2023 – 2024

PROGRAM GUIDE FOR:

MANUFACTURING CLUSTER

ALABAMA STATE DEPARTMENT OF EDUCATION
CAREER AND TECHNICAL EDUCATION
LISA BRUCE, EDUCATION ADMINISTRATOR
TRIPP MARSHALL, EDUCATION SPECIALIST
ASHLEY CRUM, ADMINISTRATIVE ASSISTANT
(334) 694-4746

Manufacturing Cluster Program Guides

The Manufacturing cluster provides the knowledge and skills to equip students for careers in additive manufacturing, industrial maintenance, electronics, manufacturing, precision machining, and robotics. These courses include significant technical depth and engineering concepts and terminology. The Manufacturing cluster provides a safe and appropriate setting for student exploration and achievement. Students gain knowledge and skills through an active, structured, and stimulating environment coordinated with simulated workplace learning experiences. The Manufacturing cluster learning environment utilizes a variety of physical space to stimulate development of effective cognitive and psychomotor skills. Students experience a wide range of hands-on activities based on authentic representations of expectations found in the workplace. Theory and concepts are taught in proportion to the need for strong application opportunities with emphasis on timely learning experiences that facilitate the transition to skills attainment. Safety, proper tool use, and adherence to procedures are integral components for all student learning experiences.

**Courses highlighted in yellow are shared with other clusters. See "Shared Courses" table on page 5 for additional details.

Career Pathway Program	**Additive Manufacturing Program** **(Must teach three courses from this program list within two years)** Additive Manufacturing is based upon Computer-Aided-Design and 3-D Printing. This program provides students with the knowledge of Introduction, Intermediate, and Advanced Drafting Design Technology, Three-Dimensional Solid Modeling and Engineering Applications and the skill to be successful in the Mechanical and Technical Design fields.		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
21106G1033	Advanced Drafting Design	• Alabama Certified Employee (ACE) • Autodesk – AutoCAD Certified User • Autodesk – Fusion 360 Certified User • Autodesk – Inventor Certified User • SolidEdge Certified Associate • SolidWorks Associate	• CAD Designer • Mechanical Designer • Technical Designer
13997G1003	Career Pathway Project in Manufacturing		
13997G1001	CTE Lab in Manufacturing		
21002G1001	Engineering Design Applications		
21106G1023	Intermediate Drafting Design		
21106G1013	Introduction to Drafting Design		
21004G1001	Introduction to Engineering Design		
13001G1000	Introduction to Manufacturing		
17049G1000	Safety and Health Regulations		
21107G1012	Three-Dimensional Solid Modeling I		
21107G1022	Three-Dimensional Solid Modeling II		

Career Pathway Program	**Electronics Program** **(Must teach three courses from this program list within two years)** The electronics program covers a variety of topics including Electrical Theory; Electronic Components; Soldering-Desoldering and Tools; Block Diagrams-Schematics-Wiring Diagrams; Cabling; Power Supplies; Test Equipment and Measurements; Safety Precautions; Mathematics and Formulas; Electronic Circuits; Series and Parallel; Amplifiers; Interfacing of Electronics Products, Digital Concepts and Circuitry; Computer Electronics; Computer Applications; Audio & Video Systems; Optical Electronics; Basic Telecommunications; and Technician Work Procedures. Students will be prepared to earn entry level credentials recognized by the Electronics Technicians Association (ETA).		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
17106G1002	Alternating Current	• Alabama Certified Employee (ACE) • Electronics Technicians Association – Basic AC • Electronics Technicians Association – Basic Analog • Electronics Technicians Association – Basic DC • Electronics Technicians Association – Basic Digital • Electronics Technicians Association – Comprehensive • Electronics Technicians Association – Student Electronics Technician • MSSC – Certified Production Technician (CPT) (Each module will count as a CRI) • NCCER Core (module 6 is an elective and is not required for CRI) • NCCER Electronic Systems Technician, Electronics	• Electronics Installer • Electronics Repair Technician
13997G1003	Career Pathway Project in Manufacturing		
13997G1001	CTE Lab in Manufacturing		
17104G1003	Digital Electronics		
17106G1001	Direct Current		
20101G1033	Electronics and Control Systems		
21009G1005	Embedded Arduino Controls		
13001G1000	Introduction to Manufacturing		
21009G1001	Introduction to Robotics		
21009G1002	Robotics Applications		
17049G1000	Safety and Health Regulations		
17106G1003	Semiconductors		
17109G1000	Telecommunications Cabling		

Career Pathway Program	Industrial Maintenance Electrical & Instrumentation Program **(Must teach three courses from this program list within two years)** Industrial maintenance is divided into two distinct pathways, electrical and instrumentation and mechanical. Industrial maintenance technicians are needed in every industry that uses machinery, from automotive assembly plants to computer manufacturers. Not only do they repair and maintain electrical instruments and equipment, but they also install and dismantle them. Every time a new appliance leaves a factory, or a new car rolls off the line, a skilled industrial maintenance technician played a role in producing it. This program aligns with NCCER standards and covers topics such as Fasteners and Anchors, Process Mathematics, Pneumatic Controls, Oxyfuel Cutting, Introduction to Piping Components, and Laser Alignment.		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
13997G1003	Career Pathway Project in Manufacturing	• Alabama Certified Worker (Ready to Work) • FANUC CERT – Handling Tool Operations and Programming • MSSC – Certified Production Technician (CPT) (Each module will count as a CRI) • NCCER Core (module 6 is an elective and is not required for CRI) • NCCER Industrial Maintenance E&I Level 1	• Industrial Maintenance Electrical Repair Technician • Industrial Maintenance Instrumentation Repair Technician
13997G1001	CTE Lab in Manufacturing		
13303G1001	Industrial Maintenance – Electrical & Instrumentation I		
13303G1002	Industrial Maintenance – Electrical & Instrumentation II		
13303G1003	Industrial Maintenance – Electrical & Instrumentation III		
13001G1000	Introduction to Manufacturing		
17049G1000	Safety and Health Regulations		

Career Pathway Program	Industrial Maintenance Mechanical Program **(Must teach three courses from this program list within two years)** Industrial maintenance is divided into two distinct pathways, electrical and instrumentation and mechanical. Industrial maintenance technicians are needed in every industry that uses machinery, from automotive assembly plants to computer manufacturers. Not only do they repair and maintain electrical instruments and equipment, but they also install and dismantle them. Every time a new appliance leaves a factory, or a new car rolls off the line, a skilled industrial maintenance technician played a role in producing it. This program aligns with NCCER standards and covers topics such as Fasteners and Anchors, Process Mathematics, Pneumatic Controls, Oxyfuel Cutting, Introduction to Piping Components, and Laser Alignment.		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
13997G1003	Career Pathway Project in Manufacturing	• Alabama Certified Employee (ACE) • FANUC CERT – Handling Tool Operations and Programming • MSSC – Certified Production Technician (CPT) (Each module will count as a CRI) • NCCER Core (module 6 is an elective and is not required for CRI) • NCCER Industrial Maintenance Mechanic Level 1	• Industrial Maintenance Mechanical Repair Technician • Pipefitting Technician
13997G1001	CTE Lab in Manufacturing		
13303G1004	Industrial Maintenance - Mechanical I		
13303G1005	Industrial Maintenance - Mechanical II		
13303G1006	Industrial Maintenance - Mechanical III		
13001G1000	Introduction to Manufacturing		
17049G1000	Safety and Health Regulations		

Career Pathway Program	Modern Manufacturing Program **(Must teach three courses from this program list within two years)** Modern Manufacturing is designed to prepare students for entry level positions in manufacturing. These courses align with MSSC and NCCER standards which include modular courses for: Safety, Quality, Production and Maintenance.		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
13997G1003	Career Pathway Project in Manufacturing	• Alabama Certified Employee (ACE) • FANUC CERT – Handling Tool Operations and Programming • MSSC – Certified Production Technician (CPT) (Each module will count as a CRI) • NCCER Core (module 6 is an elective and is not required for CRI)	• Manufacturing Operations Manager • Manufacturing Operations Technician
13997G1001	CTE Lab in Manufacturing		
13001G1000	Introduction to Manufacturing		
13002G1013	Manufacturing I - Safety		
13002G1023	Manufacturing II - Quality		
13002G1033	Manufacturing III - Production		
13002G1043	Manufacturing IV - Maintenance		
17049G1000	Safety and Health Regulations		

Career Pathway Program	Precision Machining Program **(Must teach three courses from this program list within two years)** Precision machinists set up and operate a variety of machine tools to produce precision parts and instruments. The precision machining curriculum includes necessary skills for students to fabricate, modify, or repair mechanical instruments.		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
13997G1003	Career Pathway Project in Manufacturing	• Alabama Certified Employee (ACE) • MSSC – Certified Production Technician (CPT) (Each module will count as a CRI) • NIMS Level 1 CNC Milling: Programming Setup and Operations • NIMS Level 1 CNC Turning: Programming Setup and Operations • NIMS Level 1 Drill Press Skills • NIMS Level 1 Grinding Skills • NIMS Level 1 Job Planning, Benchwork and Layout • NIMS Level 1 Manual Milling Skills • NIMS Level 1 Measurement, Materials and Safety • NIMS Level 1 Milling Operations • NIMS Level 1 Turning Operations: Turning Between Centers • NIMS Level 1 Turning Operations: Turning Chucking Skills • NIMS Level 1 Turning: Operations	• CNC Machinist • Precision Machinist
13203G1004	Computer-Aided Design and Computer-Aided Manufacturing I		
13203G1005	Computer-Aided Design and Computer-Aided Manufacturing II		
13203G1006	Computer Numerical Control (CNC) I		
13203G1007	Computer Numerical Control (CNC) II		
13204G1001	Coordinate Measuring Machine		
13997G1001	CTE Lab in Manufacturing		
13204G1006	Drill Press		
13204G1004	Intermediate Lathe and Bench Work		
13204G1002	Introduction to Lathe		
13001G1000	Introduction to Manufacturing		
13203G1001	Introduction to Precision Machining		
13203G1008	Milling and Surface Grinder I		
13203G1009	Milling and Surface Grinder II		
17049G1000	Safety and Health Regulations		

Career Pathway Program	Robotics and Automated Manufacturing Program **(Must teach three courses from this program list within two years)** The Robotics and Automated Manufacturing program covers a variety of topics including Computer Automation, Design, and Production, as well as Introduction to Robotics, Robotics Application, Electronics and Control Systems. Students will be prepared to earn entry level credentials recognized by the Electronics Technicians Association (ETA), MSSC, and NCCER.		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
13997G1003	Career Pathway Project in Manufacturing	• Alabama Certified Employee (ACE) • Autodesk – AutoCAD Certified User • Autodesk – Inventor Certified User • Electronics Technicians Association – Basic AC • Electronics Technicians Association – Basic Analog • Electronics Technicians Association – Basic DC • Electronics Technicians Association – Basic Digital • Electronics Technicians Association – Comprehensive • Electronics Technicians Association – Student Electronics Technician • MSSC – Certified Production Technician (CPT) (Each module will count as a CRI) • NCCER Core (module 6 is an elective and is not required for CRI) • NCCER Electronic Systems Technician, Electronics • SolidEdge Certified Associate • SolidWorks Associate	• Automation Technician • Controls Engineer • Electronic Technician • Industrial Maintenance • Programmable Logic Controller Technician
13997G1001	CTE Lab in Manufacturing		
21010G1001	Computer Integrated Automation		
21010G1002	Computer Integrated Design		
21010G1003	Computer Integrated Production		
20101G1033	Electronics and Control Systems		
13001G1000	Introduction to Manufacturing		
21009G1001	Introduction to Robotics		
21009G1002	Robotics Application		
21010G1002	Robotics and Automation		
17049G1000	Safety and Health Regulations		

Career Pathway Program	*SREB AC Automated Materials Joining Technology (Must teach three courses from this program list within two years.) Automated Materials Joining Technology allows students to use a project-based learning approach. Students will explore materials joining and forming methods, computer-aided design and automated systems that transform design concepts into fully developed products. Materials become more complex in chemical composition and structure, and the usefulness of many new materials is dependent upon improvements in joining science and technology.		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
13997G1003	Career Pathway Project in Manufacturing	• Alabama Certified Employee (ACE) • MSSC – Certified Production Technician (CPT) (Each module will count as a CRI) • NCCER Core (module 6 is an elective and is not required for CRI)	• Process Controls Engineer • PLC Automation Technician
13997G1001	CTE Lab in Manufacturing		
17049G1000	Safety and Health Regulations		
13104G1013	SREB Advanced Concepts in Materials Joining		
13104G1012	SREB Applications in Automated Materials Joining		
13104G1011	SREB Introduction to Automated Materials Joining		
13104G1014	SREB Projects in Automated Materials Joining		
***NOTE:** LEAs must contact SREB for additional information prior to utilizing any of the course codes listed above, as it does require commitment to the conditions in a MOU and participation in mandatory training provided by the provider.			

Career Pathway Program	*SREB AC Energy and Power Program (Must teach three courses from this program list within two years) Energy and Power program allows students to understand various means of power generation and distribution with topics that include turbines, motor/generator sets, renewable and non-renewable energy generation, and electrochemical systems. Students will also gain knowledge and skills about single and multiple phase generation and distribution systems, transformers, and high voltage AC and DC systems.		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
13997G1003	Career Pathway Project in Manufacturing	• Alabama Certified Employee (ACE) • Autodesk – AutoCAD Certified User • Autodesk – Fusion 360 Certified User • Autodesk – Inventor Certified User • SolidEdge Certified Associate • SolidWorks Associate	• Civil Engineer • Electrical Engineer • Environmental Scientist/Specialist • Project Engineer
13997G1001	CTE Lab in Manufacturing		
17049G1000	Safety and Health Regulations		
21049G1000	SREB Advanced Science and Engineered Systems		
21049G1025	SREB Electronics and Control Systems		
20101G1013	SREB Energy and Power Foundation		
20101G1023	SREB Energy Transmission and Distribution		
***NOTE:** LEAs must contact SREB for additional information prior to utilizing any of the course codes listed above, as it does require commitment to the conditions in a MOU and participation in mandatory training provided by the provider.			

Career Pathway Program	*SREB AC Integrated Production Technologies Program (Must teach three courses from this program list within two years.) Integrated Production Technologies allows students to apply what they learn in physics, chemistry and biology to real-world projects using emerging, cutting-edge materials. Students will work on the frontiers of product development by applying nanotechnology to new areas of need. Students will reengineer existing products to reduce the energy and material costs required to produce them, invent new products, and create more durable and efficient products using automated computer-aided design and manufacturing programs.		
Course Number	**Career Pathway Program Courses**	**Career Readiness Indicator (CRI)**	**In Demand Occupations**
13997G1003	Career Pathway Project in Manufacturing	• Alabama Certified Employee (ACE) • FANUC CERT – Handling Tool Operations and Programming • MSSC – Certified Production Technician (CPT) (Each module will count as a CRI) • NCCER Core (module 6 is an elective and is not required for CRI)	• Manufacturing Operations Manager • Manufacturing Operations Technician
13997G1001	CTE Lab in Manufacturing		
17049G1000	Safety and Health Regulations		
13104G1001	SREB Advanced Technology for Design and Production		
13104G1004	SREB Design for the Production of Advanced Products		
13104G1003	SREB Mechatronic Systems for Advanced Production		
13104G1002	SREB Systems of Advanced Technology		
***NOTE:** LEAs must contact SREB for additional information prior to utilizing any of the course codes listed above, as it does require commitment to the conditions in a MOU and participation in mandatory training provided by the provider.			

2023-2024 Subject and Personnel Codes
Manufacturing Cluster

Course Number	Course Name	Course Number	Course Name
21106G1033	Advanced Drafting Design	13001G1000	Introduction to Manufacturing
17106G1002	Alternating Current	13203G1001	Introduction to Precision Machining
13997G1003	Career Pathway Project in Manufacturing	21009G1001	Introduction to Robotics
13203G1004	Computer-Aided Design and Computer-Aided Manufacturing I	13002G1013	Manufacturing I - Safety
13203G1005	Computer-Aided Design and Computer-Aided Manufacturing II	13002G1023	Manufacturing II - Quality
21010G1001	Computer Integrated Automation	13002G1033	Manufacturing III - Production
21010G1002	Computer Integrated Design	13002G1043	Manufacturing IV - Maintenance
21010G1003	Computer Integrated Production	13203G1008	Milling and Surface Grinder I
13203G1006	Computer Numerical Control (CNC) I	13203G1009	Milling and Surface Grinder II
13203G1007	Computer Numerical Control (CNC) II	21009G1004	Robotics and Automation
13204G1001	Coordinate Measuring Machine	21009G1002	Robotics Applications
13997G1001	CTE Lab in Manufacturing	17049G1000	Safety and Health Regulations
17104G1003	Digital Electronics	17106G1003	Semiconductors
17106G1001	Direct Current	13104G1001	SREB Advanced Technology for Design and Production
13204G1006	Drill Press	13104G1013	SREB Advanced Concepts in Materials Joining
20101G1033	Electronics and Control Systems	21049G1000	SREB Advanced Science and Engineered Systems
21009G1005	Embedded Arduino Controls	13104G1012	SREB Applications in Automated Materials Joining
21002G1001	Engineering Design Applications	13104G1004	SREB Design for the Production of Advanced Products
13303G1001	Industrial Maintenance – Electrical & Instrumentation I	21049G1025	SREB Electronics and Control Systems
13303G1002	Industrial Maintenance – Electrical & Instrumentation II	20101G1013	SREB Energy and Power Foundation
13303G1003	Industrial Maintenance – Electrical & Instrumentation III	20101G1023	SREB Energy Transmission and Distribution
13303G1004	Industrial Maintenance - Mechanical I	13104G1011	SREB Introduction to Automated Materials Joining
13303G1005	Industrial Maintenance - Mechanical II	13104G1003	SREB Mechatronic Systems for Advanced Production
13303G1006	Industrial Maintenance - Mechanical III	13104G1014	SREB Projects in Automated Materials Joining
21106G1023	Intermediate Drafting Design	13104G1002	SREB Systems of Advanced Technology
13204G1004	Intermediate Lathe and Bench Work	17109G1000	Telecommunications Cabling
21106G1013	Introduction to Drafting Design	21107G1012	Three-Dimensional Solid Modeling I
21004G1001	Introduction to Engineering Design	21107G1022	Three-Dimensional Solid Modeling II
13204G1002	Introduction to Lathe		

Shared Courses			
Course Number	**Course Name**	**Cluster(s)**	**Required Year to Implement COS**
17106G1002	Alternating Current	Information Technology	2022-2023
17106G1001	Direct Current	Information Technology	2022-2023
17049G1000	Safety and Health Regulations	Architecture and Construction Transportation, Distribution and Logistics	2022-2023

General Note: Course descriptions and content standards for most courses are located on the Alabama Department of Education website at: https://www.alabamaachieves.org/career-and-technical-education/cte-courses-of-study/.

College and Career Readiness Indicator Course Matrix

Program Name	Additive Manufacturing	Electronics	Industrial Maintenance Electrical & Instrumentation	Industrial Maintenance Mechanical	Modern Manufacturing
Foundation Course(s)	Introduction to Manufacturing Safety and Health Regulations	Introduction to Manufacturing Safety and Health Regulations	Introduction to Manufacturing Safety and Health Regulations	Introduction to Manufacturing Safety and Health Regulations	Introduction to Manufacturing Safety and Health Regulations
Concentrator Course(s)	Advanced Drafting Design Engineering Design Applications Intermediate Drafting Design Introduction to Drafting Design Introduction to Engineering Design Three-Dimensional Solid Modeling I Three-Dimensional Solid Modeling II	Alternating Current Digital Electronics Direct Current Electronics and Control Systems Embedded Arduino Controls Introduction to Robotics Robotics Applications Semiconductors Telecommunications Cabling	Industrial Maintenance – Electrical & Instrumentation I Industrial Maintenance – Electrical & Instrumentation II Industrial Maintenance – Electrical & Instrumentation III	Industrial Maintenance - Mechanical I Industrial Maintenance - Mechanical II Industrial Maintenance - Mechanical III	Manufacturing I - Safety Manufacturing II - Quality Manufacturing III - Production Manufacturing IV - Maintenance
Capstone Course(s)	Career Pathway Project in Manufacturing CTE Lab in Manufacturing	Career Pathway Project in Manufacturing CTE Lab in Manufacturing	Career Pathway Project in Manufacturing CTE Lab in Manufacturing	Career Pathway Project in Manufacturing CTE Lab in Manufacturing	Career Pathway Project in Manufacturing CTE Lab in Manufacturing

Program Name	Precision Machining	Robotics and Automated Manufacturing	SREB AC Automated Materials Joining Technology	SREB AC Energy and Power	SREB AC Integrated Production Technologies
Foundation Course(s)	Introduction to Manufacturing Safety and Health Regulations	Introduction to Manufacturing Safety and Health Regulations	Safety and Health Regulations	Safety and Health Regulations	Safety and Health Regulations
Concentrator Course(s)	Computer-Aided Design and Computer-Aided Manufacturing I Computer-Aided Design and Computer-Aided Manufacturing II Computer Numerical Control (CNC) I Computer Numerical Control (CNC) II Coordinate Measuring Machine Drill Press Intermediate Lathe and Bench Work Introduction to Lathe Introduction to Precision Machining Milling and Surface Grinder I Milling and Surface Grinder II	Computer Integrated Automation Computer Integrated Design Computer Integrated Production Electronics and Control Systems Introduction to Robotics Robotics Application Robotics and Automation	SREB Advanced Concepts in Materials Joining SREB Applications in Automated Materials Joining SREB Introduction to Automated Materials Joining SREB Projects in Automated Materials Joining	SREB Clean Energy Application SREB Clean Energy Innovation SREB Clean Energy Strategies SREB Clean Energy Systems	SREB Advanced Technology for Design and Production SREB Design for the Production of Advanced Products SREB Mechatronic Systems for Advanced Production SREB Systems of Advanced Technology
Capstone Course(s)	Career Pathway Project in Manufacturing CTE Lab in Manufacturing	Career Pathway Project in Manufacturing CTE Lab in Manufacturing	Career Pathway Project in Manufacturing CTE Lab in Manufacturing	Career Pathway Project in Manufacturing CTE Lab in Manufacturing	Career Pathway Project in Manufacturing CTE Lab in Manufacturing

To meet the CCR Indicator as a CTE completer, a student must earn three (3.0) credits with the grade of a "C" or higher in CTE courses that are part of an approved CTE program of study. Additional requirements are outlined in Memorandum **FY22-2065.**

***Courses are listed in alphabetical order, not in sequential order.**