

COURSE TITLE AND NO.: AUT 240 - 6 Introduction to Engine Controls

COURSE DESCRIPTION:

Course consists of a specialized study of automotive computerized engine control electronics and electrical circuits. Lectures will focus on the operational characteristics, application, and diagnosis of electronic and computerized engine control systems. Particular emphasis will be placed on electronic components and operation for the diagnosis of engine performance problems. Discussion topics will include operational strategies, sensor inputs, actuators, ignition systems, and fuel injection systems. Laboratory experience will provide the opportunity to use standard electronic diagnostic tools, specialized equipment, and computerized diagnostic tools used for engine performance diagnosis. Prerequisite: AUT 120, AUT 150, and AUT 170

PREREQUISITE TO: AUT 250, AUT 340

COURSE MEETINGS: As per the published SIUC course schedule.

COURSE OBJECTIVES:

Will provide the student with the opportunity to:

1. Study the principles and application of computerized engine control devices and electronic fuel and ignition management systems in the modern automobile.
2. The student will be introduced to computerized testing and diagnosis procedures for various manufactures of engine control systems.

COURSE OUTLINE:

I. COURSE INTRODUCTION AND LABORATORY SAFETY

- A. Course Overview and Grading
- B. Laboratory Safety
- C. Emergency Procedures

II. ELECTRONIC ENGINE CONTROLS

- A. Theory of Operation
 1. Analog & Digital Signals
 2. Binary Numbers & Memories
 3. Data Links & Multiplex Communication
 4. Types of Fuel Injection
 5. Common Components
 6. On Board Diagnostics II

B. Engine Computer: Input Sensors

1. Temperature
 - a. Coolant (ECT)
 - b. Intake (IAT)
 - c. Battery
2. Throttle Position (TP)
3. Crankshaft Position/Rotation (CKP)
4. Camshaft Position/Rotation (CMP)
5. Manifold Absolute Pressure (MAP)
6. Heated Oxygen (HO2S)
7. Air/Fuel Ratio
8. Knock (KS)
9. Battery
10. Mass Air Flow (MAF)
11. Accelerator Pedal Position (APP)
12. Switch inputs
13. Vehicle Speed & Distance

C. Engine Computer: Output Devices

1. Malfunction Indicator Light
2. Relays & Solenoids
3. Pulse-width modulation (PWM)
4. Fuel System Supply
5. Injector Sequencing & Management
6. Idle Air Control (IAC)
7. Exhaust Gas Recirculation (EGR)
8. Electronic Throttle Control (ETC)
9. Variable Valve Timing (VVT)
10. Evaporative Emissions (EVAP)

D. Speed Density/Mass Air Flow Fuel Management Strategies

1. Open & Closed Loop
2. Adaptive Memory Cells
3. Key ON/OFF Modes
4. Crank Mode
5. Wide-Open Throttle
6. Cruise & Decel

III. FUEL INJECTION SYSTEMS

A. Electronic Fuel Systems Diagnostics

B. Engine Diagnostic Procedures

1. Fuel System testing
2. On Board Diagnostics & Strategies
3. Monitored & Non Monitored Circuits
4. Diagnostic Trouble Codes

C. Electronic Throttle Actuator Control Systems

D. Injection System Inspection and Maintenance

COURSE MATERIALS:

Required Textbook:

Halderman, J. & Linder, J. (2012). *Automotive Fuel and Emissions Control Systems (3rd Edition)* Upper Saddle River, NJ: Pearson Education. [ISBN 13:978-0-13-254292-0]

Reference Textbooks:

Halderman, J. D. (2011). *Diagnosis & Troubleshooting of Automotive Electrical, Electronic, & Computer Systems (6th Edition)* Upper Saddle River, NJ: Pearson Education. [ISBN 13:978-0132551557]

Supplemental Materials:

Instructor prepared study guide, laboratory worksheets, and informative handouts.

COURSE GRADING PROCEDURE:

- Tests can be made-up within one week at the convenience of the professor.
- Quizzes are given without prior notification and *cannot* be taken at a later date.
- Laboratory Worksheets will be used as a record of laboratory projects, should be kept current, and submitted as part of the final grade.
- Laboratory Practical Evaluations may be given at various times throughout the course and cannot be made-up.

CONTACT INFORMATION:

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Emergency Procedures:

Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the SIUC Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on the BERT's website at www.bert.siu.edu, Department of Public Safety's website www.dps.siu.edu (disaster drop down) and in the Emergency Response Guidelines pamphlet. Know how to respond to each type of emergency.

Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. **It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.** The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or sheltering within the facility.

Supplementary Assistance:

With the cooperation of SIU's Disability Support Services (DSS), each student who qualifies for reasonable supplementary assistance has the right to receive it. Students requesting supplementary assistance must first register with DSS in Woody Hall B-150, (453-5738) or <http://disabilityservices.siu.edu/>

Notice: If you have any type of special need(s) or disability for which you require accommodations to promote your learning in this class, please contact me as soon as possible. The Office of Disability Support Services (DDS) offers various support services and can help you with special accommodations. You may wish to contact DDS at 453-5738 or go to Room 150 at Woody Hall to verify your eligibility and options for accommodations related to your special need(s) or disability.

SIU Policy on "Incomplete" as a Course Grade:

An *INC* is assigned when, for reasons beyond their control, students *engaged in passing work* are unable to complete all class assignments. An *INC* must be changed to a completed grade within a time period designated by the instructor but not to exceed one year from the close of the term in which the course was taken, *or graduation*, whichever occurs first. Should the student fail to complete the course within the time period designated, not to exceed one year, or graduation, whichever comes first, the incomplete will be converted to a grade of *F* and the grade will be computed in the student's grade point average. Students should not reregister for courses in which an *INC* has been assigned with the intent of changing the *INC* grade. Re-registration will not prevent the *INC* from being changed to an *F*.

Student Guidelines: Expectations and Department Standards

Attendance & Scholastics

- Class attendance is required. One (1) absence can potentially lower your grade 2.5% and three (3) tardies count as one (1) absence. After three (3) absences, you will be required to have a conference with the instructor before returning to class.
- The Automotive Technology program maintains the following scholastic standards for grades:
93-100% = A, 85-92% = B, 77-84% = C, 70-76% = D, Lower than 70% = F

Attire and Conduct

Attire and conduct reflects the expectations of the Department and industry partners. The following guidelines are mandated to provide maximum safety protection and reflect professionalism.

- Students are to maintain a clean and professional appearance at all times. Lockers and showers are available in restrooms 112 and 172. Lockers are also available in corridors 150 and 170.
- The Automotive Technology Department uniform shirt is required to be worn in all automotive technical classes. Students will be provided a single Department uniform shirt, and it is recommend to purchase additional uniform shirts. The shirts can be purchased at the Automotive Technology Parts Store. Any T-shirt or sweatshirt being worn is to be underneath the Department uniform shirt.
- In automotive non-laboratory classes, students can also wear a clean and professional shirt such as a dress shirt, or a shirt with a collar. T-shirt style shirts are not acceptable.
- Full-length pants are required to be worn while in all automotive classes. Uniform, dress, khaki, or neat blue-jean style pants are acceptable. Shorts, sweat, workout, or pajama styles are not acceptable.
- Hats and ball caps are not allowed to be worn in the building. No oversize and loose fitting clothing is to be worn while in automotive classes. No Hoodie style sweat shirts are allowed in the labs. All long hair is to be confined.
- Non-perforated, closed-toe shoes are required in all automotive classes and laboratories.
- Wearing jewelry may pose a safety hazard. We strongly discourage the wearing of any jewelry.
- Safety glasses must be worn in the laboratories while lab activities are in session and/or when you are performing any actions that may cause an eye hazard. Safety glasses may be purchased at the Automotive Technology Parts Store.
- Cell phones are not to be used for calls or texting during class time unless approved by the instructor. Practice professional courtesy.

Laboratory Activities and Items

- Students are not allowed to work in the labs unsupervised. Students are to work directly with their instructor for access to laboratories, tools, equipment, training vehicles, fuel, and supplies. All of these items are State or others property. Students are not to assume they can acquire or use these items without the instructor's approval. Access to and use of these items is a privilege. Improper use will lead to disciplinary action.

- Students are expected to follow all safety guidelines in the use of all tools and equipment. If proper guidelines are not known, students are to contact their supervising instructor before proceeding. Tools and equipment needing repair/service are to be brought to the attention of the supervising instructor.
- Fender covers and other protection and safety items are to be used as needed.
- Each student must provide their own required tools for use in the labs with their name clearly visible on the outside of the toolbox. Tool sets can be purchased through the Automotive Technology Parts Store.
- **All** test drives of “customer vehicles” **must be** performed with an instructor on board. SIU “Training vehicles” are not allowed to be driven.
- All vehicles and/or components brought in for work **must be** scheduled through the instructor; this includes personal vehicles. All vehicles and/or components being worked on in the labs **must have a completed work order on file** in the Automotive Technology Parts Store.
- Parts and supplies for items being worked on in the labs are to be purchased through the Automotive Technology Parts Store unless prior approval from the SIU Parts Store Manager is obtained. Students can purchase repair parts through the Parts Store at a discount.

Workspace Cleaning

- Each student is expected to keep his/her work area and equipment orderly and clean at all times. The labs are provided with various drain pans and cleaning products. All messes caused by or in the students’ work area (i.e. dirt and oil on floor, dirty drain pans, shavings on drill press, and grease prints on equipment) are required to be cleaned up. Not maintaining an orderly and clean work environment may lead to disciplinary action due to the potential hazards caused to others.

Food, Drink, Smoking and Tobacco Products

- No food or drink is allowed to be brought in to the computer lab and automotive service or component laboratories. Eating, drinking, handling contact lenses, chewing gum, or applying makeup/lip balm is not allowed in any of the automotive labs.
- Smoking is not allowed in or within 15 feet of any campus building. There is absolutely no smoking allowed in the lot on the west side of the Transportation Education Center (TEC) building. Smokeless tobacco products are not permitted in the TEC.

Parking

- All students, faculty, and staff are to park in designated areas. Parking on the west side of the TEC is restricted to Automotive Technology fleet and customer vehicles or deliveries. Unauthorized parking will result in towing at the owner’s expense.
- The roadways and parking lots around the TEC are under the authority of the Southern Illinois Airport. All users are to abide by their regulations. Citations can and will be issued.

Outdoor Student Space

- Outdoor gathering space is available at either the northeast, northwest or south entrance of the TEC. There is to be no outdoor gathering on the west side of the TEC. This area is restricted.