I.C. ENGINES

Course Code: 15ME2304

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

Course Outcomes: The student will be able to

CO1: Explain the design and operating parameters of an engine and analyze thermodynamic concepts of fuel- air cycles.

CO2: Summarize the concepts of volumetric efficiency, turbo charging and supercharging.

CO3: Explain the concepts of types of charge motion within the cylinder and flow in intake manifold.

CO4: Analyze different stages of combustion in SI and CI engines and explain the formation of different pollutants, their affect and their treatment

CO5: associate the concepts of modern trends in IC engines.

UNIT I (10-Lectures)

Engine types and their operation, engine design and operating parameters, Characterization of flames, first law of thermodynamics and combustion, second law of thermodynamics and combustion, Effects of Fuel/Air Ration No uniformity, Comparison with real engine cycles.

UNIT II (10-Lectures)

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 (10-Lectures)

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.

UNIT IV (10-Lectures)

SI Engine combustion-Stages, Effect of engine variables on ignition lag, effect of engine variables on flame propagation and abnormal combustion.

CI Engine combustion-Stage, effect of engine variable on delay period, fuel spray behavior, ignition delay.

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

UNIT V (10-Lectures)

Modern trends in I.C. engines, Duel fuel and multi fuel engines, Stratified charge Engine, Variable compression ratio engine, Free Piston Engine, lean burning engines-rotary engines, modification in I.C engines to suit Bio – fuels, GDI concepts.

TEXT BOOK:

1. John B. Heywood, "*Internal Combustion Engine Fundamental"*, 1st Edition, Tata McGraw-Hill Education, 2011.(Units I,II,III, & Partially IV)
2. M.L.Mathur and R.P. Sharma, "*Internal Combustion Engines"*, Dhanpat Rai, 2008. (Units IV& V)

REFERENCES:

1. Heinz Heisler, "*Advanced Engine Technology"*, Trafalgar Square, 1997.
2. V. Ganesan, "*Internal Combustion Engines"*, 2nd Edition, Tata McGraw Hill, 2002.