I. INTRODUCTION

A. Diagnosis and repair of emission systems, computerized engine performance systems, and advanced ignition and fuel systems and proper use of advanced engine performance diagnostic equipment.

B. Automotive Engine Performance and Analysis II (AUMT 2434) is a required course for the completion of a two year Associate of Applied Science degree in Automotive Mechanic/Technician or a Level I or Level II certificate of completion in the Automotive Technician Program.

C. This course is occupationally related and serves as a preparation for a career in the Automotive Service and Repair field.

D. Prerequisites: This course has a prerequisite of AUMT 1407, 1471, 1472, 2305 and 2437 or consent of the Dept. Chair.

E. Alphanumeric coding used throughout this module book denotes integration of SCANS occupational competencies (C1, etc.) and Foundation skills (F1, etc.).

II. LEARNING OUTCOMES

Upon successful completion of this course, Automotive Engine Performance and Analysis II the student will be able to:

A. Explain the basic function of the Exhaust Gas Recirculation (EGR) valve. (C5, 10, 15)

B. Examine the basic differences between OBD I and OBD II. (C15) (F1, 11, 12)

C. Explain the basic principles of personal safety, including protective eye wear, clothing, gloves, shoes, and hearing protection. (C3, 4, 5, 19)

D. Properly and safely use and maintain tools and equipment. Explain what should be done to maintain a safe work area, including handling vehicles in the shop and venting carbon monoxide gases. (C18) (F17)

E. Understand basic diagnostic procedures. (C5, 7, 11, 15) (F1, 5)

F. Describe the basic application of the diagnostic tools and equipment commonly used in vehicle repair work. (C5, 6, 20) (F6, 9, 11)

May 2014
G. Explain the most common types of energy and energy conversions. (C5, 7, 15) (F1, 5, 9, 10)
H. Explain what happens during combustion. (C19) (F11, 12)
I. Explain volumetric efficiency. (C5, 8, 16, 18) (F1, 9)
J. Describe three different methods of measuring engine efficiency. (F1, 2, 6, 9, 12)
K. List the steps in a general diagnostic procedure that may be used in any situation. (C5, 6, 18) (F5, 8, 9, 12)
L. Perform a cylinder leakage test and determine the needed repairs. (C18, 20) (F9, 12, 17)
M. Name the various electrical components and their uses in electrical circuits. (C5, 6, 7)
N. Explain the differences between series, parallel, and series-parallel circuits. (C19) (F6, 10)
O. Practice shop safety. Perform troubleshooting procedures using DVOM, test light, logic probe, digital storage oscilloscope. (C20) (F11, 12)
P. Perform voltage drop tests on starter and starter control circuits. (C5, 19) (F1, 8, 11)
Q. Describe the advantage of port fuel injection (PFI) in relation to manifold design. (C5, 15, 18) (F12)
R. Explain how carbon monoxide (CO), unburned hydrocarbons (HC), and oxides of nitrogen (NOx) are formed during the combustion process. (C5, 15, 19) (F6, 10, 11, 17)
S. Explain a three-way catalytic converter. (C5, 19) (F6)
T. Briefly explain the operating principles of an electronic muffler. (C5, 19) (F2, 12)
U. Explain the operation, diagnosis and repair of emission control systems. Inspect and troubleshoot vacuum and air induction systems. (C5, 15, 19) (F1, 2, 12)
V. Use service publications. Diagnose catalytic converters. (C5, 18, 19) (F1, 10, 12)
W. Describe oxygen (O²) emissions in relation to air-fuel ratio. (C15) (F2, 6, 12)
X. Explain the operation of a linear EGR valve. (C19) (F1, 2, 6)
Y. Diagnose engine performance problems caused by improper exhaust gas recirculation (EGR) operation. (C15, 19) (F1, 11, 12)
Z. Check the efficiency of a catalytic converter. (C19)

AA. Explain the importance of the engine coolant temperature sensor signal in relation to the output control functions of the computer. (C15, 18) (F11)

BB. Identify the output control functions affected by the vehicle speed sensor signal. (C16, 19)

CC. Perform a flash code diagnosis on various vehicles. (C18) (F8, 9)

DD. Demonstrating the proper use of advanced engine performance diagnostic equipment, perform a scan tester diagnosis on various vehicles. (C12, 15, 16, 19) (F6, 11, 12)

EE. Explain duty cycle. (C15) (F6)

FF. Explain the operation of controller area networking. (C18, 19) (F1, 2, 5, 6, 12)

GG. Diagnose problems with high-side and low-side drivers. (C19) (F1, 8, 11, 12)

HH. Diagnose computer output actuators. (C19) (F1, 10)

II. Explain a trip and drive cycle in an OBD II system. (C10, 15, 19) (F1, 6, 10, 12)

JJ. Describe the purpose of having two oxygen sensors in an exhaust system. (C5,15) (F6, 12)

KK. Describe the operation, diagnosis, and repair of computerized engine performance systems and advanced ignition and fuel systems. Explain how to logically approach diagnosing a problem in an OBD II system. (C15, 19) (F1, 8, 12)

LL. Explain the basic format of OBD II diagnostic trouble codes. (C15) (F2, 5)

MM. Describe the different alternative fuels, including diesel. (C15, 17, 19) (F6, 7, 10)

NN. Explain the design and function of major electronic fuel injection (EFI) components. (C15, 19) (F1, 11, 12)

OO. Remove, inspect, service, and replace electric fuel pumps and gauge sending units. (C5, 6, 8, 15, 19) (F 8, 12)

PP. Service and diagnose fuel injection systems. (C18, 19) (F8, 9)

QQ. Describe the inputs used by the computer to control the idle air control and idle air control bypass motors. (C15) (F2, 6, 10)
RR. Perform a preliminary diagnostic procedure on a fuel injection system. (C5, 15, 18, 19) (F1, 8, 12)

SS. Perform an injector balance test and determine the injector condition. (C5, 8, 15, 19) (F1, 8, 12)

TT. Describe the three major functions of the ignition system. (C15) (F1, 6)

UU. Describe the various types of spark timing systems. (C5, 7, 10, 15, 19) (F1, 6, 10, 11)

VV. Perform a no-start diagnosis and determine the cause of the no-start condition. (C5, 7, 8, 15, 18, 19) (F1, 5, 8, 12)

WW. Describe what an oscilloscope, its functions, and how it is used in ignition system troubleshooting. (C5, 18, 19) (F1, 10, 11, 12)

XX. Explain how the fuel injection system may rely on components of the ignition system. (C15, 18) (F7, 10)

YY. Explain the purpose of the SYNC sensor signal in an EI system with a combined crankshaft and SYNC sensor. (C15) (F11, 12)

ZZ. Diagnose service and repair automotive systems that affect performance. Diagnose the cause of a no-start condition on an EI system. (C8, 15, 19) (F8, 9, 11, 12)

AAA. Perform tests on the camshaft and crankshaft sensors as well as EI systems. (C15, 19) (F9, 12)

BBB. List the basic systems that make up an automobile and name their components and functions. (C5, 7, 8, 15, 19) (F1, 2, 5, 6, )

CCC. Diagnose related systems for drivability problems. (C5, 11, 15, 18, 19) (F1, 8, 11, 12)
III. INSTRUCTIONAL MATERIALS

A. Instructional materials for this course may be found at www.ctcd.edu/books

B. Supplemental Reading: As assigned by the instructor.

C. Audio-visual aids: See resource list at end of this module book.

D. Other instructional material: as selected by the instructor.

IV. COURSE REQUIREMENTS

A. This course is being taught in a self-paced mode. It differs from the traditional college course in that you are allowed to work on your own and at your own speed within limitation. This course is 144 clock hours in length. The student may set his/her own schedule within the time frame the course is offered. You must attend class on the days and at the times you selected when you enrolled in the course.

You will have an assigned instructor. If at any time you do not understand a reading assignment, audio visual presentation or lab work, ask your instructor for assistance. He is there for you!

This module book is designed to inform you of the sequence in which this course will be presented. You must follow this sequence and you must do what the module book says. It contains reading assignments, written assignments, audio visual presentations and lab assignments that you must complete or watch. Written assignments will be turned in as directed by the instructor. Late assignments will not be accepted. You must let your instructor know when you are ready to do a learning activity, performance exam or take a scheduled exam.

B. The student must take notes when viewing filmstrips, slides, or videos. Exams may be taken from audio visual aids, reading and lab assignments. If instructor notes or handouts are given to you, you must study them, exams may be taken from these notes also.

C. The instructor may give written assignments or “pop” quizzes as he deems necessary.

D. Performance Exams:

Each student will clean all tools and equipment that they use and properly store them and clean their work area after the completion of each task.
Certificate Students: All lab work will be completed on an individual basis. The student will receive a Apass@ or Afail@ on the task. Students who fail to complete a task correctly to industry standards must repeat the task. The instructor will date and initial each performance exam task as it is satisfactorily completed. NOTE: Students who have selected the alpha-numeric grading system will be graded as outlined for degree students (see below).
Degree Students: Laboratory tasks (performance exam) will be completed on an individual basis except when limited by tools and/or materials. Each performance exam is worth a maximum of 11.1 points. The maximum lab grade is 100 points. The instructor will deduct points from each lab task score for failure to follow safety precautions and/or a failure to complete the project to industry standards. The instructor will date, initial, and post the points earned for each performance exam as it is completed.

E. The following is part of the course requirements: Each student will assist in lab clean-up at the close of the evening classes and will assist in unloading and storing supply shipments. Failure to do so will result in a failure to complete all course requirements and the student could receive a “F” or “N” for the course.

F. There will be eight (8) written examinations in this course (7 module/unit exams and an exit exam). Written exams must be completed before taking the performance exam for each module. The exit exam is a comprehensive exam that covers the entire course. Certificate students must score 70% on the exit exam. Certificate students will be allowed to take the exit exam a maximum of three (3) times. Failure to achieve a 70% score on the exit exam in three (3) tries will result in an "N" for the course and the student must retake the course. Degree Students should refer to the "grading" section of this outline for guidance.

G. The student must complete the written assignments to receive a grade. Written assignments for each unit will be turned into the instructor prior to starting performance exams for that module. Degree students must complete reading and written assignments at home.

H. If you have special needs because of learning disabilities or other kinds of disabilities, please feel free to discuss this with the instructor. The instructor will attempt to meet your needs with the assistance of counselors, tutors (Project Mainstream), and the assistance of the Disabilities Services Office. Program/course integrity will not be sacrificed. Students must meet all course requirements.
GRADING

Certificate Students: Students will be graded using the standard Skills Center "Pass-Fail" system used for self-paced programs. To satisfactorily complete the written exams, the student must score 80% on tests (except the exit exam, 70%). Students who fail to make the 80% on any exam (except the exit exam) must retake the exam. The current test re-take policy will apply to all certificate students. The student must satisfactorily complete all written and performance exams to receive a passing grade ("P").

Degree Students: Students will be graded using an "alpha-numeric" system as outlined below. Grades made on performance and written exams will be the grade received, including the exit exam. **Students will not be allowed to retake written exams or redo performance exams.**

A. Written exams: Average of written exams will count 40% of the final grade.

B. Completion of written assignments/activities will count 10% of the students final grade.

C. Performance Exams (Lab work) will count 50% of the final grade.

D. Grade Computations: (Example)

Written Exam Scores: (There will be 7 written exams)

<table>
<thead>
<tr>
<th>Exam</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>90</td>
</tr>
<tr>
<td>Exam 2</td>
<td>80</td>
</tr>
<tr>
<td>Exam 3</td>
<td>70</td>
</tr>
</tbody>
</table>

240 divided by 3 = 80 (Average Written Exams)

Written Exam Score Average 80 x 40% = 32 points
Written Assignments 100 x 10% = 10 points
Performance Exam Score 80 x 50% = 40 points

Total = 82 points

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V. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE COURSE INSTRUCTOR

A. **Course Withdrawal:** It is the student=s responsibility to officially withdraw from a course if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file a Central Texas College Application for Withdrawal (CTC Form 59). The withdrawal form must be signed by the student.

CTC Form 59 will be accepted at any time prior to Friday of the 12th week of classes during the 16-week fall and spring semesters. The deadline for sessions of other lengths is:

- 10-week session: Friday of the 8th week
- 8-week session: Friday of the 6th week
- 5-week session: Friday of the 4th week
The equivalent date (75% of the semester) will be used for sessions of other lengths. The specific last day to withdraw is published each semester in the Schedule Bulletin.

A student who officially withdraws will be awarded the grade of “W” provided the student’s attendance and academic performance are satisfactory at the time of official withdrawal. Students must file a withdrawal application with the College before they may be considered for withdrawal.

A student may not withdraw from a class for which the instructor has previously issued the student a grade of “F”, “N”, “FN”, or “XN” for nonattendance.

B. Administrative Withdrawal: An administrative withdrawal may be initiated when the student fails to meet College attendance requirements. The instructor will assign the appropriate grade on CTC Form 59 for submission to the registrar.

C. Incomplete Grade: The College catalog states, “An incomplete grade (“IP”) may be given in those cases where the student has completed the majority of the coursework but, because of personal illness, death in the immediate family, or military orders, the student is unable to complete the requirements for a course”. Prior approval from the instructor is required before the grade of AIP® for Incomplete is recorded. A student who merely fails to show for the final examination will receive a zero for the final and an “F” or “N” for the course.

D. Cellular Phones and Beepers: Cellular phones and beepers will be turned off while the student is in the classroom or laboratory.

E. American’s With Disabilities Act (ADA): Disability Support Services provide services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Explore the website at www.ctcd.edu/disability-support for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

F. Instructor Discretion: The instructor reserves the right of final decision in course requirements.

G. Civility: Individuals are expected to be cognizant of what a constructive educational experience is and respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.
H. Absence from the class may be unavoidable in some situations. These include illness, military/civilian job requirements, or a death in the immediate family. Documentation is required in the case of excused absences for job requirements. Excuses will be on company letterhead stationary signed by the immediate supervisor stating the reason for the absence for civilian jobs. Excuses for military personnel must be signed by the 1st Sergeant or the Company Commander. **NOTE: This does not apply to VA, VA/Voc, or Financial Aid students. There are no excused absences for these students. Talk to your funding agency if you have questions.**

Disability Support Services provides services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Review the website at [www.ctcd.edu/disability-support](http://www.ctcd.edu/disability-support) for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.
VI FIRST CLASS MEETING

A. The instructor will introduce the course and show the student the textbook.

B. The instructor will verify the class roster/enrollment form:
   1. Call roll
   2. Have each student verify the spelling of his/her name and the social security number by initialing the class roster/enrollment form.
      NOTE: When a student’s name does not appear on the degree program class roster, they must bring it to the attention of the instructor and must present the instructor with CTC Form 29 (Add/Drop Slip) reflecting that he/she has properly registered for the course.

C. The instructor will have the student read and sign the course requirements sheet.

D. The instructor will discuss the following topics with the student:
   1. Course requirements, objectives and how the course works
   2. Policy letters
   3. Student handouts
   4. Lab sheet and lab work (Learning activities, Performance exams, competency profile)
   5. Exam, grading, reading and written assignments.
   6. Absences
   7. Shop/classroom cleanup tools
   8. Dress code
   9. Parking
   10. Sign-in computer
   11. Course outline/fact sheets/student handouts
   12. Hazardous communications/MSDS information
   13. Shop safety
COURSE OUTLINE OR SEQUENCE:

Module 2434-01: Overview of Engine Performance, Safety, and Equipment

A. Time:
   Certificate Students 18 Clock Hours
   Degree Students 2 Weeks

B. Module Learning Outcomes: Upon completion of this module the student will:
   1. Explain the basic function of the Exhaust Gas Recirculation (EGR) valve. (C5, 10, 15)
   2. Examine the basic differences between OBD I and OBD II. (C15) (F1, 11, 12)
   3. Explain the basic principles of personal safety, including protective eye wear, clothing, gloves, shoes, and hearing protection. (C3, 4, 5, 19)
   4. Properly and safely use and maintain tools and equipment. Explain what should be done to maintain a safe work area, including handling vehicles in the shop and venting carbon monoxide gases. (C18) (F17)
   5. Understand basic diagnostic procedures. (C5, 7, 11, 15) (F1, 5)
   6. Describe the basic application of the diagnostic tools and equipment commonly used in vehicle repair work. (C5, 6, 20) (F6, 9, 11)

C. Study Appendix A, and the Glossary in Resource 2434-01 (Classroom Manual) to learn electrical terminology.

D. Read Chapters 1 and 2 in Resource 2434-02 (Shop Manual) and in Resource 2434-01 (Classroom Manual) and answer the review questions (be sure to include the page number where you found your answer) at the end of each chapter and turn the written assignment into the instructor. Be prepared to discuss the definitions of the “Terms to Know” at the end of each chapter.

E. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

F. View Audio Visuals: (See your instructor)
   Understanding and Using OBD II - Release 2”, Thompson Delmar Learning #A-50 (CD-ROM) Resource AUMT 2434-03
   “LBT-84 Getting Technical with your Tech II” Tech II training, Automotive Video, Inc. 1 DVD Video and 1 Booklet AUMT 2434-04
   “LBT-59 Computer Engine Data II” General Motors, Ford, Chrysler, and Generic OBDII Training for the Snap-On Scan MT-2500, Automotive Video, Inc. 3 DVD Videos and 1 Booklet AUMT 2434-05
G. See your instructor and ask him to explain any part of the audio visuals that you do not understand. See your instructor and ask him if there is anything else that you should read or see that pertains to this module.

H. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the learning activities for this module. (See your instructor)

I. Review for Module 2434-01 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

J. Module 2434-01 Written Exam: (See your instructor)

K. Critique Module 2434-01 Written Exam: (See your instructor)

L. Performance Exam Module 2434-01: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

M. Certificate students should complete this module by the end of the 18th clock hour. Degree students should complete this module by the end of the 2nd week.

II. Module 2434-02: Engine Design, Diagnosis, Electricity, Tests, and Service

A. Time:  
Certificate student 18 Clock Hours  
Degree Student 2 Weeks

B. Module Learning Outcomes: Upon completion of this module the student will:

1. Explain volumetric efficiency. (C5, 8, 16, 18) (F1, 9)

2. Describe three different methods of measuring engine efficiency. (F1, 2, 6, 9, 12)

3. List the steps in a general diagnostic procedure that may be used in any situation. (C5, 6, 18) (F5, 8, 9, 12)

4. Perform a cylinder leakage test and determine the needed repairs. (C18, 20) (F9, 12, 17)

5. Name the various electrical components and their uses in electrical circuits. (C5, 6, 7)

6. Explain the differences between series, parallel, and series-parallel circuits. (C19) (F6, 10)

7. Practice shop safety. Perform troubleshooting procedures using DVOM, test light, logic probe, and digital storage oscilloscope. (C20) (F11, 12)
8. Perform voltage drop tests on starter and starter control circuits. (C5, 19) (F1, 8, 11)

C. Read Chapters 3 and 4 in Resource 2434-02 (Shop Manual) and in Resource 2434-01 (Classroom Manual) and answer the review questions (be sure to include the page number where you found your answer) at the end of each chapter and turn the written assignment into the instructor. Be prepared to discuss the definitions of the “Terms to Know” at the end of each chapter.

D. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

E. View Audio Visuals: (See your instructor). Review any of the audio visuals listed on the Resource List in this module book as deemed necessary.

F. See your instructor and ask him to furnish you a vehicle that you can look at the ignition system on. Ask him to explain any part of the systems that you do not understand.

G. See your instructor and ask him to show you the diagnostic and test equipment that you will use in this course. Ask him to demonstrate the proper use of the diagnostic and test equipment that you do not know how to use.

H. Ask your instructor if there is anything else that you should read or see that pertains to this module.

I. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the learning activities for this module. (See your instructor)

J. Review for Module 2434-02 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

K. Module 2434-02 Written Exam: (See your instructor)

L. Critique Module 2434-02 Written Exam: (See your instructor)

M. Performance Exam 2434-02: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

N. Certificate students should complete this module by the end of the 36th clock hour. Degree students should complete this module by the end of the 4th week.

III. Module 2434-03: Intake, Exhaust, and Emission Control Diagnostics and Service

A. Time:
Certificate Student 18 Clock Hours
Degree Student 2 Weeks

AUMT2434 13
B. Module Learning Outcomes:  Upon completion of this module the student will:

1. Describe the advantage of port fuel injection (PFI) in relation to manifold design. (C5, 15, 18) (F12)

2. Explain how carbon monoxide (CO), unburned hydrocarbons (HC), and oxides of nitrogen (NOx) are formed during the combustion process. (C5, 15, 19) (F6, 10, 11, 17)

3. Explain a three-way catalytic converter. (C5, 19) (F6)

4. Briefly explain the operating principles of an electronic muffler. (C5, 19) (F2, 12)

5. Explain the operation, diagnosis and repair of emission control systems. Inspect and troubleshoot vacuum and air induction systems. (C5, 15, 19) (F1, 2, 12)

6. Use service publications to diagnose catalytic converters. (C5, 18, 19) (F1, 10, 12)

7. Describe oxygen (O²) emissions in relation to air-fuel ratio. (C15) (F2, 6, 12)

8. Explain the operation of a linear EGR valve. (C19) (F1, 2, 6)

9. Diagnose engine performance problems caused by improper exhaust gas recirculation (EGR) operation. (C15, 19) (F1, 11, 12)

10. Check the efficiency of a catalytic converter. (C19)

C. Read Chapters 5 and 13 in Resource 2434-01 (Classroom Manual) and in Resource 2434-02 (Shop Manual) and answer the review questions (be sure to include the page number where you found your answer) at the end of the each chapter and turn the written assignment into the instructor. Be prepared to discuss the definitions of the “Terms to Know” at the end of each chapter.

D. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

E. View Audio Visuals: (See your instructor.) Review any of the audio visuals listed on the Resource List in this module book as deemed necessary.

F. See your instructor and ask him if there is anything else that you should read or see that pertains to this module.

G. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the learning activities for this module. (See your instructor)
H. Review for Module 2434-03 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

I. Module 2434-03 Written Exam: (See your instructor)

J. Critique Module 2434-03 Written Exam: (See your instructor)

K. Performance Exam 2434-03: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

L. Certificate students should complete this module by the end of the 54th clock hour. Degree students should complete this module by the end of the 6th week.

IV. Module 2434-04: Engine Computer Controls, Sensors, Networks, Diagnosis and Service

A. Time:
   Certificate Students 18 Clock Hours
   Degree Students 2 Weeks

B. Module Learning Outcomes: Upon completion of this module the student will:
   1. Explain the importance of the engine coolant temperature sensor signal in relation to the output control functions of the computer. (C15, 18) (F11)
   2. Identify the output control functions affected by the vehicle speed sensor signal. (C16, 19)
   3. Perform a flash code diagnosis on various vehicles. (C18) (F8, 9)
   4. Demonstrating the proper use of advanced engine performance diagnostic equipment, perform a scan tester diagnosis on various vehicles. (C12, 15, 16, 19) (F6, 11, 12)
   5. Explain duty cycle. (C15) (F6)
   6. Explain the operation of controller area networking. C18, 19) (F1, 2, 5, 6, 12)
   7. Diagnose problems with high-side and low-side drivers. (C19) (F1, 8, 11, 12)
   8. Diagnose computer output actuators. (C19) (F1, 10)

C. Read Chapters 6 and 7 in Resource 2434-01 (Classroom Manual) and in Resource 2434-02 (Shop Manual) and answer the review questions (be sure to include the page number where you found your answer) at the end of the each chapter and turn the written assignment into the instructor. Be prepared to discuss the definitions of the “Terms to Know” at the end of each chapter.
D. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

E. View Audio Visuals: (See your instructor.)
Review any of the audio visuals listed on the Resource List in this module book as deemed necessary.

F. See your instructor and ask him to explain any part of the audio visuals that you do not understand.

G. See your instructor and ask him if there is anything else that you should read or see that pertains to this module.

H. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the learning activities for this module. (See your instructor)

I. Review for Module 2434-04 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

J. Module 2434-04 Written Exam: (See your instructor)

K. Critique Module 2434-04 Written Exam: (See your instructor)

L. Performance Exam 2434-04: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

M. Certificate students should complete this module by the end of the 72nd clock hour. Degree students should complete this module by the end of the 8th week.

V. Module 2434-05: On-Board Diagnostics, Computer Systems and Servicing

A. Time:
Certificate Students 15 Clock Hours
Degree Students 1 Weeks

B. Module Learning Outcomes: Upon completion of this module the student will:
1. Explain a trip and drive cycle in an OBD II system. (C10, 15, 19) (F1, 6, 10, 12)
2. Describe the purpose of having two oxygen sensors in an exhaust system. (C5, 15) (F6, 12)
3. Describe the operation, diagnosis, and repair of computerized engine performance systems and advanced ignition and fuel systems. Explain how to logically approach diagnosing a problem in an OBD II system. (C15, 19) (F1, 8, 12)
4. Explain the basic format of OBD II diagnostic trouble codes. (C15) (F2, 5)

C. Read Chapter 8 in Resource 2434-01 (Classroom Manual) and in Resource 2434-02 (Shop Manual) and answer the review questions (be sure to include the page number where you found your answer) at the end of the each chapter and turn the written assignment into the instructor. Be prepared to discuss the definitions of the “Terms to Know” at the end of each chapter.

D. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

E. View Audio Visuals: (See your instructor.)
Review any of the audio visuals listed on the Resource List in this module book as deemed necessary.

F. See your instructor and ask him to explain any part of the audio visuals that you do not understand.

G. See your instructor and ask him if there is anything else that you should read or see that pertains to this module.

H. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the learning activities for this module. (See your instructor)

I. Review for Module 2434-04 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

J. Module 2434-05 Written Exam: (See your instructor)

K. Critique Module 2434-05 Written Exam: (See your instructor)

L. Performance Exam 2434-05: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

M. Certificate students should complete this module by the end of the 84th clock hour. Degree students should complete this module by the end of the 9th week.

VI. Module 2434-06: Electronic Fuel Injection Systems and Servicing

A. Time:
Certificate Students 18 Clock Hours
Degree Students 2 Weeks

B. Module Learning Outcomes: Upon completion of this module the student will:
1. Describe the different alternative fuels, including diesel. (C15, 17, 19) (F6, 7, 10)
2. Explain the design and function of major electronic fuel injection (EFI) components. (C15, 19) (F1, 11, 12)

3. Remove, inspect, service, and replace electric fuel pumps and gauge sending units. (C5, 6, 8, 15, 19) (F8, 12)

4. Service and diagnose fuel injection systems. (C18, 19) (F8, 9)

5. Describe the inputs used by the computer to control the idle air control and idle air control bypass motors. (C15) (F2, 6, 10)

6. Perform a preliminary diagnostic procedure on a fuel injection system. (C5, 15, 18, 19) (F1, 8, 12)

7. Perform an injector balance test and determine the injector condition (C5, 8, 15, 19) (F1, 8, 12)

C. Read Chapters 9 and 10 in Resource 2434-01 (Classroom Manual) and in Resource 2434-02 (Shop Manual) and answer the review questions (be sure to include the page number where you found your answer) at the end of each chapter and turn the written assignment into the instructor. Be prepared to discuss the definitions of the “Terms to Know” at the end of each chapter.

D. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

E. View Audio Visuals: (See your instructor.) Review any of the audio visuals listed on the Resource List in this module book as deemed necessary.

F. See your instructor and ask him to explain any part of the audio visuals that you do not understand.

G. See your instructor and ask him if there is anything else that you should read or see that pertains to this module.

H. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the learning activities for this module. (See your instructor)

I. Review for Module 2434-06 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

J. Module 2434-06 Written Exam: (See your instructor)

K. Critique Module 2434-06 Written Exam: (See your instructor)
L. Performance Exam 2434-06: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

M. Certificate students should complete this module by the end of the 102^{nd} clock hour. Degree students should complete this module by the end of the 11^{th} week.
VII. Module 2434-07: Electronic Ignition Systems and Service

A. Time:
Certificate Students 18 Clock Hours
Degree Students 2 Weeks

B. Module Learning Outcomes: Upon completion of this module the student will:

1. Describe the three major functions of the ignition system. (C15) (F1, 6)
2. Describe the various types of spark timing systems. (C5, 7, 10, 15, 19) (F1, 6, 10, 11)
3. Perform a no-start diagnosis and determine the cause of the no-start condition. (C5, 7, 8, 15, 18, 19) (F1, 5, 8, 12)
4. Describe what an oscilloscopes, its functions, and how it is used in ignition system troubleshooting. (C5, 18, 19) (F1, 10, 11, 12)
5. Explain how the fuel injection system may rely on components of the ignition system. (C15, 18) (F7, 10)
6. Explain the purpose of the SYNC sensor signal in an EI system with a combined crankshaft and SYNC sensor. (C15) (F11, 12)
7. Diagnose service and repair automotive systems that affect performance. Diagnose the cause of a no-start condition on an EI system. (C8, 15, 19) (F8, 9, 11, 12)
8. Perform tests on the camshaft and crankshaft sensors as well as EI systems. (C15, 19) (F9, 12)

C. Read Chapters 11 and 12 in Resource 2434-01 (Classroom Manual) and in Resource 2434-02 (Shop Manual) and answer the review questions (be sure to include the page number where you found your answer) at the end of the each chapter and turn the written assignment into the instructor. Be prepared to discuss the definitions of the “Terms to Know” at the end of each chapter.

D. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

E. View Audio Visuals: (See your instructor.) Review any of the audio visuals listed on the Resource List in this module book as deemed necessary.

F. See your instructor and ask him to explain any part of the audio visuals that you do not understand.
G. See your instructor and ask him if there is anything else that you should read or see that pertains to this module.

H. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the learning activities for this module. (See your instructor)

I. Review for Module 2434-07 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

J. Module 2434-07 Written Exam: (See your instructor)

K. Critique Module 2434-07 Written Exam: (See your instructor)

L. Performance Exam 2434-07: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

M. Certificate students should complete this module by the end of the 120th clock hour. Degree students should complete this module by the end of the 13th week.

VIII. Module 2434-08: Related Systems and Diagnostics

A. Time:
   Certificate Students 15 Clock Hours
   Degree Students 1 Weeks

B. Module Learning Outcomes: Upon completion of this module the student will:
   1. List the basic systems that make up an automobile and name their components and functions. (C5, 7, 8, 15, 19) (F1, 2, 5, 6)
   2. Diagnose related systems for drivability problems. (C5, 11, 15, 18, 19) (F1, 8, 11, 12)

C. Read Chapters 14 in Resource 2434-01 (Classroom Manual) and in Resource 2434-02 (Shop Manual) and answer the review questions (be sure to include the page number where you found your answer) at the end of the each chapter and turn the written assignment into the instructor. Be prepared to discuss the definitions of the “Terms to Know” at the end of each chapter.

D. See your instructor and ask him to explain any part of the reading assignment that you do not understand.

E. View Audio Visuals: (See your instructor.)
   Review any of the audio visuals listed on the Resource List in this module book as deemed necessary.

F. See your instructor and ask him to explain any part of the audio visuals that you do not understand.
G. See your instructor and ask him if there is anything else that you should read or see that pertains to this module.

H. Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the learning activities for this module. (See your instructor)

I. Review for Module 2434-08 Written Exam: Study all previous assignments in this module. See your instructor and ask him to explain any area that you do not understand.

J. Module 2434-08 Written Exam: (See your instructor)

K. Critique Module 2434-08 Written Exam: (See your instructor)

L. Performance Exam 2434-04: Refer to the Laboratory Learning Activities (Lab Sheet) in this module book and complete the Performance exam for this module. (See your instructor)

M. Certificate students should complete this module by the end of the 132nd clock hour. Degree students should complete this module by the end of the 14th week.

IX. Module 2434-09: Exit Exam

A. Time:
Certificate students: 6 Clock Hours
Degree students: 2 Week

B. Module Learning Outcomes: Upon completion of this module the student will:

1. Use basic thinking skills and demonstrate personal qualities and work practices used in the work place.
2. Complete the Exit Exam.

C. Review for Exit Exam: Review all previous assignments.

D. See your instructor and ask him to explain anything that you do not understand about engine performance.

E. Module 2434-09 Written (Exit) Exam: (See your instructor) you must complete this exam by the end of the 16th week.

F. Critique Module 2434-09 Written (Exit) Exam: (See your instructor)

G. There is no performance exam for this module.

H. End of Course Critique and enrollment in the next course in the program. (See your instructor)