

Fuel and Emission Systems

Course Design

2002-2003

Course Information

Organization:	Eastern Arizona College
Division:	ITE
Course Number:	AUT 110
Title:	Fuel and Emission Systems
Credits:	3
Developed by:	Brian Coppola
Lecture/Lab Ratio:	2 hours lecture, 3 hours lab per week
Transfer Status:	ASU: DEC(IST); NAU: DEC(VTE); UofA: NT.
Extended Registration	
Class:	No
CIP Code:	47.0604
Assessment Mode:	PRE/POST Test 25 Questions, 100 total points
Semester Taught:	Offered upon request.
Gen. Ed. Area:	None
Separate Lab:	No
Awareness Course:	No
Intensive Writing	
Course:	No
Prerequisites:	1. None.
Educational Value:	This course is designed to reinforce and apply information, processes, and ideas gained in other courses. The major intent of this course is to enhance the individuals abilities to work with and diagnosis of the vehicle's fuel, air & emission systems.
Goals:	1. It is the intent of this course to prepare the student to work as an automotive service technician capable of satisfactorily servicing fuel and emission control systems.
Description:	Provides theory, diagnosis and service of automotive fuel and emission systems. Includes an opportunity to analyze fuel and emission components and systems with emphasis on practical application of computer controlled fuel and emission systems. This class, together with AUT 260, prepares students for the ASE Certification test on Engine Performance.
Textbooks:	IML / Instructional Materials Laboratory. Module3, Engine Performance

(Section B: Fuel and Exhaust Systems) Newest Edition. University of Missouri-Columbia, NA.

This textbook is required. Catalog Number 70-183B-S (student reference)

ILM / Instructional Materials Laboratory. Module 3, Engine Performance (Section B: Fuel and Exhaust Systems) Newest Edition. University of Missouri, NA.

This textbook is required. Catalog Number 70-183B-W (student workbook)

IML / Instructional Materials Laboratory. Module 3, Engine Performance (Section C: Emission Control Systems) Newest Edition. University of Missouri-Columbia, NA.

This textbook is required. Catalog Number 70-183C-W (student workbook)

IML / Instructional Materials Laboratory. Module 3, Engine Performance (Section C: Emission Control Systems) Newest Edition. University of Missouri-Columbia, NA.

This textbook is required. Catalog Number 70-183C-S (student Reference)

Supplies:

safety glasses

Competencies and Performance Standards

1. Apply proper safety procedures and processes.		
<i>Domain--Psychomotor</i>	<i>Level--Practice</i>	<i>Importance--Essential</i> <i>Difficulty--Low</i>
<p>Criteria--Criteria - Performance will be satisfactory when:</p> <ul style="list-style-type: none"> • learner observes and practices safety procedures. 	<p>Conditions--Competence will be demonstrated:</p> <ul style="list-style-type: none"> • when learner completes safety assignments and written exam at a satisfactory level. 	<p>Learning Objectives:</p> <ol style="list-style-type: none"> Acquaint self with shop environment and hazards. Acquaint self with emergency procedures and policy. Accept responsibility for personal well being and practice and follow safety guidelines. Acquaint self with material safety data sheets and chemical used in shop.
2. Diagnose general engine driveability concerns using a strategy-based process. (NATEF VIII A)		
<i>Domain--Cognitive</i>	<i>Level--Analysis</i>	<i>Importance--Important</i> <i>Difficulty--Medium</i>
<p>Criteria--Criteria - Performance will be satisfactory when:</p> <ul style="list-style-type: none"> • learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan. • learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan. • learner actively participates in the NATEF task requirements listed in the related learning plan. • learner attends required class and lab sessions and shows up on time. 	<p>Conditions--Competence will be demonstrated:</p> <ul style="list-style-type: none"> • when learner completes NATEF aligned assignment and job sheets listed in the related learning plan. (The assignment and job sheets must be completed at a satisfactory level to the instructor). • when the learner performs the priority NATEF tasks listed in the related learning plan. (The tasks must be completed with limited supervision - entry level). 	<p>Learning Objectives:</p> <ol style="list-style-type: none"> Determine root cause of poor engine performance related to mechanical engine components. Interpret 4 or 5 exhaust analyzer readings and suggest needed action. (NATEF VIII A 10)

3. Diagnose driveability concerns related to the vehicle's fuel, air induction and exhaust systems on vehicles with non-computerized and computerized engine controls. (NATEF VIII B & NATEF VIII E)			
<i>Domain--Cognitive</i>	<i>Level--Analysis</i>	<i>Importance--Important</i>	<i>Difficulty--Medium</i>
<p>Criteria--Criteria - Performance will be satisfactory when:</p> <ul style="list-style-type: none"> • learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan. • learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan. • learner actively participates in the NATEF task requirements listed in the related learning plan. • learner attends required class and lab sessions and shows up on time. 	<p>Conditions--Competence will be demonstrated:</p> <ul style="list-style-type: none"> • when learner completes NATEF aligned assignment and job sheets listed in the related learning plan. (The assignment and job sheets must be completed at a satisfactory level to the instructor). • when the learner performs the priority NATEF tasks listed in the related learning plan. (The tasks must be completed with limited supervision - entry level). 	<p>Learning Objectives:</p> <ol style="list-style-type: none"> Determine causes of hard fault conditions related to computerized engine controls and make needed repair. (NATEF VIII B 3) Determine causes of intermittent driveability concerns (no code) and make needed repair. (NATEF VIII B4) Determine causes of fuel and air induction engine performance problems. 	
4. Diagnose emission concerns related to the vehicle's non-computerized and computerized emission control systems. (NATEF VIII E)			
<i>Domain--Cognitive</i>	<i>Level--Analysis</i>	<i>Importance--Important</i>	<i>Difficulty--Medium</i>
<p>Criteria--Criteria - Performance will be satisfactory when:</p> <ul style="list-style-type: none"> • learner is productive, works safely, and in a professional manner while working on NATEF task requirements listed in related learning plan. • learner provides acceptable oral and/or written responses to questions and/or situations asked by the instructor, while working on the NATEF task requirements listed in related learning plan. • learner actively participates in the NATEF task requirements listed in the related learning plan. • learner attends required class and lab sessions and shows up on time. 	<p>Conditions--Competence will be demonstrated:</p> <ul style="list-style-type: none"> • when learner completes NATEF aligned assignment and job sheets listed in the related learning plan. (The assignment and job sheets must be completed at a satisfactory level to the instructor). • when the learner performs the priority NATEF tasks listed in the related learning plan. (The tasks must be completed with limited supervision - entry level). 	<p>Learning Objectives:</p> <ol style="list-style-type: none"> Determine engine performance concerns causing emissions failures and make suggested repairs. 	

Types of Instruction

Classroom Presentation

Lab

Simulated or Actual Work Experience

Computer-Based Instruction

Group Activities/cooperative learning

Grading Policy

Evaluation Methods: Grading Weights
Lab=45%
Class (Includes Test and Assignments)=45%
Final Exam (Post Test is the final)=10%

Note: The Pre / Post test has a total of 25 questions which are worth "4" points each. Total possible on the AUT 110 Pre / Post test is 100 points. However, the district requires the instructor to record number of questions correct as the raw score with maximum = 25 questions.

Grading Methods

Class score calculation-

Quizzes, assignments and job sheet points shall be added and carry a weight equal to one test score.

All exam except the final shall have equal weight (test scores averaged) and used in class score calculations.

The final (post test) will be worth at least 10% of the overall final grade calculation.

Lab score calculation-

Instructor should evaluate each student's work habits using lab time card. Each student should be evaluated on productivity and progress on task requirements, working in a professional manner, clean-up and safe work habits. Instructor is also required to evaluate each student's skill level in achieving the NATEF task requirements outlined in the various learning plans.

Instructors are encouraged to reward students for showing up on time and attending each class and lab session. This can be done by requiring students to make arrangements with the instructor to make-up any lost time prior to missed day. All students need to notify the instructor of sick days through voice mail, etc. on the day of sickness. Instructors should not allow for any work to be turned in late or any test made up without some type of deduction for late assignments/test. Suggested deduction 50% of original score.

Grading Scale:

Grade	Requirement
A	90-100%
B	80-89.9%
C	70-79.9%
D	60-69.9%
F	00-59.9%
Pass/Fail	A non-major student may choose to have a grade of P or F rather than a letter grade. a grade of P will require that the student receive a percentage grade of at least 68%. A grade less than this will result in a grade of F.

Learning Plans

Learning Plan 1-- Safety

Overview: In this learning plan you will develop the knowledge needed to work safely in a shop environment. You will learn safety procedures, the location of safety equipment, and the safety features of various shop equipment. The instruction will cover general shop safety processes, fire safety, battery safety, lifting procedures, and health related hazards.

Competency: 1. **Apply proper safety procedures and processes.**

Learning Activities:

- _____1. Complete a worksheet/assignment sheet.
- _____2. Collect a current article that relates to concepts and issues about which you are studying.
- _____3. Listen and observe a lecture covering safety procedures and practices - review a safety and hazards video.
- _____4. Operate hoist, floor jack (jack stands) and any equipment needed during assigned lab activities.
- _____5. Identify location of safety equipment, first aid kit, phone, fire blanket, fire extinguishers, exits, light switches and vents.

Performance Assessment Activities:

- _____1. Participate in safety discussion.
- _____2. Complete activities in lesson.
- _____3. Complete written safety test.

Learning Plan 2-- General Driveability Diagnosis

Overview: In this learning plan the student will develop the basic skills and knowledge to quickly recognize and diagnose performance concerns related to the mechanical components of the engine.

Competency: 2. **Diagnose general engine driveability concerns using a strategy-based process. (NATEF VIII A)**

Learning Activities:

- _____1. Verify customer concern to determine needed action. (P-1 NATEF VIII A 1)
- _____2. Identify unusual exhaust color, odor, and sound to determine

necessary action. (P-2 NATEF VIII A 4)

- _____3. Test engine absolute (vacuum/boost) manifold pressure. (P-1 NATEF VIII A 5)
- _____4. Prepare vehicle for 4 or 5 gas testing processes. Obtain 4 or 5 gas exhaust readings. (P-1 NATEF VIII A 10)

**Performance
Assessment Activities:**

- _____1. Access and use repair information/manuals during the diagnostic process.
- _____2. Participate in various classroom discussions related to appropriate reading assignment/engine diagnosis.
- _____3. Complete classroom assignments sheet related to engine diagnosis.
- _____4. Complete lab activities/job sheets-compression test, power balance, vacuum test, exhaust analysis.
- _____5. Preview CBI or A/V material related to engine diagnosis.
- _____6. Complete written test covering engine theory and diagnostic process.

Learning Plan 3-- Fuel, Air Induction and Exhaust Systems Diagnosis

Overview:

In this learning plan the student will develop the basic skills and knowledge necessary to properly diagnose engine performance problems related to the engine's fuel, air induction and exhaust systems.

Competency:

- 3. **Diagnose driveability concerns related to the vehicle's fuel, air induction and exhaust systems on vehicles with non-computerized and computerized engine controls. (NATEF VIII B & NATEF VIII E)**

Learning Activities:

- _____1. Verify customer concern to determine needed action. (P-1 NATEF VIII A 1)
- _____2. Retrieve and record stored OBD I diagnostic trouble codes. Clear codes. (P-1 NATEF VIII B 1)
- _____3. Retrieve and record stored OBD II diagnostic trouble codes. Clear codes. (P-1 NATEF VIII B 2)
- _____4. Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, and circuits. (P-2 NATEF VIII B 5)
- _____5. Obtain and interpret digital multimeter (DMM) readings. (P-1 NATEF VIII B 6)
- _____6. Access and use electronic service information (ESI). (P-3 NATEF VIII B 7)

- _____ 7. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). (P-1 NATEF VIII B 8)
- _____ 8. Inspect and test power and ground circuits and connections. (P-1 NATEF VIII B 9)
- _____ 9. Practice recommended precautions when handling static sensitive devices. (P-2 NATEF VIII B 10)
- _____ 10. Inspect fuel tank and fuel cap, fuel lines, fittings and hoses. (P-2 NATEF VIII D 3)
- _____ 11. Check fuel for contaminants and quality to determine necessary action. (P-2 NATEF VIII D 4)
- _____ 12. Inspect and test mechanical and electrical fuel pumps and pump control systems to perform necessary action. (P-2 NATEF VIII D 5)
- _____ 13. Replace fuel filters. (P-1 NATEF VIII D 6)
- _____ 14. Inspect and test fuel pressure regulation system and components of injection-type fuel systems and perform necessary action. (P-1 NATEF VIII D 7)
- _____ 15. Inspect and test cold enrichment system and components. (P-3 NATEF VIII D 8)
- _____ 16. Remove, service, and install throttle body and adjust related linkages. (P-2 NATEF VIII D 9)
- _____ 17. Inspect, test, and clean fuel injectors. (P-2 NATEF VIII D 10)
- _____ 18. Inspect throttle body mounting plates, air induction and filtration system, intake manifold, and gaskets. (P-2 NATEF VIII D 11)
- _____ 19. Check idle speed and fuel mixture. (P-2 NATEF VIII D 12)
- _____ 20. Adjust idle speed and fuel mixture. (P-3 NATEF VIII D 13)
- _____ 21. Remove, inspect, and test vacuum and electrical circuits, components and connections of fuel system. (P-2 NATEF VIII D 14)

**Performance
Assessment Activities:**

- _____ 1. Access and use repair information/manuals during the diagnostic process.
- _____ 2. Participate in various classroom discussions related to appropriate reading assignment/fuel and air system diagnosis.
- _____ 3. Complete classroom assignments sheet related to fuel and air system diagnosis.

- _____ 4. Complete lab activities/job sheets-JS1-L1-UIII, JS2-L1-UIII, JS3-L1-UIII, JS1-L1-UIV, JS2-L1-UIV, JS3-L1-UIV, JS4-L1-UIV, JS5-L1-UIV, JS1-L1-UVI.
- _____ 5. Preview CBI or A/V material related to fuel and air system diagnosis.
- _____ 6. Complete written tests covering carburetion and fuel injection.

Learning Plan 4-- Emission Systems' Diagnosis

Overview: In this learning plan the student will develop the basic skills and knowledge to recognize emission failures and components causing failure.

Competency: 4. **Diagnose emission concerns related to the vehicle's non-computerized and computerized emission control systems. (NATEF VIII E)**

Learning Activities:

- _____ 1. Inspect and test positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses and perform necessary action. (P-2 NATEF VIII E 1-2)
- _____ 2. Inspect and test PCV valve, intake manifold, and exhaust passages of exhaust gas recirculation (EGR) systems and perform necessary action. (P-2 NATEF VIII E 2-2)
- _____ 3. Inspect and test vacuum/pressure controls, filters, and hoses of exhaust gas recirculation (EGR) systems and perform necessary action. (P-2 NATEF VIII E 2-3)
- _____ 4. Inspect and test electrical/electronic sensors, and controls, and wiring of exhaust gas recirculation (EGR) systems. (P-2 NATEF VIII E 2-4)
- _____ 5. Inspect and test mechanical components of secondary air injection systems. (P-2 NATEF VIII E 3-2)
- _____ 6. Inspect and test electrical/electronically-operated components and circuits of air injection systems. (P-2 NATEF VIII E 3-3)
- _____ 7. Inspect and test components of catalytic converter systems. (P-2 NATEF VIII E 3-4)
- _____ 8. Inspect and test components of intake air temperature control system. (P-3 NATEF VIII E 4-2)
- _____ 9. Inspect and test components of early fuel evaporation control system. (P-3 NATEF VIII E 5-2)
- _____ 10. Inspect and test components and hoses of evaporative

emissions control system and perform necessary action. (P-2 NATEF VIII E 6-2)

**Performance
Assessment Activities:**

- _____ 1. Access and use repair information/manuals during the diagnostic process.
- _____ 2. Participate in various classroom discussions related to appropriate reading assignment/emission diagnosis.
- _____ 3. Complete classroom assignments sheet related to emission diagnosis.
- _____ 4. Complete lab activities/job sheets-JS1-L1-UI, JS1-L3-UI, JS1-L2-UII, JS2-L2-UII, JS1-L2-UIII, JS2-L2-UIII, JS3-L2-UIII, JS1-L2-JIV, JS2-L2-UIV, JS1-L1-UV, JS2-L1-UV, JS1-L2-UV, JS2-L2-UV.
- _____ 5. Preview CBI or A/V material related to emission diagnosis.
- _____ 6. Complete written test covering emission control systems.