

EM461 Engines: Principles, Design, and Applications

**United States Naval Academy
Mechanical Engineering Department**

Catalog Description: EM461 Engines: Principles, Design, and Applications **Credit:** 3 (2-2-3)

Designation: Elective, engineering major

The course objective is to provide a fundamental understanding of reciprocating internal-combustion engine design and operation. This is achieved by linking existing engine hardware design and performance analysis to concepts and disciplines studied in the mechanical engineering curriculum.

Prerequisites: EM320 (Applied Thermodynamics)
EM324 (Fluid Dynamics)

Corequisites: None

Textbook: None

Course Director: Assistant Professor Patrick A. Caton

Course Content:

No.	Topic or Subtopic	hrs.
1	Classification and Design of Engines	4
2	Thermodynamics and Metrics of Engines	6
3	Flames and Fuels	10
4	Gasoline (HCSI) Engines	6
5	Diesel (SCCI) Engines	4
6	Emissions from Engines	6
7	Breathing	4
8	Advanced Engine Cycles	2

Assessment Methods:

		YES	NO
A	Quizzes		X
B	Homework	X	
C	Exams	X	
D	Laboratory Reports	X	
E	Oral Presentations	X	
F	Design Reports/Notebooks		X
G	Prototypes/Demonstrations		X
H	Projects		X
I	Other		X

Course Outcomes¹

1. Analyze engine performance data (e.g. torque, power, BMEP, volumetric efficiency, thermal efficiency). (C, D)

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2. Quantify various design parameters and their effect on engine performance (e.g. compression ratio and air-fuel ratio). (B, C, D, E)
3. Identify optimal engine parameters with respect to efficiency and emissions (e.g. fuel and spark timing effects). (B, C, D, E)
4. Identify engine losses and areas in which engines may be improved (e.g. pumping, thermal, flow, etc.). (B, C, D, E)
5. Quantify various fuel effects on engine performance (e.g. energy density, air-fuel ratio, etc.). (B, C, D, E)

¹ Letters in parenthesis refer to the assessment methods listed in the previous section.

Program Outcomes	Course Outcomes				
	(1)	(2)	(3)	(4)	(5)
(a)	X	X	X	X	X
(b)		X	X	X	X
(c)			X		X
(d)					
(e)					X
(f)					
(g)					
(h)			X	X	
(i)					
(j)					X
(k)	X	X	X	X	X

Date of Latest Revision: 9 JUNE 2010, Assistant Professor Patrick A. Caton