GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Automobile Engineering

Course / Subject Code : DI03002021

Course / Subject Name : Automobile Engine

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC

Prerequisite:	
Rationale:	While playing a major role of transportation, automobile sector also plays a pivotal role in world economy and other areas of human life. And heart of any vehicle is its engine. Ability to perform various task of any vehicle directly depend on performance and capacity of an engine. Utmost automobile vehicles are powered by petrol, natural gas, and flex-fuel and diesel fuel-based engine. Hence the fundamental knowledge of automobile engine and its associated system like fuel supply system, cooling system, lubricating system etc. are most essential. This course is helpful for learner to understand basic fundamentals of engine working, identifying and locating parts, components and assemblies of engine. This course is pre-requisite for maintenance and service-I.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Interpret engine fundamental, terminology and specification.	R & U
02	Illustrate function of engine components.	U & A
03	Illustrate different components of fuel supply systems for SI & CI Engines.	U & A
04	Describe the different component of cooling system with reference to their construction and working.	R & U
05	Describe the different component of lubricating system with reference to their construction and working.	R & U

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

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

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	1.1 Brief introduction history of automobile vehicles and evolution of automobile engine. 1.2 Definition of Internal Combustion Engine. 1.3 Engine terminology: bore, stroke, clearance volume, swept volume, TDC, BDC, compression ratio, mean effective pressure, Volumetric efficiency, indicated power, break power, friction loss, mechanical efficiency, thermal efficiency, power and torque. 1.4 Classification of Internal Combustion Engine on basis of its working and construction, operating principal and basic Engine cycle: - Four stroke spark ignition engine cycle. - Four stroke compression ignition engine cycle 1.5 Engine specification details for single cylinder and multi cylinder engine.	07	14%
2.	2.1 Construction, functions, requirement, working process, engineering material, manufacturing process involved for making and engineering considerations for following engine components, sub-assemblies and system. - Piston - Piston rings - Cylinder liner	08	20%

	- Cylinder block - Connecting rod - Crankshaft - Camshaft - Crankcase - Flywheel - Engine head assembly - Combustion chamber 2.2 Construction, functions, requirement and working process of following engine components, sub-assemblies and system. - Intake manifold - Air filter - Exhaust manifold - Intake & exhaust valves - Catalytic converter - Resonator - Muffler - Engine Pulley - Timing belt - Gasket - Bearings use in engine. 2.3 Requirement of combustion chamber in S.I. and C.I engine. - Types of combustion chamber and its effects on combustion process. 2.4 Valve timing diagram for four stroke spark ignition and compression ignition engine. 2.5 Construction, functions and working of following valve timing mechanism - Push rod and rocker arm - Single Over Head Camshaft (SOHC) - Dual Over Head Camshaft (DOHC) - Variable Valve Timing. 2.6 Engine Ignition Timing, firing order 2.7 Types of Engine mounting and vibration damper.		

3.	3.1 Requirement of fuel supply system for engine. 3.2 Define air-fuel ratio, stoichiometric air–fuel ratio and lean & rich air-fuel ratio. 3.3 Engine operational modes and air fuel ratio requirements. 3.4 Basic working principal of carburation process. - Construction and working details of simple carburetor. - List merit and demerit of carburetor-based fuel supply system. 3.5 Construction, functions, types and working details of following components of fuel supply system. - Fuel tank - Electronic fuel pump - Fuel filters - Canister - Fuel line and fittings - High pressure fuel pump - Throttle body - Intake manifold, port and runner. - Fuel water separator 3.6 Construction, working and type of fuel injectors. 3.7 Define fuel atomization process and important of atomization process. 3.8 Basic principle and working of Electronic Fuel Injection system. - Throttle Body Injection (TBI) system. - Port Fuel Injection (PFI) system. - Multiport injection (MPI) - Sequential fuel injection (SFI) 3.9 Common Rail Diesel Fuel Injection (CRDI) system. 3.10 Gasoline Direct Injection (GDI) System. Advantages of Gasoline Direct Injection (GDI) System.	15	32%
4.	4.1 Requirement of cooling system in internal combustion engine. 4.2 Types of cooling system use in engine. 4.3 Construction, working of liquid cooling system and its components. - Thermostat - Water pump	8	20%

	- Water jacket - Upper and lower radiator hose - Radiator - Cooling fan - Electric cooling fan - Coolant temperature sensor - Radiator expansion tank and radiator cap 4.4 Characteristics, properties, purpose and types of coolant use in liquid cooling system. 4.5 Causes of overheating. 4.6 Disposable techniques used for engine coolant.		
5.	5.1 Requirement and importance of lubricating system in engine. 5.2 Properties, additives and types of engine oil. 5.3 SAE & API rating of engine oils. 5.4 Types of lubricating system. 5.5 Construction, working of splash, dry sump, wet sump and pressure feed lubrication system and its components. 5.6 Disposable techniques used for engine oil.	7	14%
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
40	**40**	**20**	**-**	**-**	**-**

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:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Automobile Mechanics	William Crouse	Tata Mc-Graw Hill Publication ISBN-13:978-0-07-063435-0

2	Automotive engine Theory and servicing	James D Halderman	Pearson Education ISBN-13: 978-0134654003
3	Automobile Engg Vol-1	Anil Chhikara	Satya Prakashan ISBN:9788176845051
4	Automobile engineering	R B Gupta	Satya Prakashan, New Delhi ISBN: 9788176848589, 8176848581
5	Automobile engineering	K. M. Gupta	Umesh Publication ISBN: 818811422005
6	Automobile Engineering: Volume 1	Singh Kirpal	Standard Publishers ISBN: 9788180141713, 9788180141713
7	Automobile Engineering	Jain K K Asthana	McGraw Hill Education, New Delhi ISBN: 978-0-07-044529-1

(b) Open source software and website:

1. https://nptel.ac.in
2. https://swayam.gov.in
3. https://vlab.co.in

Suggested Course Practical List:

Sr. No	Practical Outcomes (PrOs)		Unit No.	Approx. Hrs. required
1	Interpret four-stroke Otto-cycle using cut-section of four-stroke petrol engine and prepare specification list for petrol engine.	Any one	I	04
2	Interpret four-stroke Diesel-cycle using cut-section of four-stroke diesel engine and prepare specification list for diesel engine.		I	04
3	Identify, locate & constructional and functional details of components, assembly and sub-assembly of four-stroke single or multi -cylinder petrol/diesel cut-section engine.		II	06

4	Draw valve timing diagram of four-stroke petrol/diesel engine referring single cylinder four-stroke petrol/diesel cut-section engine model.	Any one	II	04
5	Identify components and illustrate working of Single Over Head Camshaft (SOHC) and Dual Over Head Camshaft (DOHC). Measure tappet clearance.		II	04
6	Identify and locate basic components of fuel supply system, electronic sensors and control module of single or multi-cylinder petrol engine (BS-IV or BS-VI).	Any two	III	04
7	Identify and locate basic components of fuel supply system, electronic sensors and control module of single or multi-cylinder diesel engine (BS-IV or BS-VI).		III	04
8	Compare construction details of mechanical and electronic fuel injector.		III	04
9	Identify and locate part, components and electronic parts involved in construction of coolant-based engine cooling system.	Any one	IV	04
10	Prepare list for petrol and diesel engine coolant, discuss major characteristic and property difference based on coolant grade and type.		IV	04
11	Identify and locate, components of engine lubrication system. Perform engine lubrication oil level and quality check test using dipstick.		V	04
	Total Hrs.			**30**

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Demonstration model of four stroke (single/multi-cylinder) Petrol/Diesel engine should have following requirements: • Engine model in working condition • Fuel injector-based fuel supply system	1,2

	• Equipped with electronic ignition system and basic sensors for engine management system. • Having complete setup with intake system and exhaust system. • Engine unit mounted on M.S frame with engine vibration damper for control engine vibration while working and have proper anchor points for mounting on laboratory floor. • Complete unit and its components are coated with attractive color for identify various engine system.	
2	Cut section model of two stroke single cylinder petrol engine. Cut-section model should have following requirements: • Equipped with electric motor for engine motoring purpose or manual handle bar. • Complete unit and its components will be coated with attractive color for identify various engine system components and assembly. • Cut- section working model of two stroke petrol/diesel engine mounted on M.S. stand.	1&2
3	Cut-section model of four stroke multi-cylinder petrol engine. Cut-section model should have following requirements: • Cut-section have internal view of piston, connecting rod and crankshaft mechanism. • Single/Double overhead camshaft. • Modern fuel injection system. • Detail internal constructional view of engine head. • Pressure feed lubrication system. • Complete exhaust system with catalytic converter and tail pipe. • Lubrication and cooling system with internal constructional view. • Coolant base engine cooling system.	3,9,10,11

	• Complete engine cut-section is coated with attractive color for identify various engine system. • Engine unit mounted on M.S frame and have proper anchor points for mounting on laboratory floor.	
4	Cut-section model of four stroke multi-cylinder diesel engine. Cut-section model should have following requirements: • Cut-section have internal view of piston, connecting rod and crankshaft mechanism. • Single/Double overhead camshaft. • Modern fuel injection system. • Detail internal constructional view of engine head. • Equipped with single or double turbocharge induction system with intercooler. • Complete exhaust system with catalytic converter and tail pipe. • Lubrication and cooling system with internal constructional view. • Coolant base engine cooling system. • Complete engine cut-section is coated with attractive color for identify various engine system. • Engine unit mounted on M.S frame and have proper anchor points for mounting on laboratory floor.	3,9,10,11
5	Demonstrate models of various type of valve mechanism are used in petrol & diesel four stroke engine. • Single or double overhead camshaft. • Cross-sectioned various parts to show internal operation and working of vale train mechanism.	4,5
6	Demonstration board of fuel supply system (MPFI/TSI/GDI) used in four stroke petrol engines (BS-IV or BS-VI) with requirements mentioned in following points.	6

	• Original components of fuel supply system are mounted on a panel. All the components are labelled for better understanding. An electric motor driven system is supplied to demonstrate fuel delivery system. • Demonstration board should have following components: - Sensors:- lambda sensor, engine speed sensor, cam position sensor, throttle position sensor, mass air flow sensor, intake manifold pressure sensor etc. - Inlet manifold with pressure gauge/sensor. - Fuel filters - Fuel injector - Throttle body - Canister purge valve - Electronic control unit and fuel supply system electric and electronic wiring harness. - Small fuel tank - Primary & secondary fuel pump - Fuel rails - Fuel hoses - Fuel injector sequence simulator with variable speed drive.	
7	Demonstration board of fuel supply system (CRDI) used in four stroke diesel (BS-IV or BS-VI) engines with requirements mentioned in following points. • Original components of fuel supply system are mounted on a panel. All the components are labelled for better understanding. An electric motor driven system is supplied to demonstrate fuel delivery system. • Demonstration board should have following components: - Air pressure sensor, Camshaft position sensor, Crankshaft sensor, lambda sensor, engine speed sensor, mass air flow sensor, intake manifold pressure sensor etc.	7

	- Electronic control unit and fuel supply system electric and electronic wiring harness. - Fuel injector and rail assembly - Fuel pressure sensor and fuel rail pressure regulator - Fuel water separator unit - Optimum size fuel tank - Primary & secondary fuel pump - Fuel hoses - Fuel injector sequence simulator with variable speed drive.	
8	Demonstration model of various types of mechanical and electronic operated fuel pump and fuel injector used in fuel supply system of single/multi-cylinder petrol & diesel engine.	8
9	Demonstration model of various types of thermostat unit, radiator, radiator fan, cold and hot coolant hoses used in coolant-based engine cooling system.	9

Suggested Project List:

Make a few engine components / their model using suitable material like thermocol/wood/ plastic.
Select any one type IC engine, search information on any system from website and prepare report for the same.
Collect the data of different types of engines and writes a report on it.
Observe the engine on different fuel basis and identify their different parts.
Calculate the swept volume & compression ratio of a single cylinder engine assuming the clearance volume.
Prepare report on different engine identification.
Draw neat sketch on Valve mechanism.
Collect the data of coolant with its properties and write a report on it.

Prepare PPT or Poster presentation on different type of Lubrication Systems.
Collect the data of different types of Advance engine systems and writes a report on it.
Visit nearby authorized garage/workshop and make a report on different engine technologies.

Suggested Activities for Students: If any

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of each activity. They should also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Charts can be prepared.
b) Small report on any topic given by concern faculty.
c) Small groups of students can be formed for assigned work. Assigned work should be such that it covers market survey, team work, presentation, time management, quality development.

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