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| **Course Acronym:** | ATEC |
| **Course Number:** | 22B |
| **Descriptive Title:** | Electrical, Electronics and Computer Controlled Systems |
| **Division:** | Industry and Technology |
| **Department:** | Automotive Technology |
| **Course Disciplines:** | Automotive Technology |
| **Catalog Description:** | This course covers the study of Automotive On-Board Diagnostics II computer controlled engine management systems, body electrical and electronic systems, onboard computer networking and computer controlled ignition testing, including diagnosis and repair procedures. Laboratory activities stress the proper use of test equipment utilized in industry.<br><br>*Note: Automotive Technology 22B is the same as two-course sequence Automotive Technology 25 and 26. Students who have completed Automotive Technology 25 and 26 will not receive credit for Automotive Technology 22B.* |
| **Prerequisite:** | Automotive Technology 22A with a minimum grade of C or equivalent |
| **Co-requisite:** | |
| **Recommended Preparation:** | |
| **Enrollment Limitation:** | |
| **Hours Lecture (per week):** | 5 |
| **Hours Laboratory (per week):** | 10 |
| **Outside Study Hours:** | 10 |
| **Total Course Hours:** | 270 |
| **Course Units:** | 8 |
| **Grading Method:** | Letter Grade only |
| **Credit Status:** | Credit, degree applicable |
| **Transfer CSU:** | Yes |
| **Effective Date:** | Prior to July 1992 |
| **Transfer UC:** | No |
| **Effective Date:** | |
| **General Education: ECC** | |
| **Term:** | |
| **Other:** | |

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| **CSU GE:** | |
| **Term:** | |
| **Other:** | |
| **IGETC:** | |
| **Term:** | |
| **Other:** | |
| **Student Learning Outcomes:** | **SLO #1 Safety Exam**<br><br>Given an in class exam, based on readings, classroom discussions and demonstrations, the student will be able to work in the Automotive Shop safely and pass the Automotive Safety Exam with 100% accuracy.<br><br>**SLO #2 Battery System Test**<br><br>The student will be able to test the performance of the automotive battery charging and starting systems using the Automotive Battery/ Charging/ Starting Systems Testing lab worksheet and manufacturer specifications.<br><br>**SLO #3 Powertrain Control Module**<br><br>The student will be able to test the performance of the automotive computer controlled system using the Automotive Powertrain Control Module Data lab worksheet and manufacturer specifications. |
| **Course Objectives:** | 1. Score 100% accuracy on a safety test.<br>2. Perform an analysis of an engine by performing compression, cylinder leakage, cylinder balance and vacuum testing.<br>3. Service, test and evaluate a valve train.<br>4. Perform engine diagnosis using a flow chart.<br>5. Diagnose and repair cooling systems.<br>6. Evaluate and test a lead-acid battery.<br>7. Evaluate, test and repair charging systems.<br>8. Evaluate, test and repair starting systems.<br>9. Evaluate, diagnose and repair electrical systems.<br>10. Evaluate, test and diagnose an engine using engine analyzers.<br>11. Evaluate, test, diagnose and repair fuel systems.<br>12. Evaluate and test an emission system.<br>13. Evaluate, test, diagnose and repair computer controlled systems.<br>14. Evaluate, test, diagnose and repair fuel injection systems.<br>15. Evaluate digital engine analyzer data, form conclusions and recommend repairs.<br>16. Analyze computer controlled engine data, form conclusions and recommend repairs. |
| **Major Topics:** | **I. Course Overview and Safety (2.5 hours, lecture)**<br><br>A. Personal Protective Equipment (PPE)<br>B. Shop and environmental hazards<br>1. Commonly used shop chemicals<br>2. Safety Data Sheets (SDS)<br>3. Tool and shop equipment hazards<br>C. Proper hand/power tool and shop equipment identification and usage |

D. Vehicle hoist operation
E. Service information accessing procedures
   1. Published repair procedures and specifications
F. Repair orders
   1, Proper procedures and legal guidelines
   2. California Department of Consumer Affairs, Bureau of Automotive Repair (BAR) - "Write It Right"
   3. Purpose and workflow process
G. Technician training and certifications

**II. Tools and Safety (5 hours, lab)**

A. PPE usage
B. Shop safety rules demonstration
   1. Proper hand tool identification and usage
   2. Shop equipment identification and usage
C. Safe work area maintenance
   1. In-shop vehicle handling
   2. Proper in-shop engine emissions venting
   3. Safe vehicle hoisting
   4. Clean up procedures
D. Automotive Service Excellence (ASE) technician certification process A-1 through A-8 lab sheet
E. Vehicle repair work order

**III. Automotive Service Industry Terms and Conventions (1.5 hours, lecture)**

A. Key Terms - speaking the language of a technician
B. Employee obligations
C. Accessing and usage of correct service and repair procedures
   1. Workshop manuals
   2. Electronic service information sources
   3. Other references
   4. Published repair, service procedures and specifications.
D. Legal rights and responsibilities under repair orders
E. Technician training and certifications.
F. ASE automotive technician testing and certification process
   1. G-1, A-1 through A-8, L-1

**IV. Automotive Service Industry Terms and Conventions (1.5 hours, lab)**

A. Complete vehicle repair work order
B. Access online service information

**V. Electrical Fundamentals (7 hours, lecture)**

A. Atomic structure and components
   1. Positive and negative charges
   2. Electron shells
   3. Free and bound electrons
B. Conductors, insulators and semiconductors

C. Units of electricity
    1. Volts, amperes and resistance
    2. Watts
D. Current flow
    1. Conventional theory vs. electron theory
E. Sources of electricity
F. Conductors and resistance
    1. Fixed and variable resistors
G. Electrical circuit components and operation
    1. Circuit fault types
H. Ohm's Law
    1. Definition, formulas and application
    2. Watt's Law
I. Series circuits
    1. Ohm's Law applications
    2. Kirchhoff's Voltage Law applications and usage
    3. Series circuit laws
J. Parallel circuits
    1. Kirchoff's Current Law
    2. Parallel circuit laws
    3. Determining total resistance - 5 methods
K. Series-parallel circuits
    1. Circuit faults and problem solving

**VI. Electrical Fundamentals (13 hours, lab)**

A. Units of electricity
    1. Volts, amperes and resistance
    2. Watts
B. Sources of electricity
C. Conductors and resistance
    1. Fixed and variable resistor identification
D. Circuit component labeling
    1. Circuit fault type descriptions
E. Ohm's Law
    1. Problem solving
F. Series circuits
    1. Ohm's Law applications and problem solving
    2. Kirchhoff's Voltage Law applications and usage
    3. Voltage drops
    4. Circuit board usage and building of operational series circuits
G. Parallel circuits
    1. Kirchhoff's Current Law applications
    2. Determining total resistance
    3. Circuit board usage and building of operational parallel circuits
H. Series-parallel circuits
    1. Circuit faults and problem solving
    2. Circuit board usage and building of operational series-parallel circuits
I. Conductors, insulators and semiconductors

**VII. Circuit Testing Procedures and Equipment (2.5 hours, lecture)**

A. Jumper wires and test lights
    1. Logic probes
B. Digital Multimeters (DMM)
    1. Usage and interpretation of meter readings
    2. Inductive ammeters
    3. Electrical unit prefixes
C. Oscilloscopes and graphing multimeters
    1. Terminology and setup
    2. Usage and interpretation of readings

**VIII. Circuit Testing Procedures and Equipment (5 hours, lab)**

A. Jumper wire and test light usage
B. Logic probe usage
C. DMM, Digital Storage Oscilloscope (DSO) usage
    1. Reading source voltage and voltage drops
    2. Reading amperage
    3. Reading resistance
    4. Circuit and wire continuity testing

**IX. Wiring and Wire Repair (3.5 hours, lecture)**

A. Metal conductivity
B. Wire gauge sizing
    1. American Wire Gauge (AWG) system
    2. Metric wire gauge sizes
C. Ground wires, battery cables and jumper cables
    1. Aluminum wire
    2. Twisted/shielded wire
D. Fuses and circuit protection devices
    1. Fuse types and ratings
    2. Circuit breakers and protectors
    3. Fusible links and mega fuses
E. Terminals and connectors
    1. Removal and crimping
F. Wiring harness repair
    1. Solderless connections and splices
    2. Solder splices
    3. Crimp-and-seal connectors
    4. Heat shrink tubing
G. Electrical conduit color interpretation

**X. Wiring Repair (10 hours, lab)**

A. Solderless wire splicing
    1. Crimp-and-seal
    2. Square knot method
    3. Heat shrink application
B. Solder splices
C. Aluminum wire repair
D. Twisted/shielded wire repair
E. Identify, test and replace fuses and fusible links

F. Hard-shell connector terminal repair/replacement
G. Weather-pack and metri-pack connector terminal repair/replacement

**XI. Wiring Schematics and Circuit Testing (2.5 hours, lecture)**

A. Wiring schematic interpretation and symbols
   1. Terminology and circuit information
   2. Wire size, color and circuit identification
   3. Electrical component identification
B. Single-stranded or multi-stranded wire usage
C. Resistive wire usage
D. Purpose of wiring diagrams
E. Fuse and relay terminal identification
F. Connector end views, legends and terminal identification
G. Component locators
H. Circuit troubleshooting procedures
   1. Locating opens and shorts
   2. Common power or ground
   3. Locating intermittent problems - wiggle test
   4. Methods of fault location

**XII. Wiring Schematics and Circuit Testing (10 hours, lab)**

A. Wiring schematic acquisition, interpretation and circuit diagnostic application
B. Circuit specific testing procedures
   1. Wiper motor circuit
   2. Brake and tail light circuit
   3. Horn circuit
   4. Blower motor circuit
C. Electrical fault diagnosis
   1. Visual inspection and circuit testing
   2. Circuit fault location and identification
   3. Relay testing and inspection

**XIII. Automotive Batteries (5 hours, lecture)**

A. Purpose and construction
   1. Main components
   2. Chemical reaction process
   3. Safety concerns
B. Battery types, differences and advantages/disadvantages
C. Types of battery terminals
D. Specific gravity and state-of-charge indicators
E. Battery ratings and applications
F. Temperature and load effects on battery performance
G. Causes and types of battery failure
H. Battery related terminology
I. Battery sizes
J. Battery trays, hold-downs, clamps and cables

**XIV. Battery Testing, Diagnosis and Service (10 hours, lab)**

A. Safe battery servicing
B. Proper charging and jump starting procedure
C. Safe battery disconnect and reconnect procedure
D. Battery, cable and terminal visual inspection
E. Open circuit battery voltage test and results evaluation
    1. DMM battery case voltage reading
    2. Battery removal, cleaning and reinstallation
    3. Battery memory saver usage procedure
    4. Electronic module reinitialization
F. Specific gravity test
G. Battery capacity test and analysis
H. Battery rating identification
I. Volt Amp Tester (VAT) usage
J. Starter cranking test
K. 3-minute charge test
L. Battery conductance test
M. Parasitic draw test and fault location procedure

**XV. Capacitance and Capacitors (1 hour, lecture)**

A. Definition, history and working principles of capacitance
B. Capacitor construction and operation
C. Factors of capacitance
    1. Units of measurement
    2. Plate surface area, plate distance and dielectric material
D. Capacitor uses
    1. Series circuits
    2. Parallel circuits
    3. Suppression

**XVI. Capacitance and Capacitors (2 hours, lab)**

A. Radio noise in a blower motor circuit diagnosis
B. Capacitor testing in a blower motor circuit
C. Capacitor test on a vehicle sound system power circuit

**XVII. Magnetism and Electromagnetism (2.5 hours, lecture)**

A. Fundamentals of magnetism
B. Electromagnetism
    1. Definition and operating principles
    2. Uses of electromagnetism
C. Principles of electromagnetic induction
    1. Lenz's Law
    2. Self-induction and mutual induction
D. Ignition coil windings, construction and operation
E. Electromagnetic interference

**XVIII. Magnetism and Electromagnetism (5 hours, lab)**

A. Alternator rotor electromagnetism demonstration
B. Circuit and relay identification

C. Relay inspection and testing
D. Relay pin identification with an ohmmeter

**XIX. Starting Systems (7.5 hours, lecture)**

A. Starting system purpose and components
B. Starter motor principles of operation
   1. Parts identification
   2. Types of starter motor construction
   3. Permanent magnet starters
   4. Starter drive mechanisms
   5. Positive engagement and solenoid operated starters
C. Three-phase Alternating Current (AC) motor principles of operation
D. Inverter modules
E. Integrated Starter-Generator (IGS) systems operating principles

**XX. Starting System Diagnosis and Service (10 hours, lab)**

A. Starting system diagnosis
   1. Slow crank condition
   2. No crank condition
   3. Starting system quick check test
B. Starter control circuit inspection and testing
C. Starter current draw test

D. Starter relay and solenoid testing
E. Starter motor free speed testing
F. Starter motor removal and reinstallation
G. Starter motor disassembly, cleaning, inspection, repair, and reassembly

**XXI. Charging Systems (7.5 hours, lecture)**

A. Purpose and major components
B. Alternator construction and operating principles
   1. Overrunning pulleys
   2. Components and operation
   3. Current induction and rectification
   4. Voltage regulation
C. Types of charge indicators
D. Computer controlled charging systems
   1. Types and modes of operation
   2. Pulse Width Modulation (PWM) and duty cycle
E. Introduction to Hybrid Electric Vehicle (HEV) charging systems and applications
   1. Integrated Starter Generator (ISG) and AC motors
   2. Regenerative braking in High Voltage (HV) battery charging
   3. Purpose of Direct Current (DC)/DC converter

**XXII. Charging System Testing and Service (10 hours, lab)**

A. Diagnose charging system problems
   1. Undercharge, no charge and overcharge
B. Inspect, adjust, and replace generator drive belts and pulleys

C. Charging system output test and circuit voltage drop test
D. Voltage regulator test
E. Test and replace AC generator diodes and/or rectifier bridge
F. AC generator removal and reinstallation
G. AC generator component disassembly, inspection, testing and replacement
   1. AC generator brushes and brush holder
   2. AC generator diodes and/or rectifier bridge
   3. Rotor and stator
H. Low Voltage (LV) and HV HEV inverter/converter module circuit inspection

**XXIII. Lighting and Signaling Circuits (10 hours, lecture)**

A. Automotive lamp construction and operation
B. Exterior lighting
   1. Conventional sealed-beam, halogen, and composite headlight lamps
   2. Bulb numbering and testing
   3. Brake lights and turn signals
   4. High-Intensity Discharge (HID) headlights
   5. Light Emitting Diode (LED) headlights
   6. Daytime running lights
   7. Dimmer switches
C. Interior lighting systems
   1. Courtesy lights
   2. Instrument panel lights
   3. Illuminated entry
   4. Fiber optics
   5. Automatic dimming mirrors
D. Lighting circuit diagnosis

**XXIV. Lighting Circuits Diagnosis and Repair (10 hours, lab)**

A. Lighting system troubleshooting and circuit fault finding
   1. Intermittent
   2. Dim
   3. No light operation
B. Exterior lamps and socket inspection and replacement
C. Interior lamps and socket inspection and replacement
D. HID headlight system voltage and safety precaution identification

**XXV. Driver Information Systems, Gauges and Warning Devices (3 hours, lecture)**

A. Dash warning symbols purpose and function
   1. Warning lamp recognition and interpretation
   2. Driver information system
B. Level, voltage, pressure and temperature gauges
   1. Analog and digital instruments
   2. Head Up Display (HUD)
C. Gauge sending units
D. Tachometer, speedometer, and odometer description
   1. Operating principles
   2. Digital vs. analog
   3. Integrated Circuit (IC) chip and stepper motor odometers
E. Digital electronic displays

F. Audible warning systems
G. Instrument panel illumination light dimming
   1. Body Control Module (BCM) control protocols and operation
H. OnStar, navigation Systems and Global Positioning Satellite (GPS) systems
I. Backup cameras and sensors
J. Lane Departure Warning System (LDWS)

**XXVI. Driver Information Systems, Gauges and Warning Devices Diagnosis and Repair (7 hours, lab)**

A. Instrument Panel (IP) gauge(s) testing and inspection
   1. Component failure root-cause diagnosis and identification
B. IP gauge sending unit(s) testing and inspection
   1. Component failure root-cause diagnosis and identification
C. Instrument cluster printed circuit board removal and replacement
D. IP warning device(s) incorrect operation troubleshooting
   1. Component failure root-cause diagnosis and identification
E. Driver information systems diagnosis
F. Electronic dash instrument diagnosis and troubleshooting

**XXVII. Horn, Wiper and Blower Motor Circuits (6.75 hours, lecture)**

A. Horn circuit purpose and function
   1. Horn operation and system diagnosis
   2. Horn service and replacement
B. Windshield wiper and washer system purpose and function
   1. Computer control
   2. Wiper and washer components
   3. Windshield wiper operation, testing, diagnosis and service
   4. Windshield washer operation, testing, diagnosis and service
C. Blower motor purpose and function
   1. Components, circuit description and operation
   2. Testing, diagnosis and service

**XXVIII. Horn, Wiper/Washer and Blower Motor Diagnosis and Repair (10 hours, lab)**

A. Incorrect horn operation diagnosis and causal identification
   1. No operation, intermittent operation and/or constant horn operation
   2. Poor sound quality
B. Incorrect windshield wiper operation diagnosis and causal identification
   1. No windshield wiper operation and/or one-speed only operation
   2. Slower-than-normal wiper operation
   3. Improper park operation
   4. Continuous wiper operation
C. Windshield wiper blade replacement and operation verification
D. Incorrect blower motor operation diagnosis and causal identification
   1. No operation, one-speed operation and/or constant blower motor operation
   2. Blower motor circuit schematic interpretation and testing

**XXIX. Accessory Circuits (3.5 hours, lecture)**

A. Cruise control components and operation
B. Heated mirrors and rear window defoggers
C. Power window components and operation
D. Power seat components and operation|
E. Power door locks
F. Keyless entry/remote start systems
G. Anti-theft systems
H. Door panel removal

**XXX. Vehicle Accessories Diagnosis and Repair (7 hours, lab)**

A. Incorrect cruise control operation diagnosis and repair
B. Heated mirrors and rear window defogger diagnosis
C. Incorrect power window operation diagnosis and repair
D. Power seat components and operation description
E. Power door lock diagnosis
F. Keyless entry/remote start systems description
G. Anti-theft system diagnosis
H. Door panel removal

**XXXI. Passive Restraint Systems (2.5 hours, lecture)**

A. Purpose and components
B. Passive seat belt systems basic operation
C. Air bag module components and function
D. Air bag system diagnostic modules
E. Air bag system sensors
F. Hybrid inflator modules
G. Multi-stage air bags and side-impact air bags
H. Seat belt pretensioners
I. Occupant Classification Systems (OCS)
J. Airbag disarming procedures

**XXXII. Servicing Passive Restraint Systems (5 hours, lab)**

A. Seat belt inspection
B. Airbag removal and reinstallation
1. Airbag disarming procedure
2. Indicator lamp verification

C. Supplemental restraint system problem diagnosis
D. Occupant classification system validation

**XXXIII. Audio System Operation and Diagnosis (2.5 hours, lecture)**

A. Audio fundamentals
1. Radio waves
2. Antennas
3. Receivers
B. Antenna and radio interference diagnosis
C. Speaker types and operating characteristics

D. Audio and entertainment system configurations
   1. Sound levels
   2. Crossovers
   3. Aftermarket system upgrades
E. Voice recognition and Bluetooth
F. Satellite radio

**XXXIV. Audio System Operation and Diagnosis (5 hours, lab)**

A. Radio static diagnosis
B. Audio system noise concern diagnosis
   1. Weak or intermittent signal
   2. No radio reception
C. Speaker servicing and impedance matching

**XXXV. Electronic Fundamentals (2.5 hours, lecture)**

A. Semiconductors - definition, construction and examples
B. Diode construction and operation
   1. Zener diodes
   2. High voltage spike protection
   3. Diode ratings
   4. Light emitting and photodiodes
   5. Rectifier bridges
C. Photoresistors
D. Thermistors
E. Transistors - purpose, function and construction
   1. Operating principles
   2. Types of transistors
   3. Integrated circuits and transistor gates
F. Component failures and testing
G. Converters and inverters

**XXXVI. Electronic Fundamentals (9.5 hours, lab)**

A. Diode types and differences
B. Photoresistor operation
C. Negative temperature coefficient thermistor identification, testing and description
D. Electrostatic discharge service precautions
E. Transistor identification
F. Electronic circuit oscilloscope waveform reading and interpretation

**XXXVII. Computer Fundamentals (2.5 hours, lecture)**

A. Computerized automotive control systems purpose and function
B. Computer functions
C. Digital computer components and terminology

D. Input sensors

E. Output controls
    1. Output drivers
    2. Pulse-width modulation

**XXXVIII. Computer Fundamentals (12.5 hours, lab)**

A. Powertrain Control Module (PCM) connector pin identification
B. Powertrain management schematics
C. PCM controlled actuator testing
    1. Fuel injection
    2. Ignition
    3. Electronic throttle control
    4. Emission control systems
D. Actuator output waveform reading

**XXXIX. Computer Controlled Ignition Systems (6.5 hours, lecture)**

A. Major functions
B. Operating conditions that affect ignition timing
C. Basic operation of Distributor ignition systems and distributorless ignition systems
    1. Ignition primary circuit
    2. Ignition secondary circuit
    3. Ignition dwell
    4. Ignition triggering devices
    5. Spark timing systems
D. Purpose of the electronic control unit
E. Spark timing systems
    1. Electronic switching systems
    2. Engine position sensors
    3. Fuel injection system reliance
F. Distributorless Electronic Ignition (EI) systems
    1. Advantages and operation
    2. Secondary ignition wiring connections
G. Coil-On-Plug (COP) operating principles
H. Ion and compression sense ignition

**XL. Computer Controlled EI Systems Diagnosis and Service (12.5 hours, lab)**

A. No-spark condition diagnosis
B. P0300 random misfire code diagnosis
C. Coil testing
D. Camshaft and crankshaft sensor Remove & Replace (R&R) and adjustment procedure
E. Camshaft and crankshaft sensor test
F. Magnetic sensor test
    1. Pickup coil (magnetic pulse generator)
    2. Hall-effect switch
G. Compression sense ignition diagnosis
H. Ion sense ignition diagnosis

**XLI. Introduction to the Body Computer (3.5 hours, lecture)**

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| | A. Basic functions<br>B. Body Control Module (BCM) communications<br>C. Logic gate operation<br>D. Common output actuators<br><br>**XLII. Body Computer System Diagnosis (10 hours, lab)**<br><br>A. BCM location and connector pin identification<br>B. Service precautions<br>C. BCM network schematics<br><br>D. BCM scan tool diagnostics<br>E. Fault code reading analysis, diagnosis and erasure<br>F. Visual inspection<br>G. BCM controlled actuator testing<br>H. BCM input sensor testing<br><br>**XLIII. Vehicle Communication Networks (3.75 hours, lecture)**<br><br>A. Multiplexing operating principles<br>B. Communication protocols<br>C. Network communications classifications<br>D. Controller Area Network (CAN) bus system<br>1. Components and operation<br>2. Supplemental data bus networks<br>3. Local area network (LAN)<br>E. General Motors (GM), Ford and Chrysler communication protocols<br>F. Honda/Toyota communications<br>G. European bus communications<br>H. Media Oriented System Transport (MOST) data bus<br>I. Bluetooth technology<br>J. Network communications diagnosis<br>K. ODB 2 data link connector<br><br>**XLIV. Vehicle Multiplexing Diagnostics (10 hours, lab)**<br><br>A. Module communication error scan tool check<br>B. Software transfers, updates and flash programming<br>C. OBD 2 Diagnostic Link Connector (DLC) pin identification and verification<br>D. International Standards Organization (ISO) 9141-2 bus system diagnosis<br>E. ISO-K bus system diagnosis<br>F. Class A bus system diagnosis<br>G. J1850 bus system diagnosis<br>H. CAN diagnosis |
| **Total Lecture Hours:** | 90 |
| **Total Laboratory Hours:** | 180 |
| **Total Hours:** | 270 |

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| **Primary Method of Evaluation:** | 3) Skills demonstration |
| **Typical Assignment Using Primary Method of Evaluation:** | Perform a self-diagnosis test on a computer-controlled fuel injection system and record data to a diagnostic report. Analyze data using manufacturer's specifications to determine recommended service and/or repairs and parts required and indicate needed repairs on the diagnostic report. Submit report to the instructor. |
| **Critical Thinking Assignment 1:** | Perform a digital scanner test to include a printout. Analyze data using manufacturer's specifications to determine recommended service and/or repairs and parts required. Write recommended repairs on a diagnostic report and submit report to the instructor. |
| **Critical Thinking Assignment 2:** | Perform a self-diagnosis test on a computer-controlled OBD 2 emissions system and record monitor and CAN bus data stream information to a diagnostic report. Analyze data using manufacturer's specifications to determine recommended service and/or repairs and parts required and indicate needed repairs on the diagnostic report. Submit report to the instructor. |
| **Other Evaluation Methods:** | Class Performance<br>Completion<br>Homework Problems<br>Laboratory Reports<br>Matching Items<br>Multiple Choice<br>Other Exams<br>Performance Exams<br>Quizzes<br>True/False<br>Written Homework |
| **Instructional Methods:** | Demonstration<br>Discussion<br>Group Activities<br>Lab<br>Lecture<br>Multimedia presentations |
| **If other:** | Internet Presentation/Resources<br>Collaborative learning |
| **Work Outside of Class:** | Answer questions<br>Problem solving activity<br>Required reading<br>Study<br>Written work (such as essay/composition/report/analysis/research) |
| **If Other:** | |
| **Up-To-Date Representative Textbooks:** | Halderman, James D., Automotive Electrical and Engine Performance, 8th edition, Prentice Hall, 2020. |
| **Alternative Textbooks:** | |
| **Required Supplementary Readings:** | Procedure sheets<br><br>Shop manuals |
| **Other Required Materials:** | Three ring binder notebook and paper<br><br>Pen and Pencil |

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| | Safety glasses<br><br>Shop safe clothing<br><br>Calculator<br><br>Digital Volt Ohm Meter<br><br>Tools (optional)<br><br>Lab sheets |
| **Requisite:** | Prerequisite |
| **Category:** | sequential |
| **Requisite course(s): List both prerequisites and corequisites in this box.** | Automotive Technology 22A |
| **Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).** | **Knowledge of engine components.**<br><br>ATECH 22A - Identify engine components.<br><br>**Ability to service, test and evaluate the following: battery, cooling system, starting system, charging system, fuel system and emission controls.**<br><br>ATECH 22A - Evaluate, service, test, and repair cooling systems.<br><br>ATECH 22A - Evaluate, service, and test lead-acid batteries.<br><br>ATECH 22A - Evaluate, service, test, and repair charging systems.<br><br>ATECH 22A - Evaluate, service, test, and repair fuel systems.<br><br>ATECH 22A - Evaluate, service, test, and repair emission control systems.<br><br>ATECH 22A - Evaluate, service, test, and repair starting systems.<br><br>**Operate an engine analyzer to obtain engine data and perform basic tests.**<br><br>ATECH 22A - Perform an analysis of an engine condition by conducting compression, cylinder leakage, and vacuum tests. |
| **Requisite Skill:** | |
| **Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable** | |
| **Requisite course:** | |
| **Requisite and Matching skill(s):Bold** | |

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| **the requisite skill. List the corresponding course objective under each skill(s).** | |
| **Requisite Skill:** | or equivalent |
| **Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable** | If students have taken Auto Technology 22A at another college or have engine performance, electrical and fuel system experience, they will be prepared to enroll in this course. Students must have learned the service and test skills in the following: battery, cooling system, starting system, charging system, fuel system and emission controls in order to be successful in this course. |
| **Enrollment Limitations and Category:** | |
| **Enrollment Limitations Impact:** | |
| **Course Created by:** | Robert E. Beaudoin |
| **Date:** | 10/25/1985 |
| **Original Board Approval Date:** | |
| **Last Reviewed and/or Revised by:** | Michael Anderson |
| **Date:** | 03/03/2022 |
| **Last Board Approval Date:** | 11/21/2022 |