

## Internal Combustion Engines

<b>Course Code: ME-448</b>	<b>Credit Hrs: 2-1</b>
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### **Text and Reference books:**

1. W. W. Pulkrabek, Engineering Fundamentals of IC engine, Pearson Education Inc, USA
2. J. B. Heywood, Internal Combustion Engine Fundamentals, Heywood McGraw-Hill
3. Richard Stone Palgrave Macmillan, Introduction to I. C. Engines
4. C. F Taylor, Internal combustion engines. MIT Press.
5. R. V. Schäfer, F. Schäfer, Internal Combustion Engine Handbook - Basics, Components, Systems, and Perspectives, Fred SAE International.
6. C. R. Ferguson, Internal Combustion Engines: Applied Thermo-sciences, Wiley Science

### **Course outline:**

- Introduction to I.C engines: History of I.C engine development, Engine classifications, Engine components and terminologies,
- Working principle of turbo-charged, supercharged engine, its performance characteristics.
- SI & CI engines systems: Basic engine cycle and operation,
- Two and four stroke engines, Engine operating characteristics (engine speed, compression ratio, sfc, A/F, F/A, etc), Engine parameters (efficiency, MEP, Power, torque, etc), Carburetors, Fuel injectors, Ignition system, Electronic control unit, Engine management system, Otto, Diesel and Dual cycle and their comparison
- Fuel and combustion: Hydrocarbon fuels and their properties, Thermochemistry

and Chemical

equilibrium, Self-ignition and engine knock, Ignition delay, Octane and Cetane Numbers

- Gas exchange processes and mixture preparation: Intake Manifold, Volumetric efficiency, Intake

valves, Variable valve Control, Fuel injection, EFI systems (PFI, MPFI, GDI and Commonrail), Super-charging and turbo-charging, Fluid Motion within combustion chamber, Turbulence,

Swirl, Squish and Tumble, Crevice Flow and blowby

- Combustion in SI and CI engines: Ignition and flame development, abnormal combustion and

knock, Spark timing and Maximum brake torque spark timing, Diesel Fuel injection and mixture

preparation, Phases of combustion and ignition delay, Injection timing, injection pressure,

common rail fuel injection

- Exhaust Flow: Turbocharging, Exhaust manifold, Exhaust gas recirculation

- Pollution control: engine emissions, pollutant formation, after treatment, catalytic converters, soot

traps

- Heat Transfer in Engines and engine cooling system

- Friction and Lubrication of engine, Lubrication systems

**Assessment:**

Mid Exam, Final Exam, Quizzes, Assignments, Presentation, Lab Report, Report Writing, Lab Viva, Open Ended Lab