

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE, JAIPUR
DEPARTMENT OF MECHANICAL ENGINEERING

Name of Subject :- INTERNAL COMBUSTION ENGINE

Subject Code :- 7ME5-11

Year :- 4th Year 7th Semester

Name of Faculty :- 1) Dr. Mahendra Pratap Singh , Professor

2) Mr. Rajendra Kumar Gupta, Assistant Professor

3) Mr. Ravi Yadav, Assistant Professor

7ME5-11 INTERNAL COMBUSTION ENGINE

[L/T/P - 3/0/0]

Class: B. Tech - 7th semester

External Marks: 120

Internal marks: 30

Total marks: 150

COURSE OUTCOMES:

On successful completion of this subject the student will be able to know:-

CO-1	To describe the working principle and performance of IC engines through thermodynamic cycle.
CO-2	To express the combustion phenomenon in I C Engine and Interpret different factor affecting on combustion
CO-3	To analyze the operations of various I C Engine systems
CO-4	To compare the specials and hybrid engines

JAIPUR ENGINEERING COLLEGE & RESEARCH CENTRE
DEPARTMENT OF MECHANICAL ENGINEERING
SUBJECT: Internal Combustion Engines[7ME5-11]
COs mapping with POs

SUBJECT	COURSE OUTCOME	Engineering Knowledge	Problem analysis	Design/Development of Solution	Conduct investigation of complex Problems	Modern Tool Usage	Interpersonal skills	Environment and Sustainability	Ethics	Individual and Team Work	Communication	Project Management and Finance	Life-long Learning	Professional skills	Others
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
7ME5-11 Internal Combustion Engines	To describe the working principle and performance of IC engines through thermodynamic cycle.	3	2	1	3	3	2	3	1	1	3	1	3	3	1
	To express the combustion phenomenon in IC Engine and Interpret different factor affecting on combustion	3	2	3	3	3	1	2	1	1	2	1	3	3	1
	To analyze the operations of various IC Engine systems	3	3	3	3	3	1	1	1	1	2	2	3	3	1
	To compare the specials and hybrid engines	3	3	2	3	3	1	3	1	1	3	2	3	3	1

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Scheme & Syllabus

IV Year- VII & VIII Semester: B. Tech. (Mechanical Engineering)

7ME5-11: I. C. Engines

Credit: 3 Max.
3L+0T+0P

Marks: 150(IA:30, ETE:120)
End Term Exam: 3 Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	History of IC engines: Nomenclature, Classification & Comparison, SI & CI, 4stroke- 2 stroke, First Law analysis, Energy Balance. Fuel air cycles, Actual cycles.	4
3	Testing & Performance: Performance parameters, Measurement of operating parameters e.g. speed, fuel & air consumption, Powers,IHP, BHP, FHP, Efficiencies Thermal, Mechanical, Volumetric, Emission Measurement, Indian & International standards of Testing, Emission.	4
4	Fuel & Combustion: Combustion in CI & SI engines, Ignition Limits, Stages of combustion, Combustion parameters. Delay period and Ignition Lag, Turbulence and Swirl, Effects of engine variables on combustion parameters, abnormal combustion in CI & SI engines, Detonation & knocking, Theories of detonation, Control of abnormal combustion, Combustion chamber design principles, Types of Combustion chamber.	4
5	Alternative Fuels: Methanol, Ethanol, Comparison with gasoline, Manufacturing, Engine performance with pure Methanol, Ethanol & blends, Alcohols with diesel engine, Vegetable oils, Bio	2
6	Engine Systems & Components: Fuel System (SI Engine), Carburetion & Injection, process & parameters, properties of A/F mixture, Requirements of A/F ratios as per different operating conditions, Carburetors, types, Aircraft carburettor, comparison of Carburetion & injection, F/A ratio calculations.	4
7	CI engine: Mixture requirements & constraints, Method of injection, Injection systems, CRDI etc. system components, pumps injectors.	3
8	Ignition system: Conventional & Modern ignition systems Magneto v/s Battery, CB point v/s Electronic ignition, Fuel Ignition Energy requirements. Spark advance, centrifugal, vacuum Firing order,spark plugs.	3
9	Engine Friction & Lubrication: Determination of friction, Lubrication principles, Types of lubrication, Places of lubrication Bearings and piston rings etc., Functions of Lubrication, Properties, Rating and Classification of lubricating oil, Additives, Lubrication systems. Engine Cooling: Requirements of cooling, Areas of heat flow,High temperature regions of combustion chamber. Heat Balance, Cooling Systems, Air, Water Cooling, Cooling system components.	5
10	Supercharging: Objectives, Thermodynamic cycle & performance of super charged SI & CI engines, Methods of super charging, Limitations, Two stroke engines: Comparison of 4s & 2s engines Construction & valve lining scavenging. Process parameters, systems, Supercharging of 2 stroke engines.	5
11	Dual & Multi fuel engines: Principle, fuels, Combustion, Performance Advantages, Modification in fuel system.	3
12	Special Engines: Working principles of Rotary, Stratified charge, Free piston, Variable compression ratio engines.	2
	Total	40

Department of Mechanical Engineering

LECTURE PLAN

Subject: :Internal Combustion Engine(7ME5-11)

Year/sem:
IV/VII

Faculty-Dr.M.P.Singh/R.K.Gupta/ Ravi Yadav

Unit No./ Total lec. Req.	Lecture No.	Topics	Objective of Unit	Outcome of Lecture(Student will be able to...)	Book Referred	From page to
Unit-1 (6)	1	1. Introduction,	To describe the working principle and performance of IC engines through thermodynamic cycle	Interact about the engine	T1	(T1)1-17
		2.Engine classification				
	2	3. Comparision B/W SI and CI.		compare between engines and fuel cycles	T1	(T1)18-30,117
		4. Fuel -Air Cycles.				
	3	5. Dissociation or Chemical Loss		know the chemical losses & analysis of engine cycle	T1,T3	(T1)121,(T3)21
		6. Actual Combustion Cycle.				
		6.a. First Law analysis of engine cycle.				
	4	7. Thermal Efficiency		know about the various efficiency	T1,T3	(T1)125,(T)323
		8. Volumetric Efficiency				
	5	9. Numericals		understand about the light duty diesel vehicles	T1	(T1)950
		10. Motor vehicle act				
		11. Light duty diesel vehicles				
	6	12. Fuels		know about the various fuels and pollution control	T1,T2	(T1)927,(T2)669
		13. Pollution Control System				
14. CMVR-Technical Standing Committee						
Unit-2 (10)	7	1. Combustion in CI Engine	To express the combustion phenomenon in IC Engines and Interpret different factor affection on combustion	know about the combustion and delay period in CI engine	T1	(T1)214
		2a. Variables affecting the delay peroid				
	8	2.b. Method of controlling Diesel knock		understand the diesel knock and air swirl in CI engine	T1	(T1)230
		3. Air Swirl in CI Engine				
	9	4. Combustion in SI Engine		understand the combustion in SI engine and engine variables	T1,T2	(T1)164,(T2)159
		5. Effect of Engine variables on Flame Propagation				
	10	6. Knocking & Detonation		differentiate between knocking & detonation	T1	(T1)177,181
		6.a. Theory of Detoation				
	11	6.b. Effect of Engine variables on knock		understand the design of combustion	T1	(T1)183,198
		7. Combustion Chamber Design				

			chamber		
	12	8. Fuels	know about solid fuels and their characteristics	T1,T3	(T1)263,(T3)164
		9. Solid Fuels and their Characteristics			
	13	10.a. Manufactured Solid Fuels and their Characteristics	know the manufactured solid & liquid fuels	T1	(T1)328
		11. Liquid Fuels and their Characteristics			
		11.a. Manufactured Liquid Fuels and their Characteristics			
	14	12. Gaseous Fuel and their Characteristics	know the gaseous fuels and their uses	T1	(T1)346
		13. Principles			
	15	14.Effects	know the effect of fuels and propulsion technology	T1	(T1)328
		15. Alternative Fuel and Propulsion Tech.			
	16	16. LPG	know about LPG and fuel cells	T1	(T1)307
		17. Fuel Cells			
		18 Current research Activity			
unit-3 (13)	17	1. Properties of fuel	understand the properties of fuel	T1,T3	(T1)332,418,(T3)163
		1.a. Quality of Fuel			
		1.b. Fuel Supply System in SI Engine			
	18	2. Fuel Systems	understand the working of fuel system	T1	(T1)361
		2.a. Carburetion			
	19	3. Carburettor	know the working of carburettor	T1,T2	(T1)388,(T2)249
		3.a. Simple Carburettor			
		3.a.1. Idling Circuit			
	20	4. Multi Jet Compensation	understand the working of solex carburettor	T1	(T1)382
		4.a. Solex Carburettor			
	21	5. Constant depression Carburetor	know about the aircraft engine carburetor	T1	(T1)393
		6. Aircraft Engine Carburetor			
	22	7. Ignition System types	understand the various ignition systems	T1	(T1)449-470
		7.a Coil ignition system			
	23	7.b Magneto ignition system	know the working of magneto and contact ignition system	T2	(T2)313
7.c Transistorized Assisted Contact Ignition System					
24	8. Firing Order	understand the various spark mechanism	T1,T2	(T1)468, T2-317	
	9. Centrifugal Advance Mechanism				
	10. DFIS in Gasoline engine				
25	10.a Gasoline Carburetion System	know the working of gasoline fuel injection mechanism	T1,T3	(T1)423,(T3)242	
	10.b Fuel Injection System				
	10.c Direct Injection				
			To analyze the operations of various IC Engine system		

		10.d Gasoline Direct injection			
	26	11. Diesel Engine Fuel Injection System		know the diesel fuel injection mechanism	T1 (T1)422
		12. Individual Pump Injection System			
	27	13. MPFI		understand the MPFI & Fuel injection pump	T1,T3 (T1)427,(T3)279
		14. Fuel System of Diesel Engine			
		15. Fuel injection Pump			
	28	16 CRDI		know the need of air fuel control and CRDI system	T3 (T3)653
		17. Air/Fuel Control			
	29	18. Fuel intake System		understand the construction & mechanism of spark plug & supercharger	T1,T3 (T1)466,591(T3)597
		20. Spark Plug			
		19 Supercharger			
Unit- 4 (5)	30	1. Friction	To analyze the operations of various IC Engine system	know the use of friction and lubricant	T1 (T1)486
		2. Lubricants			
	31	3. Types of lubricant		know about the cooling system	T1 (T1)519
		4. Cooling System			
	32	4.a. Pressure cooling system		understand the servicing of cooling system	T1 (T1)540
		4.b. Servicing & Cleaning of Cooling System			
	33	5. Lubrication system		need of lubrication and lubrication system	T1 (T1)508
		5.a Types of Lubrication			
		6. Troubles in Lubrication			
	34	7. Turbocharging		understand the turbocharging process	T1,T3 (T1)595,(T3)607
8. Scavenging					
Unit -5 (4)	35	1. Dual fuel	To compare the specials and hybrid engines	the use of dual fuel and natural gas	T3 (T3)654
		2. Natural Gas Injection			
	36	3. Special Engines		analysis between special engines and power	T1 (T1)822
		4. Rotary Engine Power			
	37	5. Combustion Management		know about the variable compression ratio	T3 (T3)704
		6. Variable Compression Ratio			
	38	7. Variable Height Piston		understand about the pistons and connecting rod linkage	T3 (T3)709
		8. Con Rod Linkages			
BS-1	39	Latest Trends in Vehicals			T4
BS-2	40	Materials used with advantages			T4

Recommended books:

T1-Mathur & Sharma, Internal Combustion Engines, Dhanpat Rai & Sons				
T2- R. Yadav, I.C Engine, Central Publishing House, Allahabad				
T3- Ganeshan, V., Internal Combustion Engine, Tata Mc Graw Hill.				
T4- John B. Heyword, Internal Combustion Engines Fundamentals, McGraw Hill				