Devi Ahilya University, Indore, India Institute of Engineering & Technology				**III Year B.E. (Mechanical Engg.) (Full Time)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
5MERE1: I.C. ENGINES AND JET PROPULSION	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
Duration of Theory Paper: 3 Hrs	3	1	2	3	1	1	5

Course Objective:
The course is designed
1. To make students to understand principal and working of Engines and Turbines
2. To develop the understanding of the effects of fuel combustion on environmental pollution.
3. To make students to understand principal and working of different systems used in IC Engines and Jet Propulsion.
4. To make them able to understand the testing performance parameters and various testing methods to determine these parameters of IC Engines and Jet Propulsion.
5. To understand the latest trends in IC Engines.

Prerequisite(s): Applied Thermodynamics, Elements of Mechanical Engineering.

COURSE CONTENT

UNIT-I

Introduction to I.C. Engine & Fuels: Air standard cycles, Otto, Diesel, Stirling, Engine Classification- Two and four stroke-SI and CI engines, Stirling engine, Rotary engines, Stratified charge engine, Variable compression ratio engine, Valve timing diagram,
Fuels: Fuels for SI and CI engine, important qualities of SI engine fuels, important qualities of CI engine fuels, dopes, additives, gaseous fuels, LPG, CNG, biogas, alternative fuels.

UNIT-II

SI Engine: Carburetion, mixture requirements, Carburetor types, theory of carburetor, MPFI System (petrol injection). Combustion in SI Engine, flame Speed, ignition delay, abnormal combustion and its control, Combustion chamber design for SI engines. Ignition system requirements, Battery ignition systems, Magneto ignition system, Electronic ignition system, ignition timing, firing order and spark plugs, variable valve control- VVC, VVA, VTEC-E, i –VTEC, SI Hybrid Engine.

UNIT-III

CI Engine: Requirements of Fuel injection in CI engines, types of diesel fuel injection systems (Mechanically controlled and electronically controlled), fuel pumps, fuel injectors, Injection Timings. Combustion in CI engines, ignition delay, knock and its control,
Combustion chamber design of CI engines.

UNIT-IV

Engine Cooling, Lubrication, Supercharging & Testing: Engine Cooling: Different cooling systems, radiators and cooling fans, Lubrication: lubrication principle, lubricating oils, type of lubricating systems,
Testing and Performance: Performance parameters, basic measurements, testing of SI and CI engines on conventional fuel and blending with Ethanol and calculation of performance parameters. Performance parameter curves
Supercharging: Effect of altitude on power output, Types of supercharging and turbocharging and effects on engine performance.

New Technologies of Engines- DI Turbo Ethanol engine, HCCI

UNIT-V

Compressors, Gas Turbines & Jet Propulsion: Dynamic Compressors- Centrifugal compressor and Axial Flow Compressor- elementary theory, vector diagram efficiencies, and performance analysis and curves, Losses in dynamic compressors, surging and stalling,
Gas Turbines: Introduction, Classification and Application, Gas turbine main components, Optimum pressure ratio for maximum specific output and thermal efficiency in actual gas turbine cycle, Air rate and work ratio, Open cycle Gas turbine with Regeneration , Reheat and Intercooling, Effect of operating variables on thermal efficiency.
Jet Propulsion- Turbo jet, Turbo fan, Turbo Prop, Ram jet, thrust power, propulsive efficiency and thermal efficiency, Jet propulsion performance, Specific thrust and specific fuel consumption in each case for turbo jet and turbo propulsion units. Rocket Propulsion.

LIST OF PRACTICAL ASSIGNMENTS:

1. To Study of carburettor, Induction system and combustion chamber in petrol engine
2. To study of MPFI systems and performance testing on MPFI SI engine.
3. To study of fuel injection systems and its components in diesel engines.
4. To study the Battery ignition system, Magneto ignition system and Electronic ignition system
5. To Study of Water Brake Dynamometer with Four Stroke Four Cylinder S. I. Engine.
6. Performance testing of Four Stroke Four Cylinder S. I. Engine
7. To Study of Swinging Field Electrical Dynamometer with Twin cylinder Four Stroke Diesel Engine.
8. Performance testing of Twin Cylinder Four Stroke Diesel Engine.
9. Performance testing of Single cylinder petrol and diesel engine with Ethanol blending on Computerised test rig
10. To Study of Engine Cooling and Lubrication Systems.

Course Outcome:

Students earned credits will develop ability to
CO1. Determine the air fuel ratio supplied by carburettor and MPFI system.
CO2. Determine the thermo chemistry of fuels.
CO3. Design and select the combustion chambers of SI Engines.
CO4. Draw the valve timing diagram of SI Engines (Four Stroke).
CO5. Determine the Torque/Mean effective pressure / BHP/FHP/IHP/volumetric efficiency/Brake thermal efficiency/Specific fuel consumption and other parameters of engines.
CO6. Determine the performance parameters of Centrifugal compressors, gas turbine, aircrafts and rocket engines.

Change: 5 % change from previous curriculum

Books Recommended:

[1]. Mathur & Sharma, "*Internal combustion Engines*", Dhanpat Rai Publications, 2007.
[2]. Ganeshan V "*Internal Combustion Engines*", Tata Mc Graw Hill Publication, 1992.
[3]. Heywood J. B, "*Internal Combustion Engine Fundamentals",* Mc Graw Hill, 1988.
[4]. Khajuria P.R., Dubey S.P., *Gas Turbines & Propulsive Systems*, Dhanpat Rai Pub, 2005
[5]. Sarvanamatto, Cohen H, Rogers, "*Gas Turbine Theory",* Longmans Green, 1996
[6]. Yahya S. M., "*Turbines, Compressors and Fans*", Tata McGraw Hill Publications, 1996
[7]. Dr. R. Yadav, "*Steam and Gas Turbines",* Central publishing House, 2015
[8]. Dr. R. Yadav, *Applied Thermodynamics*, Central Publishing House, 2012
[9]. Ganesan V. *Gas Turbines*, Tata McGraw Hill Publications, 1999

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Course Outcome:

Students earned credits will develop ability to

CO.No.	CO	PO
CO1	Determine the air fuel ratio supplied by carburettor and MPFI system.	PO1, PO2, PO3
CO2	Determine the thermo chemistry of fuels.	PO1, PO3, PO4
CO3	Design and select the combustion chambers of SI Engines.	PO1, PO3, PO5
CO4	Draw the valve timing diagram of SI Engines (Four Stroke).	PO1, PO2, PO3
CO5	Determine the Torque/Mean effective pressure / BHP/FHP/IHP/volumetric efficiency/Brake thermal efficiency/Specific fuel consumption and other parameters of engines.	PO1, PO2, PO3, PO5, PO7, PO12
CO6	Determine the performance parameters of Centrifugal compressors, gas turbine, aircrafts and rocket engines.	PO1, PO2, PO7, PO12

CO-PO Relationship

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO1	3	3	3									
CO2	3		3	3								
CO3	3		3		3							
CO4	3	3	3									
CO5	3	3	3		3		2					2
CO6	3	3					2					2

* CO (rows) mention nil/very small/insignificant contribution to the PO(column)

1→ relevant and small significance 2 → medium or moderate and 3 →strong