

July 2010

**Florida Department of Education
Curriculum Framework**

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

	AS	AAS
CIP Number	1615000001	0615000001
Program Type	College Credit	College Credit
Standard Length	60 credit hours	60 credit hours
CTSO	SkillsUSA	SkillsUSA
SOC Codes (all applicable)	11-9111, 17-2031, 17-2051, 17-3012, 17-3013, 17-3019, 17-3023, 17-3026, 17-3027, 17-3029, 19-4021, 27-1029, 29-2012, 29-2071, 31-9092, 51-4012, 51-9082	11-9111, 17-2031, 17-2051, 17-3012, 17-3013, 17-3019, 17-3023, 17-3026, 17-3027, 17-3029, 19-4021, 27-1029, 29-2012, 29-2071, 31-9092, 51-4012, 51-9082
Targeted Occupation List	http://www.labormarketinfo.com/wec/TargetOccupationList.htm	
Perkins Technical Skill Attainment Inventory	http://www.fldoe.org/workforce/perkins/perkins_resources.asp	

Purpose

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

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

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

Program Structure

This program is a planned sequence of instruction consisting of eight specializations with one common core. It is recommended that students complete the core or demonstrate a mastery of the student performance standards contained in the core before advancing to the course(s) in the next level of specialization. The common core consists of 18 credit hours of technical core courses from the following areas: instrumentation and measurement, manufacturing processes and materials, quality, computer-aided drafting, electronics, and safety. The total Associate in Science /Associate in Applied Science degree program(s) consists of 60 credit hours.

The 18 credit hour technical core has been defined to align with the Manufacturing Skills Standards Council's (MSSC) skills standards. MSSC skill standards define the knowledge, skills, and performance needed by today's frontline manufacturing workers. After completing this core and the General Education requirements, it is anticipated that students will be prepared to pass the MSSC Production Technician Certification.

Laboratory Activities

Laboratory activities are an integral part of this program. 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.

Special Notes

Career and Technical Student Organization (CTSO)

SkillsUSA is the appropriate 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 as identified on the secondary student's IEP or 504 plan or postsecondary student's accommodations plan 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 postsecondary service provider. 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.

Articulation

To be transferable statewide between institutions, this program must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific articulation agreements with each other.

The following industry certifications articulate credit into this degree program. These statewide articulation agreements have been approved by the Articulation Coordinating Committee.

MSSC - Production Technician Certification (MSSCN001) – 15 Credit Hours

For details on existing articulation agreements, refer to http://www.fldoe.org/workforce/dwdframe/artic_frame.asp.

Program Length

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The AAS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS. The standard length of this program is 60 credit hours according to Rule 6A-14.030, F.A.C.

Certificate Programs

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

Engineering Technology Support Specialist (0615061304) - 18 Credits
Automation (0615061301) – 12 (Primary) or 15 (Secondary) Credits
Lean Manufacturing (0615061302) – 12 Credits
Pneumatics, Hydraulics & Motors For Manufacturing (0615061303) – 12 Credits
Applied Technology Specialist (0615040302) – 16 Credits
Composite Fabrication and Testing (0615000002) - 12 (Primary) or 19 (Secondary) Credits
Electronics Aide (0615030313) - 12 Credits
Computerized Woodworking (0615080501) – 12 Credits
CNC Machinist (0615080502) – 12 Credits
Lean Six Sigma Green Belt Certificate (0615070203) – 12 Credits
Six Sigma Black Belt Certificate (0615070202) – 12 Credits
Alternative Energy Systems Specialist (0615000003) – 18 (Primary) or 15 (Secondary) Credits
Computer-Aided Design and Drafting (0615000004) – 24 Credits
Medical Quality Systems (0615000005) – 15 Credits

Standards for the above certificate programs are contained in separate curriculum frameworks.

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 electronics and electricity.

- 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.

In addition, students will complete the objectives in one of the following specializations:

Specialization Track	SOC Code	Page Number
Advanced Manufacturing	17-3027	10
Quality	17-3026	14
Mechanical Design and Fabrication	51-4012	18
Electronics	17-3023	23
Advanced Technology	17-3029	28
Alternative Energy	17-3023	31
Biomedical Systems	19-4021	35
Digital Design and Modeling	17-3026	39

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**Florida Department of Education
Student Performance Standards**

Program Title: Engineering Technology
CIP Numbers: AS - 161500001 AAS - 061500001
Program Length: 60 Credit Hours
SOC Code(s): 17-3023, 17-3026, 17-3027, 17-3029, 51-4012

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The AAS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS. 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 Demonstrate knowledge of current manufacturing processes.
 - 01.02 Demonstrate knowledge of the use of current manufacturing machines, operating systems and mechanisms.
 - 01.03 Estimate manpower needs and skills needed in assembly operations.
 - 01.04 Demonstrate knowledge of the criteria for tool design, maintenance, procurement and handling.
 - 01.05 Demonstrate knowledge of gage design, usage and limitations.
 - 01.06 Analyze and recommend the usage of jigs and fixtures, including effectors and special grippers for automated systems.
 - 01.07 Demonstrate knowledge of processes used to ensure that changes do not negatively impact production or product.
 - 01.08 Demonstrate knowledge of production timing to ensure customer satisfaction and on-time delivery.
 - 01.09 Demonstrate knowledge of time and motion to enhance productivity.
 - 01.10 Make continuous adjustments to equipment and procedures that result in improved productivity.
 - 01.11 Demonstrate knowledge of how raw materials are moved.
 - 01.12 Setup or modify new equipment per engineering specifications and documentations.
 - 01.13 Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment on operations.
- 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 Construct geometric figures.
 - 02.03 Create and edit text formatted to industry standards.
 - 02.04 Use and control accuracy-enhancement tools for entity-positioning methods.
 - 02.05 Identify, create, store, and use standard part symbols and libraries.
 - 02.06 Control entity properties by layer, color, and line type.
 - 02.07 Use viewing commands to perform zooming and panning.
 - 02.08 Use Query commands to interrogate database for entity characteristics.
 - 02.09 Plot drawings on media using layout and scale.
 - 02.10 Prepare drawings for flexibility of future editing and minimum file size.

- 02.11 Apply standard dimensioning rules.
- 02.12 Demonstrate proficiency importing and exporting various files types.
- 02.13 Operate related peripheral devices.
- 02.14 Read and interpret technical drawings to assure conformity of product.
- 02.15 Demonstrate skill in assessing and reading schematics and drawings.

03.0 Demonstrate a fundamental understanding of electronics and electricity - The student will be able to:

- 03.01 Use appropriate grounding techniques.
- 03.02 Demonstrate knowledge of AC/DC theory.
- 03.03 Solve circuit problems using unit conversion and scientific notation.
- 03.04 Solve problems involving electric charge, electric current, potential difference, energy and Ohm's Law.
- 03.05 Solve problems in electric circuits involving work and power.
- 03.06 Solve problems involving series and parallel resistance circuits.
- 03.07 Solve problems involving capacitance in DC circuits.
- 03.08 Solve problems involving magnetic circuits.
- 03.09 Solve problems involving inductance in DC circuits.
- 03.10 Solve A.C. problems involving peak value, instantaneous, average value and RMS value of a sine wave.
- 03.11 Solve problems on factors governing reactance in A.C. circuits.
- 03.12 Solve impedance problems in A.C. circuits.
- 03.13 Prepare and complete concise, neat and accurate lab reports.

04.0 Demonstrate an understanding of safety, health, and environmental requirements - The student will be able to:

- 04.01 Communicate any new or revised safety procedures.
- 04.02 Update personnel about current safety guidelines.
- 04.03 Wear appropriate Personal Protective Equipment (PPE).
- 04.04 Follow area-posted safety guidelines.
- 04.05 Demonstrate knowledge of, and follow applicable safety laws and regulations and the environment (e.g., Occupational Safety and Health Administration (OSHA)).
- 04.06 Maintain a clean and safe work environment.
- 04.07 Maintain personal protection equipment.
- 04.08 Report unsafe conditions/practices.
- 04.09 Locate emergency exits and alarms.
- 04.10 Comply with company-established safety practices.
- 04.11 Use appropriate fire fighting procedures.
- 04.12 Apply Occupational Safety Health Administration (OSHA) safety standards properly.
- 04.13 Demonstrate knowledge of when a machine or a process should be stopped to investigate or correct a hazard.
- 04.14 Demonstrate knowledge of regulatory agency fines and requirement for corrective actions.
- 04.15 Demonstrate knowledge of government and company procedures, rules and regulations concerning incident investigations.
- 04.16 Demonstrate knowledge of incident reporting procedures.

- 04.17 Use and evaluate information resources such as MSDS (Material Safety Data Sheets).
 - 04.18 Demonstrate knowledge of National Institute of Occupational Safety and Health (NIOSH), Environmental Protection Agency (EPA) and other regulatory agencies recommendations, guidelines and best practices.
 - 04.19 Demonstrate knowledge of how to safely identify, handle, monitor and measure hazardous materials.
- 05.0 Demonstrate proficiency in use of quality assurance methods, 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 by filling out quality charts and records.
 - 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 Apply data collection methods for productivity improvement and reporting.
 - 05.09 Analyze data using tools and techniques for productivity and quality problems.
 - 05.10 Analyze data using tools and techniques for cause and effect relationships.
 - 05.11 Develop and apply quality improvement strategies.
 - 05.12 Demonstrate an understanding of a quality process's capability and its applications.
 - 05.13 Demonstrate knowledge of how to implement quality assurance principles and methods.
 - 05.14 Demonstrate knowledge of quality assurance checks for inspections.
 - 05.15 Demonstrate an understanding of internal and external supply chains.
 - 05.16 Demonstrate understanding of the configuration of management.
 - 05.17 Demonstrate knowledge of standard industry practices regarding inventory control methods and procedures.
 - 05.18 Demonstrate knowledge of production floor plan and safety requirements to place materials in most efficient and safe location and position.
 - 05.19 Demonstrate knowledge of storage space available to establish lot sizes and reorder points.
 - 05.20 Demonstrate knowledge of proper forecasts and methods for conducting inventory audits to recognize and report inventory discrepancies.
 - 05.21 Identify significant inventory discrepancies.
 - 05.22 Use cycle count process to ensure accurate counts are taken.
 - 05.23 Demonstrate knowledge of trade-off techniques (e.g., balance lead time and cycle time issues with inventory)
- 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 regimes.

- 06.05 Use appropriate measurement tools (e.g., micrometers, tapes. etc).
 - 06.06 Use appropriate safety monitoring and testing equipment.
 - 06.07 Communicate issues with hand sketches.
 - 06.08 Use electronic measuring equipment and instruments.
 - 06.09 Use multi-gauging to inspect, verify, and document whether product dimensions meet customer requirements.
- 07.0 Demonstrate basic troubleshooting skills - The student will be able to:
- 07.01 Apply troubleshooting and critical thinking skills to define the problem.
 - 07.02 Identify symptoms and changes in a system.
 - 07.03 Isolate potential sources/causes of problems.
 - 07.04 Consult reference materials.
 - 07.05 Evaluate repair options.
 - 07.06 Document properly all repairs and adjustments made.
 - 07.07 Monitor and correct parameters during tests.
 - 07.08 Estimate and forecast time and resources needed to perform task.
 - 07.09 Read blueprints, schematics and technical drawings.
 - 07.10 Modify or adjust equipment per engineering specifications.
 - 07.11 Analyze process to identify and correct problems, such as bottlenecks.
- 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 appropriate communication tools correctly.
 - 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 volume, weight, area, circumference and perimeter measurements for rectangles, squares, and cylinders.
 - 09.02 Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches.
 - 09.03 Add, subtract, multiply and divide using fractions, decimals, and whole numbers.
 - 09.04 Use different unit systems appropriately.
 - 09.05 Accurately convert between unit systems.
 - 09.06 Read and interpret angle measurements.
 - 09.07 Use scientific and engineering notation appropriately.
 - 09.08 Apply the rules for significant digits properly.
 - 09.09 Solve simple algebraic equations related to the workplace.
- 10.0 Demonstrate an understanding of modern business practices and strategies - The student will be able to:
- 10.01 Demonstrate knowledge of modern business practices.

- 10.02 Demonstrate knowledge of production process to meet business requirements.
- 10.03 Describe the importance of entrepreneurship to the American economy.
- 10.04 List the advantages and disadvantages of business ownership.
- 10.05 Identify the business skills needed to operate a small business efficiently and effectively.
- 10.06 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 Demonstrate competence in job search and interview techniques.
- 11.02 Identify or demonstrate appropriate responses to criticism from employer, supervisor or other employees.
- 11.03 Identify and practice acceptable work habits.
- 11.04 Demonstrate acceptable employee health habits.
- 11.05 Demonstrate knowledge of the "Right-To-Know Law".
- 11.06 Work effectively in teams.

Program Title: Engineering Technology
Specialization Tract: Advanced Manufacturing

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as a Manufacturing Engineering Technician or Advanced Manufacturing or Production Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

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

- 12.0 Operate, troubleshoot, and maintain pneumatic, hydraulic, and electromechanical components and/or systems.
- 13.0 Identify and implement lean concepts in manufacturing environments.
- 14.0 Operate industrial automation systems.
- 15.0 Troubleshoot industrial automation systems.
- 16.0 Apply the principals of robotics to industrial automation systems.
- 17.0 Use proficiently human machine interfaces to control automated systems
- 18.0 Identify, implement and/or interpret supply chain and operations management concepts and techniques.

**Florida Department of Education
Student Performance Standards**

Program Title: Engineering Technology
Specialization Tract: Advanced Manufacturing

12.0 Operate, troubleshoot, and maintain pneumatic, hydraulic and electromechanical components and/or systems – The student will be able to:

- 12.01 Identify, classify and describe the function of pneumatic, hydraulic and electrical machines and components.
- 12.02 Construct flow diagrams and of pneumatic, hydraulic, and electromechanical systems.
- 12.03 Perform basic operation maintenance of pneumatic, hydraulic and electromechanical components, devices and/or machines.
- 12.04 Troubleshoot errors, faults, and inconsistencies of pneumatic, hydraulic and electromechanical components, machines and/or systems.
- 12.05 Define special applications of electromechanical, hydraulic and pneumatic machines and devices used process sheet metal, plastics, food and beverages, and other materials.
- 12.06 Describe important limitations of electromechanical, pneumatic and hydraulic machinery.
- 12.07 Operate independent pneumatic, hydraulic and electrical machines properly.
- 12.08 Describe the important operating parameters of pneumatic, hydraulic and electrical machines and/systems.
- 12.09 Identify and use appropriate monitoring gages for pneumatic, hydraulic, and electromechanical machines and/or systems.

13.0 Identify and implement lean concepts in manufacturing environments - The student will be able to:

- 13.01 Demonstrate product manufacturing requirements and processing flow.
- 13.02 Demonstrate the role of management in production operations.
- 13.03 Integrate personnel, hardware, and software capabilities for timely completion of products and product orders.
- 13.04 Apply manufacturing resources planning, just-in-time concepts to production and process planning.
- 13.05 Demonstrate good examples of lean manufacturing principles of pull production, perfect first-time quality, waste minimization, continuous improvement, flexibility, and building long lasting relationships with suppliers and customers.
- 13.06 Implement minimization of wastes in the form of waiting time, inventory, processing, motion, over-production, transportation, and scrap.
- 13.07 Apply the 5S's: Sort, Set in Order, Shine, Standardize, and Sustain.
- 13.08 Apply six sigma criteria correctly.

14.0 Operate industrial automation systems - The student will be able to:

- 14.01 Chart and analyze ladder logic diagrams for industrial automation systems.
- 14.02 Identify PLC input and output module locations.

- 14.03 Match wiring harness identification to program addresses for input and output modules.
 - 14.04 Identify active and passive states of each module.
 - 14.05 Interpret flow charts to match field device components with the real devices.
 - 14.06 Identify when a programmable controller is in run or program mode.
 - 14.07 Integrate control systems and equipment with production and production support mechanisms.
 - 14.08 Establish routine operations involving maintenance schedules.
 - 14.09 Perform minor repair to industrial automation systems.
 - 14.10 Integrate control systems and equipment with production and production support mechanisms.
 - 14.11 Demonstrate automatic inventory accounting related monitoring and control systems.
 - 14.12 Implement automatic tracking of materials and products using bar codes, machine vision and sensing, and/or infrared technologies.
- 15.0 Troubleshoot industrial automation systems - The student will be able to:
- 15.01 Apply troubleshooting techniques to identify root cause, errors and faults of a problem.
 - 15.02 Isolate systems for troubleshooting.
 - 15.03 Develop a strategy for making system improvements based on troubleshooting activities.
 - 15.04 Identify needed expertise to address the issue.
 - 15.05 Participate in troubleshooting and resolution team effectively.
- 16.0 Apply the principals of robotics to automated systems - The student will be able to:
- 16.01 Define the essential components of a robotic system.
 - 16.02 Choose appropriate robot equipments for specific tasks.
 - 16.03 Describe methods of moving robotic parts.
 - 16.04 Choose and implement appropriate sensors for robotic applications.
 - 16.05 Choose and install appropriate actuators for robotic applications.
 - 16.06 Program robotic devices for restricted movements.
- 17.0 Use proficiently human machine interfaces to operate automated systems - The student will be able to:
- 17.01 Match computer graphic icons to real field equipment
 - 17.02 Route data flow between computer and controlled machines.
 - 17.03 Identify the computer input and output signals and equipment destinations.
 - 17.04 Implement manual override appropriately.
 - 17.05 Perform computer based system and/or machine troubleshooting.
 - 17.06 Define the essential components of an integrated HMI system.
- 18.0 Identify, implement, and/or interpret supply chain and operations management concepts and techniques - The student will be able to:
- 18.01 Use appropriate software for supply chain management strategies.
 - 18.02 Illustrate how efficiency and effectiveness are necessary attributes of good operations management.

- 18.03 Apply simulations used for layout and design of production operations.
- 18.04 Apply engineering economy factors in equipment justification.
- 18.05 Demonstrate warehouse throughput systems.
- 18.06 Demonstrate basic principles and methods of controlling work in progress.
- 18.07 Follow raw materials from their source to distribution of the product.
- 18.08 Demonstrate strategies to optimize production operations.
- 18.09 Demonstrate strategies to optimize raw materials and products inventories.

Program Title: Engineering Technology
Specialization Tract: Quality

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Quality Assurance Technician, Process and Production Technician, or Engineering Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

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

- 12.0 Demonstrate proficiency in Lean Manufacturing.
- 13.0 Demonstrate proficiency in developing self-directed work teams.
- 14.0 Demonstrate proficiency in the tools of Lean Manufacturing.
- 15.0 Demonstrate proficiency in Six Sigma concepts.
- 16.0 Demonstrate proficiency in developing a Six Sigma project.

**Florida Department of Education
Student Performance Standards**

Program Title: Engineering Technology
Specialization Tract: Quality

- 12.0 Demonstrate proficiency in Lean Manufacturing--The student will be able to:
- 12.01 Describe and explain the concepts of Lean Manufacturing.
 - 12.02 Apply the theories of Lean Manufacturing to a manufacturing environment for improvement.
 - 12.03 Identify and apply value stream mapping.
 - 12.04 Identify and apply just-in-time procedures.
 - 12.05 Identify and apply the techniques in continual improvement.
 - 12.06 Describe and explain the system of waste-free manufacturing (WFM).
 - 12.07 Describe the changes necessary in implementing waste-free manufacturing in a lean environment.
 - 12.08 Describe and explain supply chain management.
 - 12.09 Describe and explain the use of the 5S's, (sort, set in order, shine, standardize, sustain).
 - 12.10 Develop the techniques to manage change in the manufacturing environment.
- 13.0 Demonstrate proficiency in developing self-directed work teams --The student will be able to:
- 13.01 Describe and explain how teams are developed.
 - 13.02 Demonstrate how effective team members operate.
 - 13.03 Identify the organization techniques of starting a team.
 - 13.04 Identify the limits and expectations of the team.
 - 13.05 Describe team problems.
 - 13.06 Create work plans.
 - 13.07 Identify the steps in ending a project.
 - 13.08 Use data effectively in identifying issues.
 - 13.09 Implement changes through planning and communications.
 - 13.10 Update appropriate documentation in a project.
 - 13.11 Identify the steps in ending a project.
- 14.0 Demonstrate proficiency in the tools of Lean Manufacturing --The student will be able to:
- 14.01 Define the tools required to implement and maintain a Lean Manufacturing facility.
 - 14.02 Describe and explain mistake proofing for operators.
 - 14.03 Describe the techniques using zero quality control (ZQC) techniques in manufacturing settings.
 - 14.04 Identify mistake proof devices for eliminating errors in manufacturing.
 - 14.05 Describe and apply the 5S's for efficiency, maintenance, and continuous improvement.
 - 14.06 Describe and explain the visual workplace environment.
 - 14.07 Define the terms associated with the quick changeover process.

- 14.08 Identify the changeover techniques used in production.
 - 14.09 Describe and explain the streamlining process to reduce changeover time.
 - 14.10 Describe the terms used in overall equipment effectiveness (OEE).
 - 14.11 Describe and explain the process of total productive maintenance (TPM).
 - 14.12 Describe and explain tracking process in improving the effectiveness of the operating equipment.
 - 14.13 Define the terms associated with basic cellular manufacturing concepts.
 - 14.14 Identify production teams to basic cellular manufacturing and teamwork concepts.
 - 14.15 Identify steps required to convert to a cellular arrangement.
 - 14.16 Identify the techniques used in the kanban system for just-in-time (JIT).
- 15.0 Demonstrate proficiency in Six Sigma concepts--The student will be able to:
- 15.01 Describe and explain the basic principles and theories of Six Sigma.
 - 15.02 Define the terms associated with Six Sigma.
 - 15.03 Describe the philosophy and methodology of Six Sigma.
 - 15.04 Define the five steps of the DMAIC (define, measure, analyze, improve, and control) model used in Six Sigma for quality improvement.
 - 15.05 Establish an advanced quality plan.
 - 15.06 Benchmark a project.
 - 15.07 Develop the basic cause-and-effect diagram (fishbone diagram).
 - 15.08 Describe and develop the central limit theorem.
 - 15.09 Develop a control plan to aid in production.
 - 15.10 Define the cost-benefit analysis on the shop floor.
 - 15.11 Define and describe the design of experiments (DOE) used in manufacturing processes.
 - 15.12 Run the experiment.
 - 15.13 Apply the DOE in a manufacturing process using the proper techniques.
 - 15.14 Apply the techniques of Failure Modes and Effects Analysis (FMEA).
 - 15.15 Define and describe Risk Assessment.
 - 15.16 Implement the 5S method of sorting, setting in order, shining, standardizing, and sustaining.
 - 15.17 Maintain and check the process through quality auditing.
- 16.0 Demonstrate proficiency in developing a Six Sigma project--The student will be able to:
- 16.01 Defines and describe the economic evaluation of engineering alternatives and analysis of cost allocation in technical operations.
 - 16.02 Calculate net profit, maximum profit and breakeven points when solving problems.
 - 16.03 Solve problems involving alternative designs, materials, or methods.
 - 16.04 Analyze the factor of equivalence in engineering economic problems.
 - 16.05 Solve problems related to replacement versus augmentation for economic choices.
 - 16.06 Discuss how capital projects are identified and evaluated.
 - 16.07 Describe how final projects are selected.
 - 16.08 Define the requirements of the project plan.
 - 16.09 Develop the initial project schedule.
 - 16.10 Describe each phase of the project as it relates to the budget.
 - 16.11 Develop timeline charts for planning and tracking.

- 16.12 Apply the scheduling control systems.
- 16.13 Identify the voice of the customer as the feedback mechanism.
- 16.14 Define and describe the scheduling techniques when applied in the project environment.
- 16.15 Define and describe the issues surrounding a problem to provide paths for a solution.
- 16.16 Describe the project life cycle.
- 16.17 Solve problems related to capacity factor, load factor, and diversity factors.
- 16.18 Define and describe the concepts and methods for implementing Six Sigma project management utilizing Six Sigma methodologies.
- 16.19 Develop a Six Sigma project by utilizing a Six Sigma methodologies.
- 16.20 Describe and define the design phase for a Six Sigma project.
- 16.21 Describe and define the verification phase for a Six Sigma project.
- 16.22 Describe and define the implementation phase for a Six Sigma project.
- 16.23 Close out a Six Sigma project.
- 16.24 Benchmark a Six Sigma project.

Program Title: Engineering Technology
Specialization Tract: Mechanical Design and Fabrication

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Mechanical Engineering Technician, Mechanical Design Technician or Mechanical Fabrication Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

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

- 12.0 Demonstrate proficiency in the principles, concepts and applications in metal fabrication methods.
- 13.0 Demonstrate proficiency in the principles, concepts and applications in woodworking and composite fabrication methods.
- 14.0 Demonstrate proficiency in the set-up and operation of CNC machining centers.
- 15.0 Demonstrate proficiency in Computer-Aided Drafting /Computer-Aided Manufacturing (CAD/CAM) software.
- 16.0 Demonstrate a proficiency in solid modeling design & programming.

**Florida Department of Education
Student Performance Standards**

Program Title: Engineering Technology
Specialization Tract: Mechanical Design and Fabrication

- 12.0 Demonstrate proficiency in the principles, concepts and applications in metal fabrication methods - The student will be able to:
- 12.01 Understand professionalism in the manufacturing environment.
 - 12.02 Understand, use and work with precision numbers.
 - 12.03 Interpret mechanical drawings.
 - 12.04 Demonstrate the use of geometric dimensioning and tolerancing.
 - 12.05 Understand materials, and machining processes.
 - 12.06 Demonstrate safe use of hand and power tools.
 - 12.07 Identify the use and process in part layout.
 - 12.08 Demonstrate a working knowledge of metal forming equipment.
 - 12.09 Demonstrate the use of precision steel rulers.
 - 12.10 Demonstrate the use of oxy – fuel cutting.
 - 12.11 Demonstrate acceptable methods in tungsten inert gas welding.
 - 12.12 Demonstrate acceptable methods in gas metal arc welding.
 - 12.13 Demonstrate acceptable methods to use a dial indicator.
 - 12.14 Explain the use of a height gauge to measure stock.
 - 12.15 Identify aircraft sheet metal tools.
 - 12.16 Demonstrate acceptable methods hand cutting and forming sheet metal.
 - 12.17 Demonstrate the use of layout sheet metal tools.
 - 12.18 Demonstrate acceptable methods using micro-counter sinks.
 - 12.19 Demonstrate acceptable methods of Riveting solid rivets.
 - 12.20 Identify and demonstrate operation of the pneumatic rivet gun.
 - 12.21 Demonstrate the use of a rivet gauge set.
 - 12.22 Demonstrate acceptable methods using a back rivet set.
 - 12.23 Demonstrate acceptable methods using bucking bars.
 - 12.24 Demonstrate the use of rivet squeezers and dimpling.
 - 12.25 Demonstrate acceptable methods in using a blind riveting.
 - 12.26 Identify the axes on a CNC mill.
 - 12.27 Demonstrate hand jog features on a CNC mill & CNC lathe.
 - 12.28 Demonstrate acceptable methods to use an ironworker.
 - 12.29 Demonstrate acceptable methods using a break & shear.
 - 12.30 Demonstrate the use of dial calipers.
- 13.0 Demonstrate proficiency in the principles, concepts and applications in woodworking and composite fabrication methods - The student will be able to:
- 13.01 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a circular saw according to the manufacturer's recommendations.
 - 13.02 Apply the safe and proper use of and the basic adjustments and maintenance for a jointer according to the manufacturer's recommendations.
 - 13.03 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a planer according to the manufacturer's recommendations.

- 13.04 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a router according to the manufacturer's recommendations.
- 13.05 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a wood lathe according to the manufacturer's recommendations.
- 13.06 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a plate joiner according to the manufacturer's recommendations.
- 13.07 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a table saw according to the manufacturer's recommendations.
- 13.08 13.08 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a jig saw according to the manufacturer's recommendations.
- 13.09 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a band saw according to the manufacturer's recommendations.
- 13.10 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a drill press saw according to the manufacturer's recommendations.
- 13.11 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a scroll saw according to the manufacturer's recommendations.
- 13.12 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a reciprocating saw according to the manufacturer's recommendations.
- 13.13 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a hand power drill according to the manufacturer's recommendations.
- 13.14 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a brad nailer according to the manufacturer's recommendations.
- 13.15 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a disc sander according to the manufacturer's recommendations.
- 13.16 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a palm sander according to the manufacturer's recommendations.
- 13.17 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a miter saw according to the manufacturer's recommendations.
- 13.18 Demonstrate the safe and proper use of and the basic adjustments and maintenance for dust collection equipment according to the manufacturer's recommendations.
- 13.19 Demonstrate the safe and proper use of and the basic adjustments and maintenance for a circular saw according to the manufacturer's recommendations.
- 13.20 Set up and apply the use of clamps and vices.
- 13.21 Apply and use basic safety equipment (PPE).
- 13.22 Describe OSHA safety rules concerning PPE for eye protection.
- 13.23 Describe OSHA safety rules concerning PPE for hearing protection.
- 13.24 Identify common wood working joints.
- 13.25 Demonstrate the use of wood glues, adhesives and epoxies.
- 13.26 Describe rip, cross, miter, bevel, compound, and curved wood cuts.
- 13.27 Identify wood stains and sealers.
- 13.28 Identify basic construction woods.
- 13.29 Identify standard lumber dimensioning methods.
- 13.30 Identify basic woodworking layout tools.
- 13.31 Analyze lumber distortions and defects.

- 13.32 Define categories of hard and soft woods.
- 13.33 Explain marking and squaring wood stock.
- 13.34 Demonstrate basic CNC router set-up.

14.0 Demonstrate proficiency in the set-up and operation of manual and CNC machining centers. - The student will be able to:

- 14.01 Set up and maintain a manual lathe and mill.
- 14.02 Demonstrate acceptable processes using a manual lathe and mill.
- 14.03 Demonstrate acceptable control of machining processes.
- 14.04 Identify and define the physics of machine cutting metals.
- 14.05 Demonstrate the characteristics of machining cutting tools.
- 14.06 Define and identify parameters of cutting tool life.
- 14.07 Demonstrate efficient parameters in production processes.
- 14.08 Demonstrate the process to drill and layout holes to a specific size.
- 14.09 Identify baseline machining layout.
- 14.10 Identify manual machining procedures used in CNC programming.
- 14.11 Identify grinding machining practices and processes.
- 14.12 Identify thread types and tooling used in machining.
- 14.13 Identify metal alloys and their properties in machining.
- 14.14 Demonstrate job planning procedures in machining.
- 14.15 Demonstrate procedures to calculate cutting tool speeds and feeds.
- 14.16 Demonstrate methods for accessing machine RPM.
- 14.17 Identify coordinate and primary machining axes.
- 14.18 Define and describe Absolute and incremental coordinates.
- 14.19 Identify the five CNC drive components.
- 14.20 Demonstrate rapid travel and interpolation.
- 14.21 Identify coordinate and primary machining axes.
- 14.22 Identify and define industrial machining and turning centers.
- 14.23 Identify processes for program creation and data management.
- 14.24 Demonstrate acceptable procedures in starting CNC machines.
- 14.25 Demonstrate the CNC machine controls for set up and operation.
- 14.26 Demonstrate acceptable procedures to set up a CNC Machining center.
- 14.27 Demonstrate acceptable procedures to run programs using a CNC machining center.
- 14.28 Demonstrate acceptable procedures to generate a CNC program.
- 14.29 Demonstrate acceptable procedures in CNC job planning.
- 14.30 Identify cutting tools collets and holding fixtures.
- 14.31 Identify CNC tooling and applications.
- 14.32 Define CNC programming code words and conventions.
- 14.33 Define and demonstrate CNC program fixed cycles.
- 14.34 Explain basic use of CAD/CAM software and processes.

15.0 Demonstrate proficiency in computer-aided drafting/ computer-aided manufacturing (CAD/CAM) software – The student will be able to:

- 15.01 Create CAD/CAM geometry for tool path processing.
- 15.02 Demonstrate procedures to import/export CAD/CAM files.
- 15.03 Demonstrate contouring using CAM tool path commands.
- 15.04 Apply pocketing using CAM tool path commands.
- 15.05 Demonstrate drill cycles using CAM tool path commands.

- 15.06 Demonstrate thread cycles using CAM tool path commands.
 - 15.07 Demonstrate engraving using CAM tool path commands.
 - 15.08 Construct lettering using CAM tool path commands.
 - 15.09 Demonstrate nesting using CAM tool path commands.
 - 15.10 Describe procedures for CAM post-processing.
 - 15.11 Apply tool path verification for a CAM program.
 - 15.12 Apply job set-up procedures for a CAM program.
 - 15.13 Demonstrate ability to save, copy, delete, and rename computer files with Windows-based programs.
 - 15.14 Create a CNC machining working portfolio.
 - 15.15 Demonstrate the use of back plotting in a cam program.
 - 15.16 Demonstrate how to modify an existing tool path.
- 16.0 Demonstrate a proficiency in 3-D solid modeling design & programming. - The student will be able to:
- 16.01 Identify wire frame geometry for surface modeling.
 - 16.02 Demonstrate tool path verification and post processing.
 - 16.03 Create a 3D wire frame in different construction planes.
 - 16.04 Demonstrate Geometry editing commands.
 - 16.05 Create a solid body applying extruding commands.
 - 16.06 Demonstrate the programming parameters using high speed machining tooling.
 - 16.07 Demonstrate CNC tooling selection and applications.
 - 16.08 Demonstrate the chamfer command on a solid body.
 - 16.09 Apply the revolve command by editing a solid body.
 - 16.10 Demonstrate the fillet command on a solid body.
 - 16.11 Create a wire frame model for a ruled surface.
 - 16.12 Construct a sphere using primitive commands.
 - 16.13 Apply primitive commands to construct a cylinder.
 - 16.14 Edit solid geometry using loft commands.
 - 16.15 Demonstrate the use of default short-cut key assignments.
 - 16.16 Construct coons wire frame geometry.
 - 16.17 Create sweep surfaces and flow line tool path.
 - 16.18 Demonstrate raised letters on a surface.
 - 16.19 Demonstrate stock set-up for tool path creation.

Program Title: Engineering Technology
Specialization Tract: Electronics

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Electronics or Electronics Test Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

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

- 12.0 Demonstrate proficiency in soldering and basic laboratory practices
- 13.0 Demonstrate proficiency in basic direct current (D.C.) circuits.
- 14.0 Demonstrate proficiency in alternating current (A.C.) circuits.
- 15.0 Demonstrate proficiency in solid state devices.
- 16.0 Demonstrate proficiency in digital circuits.
- 17.0 Demonstrate proficiency in analog circuits.

**Florida Department of Education
Student Performance Standards**

Program Title: Engineering Technology
Specialization Tract: Electronics

12.0 Demonstrate proficiency in soldering basic laboratory practices--The student will be able to:

- 12.01 Apply proper Occupational Safety Health Administration (OSHA) safety standards.
- 12.02 Make electrical connections.
- 12.03 Identify and use hand tools properly.
- 12.04 Identify and use power tools properly.
- 12.05 Explain the theoretical concepts of soldering.
- 12.06 Identify and discuss the different soldering techniques and arrangements for through the hole and surface mount.
- 12.07 Demonstrate acceptable soldering techniques.
- 12.08 Demonstrate acceptable de-soldering techniques.
- 12.09 Demonstrate electrostatic discharge (ESD) safety procedures.
- 12.10 Describe the construction of printed circuit boards (PCB's).
- 12.11 Demonstrate rework and repair techniques.

13.0 Demonstrate proficiency in basic direct current (D.C.) circuits--The student will be able to:

- 13.01 Define the characteristics of basic D.C. circuits.
- 13.02 Solve problems in electronic units utilizing metric prefixes.
- 13.03 Identify sources of electricity.
- 13.04 Define and describe voltage, current, resistance, power and energy.
- 13.05 Apply Ohm's law and power formulas.
- 13.06 Read and interpret color codes and symbols to identify electrical components and values.
- 13.07 Measure properties of circuits using a digital multimeter meter (DMM) and oscilloscopes.
- 13.08 Set up and operate power supplies for DC circuits.
- 13.09 Compute conductance and measure resistance of conductors and insulators.
- 13.10 Apply Ohm's law to series circuits.
- 13.11 Construct and verify the operation of series circuits.
- 13.12 Analyze and troubleshoot series circuits.
- 13.13 Apply Ohm's law to parallel circuits.
- 13.14 Construct and verify the operation of parallel circuits.
- 13.15 Analyze and troubleshoot parallel circuits.
- 13.16 Measure values of resistors, capacitors and inductors.
- 13.17 Construct and verify the operation of capacitors and inductors.
- 13.18 Analyze and troubleshoot circuits containing capacitors and inductors.
- 13.19 Apply various network theorems to D.C. circuits.

14.0 Demonstrate proficiency in alternating current (A.C.) circuits --The student will be able to:

- 14.01 Solve basic trigonometric problems as applicable to A.C. circuits.
 - 14.02 Define the characteristics of AC capacitive circuits.
 - 14.03 Construct and verify the operation of AC capacitive circuits.
 - 14.04 Analyze and troubleshoot AC capacitive circuits.
 - 14.05 Define the characteristics of AC inductive circuits.
 - 14.06 Construct and verify the operation of AC inductive circuits.
 - 14.07 Analyze and troubleshoot AC inductive circuits.
 - 14.08 Define and apply the principles of transformers to AC circuits.
 - 14.09 Construct and verify the operation of AC circuits utilizing transformers.
 - 14.10 Analyze and troubleshoot AC circuits utilizing transformers.
 - 14.11 Construct and verify the operation of differentiators and integrators to determine R-C and R-L time constraints.
 - 14.12 Analyze and troubleshoot differentiator and integrator circuits.
 - 14.13 Define the characteristics of resistive, Inductive, and Capacitive (RLC) circuits (series, parallel and complex).
 - 14.14 Construct and verify the operation of series and parallel resonant circuits.
 - 14.15 Define the characteristics of series and parallel resonant circuits.
 - 14.16 Construct and verify the operation of series and parallel resonant circuits.
 - 14.17 Analyze and troubleshoot R-C, R-L, and RLC circuits.
 - 14.18 Define the characteristics of frequency selective filter circuits.
 - 14.19 Construct and verify the operation of frequency selective filter circuits.
 - 14.20 Analyze and troubleshoot frequency selective filter circuits.
 - 14.21 Define the characteristics of polyphase circuits.
 - 14.22 Define basic motor theory and operation.
 - 14.23 Define basic generator theory and operation.
 - 14.24 Set up and operate power supplies for AC circuits.
 - 14.25 Analyze and measure power in AC circuits.
 - 14.26 Set up and operate capacitor and inductor analyzers for AC circuits.
 - 14.27 Apply various network theorems to A.C. circuits.
- 15.0 Demonstrate proficiency in solid state devices--The student will be able to:
- 15.01 Identify and define properties of semiconductor materials.
 - 15.02 Identify and define operating characteristics and applications of junction diodes.
 - 15.03 Identify and define operating characteristics and applications of special diodes.
 - 15.04 Construct and verify the operation of diode circuits.
 - 15.05 Analyze and troubleshoot diode circuits.
 - 15.06 Identify and define operating characteristics and applications of bipolar transistors.
 - 15.07 Identify and define operating characteristics and applications of field effect transistors.
 - 15.08 Identify and define operating characteristics and applications of single-stage amplifiers.
 - 15.09 Construct and verify the operation of single-stage amplifiers.
 - 15.10 Analyze and troubleshoot single-stage amplifiers.
 - 15.11 Construct and verify thyristor circuitry.
 - 15.12 Analyze and troubleshoot thyristor circuitry.
 - 15.13 Set up and operate DVM for solid-state devices.
 - 15.14 Set up and operate power supplies for solid-state devices.
 - 15.15 Set up and operate oscilloscopes for solid-state devices.

- 15.16 Set up and operate function generators for solid-state devices.
- 15.17 Set up and operate capacitor and inductor analyzers for solid-state devices.
- 15.18 Set up and operate curve tracers.
- 15.19 Set up and operate transistor testers.
- 15.20 Construct and analyze electronic circuits for all operating parameters.
- 15.21 Set up and operate measuring instruments for electronic circuit analysis.
- 15.22 Apply appropriate solid state circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.

16.0 Demonstrate proficiency in digital circuits--The student will be able to:

- 16.01 Define and apply numbering systems to codes and arithmetic operations.
- 16.02 Analyze and minimize logic circuits using Boolean operations.
- 16.03 Set up and operate logic probes for digital circuits.
- 16.04 Set up and operate power supplies for digital circuits.
- 16.05 Set up and operate pulsers for digital circuits.
- 16.06 Set up and operate oscilloscopes for digital circuits.
- 16.07 Set up and operate logic analyzers for digital circuits.
- 16.08 Set up and operate pulse generators for digital circuits.
- 16.09 Identify types of logic gates and their truth tables.
- 16.10 Construct combinational logic circuits using integrated circuits.
- 16.11 Troubleshoot logic circuits.
- 16.12 Analyze types of flip-flops and their truth tables.
- 16.13 Construct flip-flops using integrated circuits.
- 16.14 Troubleshoot flip-flops.
- 16.15 Identify, define and measure characteristics of integrated circuit (IC) logic families.
- 16.16 Identify types of registers and counters.
- 16.17 Construct registers and counters using flip-flops and logic gates.
- 16.18 Troubleshoot registers and counters.
- 16.19 Analyze clock and timing circuits.
- 16.20 Construct clock and timing circuits.
- 16.21 Troubleshoot clock and timing circuits.
- 16.22 Identify types of arithmetic-logic circuits.
- 16.23 Construct arithmetic-logic circuits.
- 16.24 Troubleshoot arithmetic-logic circuits.
- 16.25 Identify types of encoding and decoding devices.
- 16.26 Construct encoders and decoders.
- 16.27 Troubleshoot encoders and decoders.
- 16.28 Identify types of multiplexer and demultiplexer circuits.
- 16.29 Construct multiplexer and demultiplexer circuits using integrated circuits.
- 16.30 Troubleshoot multiplexer and demultiplexer circuits.
- 16.31 Identify types of memory circuits.
- 16.32 Identify types of digital displays.
- 16.33 Set up and operate measuring instruments for digital circuit analysis.
- 16.34 Apply appropriate digital circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.

17.0 Demonstrate proficiency in analog circuits--The student will be able to:

- 17.01 Identify and define operational characteristics and applications of multistage amplifiers.
- 17.02 Construct multistage amplifiers.
- 17.03 Analyze and troubleshoot multistage amplifiers.
- 17.04 Identify and define operating characteristics and applications of linear integrated circuits.
- 17.05 Identify and define operating characteristics and applications of basic power supplies and filters.
- 17.06 Construct basic power supplies and filters.
- 17.07 Identify and define operating characteristics and applications of differential and operational amplifiers.
- 17.08 Construct differential and operational amplifier circuits.
- 17.09 Analyze and troubleshoot differential and operational amplifier circuits.
- 17.10 Identify and define operating characteristics of audio power amplifiers.
- 17.11 Construct audio power amplifiers.
- 17.12 Analyze and troubleshoot audio power amplifiers.
- 17.13 Identify and define operating characteristics and applications of power supply regulator circuits.
- 17.14 Construct power supply regulator circuits.
- 17.15 Analyze and troubleshoot power supply regulator circuits.
- 17.16 Identify and define operating characteristics and applications of active filters.
- 17.17 Construct active filter circuits.
- 17.18 Analyze and troubleshoot active filter circuits.
- 17.19 Identify and define operating characteristics and applications of sinusoidal and nonsinusoidal oscillator circuits.
- 17.20 Construct oscillator circuits.
- 17.21 Analyze and troubleshoot oscillator circuits.
- 17.22 Identify and define operating characteristics and applications of cathode ray tubes.
- 17.23 Identify and define operating characteristics and applications of optoelectronic devices.
- 17.24 Set up and operate measuring instruments for analog circuits.
- 17.25 Apply appropriate analog circuitry for other systems such as electronic communications, telecommunications, wireless, and other electronic applications.

Program Title: Engineering Technology
Specialization Tract: Advanced Technology

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as Engineering Technician or Advanced Technology Technician in various specialized areas, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

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

- 12.0 Demonstrate proficiency in soldering and basic laboratory practices
- 13.0 Demonstrate proficiency in surface mount soldering.
- 14.0 Demonstrate proficiency in fiber optics terminations.
- 15.0 Demonstrate proficiency in Instrumentation Fundamentals
- 16.0 Demonstrate proficiency in Destructive and non Destructive Testing.
- 17.0 Demonstrate proficiency in Composite Fundamentals.

**Florida Department of Education
Student Performance Standards**

**Program Title: Engineering Technology
Specialization Tract: Advanced Technology**

12.0 Demonstrate proficiency in soldering basic laboratory practices--The student will be able to:

- 12.01 Apply proper Occupational Safety Health Administration (OSHA) safety standards.
- 12.02 Make electrical connections.
- 12.03 Demonstrate acceptable soldering techniques.
- 12.04 Demonstrate acceptable de-soldering techniques.
- 12.05 Demonstrate electrostatic discharge (ESD) safety procedures.
- 12.06 Describe the construction of printed circuit boards (PCB's).
- 12.07 Explain the theoretical concepts of soldering.
- 12.08 Demonstrate rework and repair techniques.

13.0 Demonstrate proficiency in basic surface mount soldering --The student will be able to:

- 13.01 Identify SMD components.
- 13.02 Understand concern specific to SMD components.
- 13.03 Identify proper soldering techniques to each component type
- 13.04 Solder and de-solder chip components.
- 13.05 Solder and de-solder J-Leaded components.
- 13.06 Solder and de-solder Gull Wing components.
- 13.07 Effectively identify and demonstrate the quality requirements used to inspect soldered connections.
- 13.08 Demonstrate the skills required for circuit board rework and repair.
- 13.09 Demonstrate the proper selection and use of procedural requirements, tools, materials, and methods required to comply with the applicable standards.

14.0 Demonstrate proficiency in fiber optics termination --The student will be able to:

- 14.01 Define the basics of a Fiber Optic System.
- 14.02 Define the Advantages and types of a fiber optic system.
- 14.03 Understand how to install cables and prepare ends.
- 14.04 Understand how to install different types of connectors.
- 14.05 Understand How to make Loss measurements.
- 14.06 Understand how to install splices.
- 14.07 Understand how to certify and troubleshoot a fiber system.

15.0 Demonstrate proficiency in knowledge of instrumentation fundamentals--The student will be able to:

- 15.01 Demonstrate an understanding to instrument symbols and identifiers.
- 15.02 Demonstrate an understanding to the fundamentals of pressure measurements.
- 15.03 Demonstrate an understanding to the fundamentals of flow measurements.

- 15.04 Demonstrate an understanding to the fundamentals of liquid levels measurements.
 - 15.05 Demonstrate an understanding to the fundamentals temperature measurements.
 - 15.06 Demonstrate an understanding to the fundamentals of control systems.
- 16.0 Demonstrate proficiency in destructive and non destructive testing --The student will be able to:
- 16.01 Demonstrate an understanding of the concepts of inspection procedures used in NDT.
 - 16.02 Demonstrate an understanding of the basic types of NDT.
 - 16.03 Demonstrate an understanding of hardness testing using both destructive and non destructive testing.
 - 16.04 Demonstrate an understanding of magnetic particle testing used in NDT.
 - 16.05 Demonstrate an understanding of dye penetrant testing used in NDT.
 - 16.06 Select, configure, calibrate, and operate NDT equipment.
- 17.0 Demonstrate proficiency in composites fundamentals --The student will be able to:
- 17.01 Identify and characterize composite materials and commodities.
 - 17.02 Identify uses and hazards involved in handling common composite supplies.
 - 17.03 Explain how properties of materials determine their classification and use.
 - 17.04 Identify symptoms/causes of delaminating.
 - 17.05 Identify symptoms and causes of faulty bonds.
 - 17.06 Demonstrate knowledge of handling composite materials, adhesives, solvents, etc.
 - 17.07 Identify tools used in composite fabrication and repair.

Program Title: Engineering Technology
Specialization Tract: Alternative Energy

Specialization Concepts and Content: The purpose of this program is to prepare students to meet the industry-specific educational needs for technicians in the new and emerging alternative and renewable energy fields, including, but not limited to, occupational titles such as Electrical Engineering Technician, Industrial Engineering Technician, Solar Photovoltaic Installer and Solar Power Plant Technician, Solar Thermal Installer and Technician, Energy Auditor, and Smart Grid Technician. This program also provides supplemental training for persons previously or currently employed in occupations related to energy production and storage, manufacturing and construction.

Standards

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

- 12.0 Interpret AC and DC circuit fundamentals related to energy technologies.
- 13.0 Characterize alternative energy sources and technologies.
- 14.0 Apply energy storage, distribution and conversion systems principals.
- 15.0 Characterize the operation and performance of solar energy systems.
- 16.0 Apply policy, regulation and good business practices for alternative energy systems.

**Florida Department of Education
Student Performance Standards**

Program Title: Engineering Technology
Specialization Tract: Alternative Energy

12.0 Interpret AC and DC circuit fundamentals related to energy technologies -- The student will be able to:

- 12.01 Solve basic trigonometric problems as applicable to AC circuits.
- 12.02 Analyze and troubleshoot AC capacitive and inductive circuits.
- 12.03 Define and apply the principles of transformers to AC circuits.
- 12.04 Define the characteristics of polyphase circuits.
- 12.05 Define basic motor theory and operation.
- 12.06 Define basic generator theory and operation.
- 12.07 Analyze and measure power in AC circuits.
- 12.08 Solve problems in electronic units utilizing metric prefixes.
- 12.09 Identify sources of electricity.
- 12.10 Define and describe voltage, current, resistance, power and energy.
- 12.11 Apply Ohm's law and power formulas.
- 12.12 Read and interpret color codes and symbols to identify electrical components and values.
- 12.13 Measure properties of circuits using a digital multimeter meter (DMM) and oscilloscopes.
- 12.14 Compute conductance and measure resistance of conductors and insulators.
- 12.15 Construct and verify the operation of series circuits.
- 12.16 Analyze and troubleshoot series circuits.
- 12.17 Apply Ohm's law to parallel circuits.
- 12.18 Construct and verify the operation of parallel circuits.
- 12.19 Analyze and troubleshoot parallel circuits.
- 12.20 Measure values of resistors, capacitors and inductors.
- 12.21 Interpret basic AC and DC circuit schematics and sketches.
- 12.22 Utilize appropriate electronic testing and troubleshooting tools and equipment.
- 12.23 Utilize applicable voltage and current Laws in AC and DC circuits.
- 12.24 Apply math knowledge required for fundamental AC and DC circuit analysis.
- 12.25 Practice safety procedures required in an electrical lab environment.

13.0 Characterize alternative energy sources and technologies -- The student will be able to:

- 13.01 Describe alternative and renewable energy sources used for power production.
- 13.02 Define basic energy terms.
- 13.03 Differentiate between alternative and renewable energy sources.
- 13.04 Discuss the feasibility of emerging energy resources.
- 13.05 Describe the major sources, scale, and impacts of alternative and renewable energy.
- 13.06 Draw and label a diagram of an alternative and renewable energy system.
- 13.07 Draw and label a diagram of energy production systems that uses various alternative energy sources.
- 13.08 Distinguish between various alternative energy sources and energy potential.

- 13.09 Describe the social and environmental impact of alternative energy technologies vs. traditional energy sources.
 - 13.10 Explain the difference between passive solar and active solar systems.
 - 13.11 Evaluate advantages and disadvantages of various alternative energy sources.
 - 13.12 Compare site selection requirements for various alternative energy installations.
- 14.0 Apply energy storage, distribution and conversion systems principals -- The student will be able to:
- 14.01 Demonstrate appropriate safety procedures of energy storage devices and equipment.
 - 14.02 Calculate the energy usage requirements of a typical building structure.
 - 14.03 Optimize the energy storage performance based on the characteristics of various battery systems.
 - 14.04 Define the role of inverters in energy storage systems.
 - 14.05 Choose an appropriate inverter for a particular application.
 - 14.06 Interpret interface circuit diagrams for connecting power sources to system components.
 - 14.07 Identify the components of an energy storage system.
 - 14.08 Describe current and emerging energy storage systems.
 - 14.09 Interpret fundamental energy and energy production concepts.
- 15.0 Characterize the operation and performance of solar energy systems -- The student will be able to:
- 15.01 Describe the operation of various solar energy systems.
 - 15.02 Site a solar energy system for optimal production based on the sun's position.
 - 15.03 Specify components of solar energy systems.
 - 15.04 Calculate the energy produced, efficiency, and power derived from an installed system.
 - 15.05 Demonstrate proper safety practices in solar energy system installations and operations.
 - 15.06 Interpret basic schematics and sketches of various solar energy design configurations.
 - 15.07 Adapt the designs of solar energy systems for stand-alone and connected systems.
 - 15.08 Practice proper installation of solar energy system components.
 - 15.09 Demonstrate standard practices in system checkout, maintenance and troubleshooting a solar energy system.
 - 15.10 Determine appropriately sized components for a solar energy system.
- 16.0 Apply policy, regulation and good business practices for alternative energy systems -- The student will be able to:
- 16.01 Define current US energy and natural resources policies and regulations.
 - 16.02 Compare US energy and natural resources policies and regulations to others around the world.
 - 16.03 Calculate carbon footprints for various building types.
 - 16.04 Read and interpret facility energy utilization data.
 - 16.05 Use cost-benefit analyses to analyze various primary sources of energy.

- 16.06 Discuss the effects of financial, technical, and economic trends on the past, current, and future energy industry.
- 16.07 Demonstrate best practices for minimizing energy utilization.
- 16.08 Apply best practices based for energy production and resources utilization.
- 16.09 Determine how different climatic, geological, atmospheric, and human activities influence energy production and utilization.
- 16.10 Identify conservation practices for natural resources used for energy production.
- 16.11 Explain the environmental impacts of energy extraction, conservation, and storage systems.
- 16.12 Discuss how the conversion to alternative energy affects various business sectors.
- 16.13 Discuss the need for governmental regulations and policy for energy production and utilization.

Program Title: Engineering Technology
Specialization Tract: Biomedical Systems

Specialization Concepts and Content: The purpose of this program is to prepare students to meet the critical industry-specific educational needs for quality assurance, laboratory specialization, and regulatory standards that are required for the biomedical industry for initial employment with an occupational title as laboratory technician, research associate, clinical data manager, document manager, quality assurance technician, quality systems auditor, and quality compliance specialist in various specialized areas of regulated industries, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

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

- 12.0 Demonstrate knowledge of the Food and Drug Administration (FDA) regulations and compliance for biomedical systems.
- 13.0 Demonstrate knowledge in the design and manufacture of biomedical systems.
- 14.0 Demonstrate knowledge of risk management for biomedical products development and production.
- 15.0 Demonstrate knowledge of quality audits for biomedical systems.
- 16.0 Demonstrate knowledge of document and data management and control.

**Florida Department of Education
Student Performance Standards**

Program Title: Engineering Technology
Specialization Tract: Biomedical Systems

- 12.0 Demonstrate knowledge of the Food and Drug Administration (FDA) regulations and compliance for biomedical systems -The student will be able to:
- 12.01 Describe how the FDA is organized.
 - 12.02 Locate the Code of Federal Regulations (C.F.R.) specific to the FDA regulations that apply to biomedical systems manufacturers.
 - 12.03 Describe the role of the FDA's standing advisory committee, the Center for Devices and Radiological Health (CDRH).
 - 12.04 Define medical devices, products, and systems and their federal classifications.
 - 12.05 Explain the 510(k) Premarket Notification Process including Applications (PMA).
 - 12.06 Explain an investigational device exemption (IDE).
 - 12.07 Explain the reasons for the pre-amendments for Class III Devices.
 - 12.08 Describe and explain the Federal Food, Drug, and Cosmetic Act (FDCA).
 - 12.09 Define and describe good laboratory and clinical practices.
 - 12.10 Define and describe the quality system regulations (QSRs).
 - 12.11 Define and describe Current Good Manufacturing Practices.
 - 12.12 Define and describe foreign regulatory systems, i.e., the European Union (EU).
 - 12.13 Apply ISO 13485/ISO 13488 quality systems to medical devices and biomedical systems.
- 13.0 Demonstrate knowledge in the design and manufacture of biomedical systems – The student will be able to:
- 13.01 Describe uses for which products could be designed.
 - 13.02 Apply the steps involved in the design process.
 - 13.03 Describe how a design team is organized.
 - 13.04 Define, describe, and list product specifications.
 - 13.05 Define and describe reverse engineering.
 - 13.06 Describe, list, and apply failure modes and effects analysis (FMEA) to increase product safety.
 - 13.07 Analyze product reliability.
 - 13.08 Describe concurrent product and process development.
 - 13.09 Describe and compare installation and operation qualifications.
 - 13.10 Recognize process optimization.
 - 13.11 Develop and analyze process flow maps.
 - 13.12 Differentiate between verification and validation.
 - 13.13 Describe and determine how a design requirement is verified.
 - 13.14 Describe and analyze how customer needs are validated.
 - 13.15 Describe how a process output can be verified.
 - 13.16 Describe and analyze process capability.
 - 13.17 Define the terms associated with production scale-up.
 - 13.18 Discuss and analyze inventory management.
 - 13.19 Describe and analyze production scheduling.
 - 13.20 Describe a market release package with multiple components.

- 13.21 Determine a root cause of a problem is determined.
- 14.0 Demonstrate knowledge of risk management for biomedical products development and production – The student will be able to:
- 14.01 Describe the FDA’s definition of risk management.
 - 14.02 Explain how the subparts to the FDA’s regulatory requirements 21 CFR 820 Quality System Regulation (QSR) relate to risk management.
 - 14.03 Explain the process of identifying the key risk management activities critical to a successful risk management process.
 - 14.04 Develop a comprehensive risk management plan.
 - 14.05 Identify internal and external sources for determining product hazards.
 - 14.06 Estimate a risk using risk analysis tools and techniques.
 - 14.07 Evaluate a risk using risk evaluation tools and techniques.
 - 14.08 Identify the steps associated with risk control.
 - 14.09 Identify the risk elements that can be reduced to decrease the risk associated with a hazard.
 - 14.10 Describe the process of verification and explain its role in risk control.
 - 14.11 Explain the relationship between risk control measures and the introduction of new hazards.
 - 14.12 Explain the difference between residual risk and overall residual.
 - 14.13 Develop a risk management report.
 - 14.14 List and describe the elements of corrective action and preventive action (CAPA) and how they relate to post production information.
- 15.0 Demonstrate knowledge of quality audits for biomedical systems – The student will be able to:
- 15.01 Define terms associated with quality auditing.
 - 15.02 Describe the characteristics of internal and external quality audits.
 - 15.03 Describe the relationship between the quality audit and the FDA regulatory requirement 21 CFR 820.20 (c).
 - 15.04 List factors that can influence the credibility of quality audits.
 - 15.05 Describe the purpose and characteristics of a confidentiality agreement.
 - 15.06 Describe the auditor’s responsibilities when illegal or unsafe conditions or activities are discovered during an audit.
 - 15.07 Identify sources in a medical device manufacturing organization that generate performance history data for review prior to performing a quality audit.
 - 15.08 Identify the quality auditing strategies for data collection.
 - 15.09 Describe the purpose and scope of the quality audit opening and closing meetings.
 - 15.10 Identify auditable quality records in a medical device manufacturing company as defined by the FDA regulatory requirements 21 CFR 820.180.
 - 15.11 Describe the relationship of risk and criticality in analyzing audit data.
 - 15.12 Describe the difference between compliance issues and effectiveness issues and giving examples of each.
 - 15.13 Describe record retention requirements.
 - 15.14 Identify effective communication techniques that can be successfully used in a quality audit.
 - 15.15 Conduct a simulated audit that conforms to FDA regulatory requirements.
 - 15.16 Write a comprehensive audit report.

- 16.0 Demonstrate knowledge of document and data management and control – The student will be able to:
- 16.01 Describe how the change control procedures are organized.
 - 16.02 Locate the Code of Federal Regulations (C.F.R.) specific to the FDA regulations that apply to change control.
 - 16.03 Discuss the importance of maintaining the records of changes to documents.
 - 16.04 Review and discuss the product device master record (DMR).
 - 16.05 Define the terms associated with the change control documents.
 - 16.06 Increment and determine which code should be used by the change procedure for components including software, assemblies, devices, and associated documentation such as labeling, process procedures, and assembly drawings.
 - 16.07 Develop and implement a change control form.
 - 16.08 Describe how document management and control procedures are organized.
 - 16.09 Determine the importance of maintaining document management.
 - 16.10 Define the terms associated with document management and control.
 - 16.11 List the procedures to be followed for preparing, reviewing, and correcting documents.
 - 16.12 Discuss and explain the importance of document security.
 - 16.13 Develop a documentation management plan for a company.
 - 16.14 Define the terms associated with clinical data management.
 - 16.15 Describe the clinical protocol development and implementation.
 - 16.16 Discuss and explain the linkages between clinical trials and product development.

**Florida Department of Education
Student Performance Standards**

Program Title: Engineering Technology
Specialization Tract: Digital Design and Modeling

Specialization Concepts and Content: The purpose of this program is to prepare students for initial employment with an occupational title as computer aided design (CAD) specialists, industrial designers, product designers, architectural, civil, or mechanical drafters, technicians, or detailers in various specialized areas of industry that use digital design and modeling, or to provide supplemental training for persons previously or currently employed in these occupations.

Standards

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

- 12.0 Demonstrate proficiency in advanced CAD commands.
- 13.0 Demonstrate proficiency in three-dimensional (3-D) drawings.
- 14.0 Demonstrate knowledge of using solid modeling software.
- 15.0 Demonstrate proficiency in digital engineering design fundamentals.
- 16.0 Demonstrate proficiency in digital modeling fundamentals.

**Florida Department of Education
Student Performance Standards**

Program Title: Engineering Technology
Specialization Tract: Digital Design and Modeling

- 12.0 Demonstrate proficiency in advanced CAD commands – The student will be able to:
- 12.01 Select the correct command for specified 2 dimensional tasks.
 - 12.02 Develop the attributes needed for generic information for specific drawing types.
 - 12.03 Demonstrate proficiency in various CAD plotting and printing options.
 - 12.04 Create the plots of selected parts or drawings.
 - 12.05 Develop the attributes needed for generic information for specific drawings.
 - 12.06 Implement existing CAD library files for new drawings.
 - 12.07 Develop appropriate new library files when necessary.
 - 12.08 Demonstrate model space and paper space commands.
 - 12.09 Draw plot, floor, electrical and foundation plans.
 - 12.10 Apply standard dimensioning rules.
- 13.0 Demonstrate proficiency in three-dimensional (3-D) drawings – The student will be able to:
- 13.01 Implement the CAD commands for three-dimensional drawings.
 - 13.02 Implement and apply the CAD three-dimensional coordinate system for three-dimensional objects.
 - 13.03 Use CAD three-dimensional surface commands for 3-dimensional objects.
 - 13.04 Implement and apply basic software utilities for arranging, detailing, and plotting views of an object.
 - 13.05 Create basic building construction, architectural and object designs in three dimensions.
 - 13.06 Align, rotate, and mirror three-dimensional objects.
 - 13.07 Render a three-dimensional model.
 - 13.08 Customize screen, toolbars, and pull down menus.
- 14.0 Demonstrate knowledge of using solid (3-D) modeling software – The student will be able to:
- 14.01 Create a new part document and 2-D sketch views of a solid object.
 - 14.02 Apply and edit dimensions on an object.
 - 14.03 Create the standard drawing views to document the design procedures.
 - 14.04 Perform analyses on the computer model and refine the design.
 - 14.05 Measure and calculate properties of parts.
 - 14.06 Enter and save data for an object drawing.
 - 14.07 Create an assembly drawing.
 - 14.08 Define parts of an assembly in a directory.
 - 14.09 Apply basic solid modeling commands.
 - 14.10 Apply orthographic projection principles to drawing's layouts.
 - 14.11 Plot solid modeling drawings.
- 15.0 Demonstrate proficiency in digital engineering design fundamentals – The student will be

able to:

- 15.01 Create and execute advanced templates.
- 15.02 Convert multiple sketches into construction lines.
- 15.03 Create and use multiple work planes for advanced functions.
- 15.04 Create and modify bottom up assemblies.
- 15.05 Create multiple configurations of an individual part.
- 15.06 Apply basic drawing concepts to molded parts.
- 15.07 Create basic sheet metal drawings.
- 15.08 Create two and three-dimensional drawings related to graphic and industrial design.
- 15.09 Define fundamental two-dimensional and three-dimensional concepts of graphic and industrial design.
- 15.10 Demonstrate basic design principles of visual and spatial form as applied to products.
- 15.11 Perform analyses and refine industrial design.
- 15.12 Apply design features to the two and three dimensional drawings.
- 15.13 Describe the fundamentals of product and system design as it relates to the manufacturing and structural considerations in design.
- 15.14 Describe the theories related to product and systems design.
- 15.15 Solve elementary problems related to the form and function of objects and structures.
- 15.16 Describe the fundamentals of material selection for product and system design.
- 15.17 Conduct a system design identifying the major phases.

16.0 Demonstrate proficiency in digital modeling fundamentals – The student will be able to:

- 16.01 Convert multiple sketches into extruded features.
- 16.02 Create the desired sketch to document the design procedures.
- 16.03 Perform analyses on the sketch procedures and refine the sketch design.
- 16.04 Create multiple parts using components of a design tree.
- 16.05 Perform advanced mating using multiple parts or sub-assemblies.
- 16.06 Define the type of analysis of machine elements of a part.
- 16.07 Combine 11-13 Perform and interpret finite element analysis on modeled objects.
- 16.08 Apply basic drawing concepts to molded parts.
- 16.09 Create detailed molds or die cavities of parts and assemblies.
- 16.10 Derive component parts from an edited mold base.
- 16.11 Choose and apply a type of material to use to render parts.
- 16.12 Create and insert render parts into the sheet environment of a solid modeling drawing.
- 16.13 Fabricate a part or an assembly using a rapid prototype machine.