ADVANCED I.C. ENGINES

Course Code: 13ME2304

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Course Outcomes:

At the end of the course, the student will be able to

CO 1 : Explain the design and operating parameters of an engine and analyze thermodynamic concepts of fuel- air cycles.

CO 2 : Summarize the concepts of volumetric efficiency, turbocharging and supercharging.

CO 3 : Explain the concepts of types of charge motion within the cylinder and flow in intake manifold.

CO 4 : Analyze different stages of combustion in SI and CI engines.

CO 5 : Explain the formation of different pollutants, their affect and their treatment, and also associate the concepts of modern trends in IC engines.

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.