

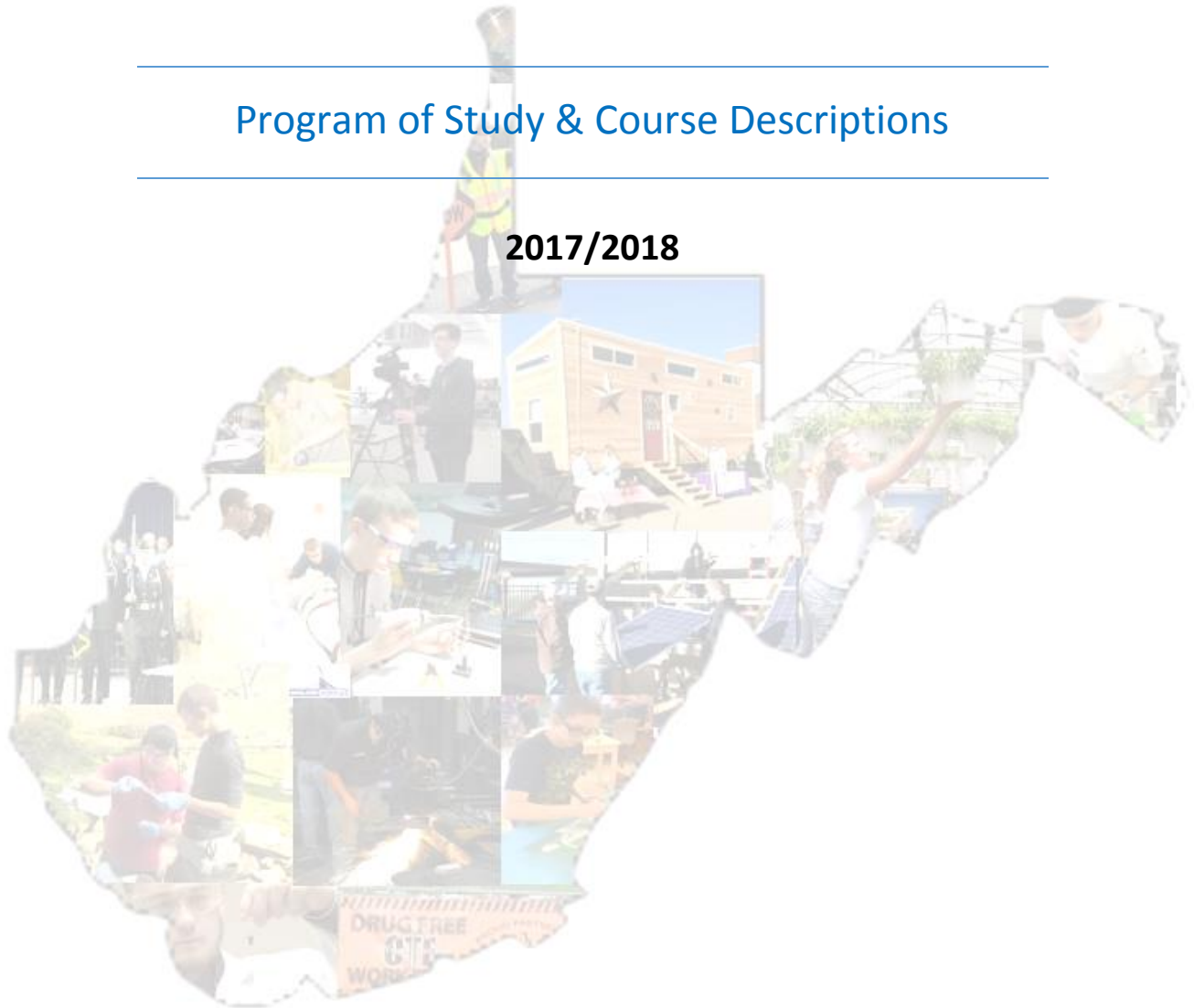
# Manufacturing

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Program of Study & Course Descriptions

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2017/2018



West Virginia DEPARTMENT OF  
**EDUCATION**



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\*\*IWRC Program of Study Available

## **Manufacturing Cluster**

### **Cluster Description:**

The Manufacturing Cluster focuses on careers planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering

### **Maintenance, Installation and Repair Pathway**

#### **Pathway Description:**

People with careers in Maintenance, Installation and Repair perform preventive maintenance procedures on machines tools and equipment. These are performed routinely and on a regular basis. They also troubleshoot and repair electrical, electronic and mechanical systems. This will include mechanical repair as well as using computer-based inventory control systems, retrieving information histories on each machine from computer records, and recording repair activities on the system to keep accurate records of repairs performed on each machine.

**Program of Study:** MA1780 Electronics Technician

- Courses:** 1666 DC Circuit Concepts
- 1667 AC Circuit Concepts
- 1668 Analog Circuits and Systems
- 1669 Digital and Computer Concepts

#### **Program of Study Description:**

The Electronic Systems Technician Program of Study focuses on careers that will build a knowledge base and technical skills in all aspects of the Electronic Trades industry. Students will have the opportunity to earn NCCER certification for each skill set mastered and be exposed to skills to develop positive work ethics.

#### **Course Descriptions:**

##### **1666 DC Circuit Concepts**

This course introduces the student to the knowledge base and technical skills of the Electrical Trades industry. Electrical Trades I begins with the NCCER Core curriculum which is a prerequisite to all Level I completions. The students will complete modules in Basic Safety; Introduction to Construction Math; Introduction to Hand Tools; Introduction to Power Tools; Introduction to Construction Drawings; Basic Rigging; Basic Communication Skills; Basic Employability Skills; and Introduction to Materials Handling. Students will then begin developing skill sets related to the fundamentals of Electronics such as Introduction to the Trade; and Wood and Masonry Construction Methods. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations,

WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

### **1667 AC Circuit Concepts**

AC Circuit Concepts will continue to build student skill sets in areas such as Concrete and Steel Construction Methods; Pathways and Spaces; Craft Related Mathematics; Hand Bending Conduit; Introduction to the National Electrical Code®; and Low-Voltage Cabling. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

### **1668 Analog Circuits and Systems**

Analog Circuits and Systems will continue to build student skill sets in areas of DC Circuits; AC Circuits; Switching Devices and Timers; Semiconductors and Integrated Circuits; and Test Equipment. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

### **1669 Digital and Computer Concepts**

Digital and Computer Concepts will continue to build student skill sets in areas of Introduction to Electrical Drawings; Introduction to Codes and Standards; Cable Selection; Wire and Cable Terminations; and Power Quality and Grounding. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**Program of Study:** MA1870 Industrial Equipment Maintenance

**Courses:** 1871 Electrical Maintenance

1873 Fundamentals of Industrial Equipment Maintenance

1875 Hydraulic and Pneumatic Systems

1985 Fundamentals of Welding Technology

**Program of Study Description:**

The Industrial Equipment Maintenance Program of Study focuses on careers that will build a knowledge base and technical skills in all aspects of the Industrial Equipment Maintenance industry. Students will have the opportunity to be to develop positive work ethic skills.

**Course Descriptions:**

**1871 Electrical Maintenance**

This course introduces the student to the knowledge base and technical skills for entry level skills in industrial Electrical Maintenance. Areas of study include basic electrical theory and calculations, electrical tools, instruments and safety, electrical symbols and diagrams, industrial power and control circuits, electrical equipment and devices, electrical motors, and an introduction to programmable logic controllers, as applied in industrial locations. Emphasis will be placed on career exploration, job seeking skills, and personal and professional ethics. Safety instruction is integrated into all activities. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**1873 Fundamentals of Industrial Equipment Maintenance**

This course introduces the student to the knowledge base and technical skills for entry level skills in Industrial Maintenance. Areas of study include workplace safety, measurement and calculation, tools, fasteners, lubrication and bearings, mechanical and belt drives, and mechanical alignment and vibration. Emphasis will be placed on career exploration, job seeking skills, and personal and professional ethics. Safety instruction is integrated into all activities. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**1875 Hydraulic and Pneumatic Systems**

This course introduces the student to the knowledge base and technical skills related to industrial Hydraulic and Pneumatic Systems. Areas of study include hydraulic principles, practical application of hydraulic systems, pneumatic principles, and practical application of pneumatic systems. Emphasis will be placed on career exploration, job seeking skills, and

personal and professional ethics. Safety instruction is integrated into all activities. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

### **1985 Fundamentals of Welding Technology**

This course introduces the student to the knowledge base and technical skills for all courses in Welding Technology. Areas of study include career opportunities in welding, welding terms and processes, oxyfuel cutting, lab, and equipment safety. Safety instruction is integrated into all activities. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

## **Manufacturing Production Process Development Pathway**

### **Pathway Description:**

Employees in Manufacturing Production Process Development are responsible for product design and design of the manufacturing process. They work with customers to ensure the manufacturing process produces a product that meets or exceeds customer expectations. They also monitor the manufacturing process and the materials used to manufacture the product.

**Program of Study:** MA2235 Advanced Manufacturing (Advanced Careers)

**Courses:** 1575 AC Advanced Manufacturing I  
1576 AC Advanced Manufacturing II  
1577 AC Advanced Manufacturing III  
1578 AC Advanced Manufacturing IV

### **Program of Study Description:**

Advanced Manufacturing is a family of activities that (a) depend on the use and coordination of information, automation, computation, software, sensing, and networking, and/or (b) make use of cutting edge materials and emerging capabilities enabled by the physical and biological sciences, for example nanotechnology, chemistry, and biology. This involves both new ways to manufacture existing products, and especially the manufacture of new products emerging from new advanced technologies.

### **Course Descriptions:**

#### **1575 AC Advanced Manufacturing I**

A project based course that introduces students to manufacturing's role in our society. In addition to concentrating on design and problem solving the course introduces the students to several other concepts as well including an introduction to control system technology, automated manufacturing systems and robotics.

#### **1576 AC Advanced Manufacturing II**

This course applies the learning from the first course. This course involves projects related to the systems that are found in factories. Students learn about effective and energy efficient use of motors, drive systems, pumping systems, conveyors, piping and control systems. Students focus on properties of materials and materials testing creating documentation examining the properties and justifying selections based on the properties. Students learn that some products manufactured become the raw materials for more complex products. Students explore the technologies utilized in manufacturing.

#### **1577 AC Advanced Manufacturing III**

This is the third course in the four-course sequence and focuses on industrial control and automation systems as they apply to the advanced manufacturing equipment. This equipment depends on the use and coordination of information, automation, computation, software, sensing, and networking. Students will design and create mechatronic systems to accomplish



advanced manufacturing tasks. Students will also create sophisticated technical reports similar to ones generated by engineers in this industry.

**1578 AC Advanced Manufacturing IV**

This course allows students to apply knowledge of materials to the design for manufacturing necessary to bring a product to market. Students explore the business of manufacturing while creating work cells to process materials into products. Students design a prototype and then redesign with the goal of manufacturing the product. Students analyze and evaluate all aspects of the design and production process with an emphasis on lean, green manufacturing. Students pay special attention to the control systems integration, data acquisition, and quality control processes necessary for Six Sigma production.

**Program of Study:** MA1630 Robotics

- Courses:** 1866 Robotics REC 1  
1867 Robotics REC 2  
1868 Robotics REC 3  
1869 Robotics REC 4

**Program of Study Description:**

The Robotics Program of Study focuses on careers that will build a knowledge base and technical skills in industry fields with a robotic component such as an Advanced Manufacturing Technician, Computer-Controlled Machine Tool Operators, or an Electro-Mechanical Technician. The Robotic curriculum follows the intelitek curriculum which includes VEX Programming, Advanced C Programming and Advanced Mechanics. The majority of coursework is taught in an industry setting, providing students with hands-on experience. Students will also be exposed to skills to develop positive work ethics.

**Course Descriptions:**

**1866 Robotics REC 1**

REC 1 includes an introduction to Robotics and to VEX programming. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of a student organization, SkillsUSA West Virginia. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**1867 Robotics REC 2**

In REC 2, students build and program the BaseBot, then use it to conduct experiments demonstrating physics and mechanical properties, adding sensors and mechanism. REC 1 concludes with a capstone project featuring competitive instructional strategies. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of a student organization, SkillsUSA West Virginia. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**1868 Robotics REC 3**

In REC 3, students continue with deeper engineering topics, building more advanced robots. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of a student organization, SkillsUSA West Virginia. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**1869 Robotics REC 4**

In REC 4, students are engaged in a Capstone project: Bucket Battle. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of a student organization, SkillsUSA West Virginia. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

## **Production Pathway**

### **Pathway Description:**

People with careers in production work on the shop floor making parts or assembling them. They work with machines, making or assembling electronic parts, constructing or assembling modular housing, performing welding jobs, or printing various materials.

### **Program of Study:** MA1900 Machine Tool Technology

**Courses:** 1903 Fundamentals of Machine Tool Technology

1905 Fundamentals of Machine Processes

1907 Machine Tool Operations

1909 Metal Trades Processes and Applications

### **Program of Study Description:**

The Machine Tool Technology Program of Study focuses on careers that will build a knowledge base and technical skills in all aspects of the Machine Tool Technology industry. Students will have the opportunity to earn NIMS certifications that are applicable to the trade.

### **Course Descriptions:**

#### **1903 Fundamentals of Machine Tool Technology**

This course introduces the student to the knowledge base and technical skills of the Machine Tool Technology industry. In the Fundamentals of Machine Tool Technology class areas of study include hydraulic principles, practical application of hydraulic systems, pneumatic principles, and practical application of pneumatic systems. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

#### **1905 Fundamentals of Machine Processes**

Fundamentals of Machine Processes will continue to build student skills in areas such as intermediate hand tools, power tools, measuring tools, vertical band saw, surface grinding, metal lathe operations, and milling machine operations. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

#### **1907 Machine Tool Operations**

This course introduces the student to the knowledge base and technical skills for concepts in Machine Tool Operations. Areas of study include grinding techniques, lathe operations, milling

operations, and CNC machining. Emphasis will be placed on career exploration, job seeking skills, and personal and professional ethics. Safety instruction is integrated into all activities. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

### **1909 Metal Trades Processes and Applications**

Metal Trades Processes and Applications will continue to build student skills in areas of power saw operations, metal lathe operations, milling machine operations, and CNC machining operations. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**\*\*Program of Study: MA2120 Millwork and Cabinetmaking**

**Courses:** 2126 Millwork and Cabinetmaking I  
2127 Millwork and Cabinetmaking II  
2128 Millwork and Cabinetmaking III  
2129 Millwork and Cabinetmaking IV

**Program of Study Description:**

The Millwork and Cabinetmaking Program of Study focuses on careers that will build a knowledge base and technical skills in all aspects of the Millwork and Cabinetmaking industry. Students will have the opportunity to earn NCCER certification for each skill set mastered and be exposed to skills to develop positive work ethics.

**Course Descriptions:**

**2126 Millwork and Cabinetmaking I**

This course introduces the student to the knowledge base and technical skills of the Millwork and Cabinetmaking industry. Millwork and Cabinetmaking I begins with the NCCER Core curriculum which is a prerequisite to all Level I completions. The students will complete modules in Basic Safety; Introduction to Construction Math; Introduction to Hand Tools; Introduction to Power Tools; Introduction to Construction Drawings; Basic Rigging; Basic Communication Skills; Basic Employability Skills; and Introduction to Materials Handling. Students will then begin developing skill sets in the fundamentals of the Millwork and Cabinetmaking such as Introduction to the Trade; and Woods and Materials Used in Cabinet Construction. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**2127 Millwork and Cabinetmaking II**

Millwork and Cabinetmaking II will continue to build student skill sets in areas such as Shop Tools Used in Cabinetmaking; Joints; Assembling the Cabinet; and Sanding and Finishing. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**2128 Millwork and Cabinetmaking III**

Millwork and Cabinetmaking III will continue to build student skill sets in areas of Applying Plastic Laminate to a Countertop; Cabinet Doors; and Cabinet Drawers. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning

opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

#### **2129 Millwork and Cabinetmaking IV**

Millwork and Cabinetmaking IV will continue to build student skill sets in areas of Cabinet Doors and Drawer Hardware; Cabinet Shelves and Shelf Hardware; and Mass Production Cabinetmaking. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**Program of Study:** MA1980 Welding

**Courses:** 1862 Welding I  
1863 Welding II  
1864 Welding III  
1865 Welding IV

**Program of Study Description:**

The Welding Program of Study focuses on careers that will build a knowledge base and technical skills in all aspects of the Welding industry. Students will have the opportunity to earn both NCCER certification and the WV Welding Certification for each skill set mastered and be exposed to skills to develop positive work ethics.

**Course Descriptions:**

**1862 Welding I**

This course is designed to introduce the student to the knowledge base and technical skills of the Welding industry. Welding I begins with the NCCER Core curriculum which is a prerequisite to all Level I completions. The students will complete modules in Basic Safety; Introduction to Construction Math; Introduction to Hand Tools; Introduction to Power Tools; Introduction to Construction Drawings; Basic Rigging; Basic Communication Skills; Basic Employability Skills; and Introduction to Materials Handling. Students will then begin developing skill sets in the fundamentals of Welding such as Welding Safety; Oxyfuel Cutting; and Plasma Arc Cutting. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**1863 Welding II**

Welding II will continue to build student skill sets in areas of Air Carbon Arc Cutting and Gouging; Base Metal Preparation; Weld Quality; SMAW-Equipment and Setup; Shielded Metal Arc Electrodes; SMAW-Beads and Fillet Welds; Joint Fit Up and Alignment; SMAW-Groove Welds with Backing; and SMAW-Open V-Groove Welds. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

**1864 Welding III**

Welding III will continue to build student skill sets in areas of Welding Symbols; Reading Welding Detail Drawings; Physical Characteristics and Mechanical Properties of Metals; Preheating and Postheating of Metals; GMAW and FCAW-Equipment and Filler Metals; and GMAW and FCAW-Plate. Students utilize problem-solving techniques and participate in hands-



on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

#### **1865 Welding IV**

Welding IV will continue to build student skill sets in areas of GTAW-Equipment and Filler Metals; and GTAW-Plate. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

## Manufacturing Cluster Electives

### Maintenance, Installation and Repair Pathway Electives

**Program of Study:** MA1780 Electronics Technician

WVEIS CODE	Courses
0520	Work-Based Integration and Transition
1692	Computer Hardware
1705	Fundamentals of Computer Systems
1763	Fundamentals of Electricity
1783	Basic AC Circuits
1787	DC Circuits and Electron Physics
1795	Wiring and Soldering

#### **Elective Course Descriptions:**

##### **0520 Work-Based Integration and Transition**

This course gives students the opportunity to integrate theory and practice by interacting with industry professionals. Students will study various requirements for employability including ethics, communication, teamwork and professionalism. Students will participate in hands-on, digital or work-based experiences related to industry settings in order to practice skill sets and to transition from student to employee. A supervised project will be developed in one or more of the following categories: Entrepreneurship (ownership or operation of a business); Placement (employment or internship); Research and Experimentation (planning and/or conducting a scientific experiment); Exploration (exploration of related careers through activities such as shadowing employees in various work settings, conducting on-line research, attending professional development activities, etc.). Students will develop materials to supplement their Simulated Workplace portfolios.

##### **1692 Computer Hardware**

This course introduces the student to the knowledge base and technical skills required to identify, configure and upgrade microcomputer hardware and peripherals. Content standards and objectives are based on testing objectives for the CompTIA A+ certification. Areas of study include personal computer components, laptop and portable devices, printers and scanners, networks, security and safety and environmental issues. Students will demonstrate knowledge and technical expertise in hardware troubleshooting and repair. Emphasis will be placed on personal and professional ethics, and students will explore a variety of career opportunities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to occupations in computer repair and networking. Safety instruction is integrated into all activities.

### **1705 Fundamentals of Computer Systems**

This course introduces the student to the knowledge and technical skills for all courses in the Computer Systems and Hardware Support Program of Study. Areas of study include computer hardware, data representation, operating system, utility, productivity software, communications and networks, and the Internet. Emphasis will be placed on personal and professional ethics, and students will explore a variety of career opportunities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to occupations in the IT industry. Safety instruction is integrated into all activities.

### **1763 Fundamentals of Electricity**

This course introduces the student to the knowledge base and technical skills for Fundamentals of Electricity. Areas of study include electrical safety, electrical math concepts, and basic circuits. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts.

### **1783 Basic AC Circuits**

This course introduces the student to the knowledge base and technical skills for Basic AC Circuits. Areas of study include alternating current, circuit evaluation, magnetic, and electromagnetic devices. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to Electronic Technology occupations.

### **1787 DC Circuits and Electron Physics**

This course introduces the student to the knowledge base and technical skills in the concepts of DC Circuits and Electron Physics. Areas of study include DC circuits, electron physics, circuit construction and analysis. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to electronic careers and occupations.

### **1795 Wiring and Soldering**

This course introduces the student to the knowledge base and technical skills for basic soldering and printed circuit board concepts. Areas of study include safety, tools and equipment, circuit board construction, basic splicing and soldering. Emphasis will be placed on safety and acceptable procedure. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop soldering skills

and an understanding of course concepts. The teachers should provide each student with real world applications and instruction related to entry level electronics technician occupation.

**Program of Study:** MA1870 Industrial Equipment Maintenance

WVEIS CODE	Courses
0520	Work-Based Integration and Transition
1601	Basic Control Circuits
1605	Fundamentals of Air Conditioning/Refrigeration
1607	Heating Systems
1765	Industrial and Commercial Wiring
1771	Rotating Devices and Control Circuitry
1903	Fundamentals of Machine Tool Technology

**Elective Course Descriptions:**

**0520 Work-Based Integration and Transition**

This course gives students the opportunity to integrate theory and practice by interacting with industry professionals. Students will study various requirements for employability including ethics, communication, teamwork and professionalism. Students will participate in hands-on, digital or work-based experiences related to industry settings in order to practice skill sets and to transition from student to employee. A supervised project will be developed in one or more of the following categories: Entrepreneurship (ownership or operation of a business); Placement (employment or internship); Research and Experimentation (planning and/or conducting a scientific experiment); Exploration (exploration of related careers through activities such as shadowing employees in various work settings, conducting on-line research, attending professional development activities, etc.). Students will develop materials to supplement their Simulated Workplace portfolios.

**1601 Basic Control Circuits**

This course introduces the student to the knowledge base and technical skills for concepts in Basic Control Circuits. Areas of study include mathematical concepts, technical writing skills, technical reading comprehension, career opportunities and personal and equipment safety. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction.

**1605 Fundamentals of Air Conditioning/Refrigeration**

This course introduces the student to the knowledge base and technical skills for all courses in the heating ventilation and air conditioning Program of Study. Areas of study include mathematical concepts, technical writing skills, technical reading comprehension, career

opportunities, personal and equipment safety, fabrication operations and basic compression refrigeration. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to air conditioning and refrigeration occupations.

### **1607 Heating Systems**

This course introduces the student to the knowledge base and technical skills for concepts in Heating Systems. Areas of study include mathematical concepts, technical writing skills, technical reading comprehension, career opportunities and personal and equipment safety. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction.

### **1765 Industrial and Commercial Wiring**

This course introduces the student to the knowledge base and technical skills for Industrial and Commercial Wiring. Areas of study include conduit and raceways and commercial load calculations and configurations. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts and teachers should provide each student with real world learning opportunities and instruction related to course concepts.

### **1771 Rotating Devices and Control Circuitry**

This course introduces the student to the knowledge base and technical skills for concepts in the Rotating Devices and Control Circuitry. Areas of study include control circuitry and motor controls. Emphasis will be placed on career exploration, job seeking skills, and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to course concepts.

### **1903 Fundamentals of Machine Tool Technology**

This course introduces the student to the knowledge base and technical skills for all courses in the Machine Tool Technology Program of Study. Areas of study include career exploration, measuring skills and techniques, interpreting blueprints, basic hand tools, filing and grinding, basic band saw, basic drill press, basic metal lathe, and basic milling machine operations and procedures. Emphasis will be placed on career exploration, job seeking skills, and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding

of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to Machine Tool Technology.

## Manufacturing Production Process Development Pathway Electives

**Program of Study:** MA2235 Advanced Manufacturing (Advanced Careers)

WVEIS CODE	Courses
0520	Work-Based Integration and Transition

### **Elective Course Description:**

#### **0520 Work-Based Integration and Transition**

This course gives students the opportunity to integrate theory and practice by interacting with industry professionals. Students will study various requirements for employability including ethics, communication, teamwork and professionalism. Students will participate in hands-on, digital or work-based experiences related to industry settings in order to practice skill sets and to transition from student to employee. A supervised project will be developed in one or more of the following categories: Entrepreneurship (ownership or operation of a business); Placement (employment or internship); Research and Experimentation (planning and/or conducting a scientific experiment); Exploration (exploration of related careers through activities such as shadowing employees in various work settings, conducting on-line research, attending professional development activities, etc.). Students will develop materials to supplement their Simulated Workplace portfolios.

**Program of Study:** MA1630 Robotics

WVEIS CODE	Courses
0520	Work-Based Integration and Transition
1713	Programming Concepts
1718	Introduction to Computer Aided Drafting
1728	Advanced Computer Aided Drafting
1875	Hydraulic/Pneumatic Systems
2436	Foundations in Engineering

### **Elective Course Descriptions:**

#### **0520 Work-Based Integration and Transition**

This course gives students the opportunity to integrate theory and practice by interacting with industry professionals. Students will study various requirements for employability including ethics, communication, teamwork and professionalism. Students will participate in hands-on, digital or work-based experiences related to industry settings in order to practice skill sets and to transition from student to employee. A supervised project will be developed in one or more of the following categories: Entrepreneurship (ownership or operation of a business); Placement (employment or internship); Research and Experimentation (planning and/or

conducting a scientific experiment); Exploration (exploration of related careers through activities such as shadowing employees in various work settings, conducting on-line research, attending professional development activities, etc.). Students will develop materials to supplement their Simulated Workplace portfolios.

### **1713 Programming Concepts**

This course introduces the student to the knowledge base and technical skills for higher-order computer programming. Areas of study include basic concepts, program planning, program structure, languages and career exploration. Students will demonstrate knowledge and technical expertise in developing and debugging code. Emphasis will be placed on personal and professional ethics, and students will explore a variety of career opportunities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to occupations in information technology. Safety instruction is integrated into all activities.

### **1718 Introduction to Computer Aided Drafting**

This course will introduce students to computer-aided drafting using CAD software. Areas of study include the CAD interface, basic geometry, working aids, basic dimensioning, plotting, and student organizations. Students will demonstrate knowledge and technical expertise in the commands and features of the program. Emphasis will be placed on personal and professional ethics and students will explore a variety of career opportunities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts and teachers should provide each student with real world learning opportunities and instruction related to drafting, design and related engineering occupations. Safety instruction is integrated into all activities.

### **1728 Advanced Computer Aided Drafting**

This course introduces the student to the knowledge base and technical skills for advanced computer aided drafting. Areas of study include paper space/model space, layout, and add-on software. Students will demonstrate knowledge and technical expertise in the use of CAD software. Emphasis will be placed on personal and professional ethics, and students will explore a variety of career opportunities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts and teachers should provide each student with real world learning opportunities and instruction related to drafting, design, and engineering occupations. Safety instruction is integrated into all activities.

### **1875 Hydraulic and Pneumatic Systems**

This course introduces the student to the knowledge base and technical skills related to industrial Hydraulic and Pneumatic Systems. Areas of study include hydraulic principles, practical application of hydraulic systems, pneumatic principles, and practical application of pneumatic systems. Emphasis will be placed on career exploration, job seeking skills, and



personal and professional ethics. Safety instruction is integrated into all activities. Students utilize problem-solving techniques and participate in hands-on activities to develop an understanding of course concepts. Teachers should provide each student with real world learning opportunities and instruction. Students are encouraged to become active members of the student organizations, WV SkillsUSA. All West Virginia teachers are responsible for classroom instruction that integrates learning skills, technology tools, and skill sets.

### **2436 Foundations in Engineering**

This course provides opportunities for students to study and apply basic principles of materials, mechanisms, structures, electricity, electronic control, fluidics, computer control, and graphic communication and how they can be integrated and used to solve a variety of complex technical challenges. Students work in engineering teams to develop work process skills, such as researching, writing, organizing, modeling, calculating, analyzing and communicating with others. Students will utilize problem-solving techniques and manipulative skills while completing laboratory activities to develop an understanding of course concepts. Safety instruction is integrated into all activities.

## Production Pathway Electives

**Program of Study:** MA1900 Machine Tool Technology

WVEIS CODE	Courses
0520	Work-Based Integration and Transition
1901	Engine Machining
1902	Machine Tool Technology
1904	Integrated Machine Processes
1906	Machining Processes and Applications
1908	CNC Machining

### **Elective Course Descriptions:**

#### **0520 Work-Based Integration and Transition**

This course gives students the opportunity to integrate theory and practice by interacting with industry professionals. Students will study various requirements for employability including ethics, communication, teamwork and professionalism. Students will participate in hands-on, digital or work-based experiences related to industry settings in order to practice skill sets and to transition from student to employee. A supervised project will be developed in one or more of the following categories: Entrepreneurship (ownership or operation of a business); Placement (employment or internship); Research and Experimentation (planning and/or conducting a scientific experiment); Exploration (exploration of related careers through activities such as shadowing employees in various work settings, conducting on-line research, attending professional development activities, etc.). Students will develop materials to supplement their Simulated Workplace portfolios.

#### **1901 Engine Machining**

The Skill Sets in this course are representative of the basic knowledge included in a Career and Technical Machine Tool Technology Program of Study. Incorporated into this course are fundamentals related to high performance engine machining skills necessary for a career in a machine shop. This course is recommended as an Elective in Machine Tool Technology.

#### **1902 Machine Tool Technology**

The Skill Sets in this course are representative of the basic knowledge included in a Career and Technical Machine Tool Technology Program of Study. Incorporated into this course are elements of advanced measuring, drill press, metal lathe, and milling machine operations skills necessary for a career in machine tool technology. This course is recommended as an Elective in Machine Tool Technology.

#### **1904 Integrated Machine Processes**

The Skill Sets in this course are representative of the basic knowledge included in a Career and Technical Machine Tool Technology Program of Study. Incorporated into this course are

elements of measuring, metal lathe, and milling operations necessary for a career in machine tool technology. This course is recommended as an Elective in Machine Tool Technology.

### **1906 Machining Processes and Applications**

The Skill Sets in this course are representative of the basic knowledge included in a Career and Technical Machine Tool Technology Program of Study. Incorporated into this course are elements of advanced lathe, milling machine, and CNC operations necessary for a career in machine tool technology. This course is recommended as an Elective in Machine Tool Technology.

### **1908 CNC Machining**

The Skill Sets in this course are representative of the basic knowledge included in a Career and Technical Machine Tool Technology Program of Study. Incorporated into this course are elements of advanced machining operations and program creation skills necessary for a career in machine tool technology. This course is recommended as an Elective in Machine Tool Technology.

**Program of Study: MA2120 Millwork and Cabinetmaking**

WVEIS CODE	Courses
0520	Work-Based Integration and Transition
1823	Finishing Carpentry
1827	Fundamentals of Building Construction
2122	Introduction to Millwork and Cabinetmaking
2123	Machine Operations
2124	Cabinet Construction
2125	Finishing Applications

**Elective Course Descriptions:**

**0520 Work-Based Integration and Transition**

This course gives students the opportunity to integrate theory and practice by interacting with industry professionals. Students will study various requirements for employability including ethics, communication, teamwork and professionalism. Students will participate in hands-on, digital or work-based experiences related to industry settings in order to practice skill sets and to transition from student to employee. A supervised project will be developed in one or more of the following categories: Entrepreneurship (ownership or operation of a business); Placement (employment or internship); Research and Experimentation (planning and/or conducting a scientific experiment); Exploration (exploration of related careers through activities such as shadowing employees in various work settings, conducting on-line research, attending professional development activities, etc.). Students will develop materials to supplement their Simulated Workplace portfolios.

**1823 Finishing Carpentry**

This course introduces the student to the knowledge base and technical skills for concepts in the Building Construction Program of Study. Areas of study include estimation, insulation, vapor barriers, interior wall coverings, interior finish and exterior finish. Emphasis will be placed on career exploration, job seeking skills, and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to finishing carpentry.

**1827 Fundamentals of Building Construction**

This course introduces the student to the knowledge base and technical skills for all courses in the Building Construction Program of Study. Areas of study include career opportunities, math and measurement skills, construction materials, fasteners and adhesives, blueprints, safety practices, hand tools and power tools. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all

activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts and teachers should provide each student with real world learning opportunities and instruction related to building construction.

### **2122 Introduction to Millwork and Cabinetmaking**

This course introduces the student to the knowledge base and technical skills for all courses in the Millwork and Cabinetmaking concentration. Areas of study include career opportunities, safety, measurement, blue prints, drawings, plans, hand tools and power tools. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to millwork and cabinetmaking occupations.

### **2123 Machine Operations**

This course introduces the student to the knowledge base and technical skills for concepts in Machine Operations. Areas of study include hand tools, power hand tools, woodworking machines, sharpening and maintaining machinery in a millwork and cabinetmaking environment. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to millwork and cabinetmaking occupations.

### **2124 Cabinet Construction**

This course introduces the student to the knowledge base and technical skills for concepts in Cabinet Construction. Areas of study include wood properties, cabinet component manufacturing and cabinet assembly operations. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to millwork and cabinetmaking occupations.

### **2125 Finishing Applications**

This course introduces the student to the knowledge base and technical skills for Finishing Applications. Areas of study include safety, surface preparation and finishing operations. Emphasis will be placed on career exploration, job seeking skills and personal and professional ethics. Safety instruction is integrated into all activities. Students will utilize problem-solving techniques and participate in laboratory activities to develop an understanding of course concepts, and teachers should provide each student with real world learning opportunities and instruction related to millwork and cabinetmaking occupations.

**Program of Study: MA1980 Welding**

WVEIS CODE	Courses
0520	Work-Based Integration and Transition
1982	Ornamental Metalwork
1983	Blueprint Reading and Metallurgy
1987	Gas Metal Arc Welding
1989	Gas Tungsten Arc Welding

**Elective Course Descriptions:**

**0520 Work-Based Integration and Transition**

This course gives students the opportunity to integrate theory and practice by interacting with industry professionals. Students will study various requirements for employability including ethics, communication, teamwork and professionalism. Students will participate in hands-on, digital or work-based experiences related to industry settings in order to practice skill sets and to transition from student to employee. A supervised project will be developed in one or more of the following categories: Entrepreneurship (ownership or operation of a business); Placement (employment or internship); Research and Experimentation (planning and/or conducting a scientific experiment); Exploration (exploration of related careers through activities such as shadowing employees in various work settings, conducting on-line research, attending professional development activities, etc.). Students will develop materials to supplement their Simulated Workplace portfolios.

**1982 Ornamental Metalwork**

This course introduces the student to the knowledge base and technical skills for concepts in the Ornamental Metal Work. Areas of study include measurement, metal layout and bending, operation of the drill press, band saw, and the iron worker. Incorporated into this course are elements of introductory knowledge and skills necessary for a career in welding. This course is recommended as an Elective in Welding.

**1983 Blueprint Reading and Metallurgy**

The Skill Sets in this course are representative of the basic knowledge included in a Career and Technical Education Welding Program of Study. Areas of study include drawing fundamentals, sketching and fabricating, basic welding symbols, and properties of metals and alloys. This course is recommended as an Elective in the Welding Program of Study.

**1987 Gas Metal Arc Welding**

The Skill Sets in this course are representative of the basic knowledge included in a Career and Technical Welding Program of Study. Incorporated into this course are elements of introductory knowledge and skills necessary for a career in welding. This course is recommended as an Elective in Metals Technology and Welding.

**1989 Gas Tungsten Arc Welding**

The Skill Sets in this course are representative of the basic knowledge included in a Career and Technical Welding Program of Study. Incorporated into this course are elements of introductory knowledge and skills necessary for a career in welding. This course is recommended as an Elective in Metals Technology and Welding

## Adult Program of Study

### Cluster Description:

The Manufacturing Cluster focuses on careers planning, managing and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance and manufacturing/process engineering

### Maintenance, Installation and Repair Pathway

#### Pathway Description:

People with careers in Maintenance, Installation and Repair perform preventive maintenance procedures on machines tools and equipment. These are performed routinely and on a regular basis. They also troubleshoot and repair electrical, electronic and mechanical systems. This will include mechanical repair as well as using computer-based inventory control systems, retrieving information histories on each machine from computer records, and recording repair activities on the system to keep accurate records of repairs performed on each machine.

#### Program of Study: MA2165 Cabling Technology

- Courses:**
- 1595 Introduction to Cabling
  - 1596 Introduction to Telecommunications
  - 1597 Introduction to Network Cabling – Copper-Based Systems
  - 1598 Introduction to Network Cabling – Fiber Optic-Based Systems

**Program of Study Description:** The Cabling Technology Program of Study courses align with C-Tech curriculum. Teachers must attend [C-Tech](#) training in Sparta, New Jersey in order to access the curriculum. Industry certifications are available to students upon successful completion of the curriculum.

#### Course Descriptions:

##### 1595 Introduction to Cabling

This course provides students with the fundamental background knowledge in the Cabling Technology Industry. It is an introduction course to familiarize students with the Cabling Industry and introduces them to the specialty areas of the industry.

##### 1596 Introduction to Telecommunications

This course provides students with the fundamental background knowledge in the theory, mediums of transmission, topologies and functions of systems used in businesses and Smart Homes. Students assemble, test and troubleshoot audio, visual, IR, wired and wireless connectivity systems to explore these principles. Students apply their knowledge by using C-Tech's Interactive Telecommunications Board (ITB). This innovative teaching aid contains simulated 4-pair data systems, coaxial cable systems, and a fiber optic system all in one compact mobile unit.



### **1597 Introduction to Network Cabling – Copper-Based Systems**

This course provides students with the knowledge and skills needed to become certified entry-level technicians in the Network Cabling industry. The course focuses on:

- Proper tool use and construction techniques
- The characteristics of various industry standards
- Troubleshooting and repair

Students construct, test, and troubleshoot copper-based cabling systems that are the basis of today's networking, cable television and satellite communications systems. The industry standards include both commercial and residential structures. Troubleshooting includes a whole chapter on testing copper-based systems. There's a chapter on networks, too—wired and wireless. All the latest information is included, on Cat 6 and quad-shield coax, VoIP, smart homes, and more.

### **1598 Introduction to Network Cabling – Fiber Optic-Based Systems**

This course provides students with a theoretical and hands-on knowledge of Fiber Optics. C-Tech's Fiber Optics certification is a perfect complement to C-Tech's Copper certification. The two together make up an unbeatable skill set much in demand by employers.

Students learn the basics of cable termination, testing and troubleshooting using sophisticated electronic equipment. They terminate fiber optic cables with ST and SC connectors, two of the industry standards, and perform a mechanical splice. They get into the theory of fiber optics and calculate a system loss budget.

**Program of Study:** MA2060 Electro Mechanical Technology

**Course:** 1873 Fundamentals of Industrial Equipment Maintenance  
1875 Hydraulic and Pneumatic Systems  
1871 Electrical Maintenance  
1763 Fundamentals of Electricity  
1765 Industrial and Commercial Wiring  
1767 National Electrical Code  
1769 Residential Wiring

**Program of Study Description:**

Components of the Electromechanical Technology program include theory, hands-on skills, and applications that qualify the student for entry-level employment in their certification level.

Approximately 60 percent of time is spent in the classroom studying Electromechanical Theory, and 40 percent of time is spent in the shop and lab.

Units of study include:

- Hydraulic and Pneumatic Systems
- Electrical Maintenance
- Fundamentals of Electricity
- Industrial and Commercial Wiring
- National Electric Code
- Residential Wiring

The mission of the Electromechanical Technology program is to enhance the quality of life for students of all ages throughout our community by developing, maintaining, and teaching a course of study that is relevant to the needs of employers in the electromechanical trades' maintenance fields.

**Course Descriptions:**

**1873 Fundamentals of Industrial Equipment Maintenance**

This course introduces the student to the knowledge base and technical skills for entry level skills in Industrial Maintenance. Areas of study include workplace safety, measurement and calculation, tools, fasteners, lubrication and bearings, mechanical and belt drives, and mechanical alignment and vibration

**1875 Hydraulic and Pneumatic Systems**

This course introduces the student to the knowledge base and technical skills related to industrial Hydraulic and Pneumatic Systems. Areas of study include hydraulic principles, practical application of hydraulic systems, pneumatic principles, and practical application of pneumatic systems.

**1871 Electrical Maintenance**

This course introduces the student to the knowledge base and technical skills for entry level skills in industrial Electrical Maintenance. Areas of study include basic electrical theory and

calculations, electrical tools, instruments and safety, electrical symbols and diagrams, industrial power and control circuits, electrical equipment and devices, electrical motors, and an introduction to programmable logic controllers, as applied in industrial locations.

**1763 Fundamentals of Electricity**

This course introduces students to the basic concepts of electrical safety, concepts and circuits.

**1765 Industrial and Commercial Wiring**

Students will learn NEC requirements for building codes and how to install commercial loads for electrical use.

**1767 National Electrical Code**

In this course students will learn to read and navigate National Electric Code.

**1769 Residential Wiring**

In this course students will learn to read residential floor plans and install the necessary circuits need for home electrical use.