ME 436: Combustion Engines

Course description: Fundamentals of combustion and internal combustion engines.

Number of credits: 3

Course Coordinator: D. McLarty

Prerequisites by course: ME 301; ME 303

Prerequisites by topic:

1. Concept and application of the ideal-gas law
2. Thermodynamic law
3. Gas power cycles
4. Conservation of mass and momentum

Textbook:

1. Jamil Ghojel, Fundamentals of Heat Engines: Reciprocating and Gas Turbine Internal Combustion Engines, 2020, DOI:10.1002/9781119548829.

Course objectives:

1. Apply the thermodynamics of reactive mixtures to balance reactions, understand limits of flammability, ignition, chemical equilibrium, pollutants, and general fuel characteristics.
2. Understand the operating principles of the reciprocating internal combustion engine including ideal-gas cycles for natural and forced induction engines, practical cycle analysis under non-ideal conditions, and work-transfer performance metrics.
3. Understand the operating principles of gas turbine internal combustion engines including ideal-gas and practical cycle analysis under ideal and no-ideal operating conditions.

Topics covered:

1. Stoichiometry of chemical reactions.
2. Engine types.
3. Standard thermodynamic analysis of internal combustion engines.
4. Ancillary systems for operating and characterizing engine components.

Expected student outcomes:

1. The student will understand how an internal combustion engine works.
2. The student will be able to apply engineering science (thermodynamics, heat transfer, fluid mechanics) to analyze the operation and performance of an internal combustion engine.
3. The student will gain an ability to identify and calculate the different mechanisms whereby an actual engine differs from the ideal cycle operation.
4. The student will gain an appreciation of the environmental concerns in the design of combustion systems and be exposed to standards and public policy concerning the regulation of combustion emissions.

Class schedule: Three 50-minute lecture sessions per week, for one semester.

Laboratory schedule: None

Contribution to meeting the professional component: Engineering Topics

Relationship of course to program objectives: Meets:

1. School of MME ME educational objectives: 1, 2, 3
2. School of MME ME program outcomes: 1, 2, 4, 7
3. ABET program outcomes: 1, 2, 4, 7

Prepared by: J. Leachman *Date:* July 5, 2022