<table>
<tr><td colspan="5">Devi Ahilya Vishwavidhyalaya, Indore, India
Institute of Engineering & Technology</td><td>III Year B. Tech. (Mechanical Engineering)</td></tr>
<tr><td>Course Code & Name</td><td colspan="5">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="3">5RMOE1

I.C. ENGINES AND JET PROPULSION</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per semester</td><td>Total Credits (Total Hours/30</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">90</td><td rowspan="2">3</td></tr>
<tr><td>20</td><td>10</td><td>0</td><td>60</td></tr>
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Course learning 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 Otto cycle, Diesel cycle, Stirling cycle 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, 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 methods and effects on engine performance.

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.

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

Course Outcome:

Students earned credits will develop ability to

No.	CO	PO
CO1	Understand the working of Actual operation of IC Engine, Valve timing diagram, Different fuels and their properties for IC Engine	PO1, PO2, PO3,
CO2	Understand mixture requirements, Combustion phenomenon, Ignition systems, ignition timing, firing order, and variable valve control, combustion chamber design for SI engines	PO1, PO2, PO3, PO4
CO3	Fuel injection computation in CI Engines, Design and selection the combustion chambers of CI Engines.	PO1, PO2, PO3, PO4, PO5

CO4	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, PO4, PO5, PO7, PO11
CO5	Determine the performance parameters of Centrifugal compressors, gas turbine, aircrafts and rocket engines.	PO1, PO2, PO3, PO4, PO7, PO11

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	2	2	2								
CO3	3	2	3	2	2							
CO4	3	3	3	3	3		2				3	
CO5	3	3	3	3			2				3	

* CO (rows) mention nil/very small/insignificant contribution to the PO (column)
1→ relevant and small significance 2 → medium or moderate and 3 →strong