

3ME03: INTERNAL COMBUSTION ENGINES AND THERMAL TURBINES
CREDITS - 4 (LTP: 3,0,1)

Course Objective:

To analyze internal combustion engines and turbines for energy transfer applications.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE		
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Topics	Teaching Hours
1	<p>Introduction: Recapitulation and applications of IC engines, P-V and valve timing diagrams. Modern engines</p> <p>Testing of I C Engine: Aims of engine testing, measurement of indicated power, brake power, friction power, speed, air consumption, fuel consumption. IC engine efficiencies, specific output, specific fuel consumption, heat balance sheet.</p>	08
2	<p>I C engine fuels: Desirable properties of I. C. engine fuels, required qualities of S.I and C I engine fuels, rating of S I and C I engine fuels, dopes/additives for S I & C I engines, alternate fuels like CNG, LNG, LPG, vegetable oils, biodiesel, alcohol, biogas and hydrogen for IC engines.</p> <p>Fuel supply systems for S.I engines: Fuel supply system for SI engines, properties of air-petrol mixture, mixture requirement for different loads and speeds, simple carburetors and its working, calculation of air-fuel ratio, types of carburetors, limitations of a single jet carburetor, modern carburetors, problems in carburetors, altitude compensation, gasoline injection in SI engines, MPFI system for modern automobile engines</p> <p>Fuel supply systems for C.I. engines: Requirement of ideal injection system, types of injection systems, CRDI injection system, fuel pumps and injectors, types of nozzles, spray formation, quantity of fuel and size of nozzle orifice.</p>	10
3	<p>Systems for I C Engine:</p> <p>Ignition system: battery, magneto, and electronic, spark plug, firing order.</p> <p>Governing system : quality, quantity & hit and miss governing,</p> <p>Scavenging systems: scavenging processes & systems</p> <p>Cooling system: Air and Water Cooling system, Types of cooling systems</p> <p>Lubricating System: Properties, additives added to lubricating oil, types of lubrication</p> <p>Supercharging: Objects, Supercharging of SI and CI engines, effects of supercharging, supercharging limits, methods of supercharging, turbo charging</p>	6

Unit No.	Topics	Teaching Hours
4	<p>Combustion in S.I. Engines: Stages of combustion, ignition lag and the factors affecting the ignition lag, flame propagation and factors affecting flame propagation, abnormal combustion and knocking in SI engines, factors affecting knocking, effects of knocking, control of knocking.</p> <p>Combustion in C.I. engines: Stages of combustion, delay period and the factors affecting it, detonation in C.I. engines, factors affecting detonation, controlling detonation.</p>	6
5	<p>Steam nozzles and turbines: Types of nozzles, velocity of steam, discharge through nozzle, critical pressure ratio and condition for maximum discharge. Principle of operation, types of steam turbines, compounding of steam turbines, impulse and Reaction turbine – velocity diagram, calculation of work, power and efficiency, condition for maximum efficiency, governing of steam turbines.</p> <p>Gas turbine: Brayton cycle, Applications and types of gas turbines, optimum pressure ratio for maximum specific work and efficiency, Methods to improve performance of gas turbine plant. Steam and gas turbine combined cycle.</p>	12
Total		42

List of References:

1. V.Ganeshan," *Internal combustion engines*", 4th Edition, Mc Grawhill Compnies.
2. Mathur & Sharma, "*Internal combustion engines*", 2014 Edition, Dhanpatrai & sons, New Delhi.
3. Heywood, *Internal combustion engine*, Mc Grawhill Compnies
4. R Yadav," *Steam and gas turbine*" 7th Edition, Central Publishing House, Ahmedabad
5. Rogowaski," *Elements of I C Engines*" (Mc Grawhill)
6. Taylor," *The I. C. Engine Theory and Practice Vol. P*" (John Wiley)
7. B S Patel, J P Hadiya, and H G Katariya, "*Internal combustion engines*" fourth Edition, Books India Publication, Ahmedabad, 2018
8. P.K. Nag," *Power Plant Engineering* ", 3rd edition, Tata McGraw-Hill, 2017
9. El Wakil M. M., "*Power Plant Technology*", 2017 Edition, Tata McGraw-Hill.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Discriminate types and working of I C Engines and to analyze the performance of I C Engine.
2. Illustrate fuel used in IC engine and its supply system
3. Explain various systems used in IC engine.
4. Illustrate the basic combustion process and categorize combustion chambers used in IC engine.
5. Apply the basic thermodynamics and fluid flow principles to different power generation methods. Analyze thermodynamic cycles of gas turbine power plant and combined cycle power plant.

