Format CO
COURSE OUTLINE (*)

AUTOMOTIVE COMPUTER CONTROL SYSTEM
Course Title

AM225
Dept. & Course No.

I COURSE DESCRIPTION

This course covers the knowledge, skills and attitude required to: install, test, and repair of engine computer controlled system such as; Electronic sensing device, computer controlled ignition system, computer controlled actuators, Power train control module, and idle speed control. And it also includes servicing of emission control components.

II SEMESTER CREDITS: 3

III CONTACT HOURS PER WEEK:

2	3	5
Lecture	Laboratory	Total

IV PREREQUISITE: AM112, AM113, and AM125

V STUDENT LEARNING OUTCOMES

Upon completion of this course the student will be able, with 65% level of accuracy, to:

1. Name electronic fuel injection system parts and components and explain their functions.

2. Explain the operating principle of EFI system.

3. Service EFI system as per engine specification.

VI. COURSE CONTENT

A. Electronic fuel injection system parts and components.
   1. Electric Fuel pump assembly
   2. Electronic fuel injectors
   3. Fuel pressure regulator
   4. Relief valve
   5. Fuel filter
   6. Fuel lines
   7. EFI sensors
   8. Engine control module

B. Operating principle of EFI system
   1. L-type EFI system
   2. D-type EFI system
   3. Fuel injection timing
   4. Fuel injection volume

C. EFI system servicing procedure
   1. Checking fuel pressure, relief valve, fuel filter, and fuel pressure regulator valve
   2. Checking fuel injectors
   3. Checking fuel injector signals

4. Name electronic controlled ignition system parts and components and explain their function.

5. Explain the operating principle of electronic controlled ignition system.

6. Service electronic controlled ignition system as per engine specification.

7. Name engine computer control unit terminals and explain their uses.

8. Explain the operating principle of engine control module.

4. Checking EFI sensors for functionality, rationality, and circuitry
5. Checking Idle speed control

D. Name Electronic controlled ignition system parts and components.
   1. Ignition coil
   2. Igniter
   3. Spark plug
   4. High tension wire
   5. Distributor assembly
   6. Pick-up coil of signal rotor
   7. Rotor

E. Operating principle of Electronic controlled ignition system.
   1. I.C type ignition system
   2. Hall effect type
   3. Optical type
   4. Computer controlled type
   5. Electrical circuitry

F. Electronic controlled ignition system servicing procedure.
   1. I.C type ignition system
   2. Hall effect type
   3. Optical type
   4. Computer controlled type
   5. Rationality and functionality check
   6. Oscilloscope pattern

G. Engine computer module terminals
   1. ECM power source
   2. ECM EFI relay signal (+B & +B1 signal and/or M-Rel signal)
   3. IGF signal (distributor signal)
   4. THW signal (coolant temperature signal)
   5. THA1 signal (air temperature sensor supply)

H. Operating principle of engine control module
   1. Microprocessor unit
   2. Sensor unit (input signals)
   3. EFI relay
   4. Actuator (output supply)
   5. ECM circuitry

9. Check ECM terminals for functionality, rationality, and circuitry.

I. Engine control module functionality, rationality, and circuity check
   1. ECM power source
   2. ECM EFI relay signal (+B & +B1 signal and/or M-Rel signal)
   3. IGF signal (distributor signal)
   4. THW signal (coolant temperature signal)
   5. THA1 signal (air temperature sensor supply)

10. Operate on-board diagnostic tool generation 2

J. On-board diagnostic generation 2 operation and specification.
   1. Diagnostic function
   2. Makers specification
   3. Oscilloscope function
   4. Multi-meter function
   5. Simulation function
   6. OBD-2 service and maintenance

11. Name emission control system parts and components and explain their functions.

K. Emission control system parts and components and their functions
   1. Oxygen sensor
   2. Exhaust gas recirculation
   3. Evaporative tank
   4. Air injection system
   5. Explain emission control operating principle

12. Explain the operating principle of emission control system.

L. Operating principle of Emission control system
   1. When temperature is too high
   2. When temperature is too low
   3. When engine is low compression
   4. FTP standards
   5. EPA
   6. CARB

13. Service emission control system as per manufacturer specifications.

M. Emission control system servicing procedure
   1. Activate Power Train Control Module Monitor
   2. Operate OBD-II (On-Board Diagnostic Generation 2) diagnostic tool
   3. Analyze Diagnostic Trouble Code
   4. Analyze OBD-II Live Data
   5. Check emission control components for circuitry and functionality as per repair manual specifications.

14. Name computerized controlled air induction system parts and components and explains their functions.

N. Computerized Control Air Induction System
   1. T-VIS (Toyota variable induction system)
   2. V-TEC (Variable timing)
   3. ACIS (Acoustic control induction system)
   4. Air Injection System

15. Explain the operating principles of computerized controlled air induction system.

O. Computerized Control Air Induction System
   1. T-VIS (Toyota variable induction system)
   2. V-TEC (Variable timing)
   3. ACIS (Acoustic control induction system)
   4. Air Injection System

16. Service computerized controlled air induction system.

P. Computerized controlled air induction system servicing procedure
   1. T-VIS (Toyota variable induction system)
   2. V-TEC (Variable timing)
   3. ACIS (Acoustic control induction system)
   4. Air Injection System

VII MATERIALS AND EQUIPMENT

Materials	Equipment
Sand paper 1000 cc	OBD II (On-Board Diagnostic Generation II)
Soldering lead	Stethoscope
Shop rugs	Oscilloscope tester
Sand paper 120 cc	Multi meter digital
Electronic contact cleaner	Multi meter analog
Electrical tape	Vehicle equip with computer control system
Starting fluid	Jack stand
Plastic tie	
Electrical tape	

VIII TEXT AND REFERENCES
   A   Required Text:

   James E. Duffy, **Modern Automotive Technology,** Tinley Park Illinois, GOODHEART-WILLCOX COMPANY, INC. 2004
   ISBN-10: 1-59070-186-0
   ISBN-13: 978-1-59070-186-7

IX METHOD OF INSTRUCTION
        A.   Lecture
        B.   Visual Aid
        C.   Demonstration
        D.   Discussion

X METHOD OF EVALUATION:

1.) The components with corresponding weight in percent included in the computation of the final grade are:

Course work (quizzes / class works / homework / projects)	30%
Skill Tests	40%
Exam (Midterm and final exam)	30%

	100%

2.) The transmutation of the total percent to a letter grade is as of follows:

        90 – 100 .... A

        80 – 89 .... B

        70 – 79 C

        65 – 69 .... D

        0 – 64 .... F

<u>**AM225 Automotive Computer Control System**</u>   Credits: **2**   **1**   <u>**48**</u>
          Course No. & Title   Lec. Lab Total lab hours

Laboratory objectives	Time allotment

1. Service Engine Computer Control System (ECCS) fuel system
  a. Check fuel pressure, relief valve, fuel filter, and fuel pressure regulator valve for functionality.
  b. Check fuel injectors for functionality, rationality, and circuitry.
  c. Check fuel injector signals for DSO pattern.
  d. Check EFI sensors for functionality, rationality, and circuitry.
  e. Check Idle speed control for functionality, circuitry and rationality.
	8 hours

2. Service electronic controlled ignition system as per engine specification.
  a. Check parts and components of I.C type ignition system for functionality, rationality, and circuitry.
  b. Check parts and components of Hall Effect type ignition system for functionality, rationality, and circuitry.
  c. Check parts and components of optical type ignition system for functionality, rationality, and circuitry.
  d. Check parts and components of computer controlled ignition system for functionality, rationality, and circuitry.
	8 hours

3. Check Electronic Control Module (ECM) terminals for functionality, rationality, and circuitry.
  a. Check PCM terminals for sensors signal voltage, grounds, and power supply.
  b. Check PCM terminal for actuator supply voltage and reference voltage.
  c. Check PCM terminals for ground and power supply.
	9 hours

4. Operate On-board Diagnostic tool generation 2
  a. Open diagnostic trouble code (DTC) window.
  b. Read and erase DTC.
  c. Select freeze frame and live data
  d. Open graph mode
  e. Select flight mode for data recording.
  f. Select actuation mode for checking parts and component functionality.
  g. Select car maker's specification correctly.
  h. Operate data storage oscilloscope (DSO) to check signal and component electrical activity.
  i. Operate simulation function for checking component functionality.
  j. Service OBD-2 diagnostic tool for maintenance purposes.
	7 hours

5. **Service emission control system as per manufacturer specifications.**
  a. Check parts and components of EGR system for functionality, rationality, and circuitry.
  b. Check parts and components of PCV system for functionality, rationality.
  c. Check parts and components of EVAP system for functionality, and rationality.
	10 hours

6. **Service computerized controlled air induction system.**
  a. Check parts and components of T-VIS (Toyota variable induction system) for functionality, rationality, and circuitry.
  b. Check parts and components of V-TEC (Variable timing air induction system) for functionality, rationality, and circuitry.
  c. Check parts and components of ACIS (Acoustic control induction system) for functionality, rationality, and circuitry.
  d. Check parts and components of Air Injection System for functionality, rationality, and circuitry.
	6 hours

During the course experience, the course learning outcomes (CLO's) will be assessed through the use of signature assignments. A rating scale will be used to determine the students' proficiency level of each CLO using specifically aligned assignments. The numerical ratings of 3, 2, and 1 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each of the numbers focus on the level of student performance of each of the course learning outcomes listed below:

Rating Scale:

3	Highly Competent …………...	85% to 100%
2	Competent …………………..	70% to 84%
1	Beginner ……………………	Below 70%

Course Learning Outcome #1: Run Power Train Control Module Monitors to Completion

Paper based assessment: Explain misfire monitor, fuel system monitor, comprehensive component monitor and non-continuous monitor functions and their enabling criteria and freeze frame data specifications.

Authentic Assessment: Analyze misfire monitor, fuel system monitor, comprehensive component monitor, and non-continuous monitor DTC's, run continuous and non-continuous monitor to completion, and Operate OBD-II (On-Board Diagnostic Generation 2) diagnostic tool, and/or Analyze OBD-II Live Data.

Numerical Value	
Highly Competent **3** **(10 points)**	Student demonstrates the knowledge and skills in running Power Train Control Module Monitors to Completion with 85% to 100% performance accuracy.
Competent **2** **(7 points)**	Student demonstrates the knowledge and skills in running Power Train Control Module Monitors to Completion with 70% to 84% performance accuracy.
Beginner **1** **(3 points)**	Student demonstrates the knowledge and skills in Run Power Train Control Module Monitors to Completion with below 70% performance accuracy.

Course Learning Outcome #2: Service Electronic Controlled Ignition System

Paper based assessment: Name electronic controlled ignition system parts and components and explain their functions, explain the operating principle of electronic and computer controlled ignition system, and explain the concepts of distributor less ignition system.

Authentic Assessment: Service I.C type, Hall effect type distributor, Optical type distributor, and Computer controlled type (distributor less) ignition system for Rationality, functionality and circuitry, and/or Check ignition system DSO (digital storage oscilloscope) pattern.

Numerical Value	
Highly Competent **3** **(10 points)**	Student demonstrates the knowledge and skills in servicing Electronic Controlled Ignition System with 85% to 100% performance accuracy.
Competent **2** **(7 points)**	Student demonstrates the knowledge and skills in servicing Electronic Controlled Ignition System with 70% to 84% performance accuracy.
Beginner **1** **(3 points)**	Student demonstrates the knowledge and skills in servicing Electronic Controlled Ignition System with below 70% performance accuracy.

Course Learning Outcome #3: Service Power Train Control Module (OBD-2 capability)

Paper based assessment: Name Power Train Control Module terminals and explain their uses, and explain the operating principle of Power train control module.

Authentic Assessment: Reprogram PCM, Check and clear diagnostic codes, Check PCM power source and ground supply, and/or Check PCM relay signal (+B & +B1 signal and M-Rel signal).

Numerical Value	
Highly Competent **3** **(10 points)**	Student demonstrates the knowledge and skills in servicing Power Train Control Module (OBD-2 capability) with 85% to 100% performance accuracy.
Competent **2** **(7 points)**	Student demonstrates the knowledge and skills in servicing Power Train Control Module (OBD-2 capability) with 70% to 84% performance accuracy.
Beginner **1** **(3 points)**	Student demonstrates the knowledge and skills in servicing Power Train Control Module (OBD-2 capability) with below 70% performance accuracy.

Course Learning Outcome #4:   Service Emission Control System

Paper based assessment: Explain the Federal Test Procedure (FTP) standards, Environment Protection Agency (EPA) standards, California Air Resources Board (CARB) standards, Name emission control system parts and components and explain their functions. Explain the operating principle of sensors and actuators of emission control system and explain the significance of emission control system in a car and to our environment.

Authentic Assessment: Service emission control system parts and components, and/or Check positive crankcase ventilation valve, PCV pipe, Measure blow-by gases pressure per minute, Service EGR valve, EGR actuator modulator, EGR sensor, charcoal canister, evaporation emission hoses, evaporation emission control valves for circuitry, rationality, and functionality.

Numerical Value	
Highly Competent **3** **(10 points)**	Student demonstrates the knowledge and skills in servicing Emission Control System with 85% to 100% performance accuracy.
Competent **2** **(7 points)**	Student demonstrates the knowledge and skills in servicing Emission Control System with 70% to 84% performance accuracy.
Beginner **1** **(3 points)**	Student demonstrates the knowledge and skills in servicing Emission Control System with below 70% performance accuracy.

Course Learning Outcome #5: Service Computer Controlled Air Induction System

Paper based assessment: Name computerized controlled air induction system parts and components and explains their functions, and explains the operating principle of computerized controlled air induction system.

Authentic Assessment: Service computerized controlled air induction system and/or Check T-VIS (Toyota variable induction system) components, V-TEC (Variable timing) components, ACIS (Acoustic control induction system) components for functionality, rationality, and circuitry.

Numerical Value	
Highly Competent **3** **(10 points)**	Student demonstrates the knowledge and skills in servicing Computer Controlled Air Induction System with 85% to 100% performance accuracy.
Competent **2** **(7 points)**	Student demonstrates the knowledge and skills in servicing Computer Controlled Air Induction System with 70% to 84% performance accuracy.
Beginner **1** **(3 points)**	Student demonstrates the knowledge and skills in servicing Computer Controlled Air Induction System with below 70% performance accuracy.