators for digital circuits.
04.09	Identify types of logic gates and their truth tables.
04.10	Construct combinational logic circuits using integrated circuits.
04.11	Troubleshoot logic circuits.

04.12	Analyze types of flip-flops and their truth tables.
04.13	Identify, define and measure characteristics of integrated circuit (IC) logic families.
04.14	Identify types of registers and counters.
04.15	Analyze clock and timing circuits.
04.16	Construct clock and timing circuits.
04.17	Identify types of arithmetic-logic circuits.
04.18	Construct arithmetic-logic circuits.
04.19	Identify types of encoding and decoding devices.
04.20	Construct encoders and decoders.
04.21	Identify types of multiplexer and demultiplexer circuits.
04.22	Construct multiplexer and demultiplexer circuits using integrated circuits.
04.23	Troubleshoot multiplexer and demultiplexer circuits.
04.24	Identify types of memory circuits.
04.25	Identify types of digital displays.
04.26	Set up and operate measuring instruments for digital circuit analysis.
04.27	Apply appropriate digital circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.
04.28	Select substitute components in 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 intercurricular 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)	17-3023 – Electrical and Electronic Engineering Technicians

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**
SOC Code(s): **17-3023**

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 using a 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 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 intercurricular 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)
Standard Length	23 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9062 – Medical Equipment Repairers

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, fluidic, 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**
SOC Code(s): **49-9062**

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 basic electrical signals.
06.02	Understand electrical diagrams.
06.03	Understand computer interface concepts.
06.04	Understand biomedical instrumentation.
06.05	Demonstrate proficiency in reading electrical diagrams.
06.06	Demonstrate proficiency in analyzing basic electrical systems.
06.07	Demonstrate proficiency in troubleshooting basic electrical systems.
06.08	Demonstrate proficiency in repairing basic electrical systems.
06.09	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 intercurricular 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)	17-3023 – Electrical and Electronic Engineering Technicians

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**
SOC Code(s): **17-3023**

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 using a 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 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 in analysis of a basic robotics and simulation systems.-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)

SkillsUSA is the intercurricular 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: **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)	17-3027 – Mechanical Engineering Technicians

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 Operate industrial automation systems.
02.0 Troubleshoot industrial automation systems.
03.0 Apply the principles of robotics to automated systems.
04.0 Use proficiently human machine interfaces to operate automated systems.

Florida Department of Education
Student Performance Standards

Program Title: **Automation**
CIP Number: **0615040601**
Program Length: **12 credit hours**
SOC Code(s): **17-3027**

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	Operate industrial automation systems.-The student will be able to:
01.01	Interpret schematic diagrams.
01.02	Analyze ladder logic diagrams for industrial automation systems.
01.03	Identify Programmable Logic Controller input and output module locations.
01.04	Match wiring harness identification to program addresses for input and output modules.
01.05	Identify active and passive states of each module.
01.06	Interpret flow charts to match field device components with the real devices.
01.07	Identify when a programmable controller is in run or program mode, or is in a fault condition.
01.08	Integrate control systems and equipment with production and production support mechanisms.
01.09	Establish routine operations involving maintenance schedules.
01.10	Troubleshoot problems and perform minor repairs to industrial automation systems.
01.11	Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.
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	Isolate systems for troubleshooting.
02.03	Develop a strategy for making system improvements based on troubleshooting activities with strong focus on fail-safe methods
02.04	Identify needed expertise to resolve complex issues.
02.05	Participate in troubleshooting and resolution teams effectively.
02.06	Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.
03.0	Apply the principles of robotics to automated systems.-The student will be able to:
03.01	Identify and describe the essential components of a robotic system.

	03.02 Choose appropriate robotic equipment for specific tasks.
	03.03 Describe the various axis of robotic motion.
	03.04 Describe the various methods for moving robot axis's.
	03.05 Choose and implement appropriate sensors for robotic applications.
	03.06 Choose and install appropriate actuators for robotic applications.
	03.07 Program robotic devices for restricted movements.
	03.08 Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.
04.0	Use proficiently human machine interfaces to operate automated systems.-The student will be able to:
	04.01 Match computer graphic icons to real field equipment
	04.02 Establish communication for data flow between computer and controlled equipment.
	04.03 Identify computer input and output signals and equipment destinations.
	04.04 Implement manual override appropriately.
	04.05 Perform computer based system and/or machine troubleshooting.
	04.06 Define the essential components of an integrated HMI system.
	04.07 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 intercurricular 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: **Alternative Energy Systems Specialist**
Specialization Tract: **Alternative Energy**
Career Cluster: **Manufacturing**

CCC	
CIP Number	0615050303
Program Type	College Credit Certificate (CCC)
Program Length	18 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	17-3023 – Electronics and Electronic Engineering Technicians 47-2231 – Solar Photovoltaic Installers 47-4099 – Construction and Related Workers, All Others

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 electricity and electronics.
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: **0615050303**
Program Length: **18 credit hours**
SOC Code(s): **17-3023; 47-2231; 47-4099**

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 electricity and electronics.-The student will be able to:
01.01	Use appropriate electrical circuit grounding techniques.
01.02	Apply knowledge of AC/DC theory.
01.03	Solve circuit problems using appropriate units and notation.
01.04	Solve problems using Ohm's Law.
01.05	Solve problems using Watt's Law.
01.06	Solve problems involving series and parallel impedance in circuits.
01.07	Solve problems involving capacitance in circuits.
01.08	Solve problems involving inductance in circuits.
01.09	Solve AC problems involving peak value, instantaneous, average value and RMS values.
02.0	Demonstrate an understanding of industrial safety, health, and environmental requirements.-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.
02.12	Demonstrate knowledge of government and company procedures, rules and regulations concerning incident investigations.
02.13	Use and evaluate information resources such as SDS (Safety Data Sheets).
02.14	Describe safe identification, handling, monitoring, and measurement of hazardous materials.
02.15	Use appropriate electrical and mechanical safety procedures.
03.0	Characterize alternative 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	Differentiate between alternative and renewable energy sources.
03.04	Discuss the feasibility of emerging energy resources.
03.05	Describe the major sources, scale, and impacts of alternative and renewable energy.
03.06	Draw and label a diagram of a solar electric renewable energy system.
03.07	Distinguish between various alternative energy sources and energy potential.
03.08	Describe the social and environmental impact of alternative energy technologies vs. traditional energy sources.
03.09	Explain the difference between passive solar and active solar thermal systems.
03.10	Evaluate advantages and disadvantages of various alternative energy sources.
03.11	Compare site selection requirements for various alternative energy installations.
03.12	Compute cost/benefit analysis and return on investment calculations for a project.
03.13	Evaluate local, state, and federal alternative energy rebates and incentives.
03.14	Explain the methods used to connect alternative 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	Site a solar energy system for optimal production based on the sun’s position.
04.03	Distinguish between an azimuth and altitude 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	Interpret basic schematics and sketches of various solar energy design configurations.

	04.09	Adapt the designs of solar energy systems for stand-alone and connected systems.
	04.10	Practice proper installation of solar energy system components.
	04.11	Demonstrate standard practices in system checkout, maintenance and troubleshooting a solar energy system.
	04.12	Determine appropriately sized components for a solar energy system.
	04.13	Describe benefits of alternative energy systems to the end customer through case studies.
05.0	Apply policy, regulation and good business practices for alternative energy systems.-The student will be able to:	
	05.01	Define 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	Use cost-benefit analyses to analyze various primary sources of energy.
	05.04	Discuss the effects of financial, technical, and economic trends on the past, current, and future energy industry.
	05.05	Demonstrate best practices for minimizing energy utilization.
	05.06	Apply best practices based for energy production and resources use.
	05.07	Determine how different climatic, geological, atmospheric, and human activities influence energy production and utilization.
	05.08	Identify conservation practices for natural resources used for energy production.
	05.09	Explain the environmental impacts of energy extraction, conservation, and storage systems.
	05.10	Discuss how the conversion to alternative energy affects various business sectors.
	05.11	Discuss the need for governmental regulations and policy for energy production and utilization.
	05.12	Compare and contrast local, state, and federal policy which positively and negatively effects the advancement of alternative energy investment and development.
	05.13	Explain structure of electrical power distribution system.
	05.14	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 intercurricular 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	0615050517
Program Type	College Credit Certificate (CCC)
Program Length	12 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	17-3023 – Electrical and Electronic Engineering Technicians

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: **0615050517**
Program Length: **12 credit hours**
SOC Code(s): **17-3023**

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 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 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 basic motor theory and operation.
03.06	Define basic generator theory and operation.
03.07	Setup and operate power supplies for AC circuits.
03.08	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)

SkillsUSA is the intercurricular 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)	17-3029 – Engineering Technicians, Except Drafters, All Other

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 electricity and electronics.
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**
SOC Code(s): **17-3029**

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 electricity and electronics.-The student will be able to:
01.01	Use appropriate electrical circuit grounding techniques.
01.02	Apply knowledge of AC/DC theory.
01.03	Solve circuit problems using appropriate units and notation.
01.04	Solve problems using Ohm's Law.
01.05	Solve problems using Watt's Law.
01.06	Solve problems involving series and parallel impedance in circuits.
01.07	Solve problems involving capacitance in circuits.
01.08	Solve problems involving inductance in circuits.
01.09	Solve AC problems involving peak value, instantaneous, average value and RMS values.
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	Identify and use power tools properly.
02.03	Use inspection equipment appropriately.
02.04	Implement appropriate testing techniques and procedures.
02.05	Use appropriate measurement tools.
02.06	Use appropriate safety monitoring and testing equipment.
02.07	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 intercurricular 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)	17-3027 – Mechanical Engineering Technicians

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, 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**
SOC Code(s): **17-3027**

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, quality control concepts.-The student will be able to:
01.01	Monitor processes for quality.
01.02	Inspect product for quality.
01.03	Document quality measurements or observations.
01.04	Compare process measurements to standards.
01.05	Identify root causes using standard techniques.
01.06	Identify Corrective Action and Preventive Action.
01.07	Describe the concept of quality assurance in increasing productivity and promoting zero defects.
01.08	Demonstrate knowledge of how to implement quality assurance principles and methods.
01.09	Demonstrate knowledge of industry practices regarding quality management systems. (e.g. ISO 9000)
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	Construct process flow charts.
02.03	Explain the role of management in production operations.
02.04	Integrate personnel, hardware, and software capabilities for timely completion of products and product orders.
02.05	Apply manufacturing resources planning and lean manufacturing principles to production and process planning.
02.06	Demonstrate good examples of lean manufacturing principles of kanban, synchronized flows, perfect first-time quality, waste minimization, continuous improvement, flexibility, and building long lasting relationships with suppliers and customers.
02.07	Implement minimization of wastes in the form of waiting time, inventory, processing, motion, over-production, transportation, and scrap.
02.08	Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.
02.09	Use six sigma tools to identify opportunities and drive improvements.

	02.10 Apply the PDCA (plan–do–check–adjust) method in improvement activities.
	02.11 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:
	03.01 Use appropriate software for supply chain management strategies.
	03.02 Illustrate how efficiency and effectiveness are necessary attributes of good operations management.
	03.03 Apply simulations used for layout and design of production operations.
	03.04 Apply engineering economy factors in equipment justification.
	03.05 Calculate machinery utilization.
	03.06 Demonstrate warehouse throughput systems.
	03.07 Demonstrate basic principles and methods of controlling work in progress.
	03.08 Follow raw materials from their source to distribution of the product.
	03.09 Develop strategies to identify improvement opportunities, prioritize and develop an implementation plan optimize production operations.
	03.10 Demonstrate strategies to optimize raw materials and products inventories to minimize waste
	03.11 Integrate control systems and equipment with production and production support mechanisms.
	03.12 Demonstrate automatic inventory accounting related monitoring and control systems.
	03.13 Implement automatic tracking of materials and products using bar codes, machine vision and sensing, and/or infrared technologies.
	03.14 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)

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Accommodations

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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)	17-3027 – Mechanical Engineering Technicians

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 electricity and electronics.
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**
SOC Code(s): **17-3027**

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.
01.02	Describe the use of current manufacturing machines, operating systems and mechanisms.
01.03	Estimate manpower needs and skills needed in assembly operations.
01.04	Describe the factors considered for tool design, maintenance, procurement and handling.
01.05	Demonstrate knowledge of gages, jigs and fixtures.
01.06	Analyze process changes for impact on product.
01.07	Identify principles and practices of production timing.
01.08	Identify effect of time and motion on productivity.
01.09	Identify effect of procedural changes on productivity.
01.10	Demonstrate knowledge of raw materials properties and requirements.
01.11	Follow engineering specifications and documentation in equipment setup.
01.12	Explain the importance of routine maintenance.
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	Apply knowledge of AC/DC theory.
02.03	Solve circuit problems using appropriate units and notation.
02.04	Solve problems using Ohm's Law.
02.05	Solve problems using Watt’s Law.
02.06	Solve problems involving series and parallel impedance in circuits.
02.07	Solve problems involving capacitance in circuits.

	02.08 Solve problems involving inductance in circuits.
	02.09 Solve AC problems involving peak value, instantaneous, average value and RMS values.
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 flow diagrams of pneumatic, hydraulic, and electromechanical systems.
	03.03 Perform basic operation maintenance of pneumatic, hydraulic and electromechanical components, devices and/or machines.
	03.04 Understand maintenance requirements.
	03.05 Troubleshoot errors, faults, and inconsistencies in pneumatic, hydraulic and electromechanical components, machines and/or systems.
	03.06 Define special applications of electromechanical, hydraulic and pneumatic machines and devices used in manufacturing and process equipment.
	03.07 Describe important limitations of electromechanical, pneumatic and hydraulic machinery.
	03.08 Operate independent pneumatic, hydraulic and electrical machines properly.
	03.09 Describe the important operating parameters of pneumatic, hydraulic and electrical machines and/systems.
	03.10 Identify and use appropriate monitoring gages for pneumatic, hydraulic, and electromechanical machines and/or systems.
	03.11 Use safe practices while operating, troubleshooting and maintaining industrial equipment.
	03.12 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)

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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: **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)	17-3026 – Industrial Engineering Technicians

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**
SOC Code(s): **17-3026**

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	Develop the basic cause-and-effect diagram (fishbone diagram).
01.04	Describe and develop the central limit theorem.
01.05	Develop a control plan to aid in production.
01.06	Define the cost-benefit analysis on the shop floor.
01.07	Define and describe the design of experiments (DOE) used in manufacturing processes.
01.08	Run the experiment.
01.09	Apply the DOE in manufacturing and non-manufacturing environments using the proper techniques.
01.10	Apply the techniques of Process Failure Modes and Effects Analysis (PFMEA).
01.11	Define and describe risk assessment.
01.12	Implement the 5S's method of sorting, setting in order, shining, standardizing, and sustaining.
01.13	Maintain and check the process through quality auditing.
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)

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Accommodations

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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)	17-3026 – Industrial Engineering Technicians

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**
SOC Code(s): **17-3026**

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 value stream mapping and other mapping methods.
01.04	Identify and apply just-in-time procedures.
01.05	Identify and apply the techniques in continual improvement.
01.06	Describe and explain the system of waste–free manufacturing (WFM).
01.07	Describe the changes necessary in implementing waste-free manufacturing in a lean environment.
01.08	Describe and explain supply chain management.
01.09	Describe and explain the use of the 5S's, (sort, set in order, shine, standardize, sustain).
01.10	Develop the techniques to manage change in the manufacturing environment.
01.11	Describe the concept of Nidoka, Heijunka, and quick changeover.
02.0	Demonstrate proficiency in developing self-directed work teams.-The student will be able to:
02.01	Describe and explain how teams are developed.
02.02	Demonstrate how effective team members operate.
02.03	Identify the organization techniques of starting a team.
02.04	Identify the limits and expectations of the team.
02.05	Identify and explain team problems.
02.06	Create work plans.
02.07	Identify the steps in ending a project.
02.08	Use data effectively in identifying issues.

	02.09	Implement changes through planning and communications.
	02.10	Update appropriate documentation in a project.
03.0	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 for operators.
	03.03	Describe the techniques using zero quality control (ZQC) techniques in manufacturing settings.
	03.04	Identify mistake proof devices for eliminating errors in manufacturing.
	03.05	Describe and apply the 5S's for efficiency, maintenance, and continuous improvement.
	03.06	Describe and explain the visual workplace environment.
	03.07	Define the terms associated with the quick changeover process.
	03.08	Identify the changeover techniques used in production.
	03.09	Describe and explain the streamlining process to reduce changeover time.
	03.10	Describe the terms used in overall equipment effectiveness (OEE).
	03.11	Describe and explain the process of total productive maintenance (TPM).
	03.12	Describe and explain tracking process in improving the effectiveness of the operating equipment.
	03.13	Define the terms associated with basic cellular manufacturing concepts.
	03.14	Identify production teams to basic cellular manufacturing and teamwork concepts.
	03.15	Identify steps required to convert to a cellular arrangement.
	03.16	Identify the techniques used in the kanban system for just-in-time (JIT).
04.0	Demonstrate proficiency in basic Six Sigma concepts.-The student will be able to:	
	04.01	Describe and explain the basic principles and theories of Six Sigma.
	04.02	Define the terms associated with Six Sigma.
	04.03	Describe the philosophy and methodology of Six Sigma.
	04.04	Define the five steps of the DMAIC (define, measure, analyze, improve, and control) model used in Six Sigma for quality improvement.
	04.05	Establish an advanced quality plan.
	04.06	Benchmark a project.
	04.07	Develop the basic cause-and-effect diagram (fishbone diagram).
	04.08	Describe and develop the central limit theorem.

04.09	Develop a control plan to aid in production.
04.10	Define the cost-benefit analysis on the shop floor.
04.11	Define and describe the design of experiments (DOE) used in manufacturing processes.
04.12	Run the experiment.
04.13	Apply the DOE in manufacturing and non-manufacturing environments using the proper techniques.
04.14	Apply the techniques of Process Failure Modes and Effects Analysis (PFMEA).
04.15	Define and describe risk assessment.
04.16	Implement the 5S's method of sorting, setting in order, shining, standardizing, and sustaining.
04.17	Maintain and check the process through quality auditing.
04.18	Apply the Six Sigma standards to non-manufacturing environments.
04.19	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)

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

	CCC
CIP Number	0615080102
Program Type	College Credit Certificate (CCC)
Standard Length	17 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	17-3021 – Aerospace Engineering and Operations Technicians

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**
SOC Code(s): **17-3021**

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 intercurricular 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
Standard Length	43 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	17-3021 – Aerospace Engineering and Operations Technicians

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**
SOC Code(s): **17-3021**

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 intercurricular 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)	51-4012 – Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic

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 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**
SOC Code(s): **51-4012**

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	Apply standard dimensioning and tolerance rules.
01.03	Import and export various file types.
01.04	Interpret technical drawings.
02.0	Demonstrate proficiency in 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 and the basic adjustments and maintenance according to the manufacturer's recommendations for the following equipment, to include but not limited to:
02.01.1	Saws
02.01.2	Planers
02.01.3	Jointers
02.01.4	Routers
02.01.5	Lathes
02.01.6	Drills
02.01.7	Nailers
02.01.8	Dust Collection
02.02	Set up and apply the use of clamps and vices.
02.03	Apply and use basic safety equipment (PPE).
02.04	Apply OSHA safety rules concerning PPE for eye protection.
02.05	Apply OSHA safety rules concerning PPE for hearing protection.
02.06	Identify and describe common wood working joints.

02.07	Demonstrate the use of wood glues, adhesives and epoxies.
02.08	Identify and describe rip, cross, miter, bevel, compound, and curved wood cuts.
02.09	Use wood stains and sealers.
02.10	Apply standard lumber dimensioning methods.
02.11	Identify and use basic woodworking layout tools.
02.12	Analyze lumber distortions and defects.
02.13	Define categories of hard and soft woods.
02.14	Demonstrate or identify CNC router set-up and operation.
03.0	Demonstrate proficiency in the set-up and operation of manual and CNC machining centers.-The student will be able to:
03.01	Demonstrate or identify maintenance procedures used in manual and/or CNC machining centers.
03.02	Demonstrate processes using manual and/or CNC machining centers.
03.03	Demonstrate and/or identify mill & lathe machining processes.
03.04	Demonstrate or identify the application of chip load to calculate feed rate.
03.05	Demonstrate and/or identify the characteristics of machining cutting tools used to cut various materials.
03.06	Identify cutting tool geometry and cutting tool materials used in CNC machining.
03.07	Demonstrate efficient toolpath processes used in 2D and 3D High Speed CNC machining operations.
03.08	Demonstrate and/or identify CNC code used in drill and tap toolpath operations.
03.09	Demonstrate and/or identify the proper use of semi-precision measuring tools used in layout techniques in machining.
03.10	Demonstrate and/or identify CAM toolpath operations used in CNC machining.
03.11	Identify grinding machining practices and processes.
03.12	Demonstrate and/or identify threading operations and processes used in machining.
03.13	Identify metal alloys and their properties in machining.
03.14	Demonstrate job planning procedures in machining.
03.15	Demonstrate mathematical calculations used to determine CNC cutting tool speed and feed rate.
03.16	Demonstrate and/or identify the relationship of the Cartesian coordinate system used in CNC programming.
03.17	Identify the use of absolute and incremental coordinates in CNC programming.
03.18	Identify and/or demonstrate the relationship of primary CNC machining axis's to secondary CNC machining axes.
03.19	Identify the format of rapid travel, linear and circular interpolation used in CNC programming.
03.20	Demonstrate and/or identify manual and CNC machining operations used in machining.

03.21	Demonstrate abilities in reading, editing and verifying CNC programs.
03.22	Demonstrate procedures to startup and shut down CNC machining centers.
03.23	Demonstrate and/or identify procedures used to set up tooling used in CNC machining centers.
03.24	Demonstrate and/or identify procedures used to set work offsets and tool offsets on a CNC machining centers.
03.25	Demonstrate and/or identify procedures used to verify run CNC programs on a CNC machining centers.
03.26	Demonstrate acceptable procedures to generate a CNC program.
03.27	Demonstrate acceptable procedures in CNC job planning.
03.28	Select cutting tools, collets and holding fixtures.
03.29	Identify CNC tooling and applications.
03.30	Define CNC programming code words and conventions.
03.31	Define and demonstrate CNC program fixed cycles.
03.32	Demonstrate use of CAD/CAM software and processes.
03.33	Produce student generated projects.
03.34	Explain the use of a height gauge to measure stock.
03.35	Identify the axes on a CNC mill.
03.36	Demonstrate hand jog features on a CNC mill and CNC lathe.
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 toolpath processes used in CAD/CAM software.
04.02	Demonstrate procedures to import/export CAD files into CAM software.
04.03	Demonstrate Chaining processes used to select geometry for creating toolpath in CAM software.
04.04	Demonstrate applications in pocketing toolpath operations used in CAD/CAM software.
04.05	Demonstrate applications in drill cycle toolpath operations used in CAD/CAM software.
04.06	Demonstrate thread cycles using CAM tool path commands.
04.07	Demonstrate engraving using CAM tool path commands.
04.08	Demonstrate and /or identify applications in rotary axis indexing for toolpath operations used in CAD/CAM software.
04.09	Demonstrate applications in 2D high speed toolpath operations used in CAD/CAM software.
04.10	Demonstrate processes used to post a CNC program using CAD/CAM software.
04.11	Demonstrate verification and Backplot to confirm toolpath operations in a CAD/CAM design.
04.12	Demonstrate the use of parameters in CAD/CAM software to calculate toolpath operational feeds & speeds.

04.13	Demonstrate applications in surface machining high speed toolpaths (HST) used in CAD/CAM software.
04.14	Demonstrate and/or identify processes to setup work coordinate offsets used in CAD/CAM software.
04.15	Demonstrate and/or identify processes using multi-Axis toolpath operations used in CAD/CAM software.
04.16	Modify existing geometry used in a toolpath operation.

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 intercurricular 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)	51-4012 – Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic 27-1021 – Commercial and Industrial Designers

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**
SOC Code(s): **51-4012, 27-1021**

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	Demonstrate or identify maintenance procedures used in manual and/or CNC machining centers.
01.02	Demonstrate processes using manual and/or CNC machining centers.
01.03	Demonstrate and/or identify mill & lathe machining processes.
01.04	Demonstrate or identify the application of chip load to calculate feed rate.
01.05	Demonstrate and/or identify the characteristics of machining cutting tools used to cut various materials.
01.06	Identify cutting tool geometry and cutting tool materials used in CNC machining.
01.07	Demonstrate efficient toolpath processes used in 2D and 3D High Speed CNC machining operations.
01.08	Demonstrate and/or identify CNC code used in drill and tap toolpath operations.
01.09	Demonstrate and/or identify the proper use of semi-precision measuring tools used in layout techniques in machining.
01.10	Demonstrate and/or identify CAM toolpath operations used in CNC machining.
01.11	Identify grinding machining practices and processes.
01.12	Demonstrate and/or identify threading operations and processes used in machining.
01.13	Identify metal alloys and their properties in machining.
01.14	Demonstrate job planning procedures in machining.
01.15	Demonstrate mathematical calculations used to determine CNC cutting tool speed and feed rate.
01.16	Demonstrate and/or identify the relationship of the Cartesian coordinate system used in CNC programming.
01.17	Identify the use of absolute and incremental coordinates in CNC programming.
01.18	Identify and/or demonstrate the relationship of primary CNC machining axis's to secondary CNC machining axes.
01.19	Identify the format of rapid travel, linear and circular interpolation used in CNC programming.
01.20	Demonstrate and/or identify manual and CNC machining operations used in machining.

01.21	Demonstrate abilities in reading, editing and verifying CNC programs.
01.22	Demonstrate procedures to startup and shut down CNC machining centers.
01.23	Demonstrate and/or identify procedures used to set up tooling used in CNC machining centers.
01.24	Demonstrate and/or identify procedures used to set work offsets and tool offsets on a CNC machining centers.
01.25	Demonstrate and/or identify procedures used to verify run CNC programs on a CNC machining centers.
01.26	Demonstrate acceptable procedures to generate a CNC program.
01.27	Demonstrate acceptable procedures in CNC job planning.
01.28	Select cutting tools, collets and holding fixtures.
01.29	Identify CNC tooling and applications.
01.30	Define CNC programming code words and conventions.
01.31	Define and demonstrate CNC program fixed cycles.
01.32	Demonstrate use of CAD/CAM software and processes.
01.33	Produce student generated projects.
01.34	Explain the use of a height gauge to measure stock.
01.35	Identify the axes on a CNC mill.
01.36	Demonstrate hand jog features on a CNC mill and CNC lathe.
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 toolpath processes used in CAD/CAM software.
02.02	Demonstrate procedures to import/export CAD files into CAM software.
02.03	Demonstrate Chaining processes used to select geometry for creating toolpath in CAM software.
02.04	Demonstrate applications in pocketing toolpath operations used in CAD/CAM software.
02.05	Demonstrate applications in drill cycle toolpath operations used in CAD/CAM software.
02.06	Demonstrate thread cycles using CAM tool path commands.
02.07	Demonstrate engraving using CAM tool path commands.
02.08	Demonstrate and /or identify applications in rotary axis indexing for toolpath operations used in CAD/CAM software.
02.09	Demonstrate applications in 2D high speed toolpath operations used in CAD/CAM software.
02.10	Demonstrate processes used to post a CNC program using CAD/CAM software.
02.11	Demonstrate verification and Backplot to confirm toolpath operations in a CAD/CAM design.
02.12	Demonstrate the use of parameters in CAD/CAM software to calculate toolpath operational feeds & speeds.

	02.13 Demonstrate applications in surface machining high speed toolpaths (HST) used in CAD/CAM software.
	02.14 Demonstrate and/or identify processes to setup work coordinate offsets used in CAD/CAM software.
	02.15 Demonstrate and/or identify processes using multi-Axis toolpath operations used in CAD/CAM software.
	02.16 Modify existing geometry used in a toolpath operation.
03.0	Demonstrate proficiency in solid modeling design and programming.-The student will be able to:
	03.01 Demonstrate applications in using 2D geometry to create solid models.
	03.02 Demonstrate applications in using Revolved surface to create solid models.
	03.03 Apply extrude, hole, fillet, chamfer and patterns to solid models.
	03.04 Edit features in solid a model.
	03.05 Demonstrate procedures used to import/export solid model files into CAM software.
	03.06 Demonstrate and/or identify applications in high speed machining (HSM) toolpath to solid models used in CAM software.
	03.07 Select tooling used in 2D and 3D toolpath operations.
	03.08 Demonstrate applications in surface machining high speed toolpaths (HST) to a solid model used in CAM software.
	03.09 Demonstrate and/or identify processes used to determine physical properties of solid models.
	03.10 Create assembly models using solid modeling software.
	03.11 Create ruled surfaces in solid a model.
	03.12 Apply and/or identify thread mill toolpath to a solid model.
	03.13 Apply geometric relations to generate solid models.
	03.14 Create working drawings to include orthographic views, sections and dimensions using a solid model.
	03.15 Apply Geometric Dimensioning and Tolerancing to drawing.
	03.16 Apply extrude, cut, thread and shell solid modeling design features to solid models.
	03.17 Apply draft, rib, pattern, and swept solid modeling design features to solid models.
	03.18 Identify and/or apply additive manufacturing processes to solid models.
	03.19 Identify simulation processes used in solid modeling.
	03.20 Identify and research emerging technologies used in 3-D modeling.

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 intercurricular 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: **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)	17-2051 – Civil Engineers 17-3019 – Drafters, All Other 17-3012 – Electrical and Electronics Drafters 27-1029 – Designers, All Other 17-3026 – Industrial Engineering Technicians 17-3013 – Mechanical Drafters

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**
SOC Code(s): **17-2051, 17-3019, 17-3012, 27-1029, 17-3026, 17-3013**

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 drawings 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 configuration 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 Plot multiple views of and render 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 intercurricular 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: **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)	29-2071 – Medical Records and Health Information Technicians 31-9092 – Medical Assistants 29-2012 – Medical and Clinical Laboratory Technicians 51-9082 – Medical Appliance Technicians 11-9111 – Medical and Health Services Managers 17-2031 – Biomedical Engineers 19-4021 – Biological Technicians

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**
SOC Code(s): **29-2071, 31-9092, 29-2012, 51-9082, 11-9111, 17-2031, 19-4021**

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 (C.F.R.) 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)

SkillsUSA is the intercurricular 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: **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)	19-4031 – Chemical Technicians

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 safety 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**
SOC Code(s): **19-4031**

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 log book.
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:
Specialty I: Organic Chemistry--The student will be able to:	
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--The student will be able to:	

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--The student will be able to:	
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, acidfast staining, spore staining, capsular staining and flagellar staining.
05.43	Describe the characteristics that identify by form yeasts, rickettsias, PPLs, viruses and molds, and show how they are distinguished from other organisms.
05.44	List the factors that affect colonial growth.
Specialty IV: Engineering--The student will be able to:	
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--The student will be able to:	
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 principle, safety features and use of common bioseparation 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--The student will be able to:	
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 ~~know~~ 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 intercurricular 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)	19-4031 – Chemical Technicians

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**
SOC Code(s): **19-4031**

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 chemical and other 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 intercurricular 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)	15-1151 – Computer User Support Specialists

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**
SOC Code(s): **15-1151**

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)

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

CCC	
CIP Number	0647061608
Program Type	College Credit Certificate (CCC)
Program Length	19 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	51-2091 – Fiberglass Laminators and Fabricators

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 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: **0647061608**
Program Length: **19 credit hours**
SOC Code(s): **51-2091**

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 safety, health, and environmental requirements.-The student will be able to:
01.01	Wear appropriate Personal Protective Equipment (PPE).
01.02	Follow appropriate safety procedures.
01.03	Follow applicable safety and environmental laws and regulations.
01.04	Maintain a clean and safe work environment.
01.05	Maintain personal protection equipment.
01.06	Report unsafe conditions and practices.
01.07	Locate emergency equipment, exits, and alarms.
01.08	Comply with established safety practices.
01.09	Explain appropriate fire extinguishing procedures.
01.10	Explain when a machine or a process should be stopped to investigate an unsafe condition.
01.11	Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
01.12	Demonstrate knowledge of government and company procedures, rules and regulations concerning incident investigations.
01.13	Use and evaluate information resources such as SDS (Safety Data Sheets).
01.14	Describe safe identification, handling, monitoring, and measurement of hazardous materials.
01.15	Use appropriate electrical and mechanical safety procedures.
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	Identify and use power tools properly.
02.03	Use inspection equipment appropriately.
02.04	Implement appropriate testing techniques and procedures.
02.05	Use appropriate measurement tools.
02.06	Use appropriate safety monitoring and testing equipment.

	02.07 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 the problem.
	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 Document properly all corrective actions.
	03.06 Monitor and correct parameters during tests.
	03.07 Estimate and forecast time and resources needed to correct problem.
	03.08 Interpret technical drawings.
	03.09 Explain equipment modifications per engineering specifications.
	03.10 Identify potential safety hazards related to the problem.
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 intercurricular 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.