

## COURSES OF INSTRUCTION

The following pages contain descriptions of the College of Technologies courses offered. The courses are arranged under the various university academic disciplines.

The number of credit hours granted for each course is in parentheses.

The University reserves the right to withdraw a course from its schedule if the enrollment is not sufficient.

### ALTERNATE FUELS

#### **AF101 Alternate Fuels I**

This intensive six-week course incorporates the basic principles of alternative fuels and their positive impact on the environment with state-of-the-art computer-controlled systems. A complete understanding of system maintenance and repair of all components including regulators, converters, lock-offs, mixers and injectors is provided. The course covers all current alternative fuels including methanol, ethanol, compressed natural gas, liquefied natural gas, liquid propane gas, biodiesel, hydrogen, electric, hybrid and flexible fuel vehicles. All safety laws and regulations will be discussed and adhered to. Students are provided lab activities that offer valuable hands-on training needed for future transportation industry maintenance and repair.

**Prerequisite: AU130. (6)**

#### **AF102 Alternate Fuels II**

An in-depth study of propane (LPG) and compressed natural gas (CNG) and an overview study of hybrids and safety. The diagnosis and repair of vehicles, as well as conversion kits and installation procedures will be completely covered. Diagnostic equipment, such as scan tools, engine analyzers and emissions analyzers, will be used. An emission dynamometer will be utilized in this class. Processing bio-diesel and ethanol for testing is also included.

**Prerequisite: AF101. (6)**

### AGRICULTURAL EQUIPMENT

#### **AG227 Combines**

The principles, maintenance, electrical, and repair of the complete combine will be studied. Proper adjustments of the cutting, threshing, cleaning, unloading, grain head, corn head and monitoring systems for farm equipment will be covered. Final drives, transmissions, slip clutches and automatic header controls will also be included.

**No Prerequisite. (6)**

#### **AG228 Tractors**

Basic operating principles of all components are taught. Maintenance, electrical, and service of the complete tractor will be stressed. Transmission and drive train construction and powerflow will be covered, including powershift transmissions, differential locks, mechanical front drives, and power take offs. Proper repair procedures of the entire tractor will be taught, including brakes, clutches and accessories.

**No Prerequisite. (6)**

#### **HY130 Hydraulics**

Basic fluid power and the various types of hydraulic pumps, motors and controls, including electro-hydraulic controls, cylinders and hydrostatic drive units are examined. Diagnosis and repair of different types of hydraulic systems and individual components will be covered.

**Prerequisite: AU123. (6)**

### AUTOMOTIVE

#### **AU116 Manual Drive Trains and Axles**

Students will examine the basic construction, operating principles, and powerflow of the manual drive train system. They will study diagnosis and overhaul of clutch assemblies, four- and five-speed transmissions and transaxles, four-wheel drive components, front- and rear-wheel drive shafts. Integral and removable ring and pinion replacement and setup will be discussed. Lab projects include disassembly, inspection and reassembly on late-model vehicles and equipment.

**No Prerequisite. (6)**

#### **AU117 Automatic Transmissions/Transaxle**

Principles of hydraulic systems, planetary gear sets, torque converters, electronic control systems and basic transmission components are the basis for this course. Diagnosis, servicing and adjustments of various automatic transmissions and transaxles are covered. Lab work includes disassembly, inspection, reassembly and adjustment on training aids. Lab projects include diagnosis, repair or overhaul of transmissions in late-model vehicles and demonstration of special tools and techniques.

**No Prerequisite. (6)**

#### **AU118 Transportation Heating Ventilation Air Conditioning**

A study of design characteristics and principles of transportation air conditioning, including basic system operation, heat transfer, component location and compressors is provided. Students should learn the use of refrigerant recovery equipment to lessen the impact of R12 destruction on the environment. Lab work includes assignments to develop the skills and

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knowledge required to perform heating and air conditioning service, diagnosis and repair, and recovery and recycling of R12 & 134A. Basic electrical system principles, use of digital multimeter and automatic climate control diagnosis will be studied.

**No Prerequisites.** (6)

### **AU122 Automotive Engine Diagnosis and Repair**

The principles of four-stroke engine designs are the foundation for this study. This introduction to automotive engines includes theory, construction and overhaul procedures, including cylinder heads, blocks, bearings, pistons, rods, crankshafts, valve train and gaskets. Proper use of hand tools, precision tools, special engine tools and equipment is demonstrated. Lab work includes application of diagnosis, overhaul and repair procedures on training aids.

**No Prerequisite.** (6)

### **AU123 Electrical and Electronics I**

This course covers the basic principles of electricity, magnetism and electronics. Basic operation of the complete electrical system is taught, including battery charging, starting, ignition, lighting, and accessory circuits. Through the use of shop manuals and electronic media, heavy emphasis is placed on wiring diagram comprehension. Students study diagnosis, troubleshooting, repair and maintenance of the automotive electrical system. (A digital volt ohm meter and calculator are required for this class.)

**No Prerequisite.** (6)

### **AU126 Suspension and Steering**

The fundamentals of the chassis, including basic and power steering systems, variable effort power steering systems, suspension systems both basic and computer controlled, geometric centerline alignment, thrust line alignment and total four-wheel alignment provide the focus of this course. Proper procedures in diagnosis of steering and suspension systems for replacing components along with basic frame and body measuring for correct locations are also covered. Lab work includes steering and suspension repair, tire balancing and alignment on computerized alignment equipment, and computerized wheel balancing, utilizing training aids and live vehicles.

**No Prerequisite.** (6)

### **AU127 Hydraulic Brake Systems**

The fundamental principles of hydraulics pertaining to the automotive and medium duty truck brake systems is presented. Students will study the theory of operation and advanced study of component principles. Students will use standard skills to diagnose and repair hydraulic systems, drum and disc brake systems, power assist units and anti-lock brake systems. Lab work includes

demonstration, on-car practice to provide a working knowledge of diagnosis and repair of the hydraulic systems, drum and disc brake systems, power assist units and associated systems. Included will be coverage of wheel bearings, parking brakes, related electrical circuits and use of on-car brake lathes.

**No Prerequisite.** (6)

### **AU128 Electrical and Electronics II**

This course will review and build on information taught in the Electrical and Electronics I course. The information covered will include instrumentation, electronic climate controls, cruise control, advanced lighting systems, air bags, multiple types of sensors, and motorized seatbelts. This material will include automotive, truck, and agricultural electronic applications. The course is an in-depth study of electronic components and how they work in the previously mentioned systems. Also to be covered is the use of digital multimeters, scan equipment, oscilloscopes, and diagnostic charts for computerized management systems. This course will instruct how these devices help in trouble-shooting electrical problems.

**Prerequisite: AU123.** (6)

### **AU130 Automotive Engine Performance**

Skills in basic engine performance on gasoline four-stroke engines are developed. Diagnosis and repair of these systems and components are stressed: ignition and related electrical circuits, sensors, fuel injection systems, air induction, computer and emission systems. Demonstrations and hands-on work on vehicles will provide a working knowledge of diagnosis using test equipment ranging from timing lights, compression testers, cylinder leakage testers and vacuum gauge to engine analyzers with oscilloscopes and five-gas analyzers.

**Prerequisites: AU128 or DT128.** (6)

### **AU132 Computerized Engine Control Systems**

The current electronic engine and fuel management systems which are being utilized on today's vehicles are introduced. Included are General Motors' electronic fuel injection (TBI, PFI, SFI), C3I ignition and direct ignition systems (D.I.S.). Chrysler electronic fuel injection and turbocharger systems are also included. Ford EEC-IV+V and OBDII on all manufactured systems are thoroughly covered. The students should be able to describe system operation, perform on-board computer diagnostic checks and perform repairs in accordance with manufacturers' procedures. Lab work includes the diagnosis of drivability and engine performance complaints, utilizing modern diagnostic computer engine analyzers and scanners on training aids and live vehicles.

**Prerequisite: AU130.** (6)

AUTOMOTIVE - TOYOTA T-TEN

**TAU116 Manual Drive Trains and Axles  
(Toyota Course #302 Manual Transmissions and Transaxles)**

Students will examine the basic construction, operating principles, and powerflow of Toyota manual drive train system and comparing them to other manufacturers. Students will study torque and torque multiplication, as well as gear ratios, diagnosis and overhaul of clutch assemblies, four- and five-speed transmissions and transaxles, four-wheel drive components, and front- and rear-wheel drive shafts. Integral and removable ring and pinion replacement and setup will be discussed. Lab projects include disassembly, inspection and reassembly on late-model vehicles and equipment.

**No Prerequisite. (6)**

**TAU117 Automatic Transmissions/Transaxle  
(Toyota Course #274 Toyota Automatic Transmission Diagnosis)**

Principles of hydraulic systems, planetary gear sets, torque converters, electronic control systems and basic transmission components are the basis for this course. Diagnosis, servicing and adjustments of Toyota automatic transmissions and transaxles are covered. Lab work includes disassembly, inspection, reassembly and adjustment on training aids. Lab projects include diagnosis, repair or overhaul of transmissions in late-model vehicles and demonstration of special tools and techniques.

**No Prerequisite. (6)**

**TAU118 Transportation Heating Ventilation Air Conditioning  
(Toyota Course #752 AC and Climate Control)**

A study of design characteristics and principles of Toyota transportation air conditioning systems, including basic system operation, heat transfer, component location and compressors is provided. Students will learn the use of refrigerant recovery equipment to lessen the impact of R12 destruction on the environment. Lab work includes assignments to develop the skills and knowledge required to perform heating and air conditioning service, diagnosis and repair, and recovery and recycling of R12 & 134A. Basic electrical system principles, use of digital multimeter and automatic climate control diagnosis will be studied.

**No Prerequisites. (6)**

**TAU122 Automotive Engine Diagnosis and Repair**

The principles of four-stroke engine designs are the foundation for this study. This introduction to automotive engines includes theory, construction and overhaul procedures, including cylinder heads, blocks, bearings, pistons, rods, crankshafts, valve train and gaskets.

Proper use of hand tools, precision tools, special engine tools and equipment is demonstrated. Lab work includes application of diagnosis, overhaul and repair procedures on training aids.

**No Prerequisite. (6)**

**TAU123 Electrical and Electronics I  
(Toyota Course #623 Electrical Circuit Diagnosis)**

This course covers the basic principles of electricity, magnetism and electronics. Digital multimeter use is thoroughly covered. Basic operation of the complete electrical system is taught, including battery charging, starting, ignition, lighting, and accessory circuits. Through the use of shop manuals and Toyota TIS (electronic media), heavy emphasis is placed on wiring diagram comprehension. Students study diagnosis, troubleshooting, repair and maintenance of the automotive electrical system. (A digital volt ohm meter and calculator are required for this class.)

**No Prerequisite. (6)**

**TAU126 Suspension and Steering  
(Toyota Course #453 Suspension Steering and Handling)**

The fundamentals of the Toyota chassis, basic and power steering systems, variable effort power steering systems, suspension systems (both standard and computer controlled), geometric centerline alignment, thrust line alignment and total four-wheel alignment provide the focus of this course. Proper procedures in diagnosis of steering and suspension systems as well as replacing components and basic frame and body measuring for correct locations are also covered. Lab work includes steering and suspension repair, tire balancing and alignment on computerized alignment equipment, and computerized wheel balancing utilizing training aids and live vehicles.

**No Prerequisite. (6)**

**TAU127 Hydraulic Brake Systems  
(Toyota Course #553 Brake Systems)**

The fundamental principles of hydraulics, pertaining to the automotive and light / medium duty truck brake systems are presented. Students will study the theory of operation and advanced study of component principles. Students will use standard skills to diagnose and repair hydraulic systems, drum and disc brake systems, power assist units and anti-lock brake systems. Lab work includes demonstration, on-car practice to provide a working knowledge of diagnosis and repair of the hydraulic systems, drum and disc brake systems, power assist units and associated systems. Additionally, wheel bearings, parking brakes, related electrical circuits and use of on-car brake lathes are covered in depth.

**No Prerequisite. (6)**

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### **TAU128 Electrical and Electronics II**

#### **(Toyota Course #652 Electrical Body Diagnosis)**

This course will review and build on information taught in the Electrical and Electronics I course (Toyota 623). The information covered will include instrumentation, electronic climate controls, cruise control, advanced lighting systems, air bags, multiple types of sensors, and motorized seatbelts. This material will include automotive, and light / medium duty truck electronic applications. The course is an in-depth study of electronic components and how they work in the previously mentioned systems. Also to be covered is the use of digital multimeters, scan equipment, oscilloscopes, and diagnostic charts for computerized management systems. This course will instruct how these devices help in trouble-shooting electrical problems.

**Prerequisite: TAU123. (6)**

### **TAU130 Automotive Engine Performance**

#### **(Toyota Course #852 Engine Control Systems I)**

Skills in basic engine performance on gasoline four-stroke engines are developed. Diagnosis and repair of these systems and components are stressed: ignition and related electrical circuits, sensors, fuel injection systems, air induction, computer and emission systems. Demonstrations and hands-on work on Toyota vehicles will provide a working knowledge of diagnosis using test equipment ranging from timing lights, compression testers, cylinder leakage testers and vacuum gauges to engine analyzers with oscilloscopes, five-gas analyzers, and Toyota Tech stream.

**Prerequisites: TAU128. (6)**

### **TAU132 Computerized Engine Control Systems**

The current electronic engine and fuel management systems which are being utilized on today's vehicles are introduced. An in-depth study of Toyota engine management systems and Tech Stream II will be covered. The students will be able to describe system operation, perform on-board computer diagnostic checks and perform repairs in accordance with manufacturers' procedures. Lab work includes the diagnosis of drivability and engine performance complaints, utilizing modern diagnostic computer engine analyzers and scanners on training aids and live vehicles.

**Prerequisite: TAU130. (6)**

## COMMUNICATION

### **CO179 Introduction to Human Communication**

Students are introduced to theory and skill building in the basic areas of human communication: interpersonal communication, nonverbal communication, small group dynamics, and public communication.

**No Prerequisite. (3)**

## DATA PROCESSING

### **DP150 Spreadsheet Applications**

This introductory course exposes students to a wide variety of fundamental electronic spreadsheet operations and functions through business-related applications. Students taking this course via Virtual College or College Without Walls must have access to a computer with appropriate software installed.

**No Prerequisite. (3)**

## DIESEL

### **CDL101 Commercial Driver License I**

In this course the student will learn what is required to get a commercial driver's license (CDL). The student will receive instruction from licensed instructors who are licensed to teach a commercial driver course. The student will receive class time and driving time in order to help prepare the student for the CDL test.

**Prerequisites: Department of Transportation (DOT) Physical. (6)**

### **CDL102 Commercial Driver License II**

In this course the student will continue learning what is required to get a commercial driver's license (CDL). The student will receive instruction from licensed instructors who are licensed to teach a commercial driver course. The student will receive class time and driving time in order to help prepare the student for the CDL test. The driving portion will consist of driving safety, starting, stopping, turning, shifting, braking, parking, docking, hook-up and unhook, emergency equipment and driving test practice.

**Prerequisites: CDL101, CDL Permit License and Physical. (6)**

### **DT119 Theory and Techniques in Welding**

Students will learn the techniques of welding and cutting of mild steel and aluminum. These materials are commonly used on automotive, truck, trailer, construction and agriculture equipment. Included are oxy acetylene welding, braze welding, Gas Metal Arc Welding (MIG), Gas Tungsten Arc Welding (TIG), Shielded Metal Arc Welding (STICK), Plasma Arc Cutting and flame cutting techniques. Students will perform practice welds in each process.

**No Prerequisite. (6)**

### **DT124 Diesel Engine Diagnosis & Repair**

This course will cover theory and operation of a 2-cycle and 4-cycle diesel engine and their components. Diesel engine systems that will be covered include: lube, cooling, fuel, intake and exhaust systems. The engines will be disassembled, measured and assembled to O.E.M. specifications. Troubleshooting

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and failure analysis of all engines and its components will also be covered. Engines covered in the course include: Detroit Diesel, Caterpillar, Cummins, Mack, Case, International and Dura-Max (Isuzu). This class precedes the D.E.E.C.

**No Prerequisite. (6)**

### **DT126 Diesel Performance and Diagnosis**

This course includes discussion of the operating principles of a compression ignition engine, operation of both mechanical and electronic fuel injection systems and turbochargers. The students will disassemble, inspect, discuss, assemble and test diesel fuel injection system components such as supply pumps, injection pumps, nozzles, injectors and governors. Testing will include the use of Bacharach injection pump test benches and nozzle testers. Students will learn to diagnose, repair and program current electronic-controlled diesel engines used on highway, agricultural, industrial, and other applications. Lab work will include work on vehicles and/or engines in the live engine lab.

**No Prerequisite. (6)**

### **DT128 Heavy Equipment and Vehicle Integrated Electronics (HEAVIE)**

This course will review and build on information taught in Electrical and Electronics I. The information covered will include instrumentation, global positioning, automated transmissions, multiple electronic control module communication, electronic climate controls, cruise control, air bags, lighting systems, and multiple types of sensors. The course is an in-depth study of electronic components and how they work in truck and agricultural applications. Also covered are multimeter, scan equipment, oscilloscopes, and trouble shooting charts for computerized management systems.

**Prerequisite: AU123. (6)**

### **DT130 Truck Air Systems, Brakes and Preventive Maintenance**

This course includes discussion, lab and shop exercises. The student will be able to identify and comply with personal and environmental safety practices common to a shop's environment. The student will identify air systems, air brakes, and antilock brake system components. The student will perform failure analysis on the truck air system, air brakes and antilock brake systems. The student will perform a complete preventive maintenance inspection on a class eight truck. Special emphasis is given to all truck electronics and Federal DOT rules and regulations covering the qualifications needed to be a brake and preventive maintenance inspector and service technician.

**No Prerequisite. (6)**

### **DT131 Truck Drive Trains**

The operating principles of the components in truck drive trains are examined. Students will remove, disassemble, inspect, assemble and install an Eaton/Fuller 9-, 10-, 13- or 18-speed transmission, two-plate clutch, rear drive axle with a power divider, a driveline including U-joints, slip yokes, king pins and related steering components on a non-drive steering axle. While performing these hands-on tasks, students will measure the various components for wear using micrometers, dial indicators and protractors and will learn proper troubleshooting techniques, preventive maintenance and failure analysis, of these components.

**No Prerequisite. (6)**

### **DT135 Diesel Engine Electronic Controls**

This course will cover diesel electronic controls, tune-up, E.G.R., Engine Brakes, and diagnostic procedures. The procedures will be done in the live engine room on running engines currently used in today's industry. The student will perform horsepower and torque performance tests using the dynamometer. Electronic troubleshooting will be done using engine manufacture-specific diagnostic programs and hand-held electronic devices. The programs include Cummins Insite, Detroit Diesel DDDL and Caterpillar Electronic Technician. Hand helds include Cummins Quickchek and ProLink. Use of wiring diagrams and D.M.M. will be covered. Engines systems covered include: Detroit D.D.E.C. II-V, Cummins Select, Select Plus, Interactive System, Caterpillar A.D.E.M. II & III, and Mack V-MAC II & III.

**Prerequisite: DT124 and DT128. (6)**

## ENGLISH

### **EN070 Basic English**

Students are provided with a thorough review of English grammar usage as well as an introduction to writing. The course is required of students who score less than 70% on the English placement test. Class meets daily. (Credit is not counted towards graduation.)

**No Prerequisite. Graded S/U. (3)**

### **EN180 Composition I**

The aim of this course is to help students learn to write competently at the university level. Emphasis is placed on organization and development of ideas. Some essays are typed and revised on the microcomputer. Outside lab time is required.

**Prerequisite: EN070 or Proficiency Credit. (5)**

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## HIGH PERFORMANCE

### **HP101 High Performance Suspension and Steering**

The objective of this course is to give the students a basic knowledge of racecar vehicle dynamics for dirt, asphalt, road race, drag race, and street performance vehicles. Safety features both built into vehicles as well as driver safety equipment are explained. Basic chassis construction and how to stiffen existing vehicles is also discussed as well as in-depth discussions on front and rear suspensions, springs, shocks, weight transfer, and tires. There is also the opportunity to have hands-on experience setting up and tuning racecar suspensions.

**Prerequisites: AU126 and AU127. (6)**

### **HP102 High Performance Drive Lines**

The objective of this course is to teach students the principles of high performance enhancements that are available for the drive-trains of both street cars and light trucks as well as race cars. Areas of instruction are: ring and pinion setup for the Ford 9" and quick change rear ends; traction aids, including lockers and spools. Automatic transmissions covers air shifters, transbrakes, torque converters, as well as powerglide modifications for circle track and drag strip. Manual transmissions covers operation and hands-on servicing for Bert, Brinn, G-Force, Jerico, Lenco and other transmissions plus clutch components.

**Prerequisites: AU116 and AU117. (6)**

### **HP105 High Performance Accessory Trends**

Students will learn proper techniques and gain expertise in the challenging career of aftermarket accessories and integration. Students will learn through hands-on experience the proper technique for installation of window film as well as the design and layout application of graphics with enhancement by airbrushing and both paint-on and vinyl-pin striping. The students will learn the basics of audio and video enhancement techniques through classroom discussion and hands-on projects. This course will also discuss the integration of aftermarket electronics like keyless entry, security systems, remote starters, add-on power door locks, and power windows as well as the modification of vehicle ride height through the use of hydraulics and air-ride suspension systems.

**No Prerequisite. (6)**

### **HP130 High Performance Engine Machining**

The required machining operations to repair engines in a typical machine shop are covered. Industry standards and procedures will be taught. The machining operations will include engine block boring, sleeving, honing and milling. Cylinder head repair will include milling, seat and guide replacement and three angle cuts. In addition, connecting rod resizing and crankshaft polishing will be

covered. The students will perform these operations on training components as well as their own engine components.

**Prerequisites: AU122 or DT124. (6)**

### **HP200 High Performance Fuel Systems/ Electronics/Ignition**

Performance enhancement principles for street and race vehicles provide the foundation for this course. Beginning with the principles of engine performance enhancement, students will learn to measure engine performance using state-of-the-art dynamometers to discover the effects of ignition, fuel system, exhaust system and air induction changes. Applied systems include produces manufactured by Holley, Edelbrock, Accel, Mallory, MSD, Enderle and others. Students will study the importance of airflow, cylinder head porting and polishing; develop skills in porting and measure their results using modern flow benches; learn to program electronic engine management systems manufactured by Accel, Holley and others; and will apply learned principles and skills to dynamometer engines and training vehicles.

**Prerequisite: AU130. (6)**

### **HP201 High Performance Custom Engine Building**

The Custom Engine Building class takes the machining class a step further. The principles of high performance enhancements available for the engine are the focus of this course. Students will start with component selection and then the additional machining processes used to increase the performance of the engine will be taught. These processes include fitting splayed main caps, squaring the deck surfaces on V-8 blocks, correcting lifter bore alignment and engine balancing. The students will also learn how to degree camshafts and proper assemble techniques. Some of the machines used are: Sunnen CH-100 line hone, Rottler F5 boring machine, Sunnen CV-616 cylinder hone, Sunnen HBS-1300 milling machine, Sunnen VGS-20 cylinder head machine, Sunnen LBB-1660 connecting rod hone and Winona Van Norman crankshaft balancer. Modifying the engine using proven after-market components as well as factory performance options will be taught along with the theory of modifications including all relevant formulas. Students will apply theory to practice with the hands-on experience of modifying their own engines as well as engines for Northwestern's racecars and dyno engines.

**Prerequisites: HP130 and HP200. (6)**

### **HP210 High Performance Welding**

Students will learn the techniques of welding and cutting of mild steel, chrome moly, nickel base alloys, aluminum, magnesium, titanium, and stainless steel. Included are plate, tubing and castings of these materials. These

materials are commonly used in the racing industry. Included are oxy-acetylene welding, gas tungsten arc welding (Tig), plasma arc cutting and flame cutting techniques. Students will perform practice welds in each welding process.

**No Prerequisite.** (6)

**HP215 High Performance Fabrication**

Students will learn different techniques of working with tubing, sheets and blocks of different types of material. Included is hand-forming techniques as well as large equipment. Students will perform practice with hammer forming, English wheels, tubing benders, brakes, slip rolls, vertical mills, lathes and other miscellaneous equipment. Students will also learn the proper construction techniques of racing chassis, with discussions on choosing the right materials based on metallurgy and safe construction techniques.

**Prerequisite: HP210 and MH065.** (6)

HEATING, VENTILATION, AIR  
CONDITIONING AND  
REFRIGERATION

**HV101 Service and Procedures I**

The fundamentals of refrigeration and heating and equipment operation are discussed, including recovery machines, refrigerant, identification, gauges and vacuum pumps. The student will learn the identification of basic components, soldering and brazing and use of all trade related tools. Safety awareness, customer relations and professionalism are stressed, along with employability skills.

**No Prerequisite.** (6)

**HV102 Service and Procedures II**

Service and Procedures II will cover detailed servicing procedures of heating, air conditioning, refrigeration of heating, air conditioning and refrigeration and heat pump systems. The subject of refrigerant retrofitting will be covered in detail and EPA 608 will be administered.

**Prerequisites: HV103 and HV203.** (6)

**HV103 Refrigeration Systems and Controls**

This course is an introduction into refrigeration systems and the use of various refrigerants used in the industry. Proper recovery, evacuation and recharging of the systems will be covered. Pressure testing, leak testing, and repair will be performed. Troubleshooting and diagnosing of refrigeration and air conditioning are discussed. The different refrigerant characteristics, lubricants and piping methods are covered. Mechanical controls of high- and low-side system operation, along with compressor types and air handling, are also covered.

**Prerequisites: HV101 and HV104.** (6)

**HV104 Electrical and Electronics**

This course is an introduction into basic electricity, voltage ohms and amperage. Included is the coverage of series, parallel and series/parallel circuits. Motor construction, electrical connections and speed controls are covered. Service procedures to check electrical circuits on domestic/commercial refrigeration freezers, coolers and ice makers are examined.

**No Prerequisite.** (6)

**HV201 Air Conditioning Systems and Controls**

An introduction into air conditioning systems refrigerant characteristics and properties are discussed. Fans and blowers, silver soldering and brazing of sweat solder joints and piping, switching devices, and compressor operation are covered. Compressor diagnosis and performance testing are also discussed. Recovery and evacuation and refrigerant documentation are also discussed.

**Prerequisites: HV101 and HV104.** (6)

**HV202 Heating Systems and Controls**

Gas furnace safety, motor protectors and safety controls, electric furnaces and heaters, standing pilot, auto ignition, auto re-ignition, ultra-high efficient units, zone heating and split systems are studied. Service and repair of propane and natural gas furnaces and oil, electric and gas furnace efficiency testing are covered.

**Prerequisite: HV104.** (6)

**HV203 Heating Systems II and Heat Pumps**

This course is a continuation of HV201 and HV202. Additionally, this course covers the principles of heat pump systems and controls, air conditioning and heating cycles, flow defrost cycles, troubleshooting and performance testing. Wiring and electrical demands and heat transfer principles are also studied.

**Prerequisites: HV201 and HV202.** (6)

**HV204 Special Topics & Applications of Refrigeration & Temperature Controls**

System theory and operation of the following systems are taught: hydronic, absorption, large chillers, pneumatic controls, boilers and radiant heating. Also, this course will discuss diagnostic fees, hourly rates, documentation and accounting. Duct sizing and design calculations and layout of duct systems are discussed. Calculation of heat loads is also included. Also, hands-on performance testing will be done on all past areas of study.

**Prerequisites: HV101, HV102, HV103, HV104, HV201, HV202 and HV203.** (6)

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## MANAGEMENT

### **MA127 Computer-Assisted Management**

In this course, the student will acquire the basic knowledge of the service management field. Using the Quickbooks program and the microcomputer, the student will pay employees; order, receive, and pay for parts from vendors; use profit and loss sheets; and organize customers. Instruction will also include service management, such as managers', writers' or advisors' duties and responsibilities. Students will be exposed to the evaluation of technicians, time study proficiency and the discussion of the psychology of dealing with customers.

**No Prerequisite. (5)**

## MATH

### **MH065 Review Math**

Basic mathematical operations are studied with emphasis on concepts, facts and properties to prepare the student for college-level mathematics. Use of calculators is limited. The course is required of students who score less than 70% on the math placement test. Credit does not apply to graduation requirements.

**No Prerequisite. Graded S/U. (3)**

### **MH169 Business Math**

Business math applications are studied and include bank records, payroll, simple and compound interest, annuities, business and consumer loans, inventory valuation, depreciation, and international currencies. A TI-30 or higher numbered calculator is required.

**Prerequisite: MH065 or Proficiency Credit. (5)**

## POLITICAL SCIENCE

### **PS274 The American Political Scene**

This course is designed to inform students about government and politics in America: how the system works, its history and its strengths and weaknesses. It attempts to integrate the traditional with the modern approach so that students can understand the interconnection between political thought/the formal structure of politics on one hand and the policymaking process/political behavior on the other.

**Prerequisite: EN070. (3)**

## PSYCHOLOGY

### **PY177 Psychology**

Focusing on scientific aspects of human behavior, students will examine the history, methods and theories of psychology as a behavioral science. The brain and the senses will be explored as they relate to human development.

**No Prerequisite. (3)**

## SCIENCE

### **SC112 Physical Science**

This broad survey course investigates the interrelationship of the physical sciences and technology. Conservation of matter and energy is an underlying theme throughout the course. Topics include physics, chemistry, environmental geology, and astronomy.

**No Prerequisite. (5)**

## SOCIOLOGY

### **S0220 Cultural Diversity in the United States**

Students will explore topics related to diversity in the United States today, such as race, class, religion, sex, and gender, to learn how to better relate to a diverse society.

**No Prerequisite. (3)**

## UNIVERSITY SURVEY COURSES

### **UN070 Success Strategies**

Students receive information on curricula, the grading system, notetaking, study habits, methods of taking tests and previewing textbooks. This course is required of traditional students in their first quarter.

**No Prerequisite. (1)**

### **UN292 Portfolio Capstone**

This course is designed for students who are in the final quarter of their associate degree program. It will provide students with the opportunity to prepare a comprehensive portfolio. In this course students will gather documentation and participate in activities to show their ability to demonstrate the University of Northwestern Ohio Goals for Institutional Effectiveness and Student Success.

**Prerequisite: DP105. (1)**

## WORD PROCESSING

### **WP121 Applications of Word Processing using Microsoft Word**

This course introduces students to the features of Microsoft Word and many of its applications. Students will create, format, and edit documents, tables and mailing labels as well as gain exposure to Windows and file management concepts. Upon completion of this course, students will be prepared for the Microsoft Application Certification Testing. Students taking this course via Virtual College or College Without Walls must have computer access with the appropriate software.

**No Prerequisite. (3)**