

## **AT8002 ADVANCE THEORY OF IC ENGINES**

### DETAILED SYLLABUS

#### **OBJECTIVES:**

- Knowledge in usage of software for simulating the performance of IC engines
- Acquiring ability to simulate the various types combustion processes of IC engines.
- Knowledge in performance simulation of IC engines.

#### **UNIT I COMBUSTION OF FUELS**

Chemical composition and molecular structure of hydrocarbon fuels. Combustion Stoichiometry of hydrocarbon fuels – Chemical energy and heat of reaction calculations – Chemical equilibrium and adiabatic flame temperature calculation. Theory of SI and CI engine combustion – Flame velocity and area of flame front. Fuel spray characteristics – droplet size, depth of penetration and atomization.

#### **UNIT II ENGINE CYCLE ANALYSIS**

Ideal air, fuel air cycle and actual cycle analysis. Progressive combustion analysis in SI engines. Parametric studies on work output, efficiency and other engine performance.

#### **UNIT III COMBUSTION MODELLING**

Basic concepts of engine simulation – Governing equations, Classification of engine models- Thermodynamic models for Intake and exhaust flow process – Quasi steady flow - Filling and emptying - Gas dynamic Models. Thermodynamic based in cylinder models for SI engine and CI engines.

#### **UNIT IV NON-CONVENTIONAL IC ENGINES**

Concept of L.H.R. engine and its recent developments. Variable compression ratio engine and its use in engine research. Wankel rotary combustion engine. Dual fuel engine concept for multi fuel usage in CI engines - performance studies on dual fuel engine. Free piston engine. Stratified charge and lean burn engines. Locomotive and marine engines.

#### **UNIT V COMBUSTION ANALYSIS IN IC ENGINES**

Photographic studies of combustion processes – Analysis of Pressure crank angle diagrams in SI and CI engines. Knock study for Pressure crank angle histories. Apparent heat release rate and Wiebe's law analysis for combustion. Calculation of Ignition delay and combustion duration. – Hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines.

#### **TEXT BOOKS:**

1. Ganesan, V., "Internal combustion engines", Tata McGraw Hill Publishing Co., 1994.
2. Ganesan. V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderabad, 1996.

**REFERENCES:**

1. Benson, R.S., Whitehouse, N.D., "Internal Combustion Engines", Pergamon Press, Oxford, 1979.
2. Ganesan, V., "Compute Simulation of Compression Ignition engine process", Universities Press (India) Ltd., Hyderabad, 1996.
3. John, B., Heywood, "Internal Combustion Engine Fundamentals", McGraw Hill Publishing Co., New York, 1990.
4. Ramalingam. K.K., "Internal combustion engine", scitech publications, Chennai, 2003.