TECHNICAL

Programs

- Automotive - Automotive Service Technology, Associate in Applied Science Degree (https://catalog.nmc.edu/programs-az/technical/automotive/)
- Automotive - Electrical & Drivability Specialist, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/automotive-electrical-drivability-specialist-level-ii/)
- Automotive - Hybrid Technology Specialist, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/automotive-hybrid-technology-specialist-level-ii/)
- Automotive - Master Automotive Technician, Certificate of Achievement (Level III) (https://catalog.nmc.edu/programs-az/technical/automotive-master-automotive-technician-level-iii/)
- Automotive - Under Car Specialist, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/automotive-under-car-specialist-level-ii/)
- Construction Technology - Carpentry Technology, Certificate of Achievement (Level I) (https://catalog.nmc.edu/programs-az/technical/construction-technology-carpentry-technology-level-i/)
- Construction Technology - Carpentry Technology, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/construction-technology-carpentry-technology-level-ii/)
- Construction Technology - Construction Management, Associate in Applied Science Degree (https://catalog.nmc.edu/programs-az/technical/construction-technology-construction-management/)
- Construction Technology - Electrical Technology, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/construction-technology-electrical-technology-level-ii/)
- Construction Technology - Electrical, Associate in Applied Science Degree (https://catalog.nmc.edu/programs-az/technical/construction-technology-electrical/)
- Construction Technology - Facilities Maintenance, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/construction-technology-facilities-maintenance-level-ii/)
- Construction Technology - HVAC/R Technology, Certificate of Achievement (Level I) (https://catalog.nmc.edu/programs-az/technical/construction-technology-hvacr-technology-level-i/)
- Construction Technology - HVAC/R, Associate in Applied Science Degree (https://catalog.nmc.edu/programs-az/technical/construction-technology-hvacr/)
- Construction Technology - Renewable Energy Technology - Electrical, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/construction-technology-renewable-energy-technology-electrical-level-ii/)
- Construction Technology - Renewable Energy Technology - HVAC/R, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/construction-technology-renewable-energy-technology-hvacr-level-ii/)
- Engineering Technology - Biomedical Technician, Associate of Applied Science (https://catalog.nmc.edu/programs-az/technical/engineering-technology-biomedical-technician/)
- Engineering Technology - Computer Technology, Associate of Applied Science (https://catalog.nmc.edu/programs-az/technical/engineering-technology-computer-technology/)
- Engineering Technology - Electronics Technology, Associate of Applied Science (https://catalog.nmc.edu/programs-az/technical/engineering-technology-electronics-technology/)
- Engineering Technology - General, Associate in Applied Science Degree (https://catalog.nmc.edu/programs-az/technical/engineering-technology-general/)
- Engineering Technology - Marine Technology, Associate of Applied Science (https://catalog.nmc.edu/programs-az/technical/engineering-technology-marine-technology/)
- Engineering Technology - Programmable Logic Controllers (PLC), Certificate of Achievement (Level I) (https://catalog.nmc.edu/programs-az/technical/engineering-technology-programmable-logic-controllers-plc-level-i/)
- Engineering Technology - Robotics & Automation Technology, Associate of Applied Science (https://catalog.nmc.edu/programs-az/technical/engineering-technology-robotics-automation-technology/)
- Manufacturing Apprenticeship, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/manufacturing-apprenticeship-level-ii/)
- Manufacturing Technology, Associate in Applied Science Degree (https://catalog.nmc.edu/programs-az/technical/manufacturing-technology/)
- Surveying, Associate in Applied Science Degree (https://catalog.nmc.edu/programs-az/technical/surveying/)
- Welding Technology, Associate in Applied Science Degree (https://catalog.nmc.edu/programs-az/technical/welding-technology/)
- Welding Technology, Certificate of Achievement (Level I) (https://catalog.nmc.edu/programs-az/technical/welding-technology-level-i/)
- Welding Technology, Certificate of Achievement (Level II) (https://catalog.nmc.edu/programs-az/technical/welding-technology-level-ii/)

Courses

Automotive Technology

AT 100 - Automotive Service Basics
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This is the first course in the Automotive Service Program. Engine theory, cooling systems, and lube requirements will be covered. Bolts, micrometers and basic specialty tools are integrated into the class. Training in the use of acetylene torch equipment will be taught along with its use in the automotive field. The student will learn general shop organization, types of service, and cost and returns by department. Time will be devoted to employer-employee and customer relations, and instruction in the use of the service manual. Group 2 course.
Recommended Prerequisite(s): ENG 99/108

AT 110 - Automotive Brake Systems
Credit Hours: 5.5, **Contact Hours: 8**
Division: Technical
This course covers theory, components, nomenclature, and service of automotive brake systems. Students will use standard skills to diagnose hydraulic systems, drum and disk brakes, power assist units and systems. The study and repair of modern ABS systems along with the replacement of associated parts such as wheel bearings will also be covered. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 100-may be taken concurrently

AT 120 - Automotive Electrical I
Credit Hours: 5, **Contact Hours: 8**
Division: Technical
This course covers basic electricity, circuits, testing equipment, and solid state electronics. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 100-may be taken concurrently

AT 130 - Engine Performance I
Credit Hours: 5, **Contact Hours: 8**
Division: Technical
This course is designed to familiarize the student with the theory and operation of the automotive ignition system and fuel system. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 220

AT 140 - Suspension and Steering
Credit Hours: 4, **Contact Hours: 6**
Division: Technical
This course is designed to familiarize the student with the nomenclature, theory, and service techniques for the modern steering and suspension system. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 100-may be taken concurrently

AT 150 - Automatic Transmissions
Credit Hours: 6, **Contact Hours: 9**
Division: Technical
This course is designed to familiarize the student with hydraulic theory, internal transmission powerflow, electronic control and torque converter operation. All aspects of transmission operation will be covered as well as removal, overhaul, and installation procedures. Students will remove, dyno-test, and install actual failed units in the lab. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): Instructor signature required

AT 160 - Engine Repair
Credit Hours: 6, **Contact Hours: 8**
Division: Technical
This course covers the theory, construction, and repair of the four stroke automotive engine. This will include the proper use of compression leakage and test equipment, precision measuring tools, special engine tools and valve grinding equipment. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 100-may be taken concurrently

AT 170 - Heating and Air Conditioning
Credit Hours: 4, **Contact Hours: 6**
Division: Technical
This course covers the principles of refrigeration with emphasis on the particular problems of application to automotive air conditioning. The course also covers automotive heating systems which include heater cores, blower motors, vent systems and the electronic controls for them. The student will learn how to use refrigerant recovery and charging equipment and will have hands-on experience in the lab with that equipment. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 120

AT 180 - Manual Drivetrain and Axles
Credit Hours: 6, **Contact Hours: 9**
Division: Technical
This course covers the basic operating principles, construction, power flow and repair of clutches, manual transaxles, and drive shafts. Differential theory and overhaul will be covered including ring and pinion replacement and set up. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 100-may be taken concurrently

AT 210 - Hybrid Technology
Credit Hours: 4, **Contact Hours: 6**
Division: Technical
This course provides a comprehensive systems overview of the operating principles, maintenance, and service of hybrid electric vehicles. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 130 or Certification in Electrical and Engine Tune Up.

AT 220 - Automotive Electrical II
Credit Hours: 5, **Contact Hours: 8**
Division: Technical
This course covers advanced automotive electronics with the emphasis placed on operation, troubleshooting, and repair of lighting, gauges, accessories, and power option circuits. Body hardware is covered including diagnostics of modern systems with body control modules. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 120

AT 230 - Engine Performance II
Credit Hours: 4.5, **Contact Hours: 7**
Division: Technical
This course covers computerized engine controls including the latest emission control systems. The student will become proficient with the use of scanners, scopes, and the latest engine analyzers. The art of diagnostics and troubleshooting will be stressed. The student will have hands-on experience in this area including practice using the computer as a source of information. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): AT 130

AT 290 - Automotive Internship
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
The purpose of the internship is to provide on-the-job training for the student who wishes to pursue a career in a technical field of study. The internship will be customized to meet the learning needs of the student and the job requirements of the sponsoring firm. Students spend 10-15 hours per week in this paid, supervised on-the-job training experience. In addition to the required 50 hours at a work site, students participate in semi-monthly seminars. Students must apply one month prior to the semester in which they will complete the internship. Group 2 course.
Required Prerequisite(s): 30 credits of program specific courses with a GPA of 2.0 or higher.

Carpentry Technology

CAR 101 - Introduction to Carpentry
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course provides an introduction to residential carpentry. Through structured classroom and hands-on skill building, the student will learn about the construction industry, building materials, fasteners and adhesives, hand and power tools, introduction to print reading, and floor systems. Group 2 course.
Required Prerequisite(s): CMT 100, may be taken concurrently.

Recommended Prerequisite(s): Placement into MTH 100 or higher, or co-enrollment in the recommended developmental math course, and placement into ENG 11/111 or higher, or co-enrollment in the recommended English course

CAR 102 - Intro to Woodworking
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course is for the student that has a desire to experience woodworking in the area of basic cabinet and furniture. Techniques in the usage and maintaining of basic hand and power tools, understanding of how wood movement will affect design of an assembly, application of basic joinery, adhesives, and fasteners in the woodworking completion of this class establishes a foundation in which the student can build simple furniture and cabinets. Group 2 course.
Recommended Prerequisite(s): Students will greatly benefit from having competency up to MTH111

CAR 104 - Woodworking Applications I
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course is for the student with a strong understanding of hand and power tools used in the craft of woodworking. A desire to expand their knowledge in the aspects involved with basic furniture and cabinet building is a must. Students will be constructing projects that, by design, will challenge those of the advanced beginner and intermediate skill abilities. Students will plan and implement the necessary steps to address the projects' hardware and joinery requirements. Group 2 course.
Required Prerequisite(s): CAR 102

Recommended Prerequisite(s): MTH 100

CAR 105 - Foundations and Framing
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
Through structured classroom and hands-on skill building, the student will learn foundation design, layout, concrete material forms, and applications. Floor, wall, ceiling and roof framing will be covered, as well as basic stair layout and construction. Group 2 course.
Recommended Prerequisite(s): Placement in MTH 100 or co-enrollment in the recommended developmental Math course, placement into ENG 11/111 or co-enrollment in the recommended English course

CAR 121 - Exterior Construction
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
Through structured classroom and hands-on skill building, the student will learn about various roofing materials and applications, window and door installation, siding, cornice design and installation, gutters, downspouts, decks and fences. Group 2 course. Placement into ENG 11/111 or higher, or co-enrollment in the recommended English course.
Recommended Prerequisite(s): Placement into MTH 100 or higher, or co-enrollment in the recommended developmental math course

CAR 125 - Interior Construction
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
Through structured classroom and hands-on skill building, the student will learn about drywall products, installation, and finishing, wall panels, tile, suspended ceilings, finish trim, flooring, and cabinet and countertop installation. Group 2 course. Placement into ENG 11/111 or Co-enrollment in the recommended English Course.
Recommended Prerequisite(s): Placement in MTH 100 or co-enrollment in the recommended developmental Math course

Drafting and Design

DD 101 - Print Reading and Sketching
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
Students will learn to read engineering drawings of products and tooling used in today's manufacturing. Basic drawing format and layout are presented using product, tooling assembly, and tooling detail drawings. Students learn methods of three dimensional shape description, dimensioning and tolerancing. Types of fasteners along with related terminology and manufacturing processes, material specifications, and welding symbols are presented. Students learn the presentation skills of orthographic projection, isometric and oblique pictorial drawings using 2D CAD software. Group 2 course. Critical Thinking - Direct.

DD 110 - Basic Metallurgy
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
This course presents the making and forming of steel and the classification of steel and cast iron. Mechanical and physical properties are presented along with hardness labs. Principles of alloying, crystal structure, and the iron-carbon diagram help students understand how annealing, hardening, and tempering processes alter the mechanical properties of steel. Group 2 course.
Recommended Prerequisite(s): Placement into MTH 100 and ENG 99/108 recommended for entry

DD 160 - Tolerancing and GD&T
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
This course first presents conventional tolerancing terminology, expressions, and accumulations in both inch and metric formats. Next, Geometric Dimensioning and Tolerancing (GD&T) presents an international system of symbols used to dimension products or tooling components. The course is based on the current ASME Y14.5M2009 Dimensioning and Tolerancing standard. Engineers, designers, drafters, cost estimators, machinists, and inspectors must understand this system. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): DD 101

DD 170 - CADD/Computer Modeling
Credit Hours: 4, **Contact Hours: 5**
Division: Technical
Graphic communication course using 3D parametric modeling techniques. Topics include 3D modeling using SolidWorks software in an engineering design environment. Students will also develop 2D drafting skills including proper organization and layout of component drawing views, dimensioning and tolerancing, sectioning and detailing, detail descriptive geometry. As part of this course, students will earn a CSWA Certified SolidWorks Associate certification. Group 2 course. Critical Thinking - Direct.
Recommended Prerequisite(s): Placement into MTH 100 and ENG 99/108

DD 290 - Drafting Internship
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
The purpose of the internship is to provide on-the-job training for the student who wishes to pursue a career in a technical field of study. The internship will be customized to meet the learning needs of the student and the job requirements of the sponsoring firm. Students spend 10-15 hours per week in this paid, supervised on-the-job training experience. In addition to the required 50 hours per credit in a work site, students participate in semi-monthly seminars. Students must apply one month prior to the semester in which they will complete the internship. Group 2 course.
Required Prerequisite(s): 30 credits of program specific courses with a GPA of 2.0 or higher.

Construction Management

CMT 100 - Introductory Craft Skills
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides an introduction to essential construction skills. Through structured classroom and hands-on skill building, the student will be introduced to the construction industry, building materials, safety, hand and power tools, print reading, construction math, communication and employability skills. Group 2 course.

CMT 102 - Construction Blueprint Reading
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
Students will learn the skills needed to read and understand construction drawings, as well as an understanding of manufacturers' literature of component parts used in buildings. Both commercial and residential construction materials and drawings are studied. Problems encountered in design development such as site limitations, zoning restrictions, utility availability, coordination of product specifications, adherence to building codes and life safety are explored. Group 2 course.
Recommended Prerequisite(s): Placement into MTH 111 or co-enrollment in MTH 100, placement into ENG 111 or co-enrollment in ENG 99/108

CMT 107 - Construction Supervision
Credit Hours: 4, **Contact Hours: 4**
Division: Technical
Students will learn the skills needed for construction management including: business management, estimating and job costing, design and building science, contracts, liability and risk management, marketing and sales, project management and scheduling, the Michigan Residential Code, MIOSHA construction safety standards, and effective communication for construction project management. As part of this course, students will earn pre-licensure for the Residential Builders/ Maintenance & Alteration Contractors Examination. Group 2 course. Critical Thinking - Direct.
Recommended Prerequisite(s): Students have completed or are co-enrolled in MTH 100 and ENG 99/108

CMT 110 - Introduction to 3D Concrete Printing
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
This course will equip students with the knowledge and skills required for 3DCP construction printing using industry-recognized printing technologies. Participants will learn about materials, design, operation, and workforce development related to 3DCP home printing. Group 2 course.
Required Prerequisite(s): CAR 121, CAR 125

CMT 207 - Construction Cost Estimating
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
In this course students will explore topics pertaining to the processes of construction estimating and bidding techniques. Those topics will include, but are not limited to, the discussion and exploration of the identification and quantification of construction materials, labor, and equipment for the construction bidding process. Some computer estimation programs and/or cost data publications will be used to develop estimates. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): CIT 100, CMT 102, CMT 107, MTH 111 or higher.

Recommended Prerequisite(s): ENG 111-may be taken concurrently, math and reading skills are necessary for success in this course

CMT 290 - Construction Mgmt. Internship
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
The purpose of the internship is to provide on-the-job training for the student who wishes to pursue a career in a technical field of study. The internship will be customized to meet the learning needs of the student and the job requirements of the sponsoring firm. Students spend 10-15 hours per week in this paid, supervised on-the-job training experience. In addition to the required 50 hours per credit in a work site, students participate in semi-monthly seminars. Students must apply one month prior to the semester in which they will complete the internship. Group 2 course. Communications - Direct.

Electrical Technology

EET 102 - Intro to Engineering Tech
Credit Hours: 2, **Contact Hours: 2**
Division: Technical
This course is designed to give students an overview of Engineering Technology and the career options this profession provides. This course highlights the technical specializations within the Engineering Technology degree at NMC. Course topics also include an introduction to the makerspace, career development, teamwork, and soft skills. Communications - Direct. Group 2 course. Communications - Direct.
Recommended Prerequisite(s): Placement into MTH 100 and ENG 99/108 or higher

EET 103 - Electrical Studies I
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
Explore the fundamentals of electricity and electronics by developing introductory analysis, construction and troubleshooting techniques for DC and AC circuits. Safe electrical practices will be emphasized throughout the course as the student constructs circuits from schematics and diagrams using proper wiring and soldering techniques. Electrical measurements will be performed using multimeters and oscilloscopes. Group 2 course. Quantitative Reasoning.

EET 161 - Fundamentals of Light & Lasers
Credit Hours: 4, **Contact Hours: 6**
Division: Technical
This course introduces the elements of a laser, operation of a helium-neon gas laser, laser physics, optical-cavities, properties of laser light and a survey of laser systems. Safety procedures concerning lasers and related equipment are presented in this course. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): MTH 100 or higher

EET 180 - Biomedical Equipment I
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course introduces the learner to the field of the biomedical equipment technology and the role of the technician. Safety, patient care, ethics, regulatory requirements, healthcare equipment technology and function will be emphasized. Proper procedures and protocols for the calibration, test and troubleshooting of medical equipment will be developed. Common diagnostic equipment will be used for signal analysis. The course will begin the preparation for the CBET certification exam. Group 2 course.
Required Prerequisite(s): BIO 106, EET 204, HAH 101

EET 190 - Biomedical Internship
Credit Hours: 1, **Contact Hours: 1**
Division: Technical
The purpose of the internship is to provide on-the-job training for the student who wishes to pursue a career in Biomedical Equipment. The internship will be customized to meet the learning needs of the student and the job requirements of the sponsoring firm. Students spend 5-10 hours per week in this, supervised on-the-job training experience. In addition to the required 50 hours per credit in a work site, students participate in three seminars. Students must apply one month prior to the semester in which they will complete the internship. Group 2 course.
Required Prerequisite(s): EET 180

EET 204 - Electrical Studies II
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
A systems level approach to electronics and electrical devices will be used to analyze semiconductor applications including integrated circuits, power supplies, transistors, amplifiers, and digital logic families. Circuits will be bench tested, and integrated with others to meet system requirements. Design modifications, circuit improvements, component protection and application to other areas of engineering technology will be emphasized as designs are developed into working prototypes. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): EET 103

EET 212 - Elements of Photonics
Credit Hours: 4, **Contact Hours: 5**
Division: Technical
Elements of Photonics builds upon and applies principles presented in Fundamentals of Light and Lasers. The course includes modules on operational characteristics of lasers, specific laser types, optical detectors and human vision, principles of optical fiber communications, photonics devices for imaging, storage and display, and laser welding and surface treatment. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): EET 161

EET 221 - Industrial Controls
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course studies control circuits, electrical schematics and line diagrams. Motor circuits utilizing motor starters, contactors, timers and counters are used to demonstrate control circuitry. Industrial control devices are examined, including solid-state control devices, electro-mechanical relays, proximity sensors, photoelectric sensing devices and programmable logic controllers. Group 2 course.
Required Prerequisite(s): EET 103 or ELE 105 or MNG 234 or MNG 235

EET 232 - Programmable Logic Controllers
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course studies programmable logic controllers (PLCs). Basic models and complete applications are applied to control inputs and outputs of PLCs. Ladder logic and device wiring techniques are studied, along with advanced program instructions such as counters, timers, sequencers and integer moves. Input/output devices are used to examine PLC program logic during the control process. Group 2 course.
Required Prerequisite(s): EET 221

EET 233 - PLC Applications I
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course is a study of the integration of program styles and components used in industry. Program structures and instructions will be used in lab projects to simulate how PLCs can be used to create a variety of useful functions. A mixture of textbook and component manuals will be used to learn the necessary information to complete these functions. Group 2 course.
Required Prerequisite(s): EET 232 or ELE 142

EET 234 - PLC Applications II
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course is a continuation of the study of the integration of program styles and components used in industry. Program structure and project development will be studied. Installation of different types of components integrated with PLCs will also be studied. Group 2 course.
Required Prerequisite(s): EET 233 or ELE 146

EET 260 - System Engineering in Practice
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This class introduces students to the practice of system design and development. Students apply specific methodologies for problem-based learning and project management. Technical content from prior courses is applied to address challenges and create solutions. Student teams create prototypes and communicate results with classroom activities supporting teamwork, project planning, requirements analysis, design, development, testing, demonstration, and reporting. Group 2 course.
Required Prerequisite(s): EET 102, EET 103, RAM 155

Recommended Prerequisite(s): AVF 141, RAM 205 or WSI 200

EET 281 - Biomedical Equipment II
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course continues the study of biomedical equipment technology and the role of the technician. Healthcare problem solving techniques will be developed through the analysis, testing and troubleshooting of medical equipment. Information technology needs and requirements will be reviewed as they pertain to the healthcare environment as well as anatomy and physiology specific to the field. Students will continue preparing for the CBET certification exam. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): EET 180

EET 290 - Engineering Tech Internship
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
The purpose of the internship is to provide on-the-job training for the student who wishes to pursue a career in a technical field of study. The internship will be customized to meet the learning needs of the student and the job requirements of the sponsoring firm. Students spend 10-15 hours per week in this paid, supervised on-the-job training experience. In addition to the required 50 hours per credit in a work site, students participate in semi-monthly seminars. Students must apply one month prior to the semester in which they will complete the internship. Group 2 course.
Required Prerequisite(s): 30 credits of program specific courses with a GPA of 2.0 or higher.

EET 292 - Technical Career Development
Credit Hours: 1, **Contact Hours: 1**
Division: Technical
This course provides the career tools necessary for the student to reach their full professional potential. The student will develop essential career success skills through class activities and direct practice in the technical community. Hands-on assignments in each session will allow the student to research employers; learn about application requirements, practice meeting professionals in their field, and practice successful interviewing techniques. Group 2 course.
Required Prerequisite(s): 30 Technical division program credits

HVAC/R

HVA 101 - Introduction to HVAC/R I
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course will introduce students to the HVAC/R field by exploring basic heating, ventilation, and air conditioning concepts. Concepts of concentration include an introduction to HVAC/R, trade mathematics, basic electricity, introduction to heating, introduction to cooling, air distribution systems, basic copper and plastic piping practices, soldering and brazing, and basic carbon steel piping practices. Completion of this course will result in a Level 1 National Center for Construction Education Research Credential. Group 2 course.
Required Prerequisite(s): CMT 100, may be taken concurrently

Recommended Prerequisite(s): Placement into ENG 111 and MTH 111

HVA 104 - Introduction to HVAC/R II
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course will introduce students to the HVAC field through exploring basic heating, ventilation, and air conditioning concepts and reinforce concepts and skills learned in previous courses. Concepts include alternating current, compressors, refrigerants and oils, leak detection, evacuation, recovery, and charging, metering devices, heat pumps and basic maintenance. Group 2 course.
Required Prerequisite(s): HVA 101, may be taken concurrently.

HVA 120 - Intermediate HVAC/R I
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course will continue to develop students' knowledge of the HVAC field through exploring intermediate heating, ventilation, and air conditioning concepts and reinforce concepts and skills learned in previous courses. Concepts include chimneys, vents, and flues, sheet metal duct systems, fiberglass and fabric duct systems, commercial airside systems, air quality equipment, an introduction to hydronic systems, and fasteners, hardware and wiring terminations. Completion of this course will result in a Level 2 National Center for Construction Education Research Credential. Group 2 course.
Required Prerequisite(s): CMT 100, HVA 101, HVA 104

HVA 124 - Intermediate HVAC/R II
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course will continue to develop students' knowledge of the HVAC field by exploring intermediate heating, ventilation, and air conditioning concepts and reinforce concepts and skills learned in previous courses. Concepts include troubleshooting for control circuits and motors, cooling, heat pumps, gas heating, oil heating, and accessories. Other concepts include zoning, ductless, and variable refrigerant flow systems, commercial hydronic systems, and steam systems. Group 2 course.
Required Prerequisite(s): HVA 120

HVA 130 - Advanced HVAC/R I
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course will continue to develop students' of the HVAC field through exploring advanced heating, ventilation, and air conditioning concepts and reinforce concepts and skills learned in previous courses. Concepts include retail refrigeration systems, customer relations, water treatment, indoor air quality, energy conservation equipment, building management systems, system air balancing, and system startup and shutdown. Completion of this course will result in a Level 3 National Center for Construction Education Research Credential. Group 2 course.
Required Prerequisite(s): HVA 124

HVA 136 - Advanced HVAC/R II - EPA Certification
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
This course will continue to develop students' knowledge of the HVAC field through exploring advanced heating, ventilation, and air conditioning concepts and by reinforcing concepts and skills learned in previous courses. Concepts include construction drawings and specifications, heating and cooling system design, commercial/industrial refrigeration systems, alternative and specialized heating and cooling systems, and fundamentals of crew leadership. Completion of this course will result in a Level 4 National Center for Construction Education Research Credential. This course will also examine the impact of refrigerants on the environment and will focus on federal regulations regarding their use, recovery, and disposal methods. Students will participate in Environmental Protection Agency Certification Exams and will have an opportunity to earn an EPA Type I, Type II, Type III, or universal certification. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): HVA 124

Recommended Prerequisite(s): Placement in ENG 111 and MTH 111

Manufacturing Technology

MFG 104 - Fluid Power
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
The Fluid Power course is designed to provide students with a basic understanding of the concepts and applications of fluid power technology and the necessary skills for further study in the field. The course is an overview of fluid power technology applications; the general concept of fluid power systems; an introduction to energy input, energy output, energy control, and systems auxiliary components; as well as the design and function of components. As part of this course, students will earn an IFPS Connector and Conductor certification. Group 2 course. Critical Thinking - Direct, Quantitative Reasoning.
Recommended Prerequisite(s): Placement into ENG 99/108

MFG 106 - Fluid Power Certification
Credit Hours: 2, **Contact Hours: 2**
Division: Technical
The Fluid Power course is designed to provide students with the skills to manipulate and create fluid power connectors and conductors. As part of this course, students will earn an industry certification. Group 2 course. Critical Thinking - Direct, Quantitative Reasoning.
Recommended Prerequisite(s): MFG 104

MFG 111 - Math for Manufacturing
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
This course will apply principles of mathematics, geometry, and basic trigonometry to applications in manufacturing. Topics will include proportions, calculation of machine speed and feed and geometric relationships of triangles and circles. Problem solving will require the use of the Pythagorean Theorem and the sine, cosine, and tangent functions to solve right triangles. The Law of Sines and Law of Cosines will be used to solve oblique triangle applications. Group 2 course. Quantitative Reasoning.

MFG 113 - Machining I
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
The student will be introduced to measurement and the safe use of layout and bench tools, drill press operations, and basic lathe facing and turning operations. Basic vertical milling operations will also be included. Group 2 course. Students will greatly benefit from having competency up to MTH 111. Critical Thinking - Direct.
Recommended Prerequisite(s): Print reading, precision measurement, basic machining knowledge and skills, competencies in Communications equal to ENG99 and math equal to MTH23

MFG 114 - Machining II
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
This course will introduce students to machining procedures beyond the basic operations. The student should have previously acquired basic machining knowledge and skills. Lathe procedures will include threading and cutting tapers. Milling operations will include the offset boring head, and broaching. Precision grinding of parallel and angular surfaces using gauge blocks and a sine bar will be introduced. Students will study the process and perform hands on operations. Group 2 course. Students will greatly benefit from having competency up to MTH 111 Critical Thinking - Direct.
Required Prerequisite(s): MFG 113 or MNG 260

Recommended Prerequisite(s): Print reading, precision measurement, basic machining knowledge and skills, competencies in Communications equal to ENG 99/108 and Math equal to MTH 100

MFG 203 - Manuf/Engineering Processes
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
The Manufacturing and Engineering Processes course will provide students with an overview of various processes used in the design and development of new products. Students will be introduced to the engineering steps and processes required to take a product from concept through production. Group 2 course. Critical Thinking - Direct.
Recommended Prerequisite(s): ENG 99/108

MFG 217 - CNC Operations - Lathe
Credit Hours: 4, **Contact Hours: 6**
Division: Technical
This course will introduce students to CNC (Computer Numerical Control) turning machines or CNC lathes. CNC lathe procedures will include set up from a list of guidelines to properly and safely make a part to blueprint specifications. Students will spend lab time going over machine demonstrations with individual practice and support, supplemented with classroom and online learning going over safety procedures and machine set up operations. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): MFG 113

Recommended Prerequisite(s): MTH 100 or higher

MFG 219 - CNC Mill Operations
Credit Hours: 4, **Contact Hours: 6**
Division: Technical
This course includes the operation of CNC (Computer Numerical Control) mills including calling up programs, loading and unloading parts, part inspection, and monitoring tool wear. This course will provide an introduction to planning and writing programs for CNC mills and using standard G and M codes. Learners will set up work pieces in machines, enter programs, set tool offsets, enter work offsets, and complete part projects. Group 2 course. Quantitative Reasoning.
Recommended Prerequisite(s): MFG 113 or MNG 260

MFG 290 - Manufacturing Tech Internship
Credit Hours: 2-4, **Contact Hours: 2-4**
Division: Technical
The purpose of the internship is to provide on-the-job training for the student who wishes to pursue a career in a technical field of study. The internship will be customized to meet the learning needs of the student and the job requirements of the sponsoring firm. Students spend 10-15 hours per week in this paid, supervised on-the-job training experience. In addition to the required 50 hours per credit in a work site, students participate in semi-monthly seminars. Students must apply one month prior to the semester in which they will complete the internship. Group 2 course.
Required Prerequisite(s): 30 credits of program specific courses with a GPA of 2.0 or higher.

Plumbing

PLU 101 - Introduction to Plumbing
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course provides an introduction to plumbing. Through structured classroom and hands-on skill building, the student will learn the tools of the trade, plumbing safety, how to solder and braze copper tubing, piping skills and trade mathematics. Group 2 course.
Required Prerequisite(s): CMT 100, may be taken concurrently

Recommended Prerequisite(s): Placement into MTH 100 and ENG 11/111 or co-enrollment in the recommended developmental Math and English course

PLU 105 - Plumbing Components
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
Through structured classroom and hands-on skill building, the student will learn to work with copper pipe and fittings, cast-iron pipe and fittings, carbon steel pipe and fittings, corrugated stainless steel tubing, fixtures and faucets, drain waste and vent systems and water distribution systems. Group 2 course.
Required Prerequisite(s): PLU 101

PLU 121 - Commercial Plumbing
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
Through structured classroom and hands-on skill building, the student will learn to read commercial drawings, install hangers, supports, structural penetrations, and fire stopping, installation and testing DWV piping. Group 2 course.
Required Prerequisite(s): PLU 105

PLU 125 - Plumbing Installation
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
Through structured classroom and hands-on skill building, the student will learn installation of roof, floor, and drain areas, types of valves, installing and testing water supply piping, installing fixtures, valves, and faucets, basic electricity, installing water heaters, fuel gas systems and servicing plumbing fixtures. Group 2 course.
Required Prerequisite(s): PLU 121

Renewable Energy

EGY 105 - Sustainable Building Design
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
This course provides a great introduction to sustainable building practices. Through structured classroom activities, the student will learn about the structure of matter and the material world, whole system thinking, site and natural energy mapping, water resources, building orientation, materials and resources, indoor air quality, innovation and design. This course is required to achieve a Level II Certificate in Renewable Energy Technology. Group 2 course.
Recommended Prerequisite(s): Placement in MTH 100 or co-enrollment in the recommended developmental Math course, placement into ENG 11/111 or co-enrollment in the recommended English course

EGY 115 - Residential Energy Efficiency
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
This course provides a broad spectrum of information regarding basic residential energy conservation. Through structured classroom and hands-on skill building, the student will learn about the principles of energy, building shell construction, air leakage, insulation, windows and doors, heating, lighting, cooling, water heating, health, and safety. This course, or its equivalency, is a required class for the Renewable Energy Certificate Program. Group 2 course.

EGY 145 - Geothermal Technology
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course introduces the basic principles of geothermal energy production and technology. Essentials on how to utilize geothermal technology as an energy source will be analyzed and demonstrated. Examples of residential and commercial applications will be shown and reviewed. Group 2 course.
Required Prerequisite(s): HVA 106

Recommended Prerequisite(s): MTH 100 or placement into MTH 111, ENG 111

EGY 293 - Construction Tech Study Abroad
Credit Hours: 1, **Contact Hours: 1**
In this class, students are provided the opportunity to travel to a specified destination affiliated with the corresponding renewable energy non-trip course. This course will serve to integrate the student learning experience and provide a sense of cultural perspective, diversity and regional awareness. The course is an opportunity for students to explore other areas around the world while applying discipline-specific course content. For a more specific course description, please review the course description of the associated non-trip course. Group 2 course.
Required Prerequisite(s): EGY 105, or EGY 115.

Robotics and Automation

RAM 155 - Microcontroller Programming
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course introduces students to microcontroller systems and programming using Python language. Students construct a wheeled robot and learn to program the device. Standard coding structures including statements, loops, and functions are used to control the unit. Debugging and troubleshooting skills are developed as robot capabilities are implemented. The robot is used in subsequent Engineering Technology courses. Group 2 course. Critical Thinking - Direct.
Recommended Prerequisite(s): Basic keyboarding and computer skills

RAM 205 - Microcontroller Systems
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
This course is a continuation of RAM 155 - Microcontroller Programming. Students implement additional abilities for their robot created during RAM 155, utilizing custom sensors, actuators, and interfaces. Activities require the application and extension of both hardware and software skills developed in prerequisite Engineering Technology courses. Students determine requirements, build hardware, code software, troubleshoot, evaluate, and iterate as they create solutions. As part of this course, students will earn the PCEP - Certified Entry-Level Python Programmer certificate. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): EET 103, RAM 155

Welding

WPT 110 - Oxy-Fuel Process & Thermal Cutting
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
This course is designed for Welding students pursuing job skills or transferring into a Welding Degree program. Topics include oxyacetylene welding in the flat, horizontal, and vertical positions; oxy-acetylene cutting, and oxy-acetylene brazing. This course also introduces students to basic Plasma Arc Cutting (PAC). Students learn safety and theory as well as develop their proficiency in these operations. This skill development course is the prerequisite for WPT 120. Group 2 course. Quantitative Reasoning.

WPT 111 - Welding Theory I
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
First level lecture for all students enrolled in a Welding Technology Degree or Certificate Program. Course will cover theory and technique for Shielded Metal Arc Welding, and Oxy Fuel Processes for welding, brazing, and cutting. Group 2 course. Critical Thinking - Direct.
Corequisites: WPT 112

WPT 112 - Welding Lab I
Credit Hours: 4, **Contact Hours: 8**
Division: Technical
First level lab for all students enrolled in a Welding Technology Degree or Certificate Program. Practical application of Shielded Metal Arc Welding and Oxy Fuel Processes for welding, brazing, and cutting. Group 2 course. Quantitative Reasoning.
Corequisites: WPT 111

WPT 113 - Welding Theory II
Credit Hours: 3, **Contact Hours: 3**
Division: Technical
Second level lecture for all students enrolled in a Welding Technology Degree or Certificate Program. Course will cover theory and technique for Gas Metal Arc Welding, Gas Tungsten Arc Welding, and Arc Cutting Processes. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): WPT 111

Corequisites: WPT 114

WPT 114 - Welding Lab II
Credit Hours: 4, **Contact Hours: 8**
Division: Technical
Second level lab for all students enrolled in a Welding Technology Degree or Certificate Program. Practical application of Gas Metal Arc Welding, Gas Tungsten Arc Welding, and Plasma Arc Cutting. Welds will be performed in all positions and subjected to destructive quality testing. Group 2 course.
Required Prerequisite(s): WPT 111 and WPT 112

Corequisites: WPT 113

WPT 120 - GTAW (TIG) Welding I
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides the student with the opportunity to learn and apply the theory of basic Gas Tungsten Arc Welding (GTAW) techniques on ferrous and non-ferrous metals in the flat and horizontal positions. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): WPT 110

WPT 121 - GTAW (TIG) Welding II
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides students the opportunity to learn and apply welding techniques using the Gas Tungsten Arc Welding (GTAW) process on ferrous metals and aluminum on complex joints and in the vertical position. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): WPT120

WPT 130 - SMAW (ARC) Welding I
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
This course is designed for students pursuing job skills or transfer into a Welding degree program. Students learn theory and application of safe Shielded Metal Arc Welding (SMAW) in the flat and horizontal positions. They develop skills with "fast freeze" and "low hydrogen" type electrodes. Topics include welding terminology, electrical theory as it relates to SMAW, weld defects and quality, and the American Welding Society SMAW filter material numbering system. Group 2 course. Critical Thinking - Direct.

WPT 131 - SMAW (ARC) Welding II
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
This course provides the student with advanced theory and application of Shielded Metal Arc Welding (SMAW) techniques in the flat, horizontal and vertical positions using "fast freeze" and "low hydrogen" electrodes. Topics include weld quality, inspection, power sources, and troubleshooting. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): WPT130

WPT 140 - GMAW (MIG) Welding I
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides the student an opportunity to learn the theory and application of basic Gas Metal Arc Welding (GMAW) techniques on ferrous metals. Group 2 course. Quantitative Reasoning.

WPT 141 - GMAW (MIG) Welding II
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides students the opportunity to learn and apply safe welding techniques using the Gas Metal Arc Welding (GMAW) process on ferrous and non-ferrous metals on advanced joint designs and welding positions. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): WPT140

WPT 142 - Flux Cored Arc Welding
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides students the opportunity to learn and apply safe welding techniques using the Flux Cored Arc Welding (FCAW) process. Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): WPT140

WPT 160 - Weld. Qualification Prep-SMAW
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides experienced welders/students the opportunity to take the AWS welder qualification tests in Shielded Metal Arc Welding (SMAW). Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): WPT131

WPT 160A - Weld. Qualification Prep-GMAW
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides experienced welders/students the opportunity to take the AWS welder qualification tests in Gas Metal Arc Welding (GMAW). Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): WPT141

WPT 160B - Weld. Qualification Prep-GTAW
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides experienced welders/students the opportunity to take the AWS welder qualification tests in Gas Tungsten Arc Welding (GTAW). Group 2 course. Quantitative Reasoning.
Required Prerequisite(s): WPT121

WPT 160C - Weld. Qualification Prep-FCAW
Credit Hours: 2, **Contact Hours: 3**
Division: Technical
This course provides experienced welders/students the opportunity to take the AWS welder qualification tests in Flux Cored Arc Welding (FCAW). Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): WPT142

WPT 161 - Welding Qualification Prep
Credit Hours: 3, **Contact Hours: 4**
Division: Technical
Students will learn performance qualification according to American Welding Society (AWS) standards. As part of this course, students may earn various qualifications according to AWS standards adhering to D1.1 (steel) and D1.2 (aluminium) covering multiple processes. Group 2 course. Prerequisites: None. Critical Thinking - Direct.

WPT 210 - Welding Fabrication and Repair
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
This course provides students an opportunity to apply the process-specific welding skills that they have previously mastered to complete fabrication and repairs projects. In addition to welding, students will learn shop metal identification, how to set up and operate shop metal prep and fabricating equipment as well as plan, sketch, order and prepare for a variety of projects. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): WPT 113 or WPT 114 with a 2.0 or higher or extensive welding experience, verified by welding skill demonstration test.

WPT 211 - Welding Fabrication I
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
First level fabrication class for all students enrolled in the Welding Technology A.A.S. program. Students will learn to apply manufacturing principles and techniques in order to complete assemblies to print specifications. Proper use of common industrial tools and machinery, including CNC cutting table, will be stressed. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): WPT 113, WPT 114

WPT 212 - Welding Fabrication II
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
Second level fabrication class for all students enrolled in the Welding Technology A.A.S. program. Students will take control of a fabrication project from the planning to finishing stages. Emphasis on design, project planning, and efficient execution. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): WPT 211

WPT 213 - Weld Quality Testing
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
Class to cover theory and practical use of common methods of non-destructive examination. Processes include dye penetrant, ultrasonic, and magnetic particle. Familiarity with prevalent AWS codes and standards will be emphasized. Group 2 course. Critical Thinking - Direct.
Recommended Prerequisite(s): DD 101, DD 110

WPT 260 - Intro to Welding Automation
Credit Hours: 3, **Contact Hours: 5**
Division: Technical
This course provides students an opportunity to learn the theory behind common forms of automation utilized throughout the welding industry. Lab assignments will focus on equipment set-up and operations along with analysis of results. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): WPT 113, WPT 114

WPT 290 - Welding Internship
Credit Hours: 2-4, **Contact Hours: 2-4**
Division: Technical
The purpose of the internship is to provide on-the-job training for the student who wishes to pursue a career in a technical field of study. The internship will be customized to meet the learning needs of the student and the job requirements of the sponsoring firm. Students spend 10-15 hours per week in this paid, supervised on-the-job training experience. In addition to the required 50 hours per credit at a work site, students participate in semi-monthly seminars. Students must apply one month prior to the semester in which they will complete the internship. Group 2 course. Communications - Direct.
Required Prerequisite(s): 30 credits of program specific courses with a GPA of 3.0 or higher.

WPT 293 - Welding/Construction Technology Study Abroad
Credit Hours: 1, **Contact Hours: 1**
Division: Technical
In this class, students are provided the opportunity to travel to a specified destination affiliated with the corresponding welding non-trip course. This course will serve to integrate the student learning experience and provide a sense of cultural perspective, diversity and regional awareness. The course is an opportunity for students to explore other areas around the world while applying discipline-specific course content. For a more specific course description, please review the course description of the associated non-trip course. Group 2 course.
Required Prerequisite(s): WPT 114.