



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Diploma Engineering**

**Level: Diploma**

**Branch: Automobile Engineering**

**Subject Code : DI04002041**

**Subject Name : Recent Trends in Automobile**

<b>w. e. f. Academic Year:</b>	2025-26
<b>Semester:</b>	4 <sup>th</sup>
<b>Category of the Course:</b>	PCC

<b>Prerequisite:</b>	
<b>Rationale:</b>	The modern automobile industry is rapidly evolving, with information-centric technologies playing a pivotal role in shaping its future. The sector is integrating advanced technologies into vehicle design and manufacturing at an unprecedented pace. Recent trends emphasize the development of sophisticated engine management systems and electronic controls aimed at enhancing engine performance, transmission efficiency, driving comfort, and road safety. This course is designed to familiarize students with the latest advancements in automotive engine systems, transmission technologies, electrical and electronic systems, alternative fuel applications, and integrated safety features.

### Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Explain engine management system and various advance engine technology.	R & U
02	Describe advance vehicle transmission, braking and control system and technologies.	U & A
03	Interpret advanced vehicle starting, lighting, infotainment, communication, and driver assistance technologies.	U & A
04	Compare working mechanism of Compress Natural Gas (CNG), flex-fuel and hydrogen-based fuel cell.	R & U
05	Demonstrate the importance of vehicle crash testing and safety systems in enhancing occupant protection and overall road safety.	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
L	T	PR		C	Theory		Tutorial / Practical	
			ESE(E)		PA(M)	PA(I)	ESE (V)	
2	0	2	3	70	30	20	30	150



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## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<p><b>Advancement in engine system</b></p> <p>1.1 Engine Management System (EMS): Introduction Need, and Functions Key Operating Methods of EMS: - Speed density method. - Closed loop lambda control.</p> <p>1.2 Fundamentals concepts of Forced Induction system.</p> <p>1.3 Forced Induction Systems: Construction detail and working - Supercharger. - Turbocharger, Turbolag, Wastegate valve, variable geometry Turbocharger, twin turbocharger.</p> <p>1.4 Overview in brief of Modern Engine Technologies - DTS-i (Digital Twin Spark Ignition) - TSI (Turbocharged Stratified Injection) - TDI (Turbocharged Direct Injection) - HCCI Engines (Homogeneous Charge Compression Ignition)– construction and working - VVT-i (Variable Valve Timing-intelligent) - i-VTEC (Intelligent Variable Valve Timing and Lift Electronic Control) - Cylinder Deactivation</p> <p>1.5 Concept of Six stroke Engine.</p>	06	20%
2.	<p><b>Advancement in Transmission system</b></p> <p>2.1 Introduction and types of automatic transmission system.</p> <p>2.2 Epicyclic gearbox: Construction and Working principle</p> <p>2.3 Continuous Variable Transmission (CVT): working principle and constructional details</p> <p>2.4 Electronic Control-Based Automatic Transmission Technologies: Basic working principle and constructional details - DSG (Direct Shift Gearbox) - AGS (Auto Gear Shift) - eCVT Electric Variable Transmission.</p> <p>2.5 Electronic Brake and Vehicle Control Systems: Function and working mechanism. - Antilock Braking System. - Electronic Brake Force Distribution with Antilock Braking System (EBD + ABS). - Automatic Emergency Braking System (AEB).</p>	06	20%



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	<ul style="list-style-type: none"> <li>- Hill Hold and Hill Decent Control system.</li> <li>- Traction control system</li> </ul> <p>2.6 Introduction of the vehicle electronic stability control system.</p>		
<b>3.</b>	<p><b>Advancement in Electrical and Electronics system</b></p> <p>3.1 Modern Vehicle Starting Systems : Function and working</p> <ul style="list-style-type: none"> <li>- Engine keyless (button) start/stop system.</li> <li>- Ideal engine start-stop system.</li> <li>- Remote vehicle ignition system (starting system).</li> </ul> <p>3.2 Advanced Automotive Lighting Systems: Function and working</p> <ul style="list-style-type: none"> <li>- HID (High Intensity Discharge) head light.</li> <li>- Automatic head lamps.</li> <li>- Adaptive LED front head light system.</li> <li>- High beam assist system.</li> </ul> <p>3.3 Introduction of Vehicle Connectivity and Infotainment Systems</p> <p>3.4 Driver Assistance Technologies and Comfort Features: Function and working</p> <ul style="list-style-type: none"> <li>- Adaptive Cruise Control (ACC).</li> <li>- Advanced Driver Assistance Systems (ADAS).</li> <li>- Lane departure prevention.</li> <li>- Blind spot detection.</li> <li>- Front collision warning.</li> <li>- Tyre Pressure Monitoring System (TPMS).</li> <li>- Parking assist.</li> <li>- 360° view camera.</li> <li>- Vehicle over speed warning.</li> </ul> <p>3.5 Introduction in brief on Autonomous/ self-driving vehicle Technology.</p> <p>3.6 Construction, working and use of various Sensors.</p> <ul style="list-style-type: none"> <li>-Thermistors</li> <li>-Thermocouples</li> <li>-Inductive sensors</li> <li>-Hall Effect</li> <li>-Strain gauges</li> <li>-Various Variable capacitance sensors</li> <li>-Accelerometer (knock sensors)</li> <li>-various flow sensors</li> <li>-Optical sensors</li> <li>-Light sensors</li> </ul>	<b>07</b>	<b>23%</b>
<b>4.</b>	<p><b>Green Fuels</b></p> <p>4.1 Introduction to Compress Natural Gas (CNG) fuel supply system used in Petrol Engines.</p>	<b>5</b>	<b>17%</b>



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	<p>4.2 Layout overview of CNG sequential indirect and direct fuel supply system.</p> <ul style="list-style-type: none"> <li>- Major components of CNG supply system along with its function and working detail of each component.</li> <li>- Importance of CNG cylinder testing and CNG cylinder testing method.</li> </ul> <p>4.3 Introduction of the flex-fuel supply system for spark ignition engine.</p> <p>4.4 Introduction of the hydrogen-based fuel-cell technology for vehicle.</p> <p>4.5 Introduction of hydrogen internal combustion engine vehicle (HICEV).</p>		
<b>5.</b>	<p><b>Vehicle Safety System</b></p> <p>5.1 Vehicle crash safety: Introduction, importance and requirement</p> <p>5.2 Classification of Vehicle Safety Systems: Active Safety &amp; Passive Safety</p> <p>5.3 Overview of Vehicle Safety Testing Agencies</p> <ul style="list-style-type: none"> <li>- New Car Assessment Programs (NCAP)</li> <li>- Global NCAP</li> <li>- Federal Motor Vehicle Safety Standards (FMVSS)</li> <li>- Insurance Institute for Highway Safety (IIHS)</li> <li>- National Highway Traffic Safety Administration (NHSTA)</li> </ul> <p>5.4 Concept of the vehicle crash test.</p> <p>5.5 Types of the vehicle crash tests</p> <p>5.6 Key Passive Safety Components: Constructional details &amp; Working principle</p> <ul style="list-style-type: none"> <li>- Airbag</li> <li>- Seat belt,</li> </ul> <p>5.7 Importance and advantage of ISOFIX child seat system.</p>	<b>6</b>	<b>20%</b>
	<b>Total</b>	<b>30</b>	<b>100</b>

**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)



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## References/Suggested Learning Resources:

### (a) Books:

Sr. 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 Technology	James Halderman	Pearson Publication ISBN-10: 0-13-254261-7 ISBN-13: 978-0-13-254261-6
3	Automobile Electrical and Electronic Systems	Tom Denton	Routledge, 2017,5th edition, ISBN:978-0415725774
4	Alternative Fuels	S. S. Thipse	Jaico Publishing House ISBN:978-81-8495-078-6
5	Advanced Vehicle Technology	Heinz Heisler	Butterworth Heinemann ISBN: 0-7506-5131-8
6	Modern Vehicle Technology	James E. Duffy	Goodheart-Willcox ISBN: 978-1619603707

### (b) Open source software and website:

1. <https://nptel.ac.in>
2. <https://swayam.gov.in>
3. <https://vlab.co.in>
4. <https://nptel.ac.in>
5. <https://tinyurl.com/4w73a254> for video link
6. <https://tinyurl.com/5n93f6xv> for web link

### Suggested Course Practical List:

Sr. No	Practical Outcomes (PrOs)		Unit No.	Approx. Hrs. required
1	Interpret working and mechanism of engine force induction system using turbocharger for 4- stroke petrol/diesel engine.	Any one	I	04
2	Compare natural aspire engine and turbocharged engine for same cylinder capacity on basis of engine power, torque, fuel efficiency and prepare engine specification list.		I	04



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3	Prepare a report of construction and working of either of given six stroke engine like Bajulaz 6 stroke engine (Pre heating of Air), Velozeta six stroke engine (Injection of Air), Crower six stroke engine (Injection of Water).	Any one	I	02
4	Give pictorial comparison of Normal Valve timing diagram versus Variable Timing Electronic Control		I	02
5	Describe the gear selection procedure and gear steps in the epicyclic gear box.	Any two	II	04
6	Interpret working procedure of the gear shift knob and link mechanism used in epicyclic, CVT, DSG and AGS gearbox.		II	04
7	Compare working and performance of hydraulic/pneumatic braking system with and without the Anti-Lock Braking (ABS) system.		II	04
8	Compare working principle of various modern starting system of Engine keyless (button) start/stop system, Ideal engine start-stop system and remote vehicle ignition system (starting system)	Any two	III	04
9	Evaluation of Sensor working using a standardized sensor test kit		III	04
10	Select any one Indian car manufacturer brand and model, prepare the list of latest features available in the car. Prepare brief report regarding any five features of the car about describe its mechanism/working/technology involved in it.		III	04
11	Compare the constructional difference between flex-fuel supply system and petrol-diesel based fuel supply system (BS-IV & BS-VI) for vehicle.	Any one	IV	04
12	Compare advantages and limitations of petrol/diesel, flex-fuel and hydrogen-based fuel-cell technologies in-terms of performance, adaptability, affordability, impact on reduction of greenhouse emission gases etc.		IV	04
13	Draw the layout, installation and working procedure of sequential, indirect and direct CNG fuel supply system.		IV	04
14	List various type of vehicle crash test human dummy and classify them according to age group of human dummies.	Any one	V	04
15	Describe any one Indian car manufacturer brand and model crash test safety rating according to Global NCAP car crash test data and learn to interpretate test result.		V	04
16	Select any one Indian car manufacturer brand and model, prepare list of crash test performed on car during the vehicle crash lab test,		V	04



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	list protocols referred for the crash test and crash test result data report by refer Global NCAP test report available on Global NCAP website.			
	<b>Total Hrs.</b>	<b>8</b>		<b>30</b>

### List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Cut section model of various types of superchargers and turbocharger used in petrol & diesel engine. Complete unit and components are coated with attractive color for identifying various parts and assembly. Cut-section model should be mounted on wooden or M.S. stand.	1
2	Chart board/demonstration board of Engine Management System operation and working and technological advancement in petrol & diesel fuel-based engines.	1,2
3	Cut section model of Epicyclic Gearbox This is made from original car gearbox, suitably sectioned to show the details of gear mechanism of forward and reverse speeds. A crank lever is provided to demonstrate the mechanism. Complete unit is mounted on a sturdy iron frame. Complete engine cut-section is coated with attractive color for identify various engine system.	5
4	Cut section model of Automatic gearbox/CVT This is made from original car gearbox, suitably sectioned to show the details of gear mechanism of forward and reverse speeds. A crank lever is provided to demonstrate the mechanism. Complete unit is mounted on a sturdy iron frame.	6
5	Cut section Model of torque convertor This should be made out of original torque convertor assembly to dismantle and assembly and the whole unit mounted on a strong steel stand.	6
6	Cut section /Demonstration Model of different types of Brake (Drum, Disc, hydraulics and Air brake) A Hydraulic Brake working model unit consisting of master cylinder with brake oil reservoir bottle can be operate by a pedal for demonstration. Air brake working model unit consisting of Compressor with Air Brake reservoir/ Tank can be operated by a pedal for demonstration.	7
7	Sensor working kit Sensor working kit (petrol engine, including fuel injector pulse and spark plug firing, and with sensor likes ECT, IAT, Light, TP, Distance, oxygen, MAP,	9



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	vehicle speed)	
8	<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. 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:</p> <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></ul> <p>Fuel injector sequence simulator with variable speed drive.</p>	11,12
9	<p>Demonstration board of CNG fuel supply system used in four stroke petrol engines (BS-IV or BS-VI) 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.</p> <ul style="list-style-type: none"><li>- CNG filling valve</li><li>- CNG storage tank</li><li>- Cylinder valve</li><li>- Pressure regulator</li><li>- Filter</li><li>- Gas temperature and pressure sensor</li><li>- Electronic control unit</li><li>- Injector</li><li>- Injector rail</li></ul>	11,12



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	- Gas level indicator - Changeover switch - High pressure and low-pressure pipe	
10	Chart board/demonstration board for Different Car Crash Test Performed on vehicle human dummy used in tests with some example of vehicle safety ratings.	14,15, 16

## Suggested Project List:

- Visit any vehicle showroom and make comparative list of different features available in different models and variant of vehicle
- Prepare report on supercharger.
- Prepare report on turbocharger.
- Visit CNG installation workshop and prepare report n installation process and tune-up process
- Do literature survey on uses of hydrogen as fuel.
- Do literature survey on flex fuel technology.
- Visit 2 different vehicle show room and make comparative report on safety ratings of different models and variants
- Prepare report on non-pneumatic tires and run flat tires.
- Visit World Health Organization (WHO) website for asses latest “Global status report on road safety”. Prepare chart of showing vehicle road accident, injury and road accident death data.
- Prepare chart or power presentation on basic working mechanism of any one advance engine technology used in the passenger car.
- Prepare chart or power presentation on basic working mechanism of any one advance engine technology used in the two-wheeler.
- Prepare chart of working procedure of single or double stage turbocharger and define, turbo-lag, wastegate valve, variable geometry turbocharger with help of photograph, demonstration components or diagram.
- Prepare chart or power presentation on working of single planetary gear set and prepare gear selection and gear ratio data table.
- Prepare demonstration model of CVT gear box working mechanism by using cardboard sheet, wood or steel sheet material and apply various color on it to indicate various components.
- Prepare chart on working mechanism of the DSG gearbox.
- Prepare demonstration model of semi-automatic or automatic gear selector knob with help of replica or scrapped gear selector knob components.
- Prepare color printed chart for showing importance of the antilock braking system in the passenger and commercial vehicle, also show comparison results of vehicle with or without the antilock braking system.



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- Prepare power point presentation for explaining importance of advance electronic based braking system available in the latest car. (Include animation and audio-video clip in the presentation).
- Prepare chart for describe working mechanism any one modern features available in the latest cars with help of color diagram and figures.

## 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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