

**GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)**

**Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)  
Semester -III**

Course Title: **Automobile Engine**  
(Course Code: 4330201)

<b>Diploma programme in which this course is offered</b>	<b>Semester in which offered</b>
Automobile Engineering	3rd

**1. 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, 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.

**2. COMPETENCY**

The course content should be taught and curriculum should be implemented with the aim to develop different types of skills leading to the achievement of the following competency.

- **Apply the knowledge of construction and working of IC-engine components and its associated systems.**

**3. COURSE OUTCOMES (COs)**

The underpinning knowledge and the relevant skills associated with this competency are to be developed in the student to display the following COs:

- a) Interpret engine fundamental, terminology and specification.
- b) Illustrate function of engine components.
- c) Illustrate different components of fuel supply systems for SI & CI Engines.
- d) Describe the different component of cooling system with reference to their construction and working.
- e) Describe the different component of lubricating system with reference to their construction and working.

#### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			C	CA	ESE	CA	ESE	
3	0	2	4	30*	70	25	25	150

(\*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

**Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, CA - Continuous Assessment; ESE - End Semester Examination.

#### 5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. *These PrOs need to be attained to achieve the COs.*

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	04
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
<b>Total Hrs.</b>				<b>28</b>

**Note**

- i. More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.
- ii. Care must be taken in assigning and assessing study report as it is a study report. Study report, data collection and analysis report must be assigned in a group. Teacher has to discuss about type of data (which and why) before group start their market survey.
- iii. The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course required which are embedded in the COs and ultimately the competency.

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Identify engine component, its location in engine assembly and describe its function and working.	40
2	Prepare neat sketch, layout with name of component.	20
3	Answer to question	20
4	Timely completion of tasks	20
<b>Total</b>		<b>100</b>

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

These major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical in all institutions across the state.

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: <ul style="list-style-type: none"> <li>• Engine model in working condition</li> <li>• Fuel injector-based fuel supply system</li> <li>• Equipped with electronic ignition system and basic sensors for engine management system.</li> <li>• Having complete setup with intake system and exhaust system.</li> </ul>	1,2

	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Complete unit and its components are coated with attractive color for identify various engine system.</li> </ul>	
2	<p>Cut section model of two stroke single cylinder petrol engine. Cut-section model should have following requirements:</p> <ul style="list-style-type: none"> <li>• Equipped with electric motor for engine motoring purpose or manual handle bar.</li> <li>• Complete unit and its components will be coated with attractive color for identify various engine system components and assembly.</li> <li>• Cut- section working model of two stroke petrol/diesel engine mounted on M.S. stand.</li> </ul>	1&2
3	<p>Cut-section model of four stroke multi-cylinder petrol engine. Cut-section model should have following requirements:</p> <ul style="list-style-type: none"> <li>• Cut-section have internal view of piston, connecting rod and crankshaft mechanism.</li> <li>• Single/Double overhead camshaft.</li> <li>• Modern fuel injection system.</li> <li>• Detail internal constructional view of engine head.</li> <li>• Pressure feed lubrication system.</li> <li>• Complete exhaust system with catalytic converter and tail pipe.</li> <li>• Lubrication and cooling system with internal constructional view.</li> <li>• Coolant base engine cooling system.</li> <li>• Complete engine cut-section is coated with attractive color for identify various engine system.</li> <li>• Engine unit mounted on M.S frame and have proper anchor points for mounting on laboratory floor.</li> </ul>	3,9,10,11
4	<p>Cut-section model of four stroke multi-cylinder diesel engine. Cut-section model should have following requirements:</p> <ul style="list-style-type: none"> <li>• Cut-section have internal view of piston, connecting rod and crankshaft mechanism.</li> <li>• Single/Double overhead camshaft.</li> <li>• Modern fuel injection system.</li> <li>• Detail internal constructional view of engine head.</li> <li>• Equipped with single or double turbocharge induction system with intercooler.</li> </ul>	3,9,10,11

	<ul style="list-style-type: none"> <li>• Complete exhaust system with catalytic converter and tail pipe.</li> <li>• Lubrication and cooling system with internal constructional view.</li> <li>• Coolant base engine cooling system.</li> <li>• Complete engine cut-section is coated with attractive color for identify various engine system.</li> <li>• Engine unit mounted on M.S frame and have proper anchor points for mounting on laboratory floor.</li> </ul>	
5	<p>Demonstrate models of various type of valve mechanism are used in petrol &amp; diesel four stroke engine.</p> <ul style="list-style-type: none"> <li>• Single or double overhead camshaft.</li> <li>• Cross-sectioned various parts to show internal operation and working of vale train mechanism.</li> </ul>	4,5
6	<p>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.</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• Demonstration board should have following components: <ul style="list-style-type: none"> <li>- Sensors:- lambda sensor, engine speed sensor, cam position sensor, throttle position sensor, mass air flow sensor, intake manifold pressure sensor etc.</li> <li>- Inlet manifold with pressure gauge/sensor.</li> <li>- Fuel filters</li> <li>- Fuel injector</li> <li>- Throttle body</li> <li>- Canister purge valve</li> <li>- Electronic control unit and fuel supply system electric and electronic wiring harness.</li> <li>- Small fuel tank</li> <li>- Primary &amp; secondary fuel pump</li> <li>- Fuel rails</li> <li>- Fuel hoses</li> <li>- Fuel injector sequence simulator with variable speed drive.</li> </ul> </li> </ul>	6
7	<p>Demonstration board of fuel supply system (CRDI) used in four stroke diesel (BS-IV or BS-VI) engines with requirements</p>	7

	<p>mentioned in following points.</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• Demonstration board should have following components: <ul style="list-style-type: none"> <li>- Air pressure sensor, Camshaft position sensor, Crankshaft sensor, lambda sensor, engine speed sensor, mass air flow sensor, intake manifold pressure sensor etc.</li> <li>- Electronic control unit and fuel supply system electric and electronic wiring harness.</li> <li>- Fuel injector and rail assembly</li> <li>- Fuel pressure sensor and fuel rail pressure regulator</li> <li>- Fuel water separator unit</li> <li>- Optimum size fuel tank</li> <li>- Primary &amp; secondary fuel pump</li> <li>- Fuel hoses</li> <li>- Fuel injector sequence simulator with variable speed drive.</li> </ul> </li> </ul>	
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

## 7. AFFECTIVE DOMAIN OUTCOMES

The following *sample* Affective Domain Outcomes (ADOs) are embedded in many of the above mentioned COs. More could be added to fulfil the development of this course competency.

- a) Work as a leader/a team member.
- b) Follow ethical practices.
- c) **Practice environmental friendly methods and processes. (Environment related)**

The ADOs are best developed through the field based exercises/project work. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- i. 'Valuing Level' in 1<sup>st</sup> year
- ii. 'Organization Level' in 2<sup>nd</sup> year.
- iii. 'Characterization Level' in 3<sup>rd</sup> year.

## 8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
<b>Unit I Introduction of IC engine</b>	1.a Define internal combustion engine. 1.b Classify internal combustion engine. 1.c Define engine working parameters. 1.d Identify engine components and explain its importance for working of engine. 1.e Compare engines on basis of engine specifications.	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.
<b>Unit II Constructional and functional details of I.C engine components</b>	2.a Identify and locate components of engine. 2.b List engineering materials of engine component. 2.c State importance and significance of engine parts, components and assemblies. 2.d Compare various valve timing mechanism.	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

	<p>2.e Define engine valve timing and firing order.</p>	<ul style="list-style-type: none"> <li>- Cylinder liner</li> <li>- Cylinder block</li> <li>- Connecting rod</li> <li>- Crankshaft</li> <li>- Camshaft</li> <li>- Crankcase</li> <li>- Flywheel</li> <li>- Engine head assembly</li> <li>- Combustion chamber</li> </ul> <p>2.2 Construction, functions, requirement and working process of following engine components, sub-assemblies and system.</p> <ul style="list-style-type: none"> <li>- Intake manifold</li> <li>- Air filter</li> <li>- Exhaust manifold</li> <li>- Intake &amp; exhaust valves</li> <li>- Catalytic converter</li> <li>- Resonator</li> <li>- Muffler</li> <li>- Engine Pulley</li> <li>- Timing belt</li> <li>- Gasket</li> <li>- Bearings use in engine.</li> </ul> <p>2.3 Requirement of combustion chamber in S.I. and C.I engine.</p> <ul style="list-style-type: none"> <li>- Types of combustion chamber and its effects on combustion process.</li> </ul> <p>2.4 Valve timing diagram for four stroke spark ignition and compression ignition engine.</p> <p>2.5 Construction, functions and working of following valve timing mechanism</p> <ul style="list-style-type: none"> <li>- Push rod and rocker arm</li> <li>- Single Over Head Camshaft (SOHC)</li> <li>- Dual Over Head Camshaft (DOHC)</li> <li>- Variable Valve Timing.</li> </ul> <p>2.6 Engine Ignition Timing, firing order</p>
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		2.7 Types of Engine mounting and vibration damper.
<b>Unit III</b> <b>Fuel supply system for petrol and diesel engine</b>	<p>3.a State importance of fuel supply system for petrol and diesel engine</p> <p>3.b Explain air fuel ratio and importance of air fuel ratio on engine operational modes.</p> <p>3.c State advantages of electronic fuel injection system over the carburetor system.</p> <p>3.d Identify the components of a fuel supply system and define the purpose of each.</p> <p>3.e Explain the differences about the fuel injection point location in the throttle body or port injection systems</p> <p>3.f Describe the difference between a sequential fuel injection (SFI) system and a multiport fuel injection (MFI) system.</p> <p>3.g Describe the operation of direct gasoline injection systems.</p>	<p>3.1 Requirement of fuel supply system for engine.</p> <p>3.2 Define air-fuel ratio, stoichiometric air-fuel ratio and lean &amp; rich air-fuel ratio.</p> <p>3.3 Engine operational modes and air fuel ratio requirements.</p> <p>3.4 Basic working principal of carburation process.</p> <ul style="list-style-type: none"> <li>- Construction and working details of simple carburetor.</li> <li>- List merit and demerit of carburetor-based fuel supply system.</li> </ul> <p>3.5 Construction, functions, types and working details of following components of fuel supply system.</p> <ul style="list-style-type: none"> <li>- Fuel tank</li> <li>- Electronic fuel pump</li> <li>- Fuel filters</li> <li>- Canister</li> <li>- Fuel line and fittings</li> <li>- High pressure fuel pump</li> <li>- Throttle body</li> <li>- Intake manifold, port and runner.</li> <li>- Fuel water separator</li> </ul> <p>3.6 Construction, working and type of fuel injectors.</p> <p>3.7 Define fuel atomization process and important of atomization process.</p> <p>3.8 Basic principle and working of Electronic Fuel Injection system.</p> <ul style="list-style-type: none"> <li>- Throttle Body Injection (TBI) system.</li> <li>- Port Fuel Injection (PFI) system.</li> <li>- Multiport injection (MPI)</li> <li>- Sequential fuel injection (SFI)</li> </ul> <p>3.9 Common Rail Diesel Fuel Injection (CRDI) system.</p>

		3.10 Gasoline Direct Injection (GDI) System. Advantages of Gasoline Direct Injection (GDI) System.
<b>Unit IV Cooling system of IC engine</b>	<p>4.a List and describe the major components of the cooling system.</p> <p>4.b Describe the operation of the cooling system.</p> <p>4.c Describe the function of the water pump, radiator, radiator cap, thermostat, and thermostat in the cooling system.</p> <p>4.d Differentiate various coolant referring coolant grade and ratings.</p>	<p>4.1 Requirement of cooling system in internal combustion engine.</p> <p>4.2 Types of cooling system use in engine.</p> <p>4.3 Construction, working of liquid cooling system and its components.</p> <ul style="list-style-type: none"> <li>- Thermostat</li> <li>- Water pump</li> <li>- Water jacket</li> <li>- Upper and lower radiator hose</li> <li>- Radiator</li> <li>- Cooling fan</li> <li>- Electric cooling fan</li> <li>- Coolant temperature sensor</li> <li>- Radiator expansion tank and radiator cap</li> </ul> <p>4.4 Characteristics, properties, purpose and types of coolant use in liquid cooling system.</p> <p>4.5 Causes of overheating.</p> <p>4.6 Disposable techniques used for engine coolant.</p>
<b>Unit V Lubricating system of IC engine</b>	<p>5.a List and describe major components of the lubricating system.</p> <p>5.b Select appropriate lubrication oil for better performance of engine on basis of oil grade and rating.</p>	<p>5.1 Requirement and importance of lubricating system in engine.</p> <p>5.2 Properties, additives and types of engine oil.</p> <p>5.3 SAE &amp; API rating of engine oils.</p> <p>5.4 Types of lubricating system.</p> <p>5.5 Construction, working of splash, dry sump, wet sump and pressure feed lubrication system and its components.</p> <p>5.6 Disposable techniques used for engine oil.</p>

**Note:** The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.

**9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN**

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction of IC engine	08	8	6	0	14
II	Functional and constructional details of IC engine components	08	6	6	2	14
III	Fuel supply system for petrol and diesel engine	14	10	6	5	21
IV	Cooling system of IC engine	06	4	4	3	11
V	Lubricating system of IC engine	06	4	4	2	10
	<b>Total</b>	42	32	26	12	70

**Legends:** R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)

**Note:** This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.

**10. SUGGESTED STUDENT ACTIVITIES**

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:

- Charts can be prepared.
- Small report on any topic given by concern faculty.
- 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.

**11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- Guide student(s) in undertaking micro-projects.
- 'L' in section No. 4** means different types of teaching methods that are to be employed by teachers to develop the outcomes.

- d) About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessed using different assessment methods.
- e) With respect to **section No.10**, teachers need to ensure to create opportunities and provisions for **co-curricular activities**.
- f) **Guide students on how to address issues on environment and sustainability**

## 12. SUGGESTED MICRO-PROJECTS

**Only one micro-project** is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably being **individually** undertaken to build up the skill and confidence in every student to become problem solver so that she/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three**.

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should be about **14 - 16 (fourteen to sixteen) student engagement hours** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This has to match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

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.

**13. SUGGESTED LEARNING RESOURCES**

<b>S. No.</b>	<b>Title of Book</b>	<b>Author</b>	<b>Publication with place, year and ISBN</b>
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

**14. SOFTWARE/LEARNING WEBSITES**

- a) <https://www.howacarworks.com>
- b) <https://swayam.gov.in>
- c) <https://auto.howstuffworks.com>
- d) <https://nptel.ac.in>
- e) <https://tinyurl.com/ym2bv29b> for video link
- f) <https://tinyurl.com/2p8u6733> for web link

## 15. PO-COMPETENCY-CO MAPPING

Semester III	Automobile Engine (4330201)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation & Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
<b>Competency</b> • Apply the knowledge of construction and working of IC-engine components and its associated systems.	3	-	-	2	2	2	2
a) Interpret engine fundamental, terminology and specification.	3	-	-	-	-	-	2
b) Illustrate function of engine components.	3	-	-	-	-	1	2
c) Illustrate different components of fuel supply systems for SI & CI Engines.	3	-	-	2	-	1	2
d) Describe the different component of cooling system with reference to their construction and working.	3	-	-	1	2	1	2
e) Describe the different component of lubricating system with reference to their construction and working.	3	-	-	1	2	1	2

Legend: '3' for high, '2' for medium, '1' for low and '-' for no correlation of each CO with PO.

**16. COURSE CURRICULUM DEVELOPMENT COMMITTEE****GTU Resource Persons**

<b>S. No</b>	<b>Name and Designation</b>	<b>Institute</b>	<b>Contact No.</b>	<b>Email</b>
1	Mr. D. A. Dave (Retd. HOD Automobile)	Sir BPTI Bhavnagar	9427182407	<a href="mailto:deven_a_dave@yahoo.co.in">deven_a_dave@yahoo.co.in</a>
2	Mr. D. J. Gohel Lect. Automobile	C. U. Shah Polytechnic Surendranagar	9879428562	<a href="mailto:djgohel80@gmail.com">djgohel80@gmail.com</a>
3	Mr. H. V. Patel Lect. Automobile	Sir B.P.T.I, Bhavnagar	9978872090	<a href="mailto:hvpautodept@gmail.com">hvpautodept@gmail.com</a>
4	Mr. H. T. Shah Lect. Automobile	Govt. Polytechnic, Ahmedabad	8140894595	<a href="mailto:htshah@gpahmedabad.ac.in">htshah@gpahmedabad.ac.in</a>

**GTU BOS and Branch Co-ordinator Persons**

<b>Sr. No</b>	<b>Name and Designation</b>	<b>Institute</b>	<b>Contact No.</b>	<b>Email</b>
1	Mr. Shyam Varghese HOD Automobile Branch Co-ordinator	Govt. Polytechnic, Ahmedabad	94263 96640	<a href="mailto:shyamvarghese@gmail.com">shyamvarghese@gmail.com</a>
2	Mr. A. K. Nanavati, HOD Automobile	C. U. Shah Polytechnic Surendranagar	9426674409	<a href="mailto:aknanavati@gmail.com">aknanavati@gmail.com</a>