



FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Engineering

Semester II

Course Code: 102440208

Course Title: Advance Internal Combustion Engines

Type of Course: Program Elective IV

Course Objectives: This subject is designed to provide advancement in the field of Internal combustion engines.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	40 /16	20/08	60/24	30/12	150/60

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	ENGINE DESIGN AND OPERATING PARAMETERS Engine operating cycles, spark ignition engine operation, compression ignition engine operation, geometrical properties of reciprocating engine, brake torque and power, mechanical efficiency, mean effective pressure, specific fuel consumption, air/fuel and fuel/air ratio, specific emission and emission index, engine design and performance data	6
2	COMBUSTION REACTIONS Stoichiometric equation for fuel air reaction, equivalence ratio, enthalpy of formation, first law analysis for steady state reacting system, enthalpy of combustion, internal energy of combustion and heating values, adiabatic combustion temperature, dissociation, chemically reacting gas mixture	7
3	GAS EXCHANGE PROCESSES Flow through valves, phase of the flow, scavenging in two stroke cycle engines, turbulence, swirl, squish, flow in intake manifolds, analysis of suction and exhaust processes, fuel injection systems, supercharging, turbocharging	8
4	COMBUSTION Combustion in SI engine with homogeneous air –fuel mixture, ignition and flame development, flame propagation and termination in SI engines, octane number, MPFI, combustion in CI engines, ignition delay, cetane number, cold weather problems, fuel spray structure, spray penetration.	6



5	EMISSION FROM IC ENGINES AND ITS CONTROL: Formation of nitrogen oxides, carbon monoxide, hydrocarbon emission in petrol and diesel engines, SI and CI engine particulates, soot formation and control, exhaust gas temperature, catalytic convertor, Indian emission standards for SI and CI engines	4
6	ALTERNATE FUELS FOR IC ENGINES: FUELS AND THEIR PROPERTIES : Hydrogen, bio gas, alcohols, producer gas, LPG, CNG, non-edible vegetable oils, nonedible wild oil, NH ₃ as substitute fuel for SI and CI engine, fuel additives, pros and cons of alternate fuels, biodiesel processing and production, fuels rating, coal gasification & liquefaction	4
7	RECENT DEVELOPMENTS IN IC ENGINES PIV in turbulence measurement, optical methods for flame velocity measurement, new materials for engine components, improved two stroke engines, hybrid engines and vehicles, lean burn engines, stratified charge engines, HCCI engines	4
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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
10%	20%	20%	25%	20%	05%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1	Internal Combustion Engine Fundamentals, John B. Heywood, McGraw Hill Education Pvt Ltd.
2	Fundamentals of Internal Combustion Engines, H N Gupta, PHI Learning
3	Internal Combustion Engine, V Ganeshan, McGraw Hill Education Pvt Ltd.
4	Internal Combustion Engine, M L Mathur and R P Sharma, Dhanpat Rai Publications (P) Ltd.
5	Internal Combustion Engines: Applied Thermo-sciences, Colin R Ferguson, John Wiley and Sons.
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Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Students able to know the basic parameters and engine design.	20
CO-2	Understand the operating characteristics of IC engines.	15
CO-3	Students able to analyse the chemical reaction and gas exchange during combustion.	15
CO-4	Students able to identify the emission gases and its control in IC Engine.	20
CO-5	Students able to know and identify the alternative fuel for IC Engine.	15
CO-6	Students able to demonstrate the measuring techniques in IC engine.	15
CO-7	Click or tap here to enter text.	Click
CO-8	Click or tap here to enter text.	Click
CO-9	Click or tap here to enter text.	Click
CO-10	Click or tap here to enter text.	Click



List of Practicals / Tutorials:

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1	To study about first law analysis for steady state reacting system and combustion stoichiometric.
2	To study the effect of A/F ratio on the performance of the two stroke single cylinder petrol engine.
3	To perform variable speed test of a multi / single cylinder petrol / diesel engine as per IS standard and prepare the curves of (i) BP, IP, FP Vs Speed (ii) Indicated specific fuel consumption Vs Speed
4	To find the indicated power on multi cylinder diesel engine / petrol engine by Morse test.
5	To find friction power of multi cylinder diesel engine / petrol engine by Willian's line method or motoring method
6	To evaluate comparative performance of CI engine operated with Diesel and Diesel/Biodiesel blend.
7	To prepare heat balance sheet on multi cylinder diesel engine / petrol engine.
8	To analyze the exhaust gases emission from single / multi cylinder petrol engine.
9	To study and draw the valve timing diagram four stroke petrol and diesel engine.
10	To study the emission norms.
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Supplementary learning Material:

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Curriculum Revision:

Version:	1
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22