# ME 436: Combustion Engines

*Course description:* Internal combustion engines; spark ignition engines, diesels, and gas turbines.

*Number of credits:* 3

*Course Coordinator:* C.D. Richards

*Prerequisites by course:* ME 303

*Prerequisites by topic:*

1. Concept and application of the ideal gas law
2. First law of thermodynamics
3. Gas power cycles
4. Conservation of mass
5. Conservation of momentum

*Postrequisites:* None

*Textbooks/other required materials:* Pulkrabek, W.W. *Engineering Fundamentals of the Internal Combustion Engine.* Pearson Prentice Hall, 2003, 2/e.

*Course objectives:*

1. Types and configurations of spark ignition and diesel engines.
2. Engines performance parameters such as BMEP, Torque, BSFC and their relationship to operating conditions.
3. Basic Combustion: calculations, equilibrium concepts, introduction to kinetics.
4. Ideal air standard cycles and fuel/air cycles.
5. Parameters affecting volumetric efficiency, valve timing, port design.
6. Turbocharging: compressor and turbine performance, matching components, introduction to impeller design.
7. Combustion Processes in both spark and compression ignition engines: flame structure, cycle-to-cycle variation, knock, ignition, fuel injection, octane number, ignition delay, cetane number.
8. Emissions: $NO_x$, CO, UHC, Smoke, and Catalytic converters.
9. Analysis of the performance of ramjets, turbojets, turbofans, and turboprops.

*Topics covered:*

1. Engine types.
2. Engine performance.
3. Combustion.
4. Engine cycles.
5. Intake and exhaust processes.
6. Spark ignition engines.
7. Compression ignition engines.
8. Emissions.
9. Gas turbine engines.

*Expected learning outcomes:*

1. The student will understand how an internal combustion engine works.
2. The students will be able to apply engineering science (thermo, fluids, heat transfer) to analyze the operation and performance of an internal combustion engine.
3. The student will gain experience in component design and system matching, such as a turbocharger.
4. The student will gain an appreciation of the environmental concerns in design 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 student outcomes:*
3 strongly supported; 2 supported; 1 minimally supported

Student Outcomes Pre-Fall 2018 (ABET EC2000)

| **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | 1 | | 1 | | | 1 | 1 | 1 | |

Student Outcomes Fall 2018 forward (ABET EC2019)

| **1** | **2** | **3** | **4** | **5** | **6** | **7** |
|---|---|---|---|---|---|---|
| 3 | 1 | | 1 | | | 1 |

*Prepared by:* Andrea Butcherite and C.D. Richards *Date:* May 30, 2018