

Mechanical Engineering and Mechanics

MEM 400 Internal Combustion Engines

Winter 2007

Designation: Elective

Catalog Data: MEM 400; Thermodynamics of combustion reactions, engine descriptions, fuel chemistry and properties, engine processes as ideal cycles, equilibrium charts, combustion theory as applied to engines, detonation and air pollution.

Prerequisites by Topic: Intermediate Thermodynamics (example: MEM 310)

Textbook: Ferguson, C.R. and Kirkpatrick, A.T., Internal Combustion Engines, 2nd edition, Wiley New York, 2001. ISBN 0-471-35617-4.

References:

1. Stone, R., Introduction to Internal Combustion Engines, 2nd Edition, SAE, 1993.
2. Heywood, J.R., Internal Combustion Engine Fundamentals, McGraw Hill, New York, 1988
3. Taylor, C. F., The Internal Combustion Engine in Theory and Practice, Vol. I & II, Revised Edition, MIT Press, 1985.
4. Obert, E. F., Internal Combustion Engines and Air Pollution, 3rd edition, Harper and Row, New York, 1973.
5. SAE Publications

Course Objectives:

1. Explain the differences between ideal and actual engine processes and cycles.
2. Discuss the advantages and limitations of spark ignition and compression ignition engines.
3. Evaluate available liquid, gaseous and solid fuels for use in engines.
4. Define the correlation of engine combustion factors and emissions.
5. Appraise the severity of friction and the importance of lubrication in engines.

Topics:

1. Engine Types and Trends
2. Engine Design and Operating Parameters
3. Fuel, Air, and Combustion Thermodynamics
4. Properties of Working Fluids
5. Fuel-Air Cycles
6. Combustion in Spark Ignition engines
7. Combustion in Compression Ignition Engines
8. Pollutant Formation and Control
9. Engine Operating Characteristics
10. Fuels and Lubricants

Class/laboratory schedule, i.e., number of sessions each week and duration of each session
3 hours /wk class (3 credits)

Contribution to Professional Component:

This course is one of the final elective courses in the area of thermal fluid science in mechanical engineering and includes the fundamental aspects of internal combustion engine theory and design. The course builds upon the principles learned in MEM 310 (Thermodynamic Analysis I), MEM 220 (Fluid Mechanics), and MEM 345 (Heat Transfer). The principles taught in MEM 400 are used by some design teams in their senior design capstone project.

Relation to Program Outcomes:

MEM 400 provides knowledge of engineering principles and their application to the solution of practical problems. It provides technical competency in mobile power sources and presents an opportunity to apply engineering judgment in designing thermal systems.

0 = No content; 1 = Some content; 2 = Significant content

Outcomes a - k	Content	Explanation	Evidence
a. An ability to apply knowledge of mathematics, science and engineering	2	This course requires the students to develop a general understanding of thermodynamics. The students learn how to apply and synthesize their knowledge of mathematics, science, and engineering.	Homework; exams
e. An ability to identify, formulate and solve engineering problems	1	The homework problems require students to identify, formulate and solve engineering problems.	Homework; exams
f. An understanding of professional and ethical responsibility	1	This is considered as part of the engineer's overall responsibility.	Classroom discussions; homework; Term project
g. An ability to communicate effectively	2	Written presentation of the final Term Project is required.	Homework; Term Project
h. The broad education necessary to understand the impact of engineering solutions in a global/societal context	1	The impact of engineering design on the environment (pollution, greenhouse effect, etc.) and society are covered.	Classroom discussion of environmental issues; Final report for the design project
i. A recognition of the need for and an ability to engage in lifelong learning	1	The independent report on a new development in the field of engines demonstrates the need for continuous improvement	Classroom discussion of ever changing engineering tools and regulations; Term Project
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	1	Homework problems are sufficiently complicated to encourage of the use of modern engineering tools	Homework; Final report for the Term Project

Person(s) who prepared this description and date of preparation:

Dr. David L. Miller 1/4/07