

Course Outline for AUTO A1

ENGINE REPAIR

Effective: Fall 2016

I. CATALOG DESCRIPTION:

AUTO A1 — ENGINE REPAIR — 4.00 units

An in depth study of engines: mechanical, measurement, and assembly. A study of the above mentioned components including theory, teardown, evaluate, qualifying, and rebuilding. This class' emphasis is on engines. Students are encouraged to enroll in Automotive Lab concurrently.

2.00 Units Lecture 2.00 Units Lab

Prerequisite

AUTO INTR - Automotive Service and Introduction with a minimum grade of C (May be taken concurrently)

Grading Methods:

Letter or P/NP

Discipline:

	<u>MIN</u>
Lecture Hours:	36.00
Lab Hours:	108.00
Total Hours:	144.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

Before entering the course a student should be able to:

A. AUTOINTR

1. discuss four stroke engine cycle and identify engine parts;
2. perform basic engine teardown and reassembly;
3. apply Ohm's law, read basic schematics, test automotive electrical systems;
4. identify emissions components, understand 5 gas theory;
5. identify different transmissions, understand theory of operation of both manual and automatic transmissions and fluid requirements;

IV. MEASURABLE OBJECTIVES:

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

- A. Demonstrate the basic safety procedures of handling hazardous waste materials.
- B. Explain the history of powertrain evolution.
- C. Operate a wide variety of precision measurement equipment.
- D. Explain four cycle engine theory and identify key components involved.
- E. Teardown typical engine assembly.
- F. Take measurements of engine components and compare to specifications.
- G. Qualify new and used engine components.
- H. Rebuild engine to manufacturer specifications.
 - I. Explain Ohm's Law.
 - J. Demonstrate Ohm's Law in practice, series, parallel circuits.
 - K. Maintain a clean and professional environment.

V. CONTENT:

- A. Safety
 1. Tool usage and nomenclature
 2. Proper disposal procedures
 3. Environmentally conscious decisions
- B. Powertrain evolution
 1. The first four cycle engines
 2. Current engines
 3. Horsepower and emission trade offs

4. Environmental decisions driving design
5. The first automatic transmissions
6. Current automatic transmissions
 - a. More gear ratios
 - b. Different fluids
 - c. Internal design improvements
- C. Measurement tools
 1. Micrometer
 - a. Vernier
 - b. Caliper
 2. Dial bore gauge
 3. Snap gauges
 4. Straight edge
 5. Feeler gauges
 6. Hole gauges
- D. Four cycle engine theory
 1. Intake, compression, power, exhaust
 - a. 360 degrees in one degree intervals
 - b. Valve overlap
 - c. Timing concerns and tricks
 - d. Street vs. racing
 2. DOHV vs. OHV vs. Valve in block design
 - a. Pros and cons of each
 - b. Current technology
 3. Key Valve train components
 4. Key bottom end components
 5. Camshaft timing
 - a. Static camshaft
 - b. Dynamic camshaft
 - c. Electronic valves
 6. Crankshaft design and balance
 7. Cylinder head design
 - a. Single valve
 - b. Multiple valve
- E. Engine Teardown
 1. Removal and identification of external components
 - a. Special procedures
 1. Loosening sequence
 2. Removal and identification of internal components
 - a. Special Procedures
 1. Loosening sequence
- F. Component measurement
 1. Specification lookup
 2. Comparison
 - a. Component diagnosis
 1. Failure analysis
- G. Evaluation of replacement components
 1. Correct component?
 2. New and used part comparison
- H. Engine rebuilding
 1. Manufacturer Procedures
 - a. Component sequence
 - b. Torque specifications
 - c. Tightening sequences
 - d. Special concerns
 1. Assembly lube
 2. Gaskets and sealers
 2. Dynamic engine torque
 3. Proper engine timing
 - a. Camshaft to crankshaft
 - b. Crankshaft to balancershaft
- I. Ohm's Law
 1. Series Circuits
 2. Parallel Circuits
 3. Voltage Drop
 4. Resistance
 5. Amperage draw
- J. Professionalism
 1. Safety glasses
 2. Working shop expectations
 3. Attitude
 4. Cleanliness
 5. Maintenance of work areas and tools

VI. METHODS OF INSTRUCTION:

- A. **Lab** - Group and individual laboratory activities
- B. **Lecture** -

VII. TYPICAL ASSIGNMENTS:

- A. Lecture based assignments
 1. Lecture on Engine Construction
- B. Lab based assignments
 1. Remove cylinder heads and check for specifications
- C. Text reading assignments
 1. Read Chapter One in text

VIII. EVALUATION:

- A. **Methods**

1. Exams/Tests
2. Quizzes
3. Lab Activities

B. Frequency

1. Minimum of two tests
 - a. Midterm
 - b. Final
2. Weekly quizzes
3. Bi-weekly group lab assignments
4. Weekly homework

IX. TYPICAL TEXTS:

1. Rehkopf, Jeffery. *Automotive Engine Repair and Rebuilding.*, Prentice Hall, 2014.
2. Birch, Tom. *Automatic Transmissions and Transaxles.*, Prentice Hall, 2014.
3. Halderman, James. *Automotive Maintenance and Light Repair.* 6 ed., Pearson, 2014.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Safety Glasses