

Las Positas College
 3000 Campus Hill Drive
 Livermore, CA 94551-7650
 (925) 424-1000
 (925) 443-0742 (Fax)

Course Outline for APAU 97F
AUTOMOTIVE HVAC SYSTEMS
Effective: Fall 2009

I. CATALOG DESCRIPTION:

APAU 97F — AUTOMOTIVE HVAC SYSTEMS — 3.00 units

Diagnosing, evaluation, testing, adjustment, and repair of heating, ventilation and air conditioning (HVAC). Includes heat and energy, psychometrics, air flow, refrigerant recycling, equipment and controls. Student will be prepared to pass a nationally recognized HVAC certificate program, required by all California HVAC repair shops. Students are encouraged to enroll in Automotive Lab concurrently. Only students who are part of the automotive apprenticeship may enroll in an APAU class. 2 hours lecture, 3 hours laboratory.

2.00 Units Lecture 1.00 Units Lab

Grading Methods:

Discipline:

	MIN
Lecture Hours:	36.00
Lab Hours:	54.00
Total Hours:	90.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 4

III. PREREQUISITE AND/OR ADVISORY SKILLS:

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

1. obtain and interpret scan tool data, retrieve and record stored On Board Diagnostics (OBD) diagnostic trouble codes for the automatic and semi-automatic HVAC systems
2. diagnose the causes of HVAC system concerns resulting from malfunctions in the computerized HVAC control system with or without diagnostic trouble codes
3. chart, inspect, and test computerized HVAC control system sensors, HVAC control module, actuators, and circuits using a digital-multi-meter (DMM) on board diagnostic scan tool, and perform necessary action
4. access and use service information to perform step-by-step diagnosis
5. check and adjust HVAC system controls
6. inspect for cooling system performance
7. outline common repairs to the engine cooling systems
8. perform Air conditioning (AC) evacuation and recharge
9. diagnose malfunctions of vacuum and motor driven mode doors
10. Pass HVAC certification Test
11. outline hazardous waste handling
12. distinguish safe shop environment

V. CONTENT:

- A. On Board Computer scan data
 1. Retrieval of codes and data
 - a. Flash codes
 - b. Scanner codes
 2. Interpretation of information
 - a. Factory set procedures
 - b. Develop own diagnostic procedures
- B. Heating, Ventilation, and Air Conditioning (HVAC) diagnostics and testing
 1. Perform flow chart testing, with codes, and without codes
 2. Evaluate HVAC system test results
- C. Diagnostic flow charts, and analyze sensor and test equipment readings
 1. Scan tool, Pressure gauges, and coolant analyzers
 - a. Scanner connection
 - b. Data interpretation
 - c. Refrigerant pressure, purity, interpretation
 - d. Component testing using digital volt meters
- D. Diagnostic service information
 1. Access service information (electronic)

- a. Application of information
- 2. Access service information (paper)
 - a. Application of information
- 3. Research labor time guides for work determined in diagnostics
- E. Check adjustable HVAC system controls
 - 1. Inspection of adjustable systems
 - a. Proper operation of Mode doors, Temperature control valves
 - b. Follow factory procedures
 - c. Set actuators to specifications
- F. Explain theory and functionality of engine cooling systems
 - 1. List theory of coolant flow delivery systems
 - a. Sensor contributions during start-up, warm-up
 - 2. Describe operation of sensors during closed loop operation
 - a. Sensor contribution at operating temperature
 - b. In car temp sensors, sun load sensors
- G. Cooling system evaluation
 - 1. Pressure, flow testers
 - a. Testing and diagnosis
 - 2. Installation inspection
 - a. Water pump, thermostats and related components
- H. Air conditioning system evacuation and recharge
 - 1. Explain impact of refrigerant on the atmosphere
 - a. Evacuation procedures
 - b. Recharge procedures
 - c. Recycling procedures
- I. Mode door diagnosis and evaluation
 - 1. Vacuum Systems
 - 2. Electrical Systems
 - 3. Scanner overrides
 - 4. Programming
- J. Nationally Recognized HVAC Certification Test
 - 1. IMACA
 - 2. ASE
- K. Handling of hazardous waste materials
 - 1. Storage and handling of gasoline
 - 2. Storage and handling of diesel fuel
- L. Professional environment
 - 1. Safety glasses (clear lens) worn in all Laboratory areas
 - 2. No loose clothing (coveralls strongly recommended)
 - 3. Long Hair secured
 - 4. No open toe shoes (safety shoes recommended)
 - 5. Work areas maintained: clean free of debris and spills

VI. METHODS OF INSTRUCTION:

- A. **Audio-visual Activity** - PowerPoint presentations Mockup parts from automotive
- B. **Lecture** -
- C. **Discussion** - Group discussion
- D. **Lecture** -
- E. **Lab** - Student Hands-on laboratory activities and assignments

VII. TYPICAL ASSIGNMENTS:

A. Lecture based assignments 1. Text reading 2. Oral presentation 3. Class discussion B. Lab based assignments: 1. Completion of applied activities 2. Lab activity worksheet 3. Diagnosis and debugging C. Student Lab work sheets with emphasis on Hands-on applications D. Review of Lab sheets in both Lab and class settings E. Text reading assignments F. Class discussions of reading assignments G. Demonstrations pertaining to reading assignments

VIII. EVALUATION:

A. **Methods**

- 1. Exams/Tests
- 2. Quizzes
- 3. Projects
- 4. Home Work
- 5. Lab Activities

B. **Frequency**

- 1. Weekly Quizzes
- 2. Weekly Lab Assignments
- 3. Midterm
- 4. Final

IX. TYPICAL TEXTS:

- 1. Hollembeak, Barry *Automotive Heating and Air Conditioning*., Thomson Delmar Learning, 2005.
- 2. Tom Birch *Automotive Heating and Air Conditioning*. 4th ed., Prentice Hall, 2006.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Safety Glasses