ADVANCED I.C. ENGINES

Course Code: 13ME2304

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Pre requisites: Basic thermodynamics, Thermal Engineering and Basic Fluid Mechanics.

Course Educational Objectives:

To make the student understand

1. engine operating parameters like fuel-air mixtures, temperature and cycles
2. supercharging, turbo charging and flow through ports and valves
3. combustion process in SI engine and CI engine and emissions formation during the combustion cycle and their treatment.
4. metering and flow of charge in SI engines
5. modern trends in IC engines

Course Outcomes:

The student will be able to explain

1. design parameters like fuel-air mixtures and cycle analysis
2. gas exchange processes and motion of charge in the cylinder and its effects on combustion process in SI and CI engines and control the pollutant formation
3. flow in carburetor and Intake manifolds
4. modern concepts like Lean burn, HCCI, GDI

UNIT I

Engine types and their operation, engine design and operating parameters, Fuel-air mixtures and cycle analysis- thermo chemistry of fuel-air mixtures, properties of working fluids, ideal models of engine cycles, fuel-air cycle analysis, and availability analysis of engine processes.

UNIT II

Gas Exchange Processes - Volumetric efficiency, flow through valves, residual gas fraction, exhaust gas flow rate and temperature variation, flow through ports, supercharging and turbo charging.

UNIT III

Charge motion- Mean velocity and turbulence characteristics, swirl, squish, pre-chamber engine flows, crevice flows and blowby.

Fuel metering and manifold phenomenon-SI engine mixture requirements, carburetors, fuel injection systems, flow past throttle plate, flow in intake manifolds.

UNIT IV

SI Engine combustion**,** thermodynamic analysis of SI engine combustion, flame structure and speed, cyclic variations in combustion, and abnormal combustion.

CI Engine combustion-Essential features, types of diesel combustion systems, phenomenological model, analysis of cylinder pressure data, fuel spray behavior, ignition delay, and mixing-controlled combustion.

UNIT V

Pollutant formation and control- Nature and extent of problem, nitrogen oxides, carbon monoxide, unburned hydrocarbon emissions, particulate emissions, exhaust gas treatment.

Modern trends in I.C. engines, lean burning engines-rotary engines, modification in I.C engines to suit Bio – fuels, HCCI and GDI concepts.

TEXT BOOK:

1. John B. Heywood, "*Internal Combustion Engine Fundamental"*, 1st Edition, Tata McGraw-Hill Education, 2011.

REFERENCES:

1. Heinz Heisler, "*Advanced Engine Technology"*, Trafalgar Square, 1997.

2. V. Ganesan, "*Internal Combustion Engines"*, 2nd Edition, Tata McGraw Hill, 2002.

3. M.L.Mathur and R.P. Sharma, "*Internal Combustion Engines"*, DhanpatRai, 2008.