

## **Certificate: Internal Combustion Engines**

This certificate is designed to provide students with fundamental knowledge in internal combustion engines and their combustion processes. The basic theories of compressible flow and thermodynamics will be covered and used to examine different characteristics of the performance of internal combustion engines and their respective processes.

(12 credit hours)

### **ME 521      Dynamics and Thermodynamics of Compressible Flow**

#### **3 credits**

Review of basic equations of fluid mechanics and thermodynamics in control volume form. Along with one dimensional compressible flow involving area change, normal shocks, friction, heat transfer and combined effects. Two dimensional supersonic flow including linearization, method of characteristics and oblique shocks are also discussed as well as one dimensional, constant area, unsteady flow.

### **ME 522      Advanced Fluid Mechanics**

#### **3 credits**

Review of fluid flow phenomena based on common principles of transfer of mass, momentum, and energy. Introduction of the fundamental concepts and methods of analysis of fluid flows in industrial and environmental settings. Navier Stokes equations; viscous and inviscid flows; laminar and turbulent flows; boundary layers; drag; thermal convection.

### **ME 532      Combustion Processes**

#### **3 credits**

Introduction to combustion processes, equilibrium and reaction kinetics. Combustion of premixed gases, detonation and deflagration flames. Laminar and turbulent flames. Ignition, flammability and flame quenching. Application to spark, diesel and gas turbine engines. Combustion-generated pollution.

### **ME 535      Advanced Thermodynamics**

#### **3 credits**

Advanced treatment of engineering thermodynamics as applied to producing mechanical power and refrigeration. Involves rigorous application of the first and second laws. Topics to discuss are energy/entropy generation, thermodynamics relations, non-reacting mixtures and reacting mixtures.

### **ME 596      Internal Combustion Engines I**

#### **3 credits**

Comparison of characteristics and performance of several forms of internal combustion engines including the Otto and Diesel types of piston engines; thermodynamics of cycles, combustion, mixture formation, fuel metering and injection in spark and diesel engines; pollution from engines.

**ME 597      Internal Combustion Engines II**

**3 credits**

Fuel flow and air flow measurements and techniques; engine maps; fuel and ignition control and control strategies; combustion and burn rate considerations in engine design; intake and exhaust systems; emissions and control strategies; emission test procedures.