

GUJARAT TECHNOLOGICAL UNIVERSITY

AUTOMOBILE ENGINEERING (02)

AUTOMOBILE ENGINES

SUBJECT CODE: 2140203

B.E. 4th SEMESTER

Type of course: Basics and Fundamental

Prerequisite: Elements of Mechanical Engineering

Rationale: The course aims to impart basic skills for understanding of construction of automobile engines working principle and performance under various conditions.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	2	5	70	20	10	20	10	20	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Engine Construction and Operation: Constructional details of 4-stroke engines.. Working principle, Otto, Diesel cycle , valve timing diagrams and actual indicator diagram. Diesel and Petrol fuels, Ignition quality. Octane & Cetane numbers.	5	10
2	Two stroke engine construction and operation. Comparison of four stroke and two-stroke engine operation.Their port timing diagrams. Firing order and its significance.	4	8
3	SI Engine Fuel System: Carburettor working principle. Requirements of an automotive carburettor; Starting, idling, acceleration and normal circuits of carburettors, compensation, Maximum power devices, constant choke and constant vacuum carburettors. Fuel feed systems,Mechanical and electrical pumps. Petrol injection. LPG and CNG fuel systems. MPFI systems for petrol.	6	14
4	CI Engine Fuel System: Fuel Injection System: Requirements, Air and solid injection, function of components, Jerk and distributor type Pumps. Pressure waves,Injection lag, Unit injector, Mechanical and Pneumatic governors. Fuel injector-types of injection nozzle, Spray characteristics, injection timing, pump calibration. CRDI systems for diesel.	5	10
5	Cooling and Lubrication System: Need for cooling system. Types of cooling system, Liquid cooled system, Thermosyphon system, and Pressurecooling system. Lubrication system, Mist lubrication system, Wet sump and dry sump lubrication. Properties of lubricants. Properties of coolants.	5	10
6	Combustion and Combustion Chambers: Combustion in IC engines, stages of combustion, flame propagation, rate of pressure rise,	5	10

	abnormal combustion, knocks. Effect of engine variables and knock. Combustion chambers, Different types, Factor controlling combustion chamber design.		
7	Types of Scavenging. Theoretical scavenging methods. Scavenging pumps	3	6
8	Supercharging and Turbo charging: Necessity and limitation, Charge cooling, Types of supercharging and turbo charging, relative merits, Matching of turbocharger.	6	14
9	Engine Testing and Performance: Automotive and stationary, engine testing and related standards. Engine power and efficiencies.	4	8
10	Performance Characteristics. Variables affecting engine performance. Methods to improve engine performance. Heat balance. Performance Maps and Drivability Diagnosis.	5	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
15	16	15	14	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate and above Levels (Revised Bloom's Taxonomy)

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. Ganesan.V. Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.
2. Heldt.P.M, High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
3. Obert.E.F, International Combustion Engines Analysis and Practice, International Text Book Co., Scranton, Pennsylvania, 1988.
4. Automotive Engines (McGraw-Hill International Editions: Automotive Technology Series) Paperback – International Edition, September 1, 1994 by William H. Crouse and Donald Anglin.
5. Ellinger.H.E, Automotive Engines, Prentice Hall Publishers, 1992
6. Maleev.V.M, Diesel Engine Operation and Maintenance, McGraw Hill, 1974.
7. Dicksee.C.B, Diesel Engines, Blackie & Son Ltd., London, 1964.

Course Outcome:

After learning the course the students should be able to:

Understanding of the basic working principles of engines, its Construction and Operation, phenomena of Combustion and Design of Combustion Chambers, Engine Testing and Performance and Performance characteristics.

List of Experiments:

1. To identify the major components of different automobile engines
2. To study two stroke cycle engine.
3. To study four stroke CI and SI engine.
4. To study the fuel supply system of petrol & diesel engines and represent the same in sketches
5. To study the engine lubrication system circuit.
6. To diagnose Electronic Fuel Injection (EFI) system with Diagnostic Readout Tester /Engine scanner.
7. To analyze Computerized Exhaust Gas of a petrol engine, & a diesel engine; and, to compare the output value to the prescribed limit set by the Government.
8. To perform the Morse Test on I.C. engine.
9. To perform the Heat Balance Test on petrol / diesel engine.
10. To study the performance characteristics of petrol / diesel engine by using an engine test rig.

Design based Problems (DP)/Open Ended Problem:

To calculate the mean effective pressure from given data for to start of design of I.C. engine

Major Equipment:

1. Multi Cylinder Petrol Engine
2. Multi Cylinder Diesel Engine
3. Petrol and Diesel fuel systems
4. Ignition system of petrol/gas engines
5. Cut section models of multicylinder I.C. engines with drive. : 1 no for petrol and 1 no. for diesel engine.

List of Open Source Software/learning website:

1. <http://nptel.ac.in/>
2. www.learnerstv.com
3. <http://auto.howstuffworks.com/>
4. nptel.iitk.ac.in/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.