



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Mechanical (I.C.Engine And Automobile Engineering)

Subject Code : ME02080011

Course / Subject Name : IC Engine and Automobile Technology

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	PCC

Prerequisite:	Basic knowledge in Mechanical/Automobile engineering and mechanical systems, particularly related to I.C. engines working and basics of various automobile system.
Rationale:	The course "IC engine and Automobile Technology" is designed to provide students with comprehensive knowledge and practical skills related to the design, analysis, and application of internal combustion engines and various automobile technologies. This is increasingly important as the automotive industry shifts towards sustainable and energy-efficient transportation solutions.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Understand Engine Types and Operating Principles.	U
2	Analyze Thermodynamic Cycles and Fuel-Air Mixtures.	A
3	Apply Knowledge of Gas Exchange and Volumetric Efficiency.	N
4	Evaluate and Design Fuel Supply Systems.	E
5	Develop Practical Understanding of Advanced I.C. Engine Technologies.	C

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to I.C Engine: Engine types and their operation;	10	24



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	classification; Two stroke engines; four stroke engines; characteristics of engines; air capacity of engine; valve timing diagram; importance of volumetric efficiency, Actual cycle; air fuel cycle, Thermochemistry of fuel air cycle: ideal gas model, First law of thermodynamics and combustion, second law of thermodynamics application on combustion.		
2.	Gas Exchange Processes: Inlet and exhaust processes in the four-stroke cycle, volumetric efficiency, quasi-static and dynamic effects, flow through valves, scavenging in two- stroke cycle engines, scavenging parameters and models, actual scavenging processes, flow through ports, supercharging and turbo-charging: basic relationships, compressors, turbines characteristics, matching of compressor, turbines and engine characteristics.	09	19
3.	Fuel Supply in SI and CI Engines: Carburetion and mixture requirements; Transfer pump; Carburetors - types, constructional and design aspects; Mixture distribution and inlet manifold; The concept of multipoint fuel injection system, Fuel Supply in CI Engines; Injection system components; Jerk and Distributor pumps; Mechanical and Pneumatic governors; Injectors. CRDI system	08	19
4.	Fundamentals of Automotive Electronics, Microprocessor and micro computer applications in automobiles, Components for engine management system: Variable valve timing control, exhaust emission control, fault diagnostic systems. Developments in I. C. Engines: Stratified Charged; Low heat rejection engine; four / three valve engine; MPFI; VVT; cam less engine.	08	14
6	Automotive systems; Basic transmission systems: synchromesh gearbox, semi-automatic and automatic transmission; suspension systems; steering systems; tyre and wheel; Braking System: hydraulic brakes, ABS & EBD; Troubleshooting and repairs.	10	24
Total		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	30	25	--	--



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Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Introduction to Internal Combustion Engines”, Richard Stone, McMillan,London
2. Internal Combustion Engines Fundamentals – John B. Heyhood, McGrawHill
3. Vehicle and Engine Technology – HeinHeister
4. I.C. Engine by Maleev V. L., McGraw Hill Book,Co.
5. I. C. Engines –Ferguson
6. I. C. Engines – C. Fayette Taylor & Edward S. Taylor, International text book
7. I. C. Engine & Air Pollution – E. F. Obert, Harper & Row Publishers, NewYork
8. Automotive Engines - Herbert E. Ellinger
9. Automobile Electrical & Electronic systems – Tom denton – Elsevier publication
10. Fundamentals of Automotive Electronics - V. A. W.Hilliers - Hatchin,London
11. I.C Engine, R.K. Singhal
12. I.C Engine, Domkundwar

(b) Open-source software and website:

1. E-materials available at the website of NPTEL- <http://nptel.ac.in/>

Suggested Course Practical List: If any

1. Study of the working of four stroke and two stroke engine.
2. Study of actual valve timing diagram for four stroke SI and CI engine.
3. Study of the thermodynamics of the combustion of actual fuel air cycle.
4. Study of scavenging process in two stroke engines.
5. Study of the various carburetor used in SI engine.
6. Study of the gasoline direct injection system used in vehicles.
7. Study of the CRDI system used in CI engines.
8. Study of the Engine management system used to control the valve timing and its effect on performance.
9. Study the stratified charge and HCCI engines.
10. Study the ABS and EBD used in modern vehicle brake system.
11. Evaluate the Engine performance for the various liquid fuel.



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List of Laboratory/Learning Resources Required:

- Necessary instruments, kits and apparatus are to be provided for conducting above said practical in a group of maximum four students.

Suggested Project List:

The following project ideas are designed to provide practical experience and deeper understanding of the concepts covered in the "Electrical and Hybrid Vehicle" course. These projects aim to address real-world challenges and innovations in the field of electric and hybrid vehicles.

1. Design and Analysis of Valve Timing Optimization.
2. Comparison of Efficiency in Two-Stroke vs. Four-Stroke Engines.
3. Study on Thermal Efficiency in Actual vs. Air-Fuel Cycles.
4. Simulation of Scavenging in Two-Stroke Engines.
5. Supercharging and Turbocharging Design Analysis.
6. Port Flow Characterization in Engine Heads.
7. Design of an Efficient Multipoint Fuel Injection System.
8. Development of Low-Cost Carburetor for Small Engines.
9. Analysis of Fuel Spray Characteristics in CI Engines.
10. Design and Implementation of a Stratified Charge Engine.
11. Retrofitting Variable Valve Timing (VVT) in Small Engines.
12. Experimental Study on Low Heat Rejection (LHR) Engines.

These projects aim to provide practical experience and enhance understanding of key concepts in IC engine and Automobile Technology, preparing students for future challenges and innovations in the field

Suggested Activities for Students: Engaging students in practical activities is crucial for enhancing their understanding and skills in the field of IC engine and Automobile Technology. Here are suggested activities that can complement the theoretical learning and laboratory experiments:

1. Field Trips and Industry Visits:
2. Guest Lectures and Expert Talks:
3. Technical Workshops and Hands-on Training:
4. Design and Innovation Challenges:
5. Research Projects on Emerging Technologies:
6. Case Studies and Problem-Based Learning:
7. Simulation Exercises:
8. Public Awareness Campaigns:
9. Hackathons and Prototyping Events:
10. Internships and Industry Projects:



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These activities are designed to complement classroom learning and laboratory experiments, providing students with a holistic educational experience in the field of electrical and hybrid vehicles. They promote practical skills development, critical thinking, and preparation for future careers in the evolving automotive industry.

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