**Course, number, title**: ME 444 Automotive Engines

**Required or elective**: Elective

**Course (catalog) description**: Design and development of internal and external combustion engines for vehicular propulsion.

**Prerequisite(s)**: (ME 410 or concurrently)

**Textbook(s) and/or other required material**: Introduction to Internal Combustion Engines

Third Edition  
Society of Automotive Engineers  
Author: Richard Stone

**Class/Lab schedule**:  
Total Credits: 3  
Lecture/Laboratory/Discussion Hours: 3/0/0

**Topics covered**

- a. Power Cycle Thermodynamics, Mixtures and Solutions  
- b. Power Plants for Automobiles  
- c. Piston Engine Components and Electronic Controls  
- d. Engine Tribology (Friction, Lubrication and Wear)  
- e. Engine Modeling  
- f. Engine Vibration and Balance  
- g. Fuels and Combustion  
- h. Engine Exhaust Emissions  
- k. Engine Manufacturing

**Course learning objectives**

1.1 Reciprocating Engine fundamentals (major topic). Students have the ability to identify reciprocating engine components including crankshafts, rods, pistons, camshafts, ring pack cylinder heads, intake exhaust manifolds, valve train, fueling system and ignition system. Demonstrate knowledge of the basic design parameters of each of these elements.

1.2 Cycle Analysis. Students can demonstrate knowledge of detail of Otto and Diesel, two and four stroke cycles. Specific emphasis on thermodynamic descriptions of air-standard cycles and knowledge of the differences, which exist between air-standard and real cycles, is discussed. Performance/emission tradeoffs between different engine types.

1.3 Modeling of Engine Thermal-Fluid/Mechanical Processes. Students exhibit a knowledge of the alternatives available to study the detailed processes occurring in an I.C. engine including one-dimensional models and multi-dimensional models of manifold events, in-cylinder processes, turbulence modeling and cylinder-kit analysis (piston, rod, pistons) and vibration analysis.

1.4 Engine Selection(including hybrid concepts), Sizing, Design to Application and Diagnostics. Students exhibit knowledge of functions that influence engine performance including speed, torque, displacement, imep, bmep, bsfc and power-to-weight ratio.

1.5 Environmental considerations and conventional power plant alternatives including emissions, hybrid electric/hydraulic vehicles and fuel cells. Students exhibit knowledge of automotive emissions, emission control system, EPA regulatory system including highway and urban test cycles, global conservation issues and petroleum economics. Significant understanding of current catalytic converter systems and the engine controls associate with those systems. Well-to-wheel efficiency concept is examined.
The following measurement standard is used to evaluate the relationship between the course outcomes and the educational-program outcomes:

3 = Strong Emphasis, 2 = Some Emphasis, 1 = Little or No Emphasis.

(a) an ability to apply knowledge of mathematics, science, and engineering—3
(b) an ability to design and conduct experiments, as well as to analyze and interpret data—1
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability—2
(d) an ability to function on multidisciplinary teams—1
(e) an ability to identify, formulate, and solve engineering problems—1
(f) an understanding of professional and ethical responsibility—2
(g) an ability to communicate effectively—1
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context —1
(i) a recognition of the need for and the ability to engage in life-long learning—1
(j) a knowledge of contemporary issues—1
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice—2
(l) application of advanced mathematics—1
(m) design, build, and test in mechanical systems area—1
(n) design, build, and test in thermal/fluids area—1
(o) capstone design experience—1

Contribution to professional component: 75% Engineering Science, 25% Engineering Design

Person(s) who prepared this description: Harold Schock

Date of Preparation: March 11, 2010