

1. Preamble

This course imparts knowledge in the advanced developments in automobiles, engines and various emission controlling technologies.

2. Pre-requisite

NIL

3. Links to other courses

NIL

4. Course Educational Objectives

Students undergoing this course are expected to:

- Gain knowledge about the advanced theory and working of I.C engines.
- Express the phenomena of combustion and modelling.

5. Course Outcomes

Upon the successful completion of the course, learners will be able to

| CO Nos. | Course Outcomes | Level of learning domain (Based on revised Bloom's) |
|---------|---|---|
| CO1 | Explain the various working cycles of engine. | K2 |
| CO2 | Describe the various types of combustion in IC engines. | K2 |
| CO3 | Illustrate the engine combustion parameters. | K3 |
| CO4 | Describe the different types of modern engines. | K2 |
| CO5 | Explain the modern electronic engine management system (EMS) of IC engines. | K2 |

(K2 – Understand; K3 – Apply)

6. Correlation of COs with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | H | H | H | M | M | M | L | L | M | L | L | L |
| CO2 | H | H | H | M | M | M | L | | M | L | L | L |
| CO3 | H | H | H | M | M | M | H | | M | L | L | L |
| CO4 | H | H | H | M | M | M | H | | M | L | L | L |
| CO5 | H | H | H | M | M | M | H | | M | L | L | L |

H- High; M-Medium; L-Low

7. Course Content**UNIT I Combustion of Fuels**

L-9

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

L-9

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

L-9

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 – Nonconventional IC Engines

L-9

LHR Engines- Surface Ignition Concept and Multi Fuel Engines- Stratified Charge and Lean Burn Engines- Performance and Emission Characteristics- Merits and Demerits- GDI-RCCI-GDCI-CRDI-Lean Burn Engines

UNIT V-Electronic Engine Management

L-9

Computer Control of SI & CI Engines for Better Performance and Low Emissions- Closed Loop Control of Engine Parameters of Fuel injection and Ignition.

Total: 45 Periods

8. Text Books:

1. Ganesan .V - “IC Engines” - Tata McGraw-Hill, 2012.
2. John B. Heywood, “Internal Combustion Engine Fundamentals”, McGraw-Hill Automotive Technology Series ISBN 0-07-1000499-8, 1988.
3. B.P.Pundir, “IC Engines-Combustion and Emissions”, 1st ed., Narosa Publishing House, New Delhi

9. References:

1. Richard Stone – “Introduction to IC Engines” – 2nd edition – Macmillan – 1992.
2. BOSCH hand book, edition: 2012