

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**COURSE CURRICULUM****COURSE TITLE: MODERN VEHICLE TECHNOLOGY****(Code: 3340203)**

Diploma Programme in which this course is offered	Semester in which offered
Automobile Engineering	4th Semester

1. RATIONALE

Since last few decades, car designers have turned to high technology in order to meet ever more stringent emission control, ergonomics, safety regulations and the demands of customers for better cars at global level. Multi-modal transportation become increasingly common and intelligent vehicles will cater to diverse consumer needs for information, environmental responsibility and safety. Vehicle electronics contribute significantly to improve environmental performance of motor vehicles and are, therefore, an important enabler of “green” vehicle technology. Electronics offer improved control to a variety of vehicle systems, allowing for more efficient operation of engines and other power trains, heating and cooling systems etc., resulting in less fuel or other power consumed and thus, lower harmful emissions. Today’s complex hybrid power trains could not be operated and managed without an array of electronics, including sensors, controllers and actuators. Furthermore, replacement of mechanical components with electronic components tends to be lighter, again leading to less demand for fuel and power options. This course aims to provide understanding of importance of multidisciplinary knowledge in application by appreciation about role of sensor, actuator and electronics components for modernization of automobile.

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:

- **Improve efficiency, security, safety & performance of automobile using electronics and technology.**

3. COURSE OUTCOMES (CO’s)

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

- Describe construction, functions and applications of various sensors and actuators used in modern vehicle
- Explain modern Ignition systems of S.I. and C.I. Engines
- Explain latest advancement in Engine technology
- Identify and describe various advanced peripheral system used in automobile
- Demonstrate various safety features and equipment used in modern vehicle
- Identify various modern features for better functioning of vehicle.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
4	0	2	6	70	30	20	30	

Legends: L-Lecture; T – Tutorial/Teacher Guided Student Activity; P - Practical; C – Credit;; ESE - End Semester Examination; PA - Progressive Assessment.

5. DETAILED COURSE CONTENTS

Unit	Major Learning Outcomes (in Cognitive Domain)	Topics and Sub-topics
Unit – I Applications of Transducers, Sensors & Actuators.	<p>1a.Differentiate working principle of Mechanical and Electrical measuring systems.</p> <p>1b.Explain various equipments working on the principle of electrical energy for measurement of various quantities.</p> <p>1c. List various sensors and actuators applicable in automobile vehicle with neat sketch.</p> <p>1d.Describe construction, functions and applications of various sensors and actuators with neat sketch.</p>	<p>1.1 Concept of general measurement system & difference between Mechanical and electrical/ electronic instruments;</p> <p>1.2 Measurement of Temperature: Working of Thermocouple and Thermister;</p> <p>1.3 Measurement of Speed: Contact less electrical tachometer, Inductive, Capacitive type tachometer, Stroboscope;</p> <p>1.4 Measurement of Force: Strain gauge load cell;</p> <p>1.5 Electrical method for moisture measurement;</p> <p>1.6 Electromechanical Type Transducer – Potentiometric resistance type, Inductive, Capacitive, Piezometric; Photoelectric.</p> <p>1.7 Basic requirement of Sensors, Functions, Applications and Circuitry arrangement of various Sensors such as Mass Air flow rate sensor, Exhaust gas Oxygen concentration, Throttle plate angular position, Crankshaft angular position, Coolant temperature, Intake air temperature, Manifold absolute pressure (MAP), Vehicle speed Sensor. Transmission gear selector position, Methanol sensor, Rain Sensor & Rain sensing wiper.</p> <p>1.8 Working Principal and Functions of various Actuators such as Solenoid Actuators, Motorized Actuators, and Stepper motors.</p>
Unit– II Advance Ignition system	<p>2a.Differentiate working principle of electrical and electronics ignition system.</p> <p>2b. Explain modern Ignition systems in S.I. and C.I. Engines with neat sketch.</p>	<p>2.1 Electrical & electronics ignition system.</p> <p>2.2 Modern Spark Ignition system (e.g. D.T.S.I., T.D.S.I., Multi electrode etc. System)</p> <p>2.3 Insulated coils.</p> <p>2.4 Concept of Non-battery Energy Storage: Ultra capacitors and Flywheels.</p>

Unit	Major Learning Outcomes (in Cognitive Domain)	Topics and Sub-topics
Unit– III Advancement in Engine and related components.	3a. Explain need of advancement in Engine technology. 3b. Explain alternative power sources. 3c. Describe Blue Motion Technology for Green Vehicle Technology.	3.1 Introduction & types of hybrid vehicle. 3.2 Hybrid drives systems. 3.3 Compressed air car. 3.4 Solar Cars. 3.5 Hydrogen operated Engine. 3.6 Basic concepts of Blue Motion Technologies like DSG, TSI, TDI, GDI variable valve timing system.
Unit– IV Modernization in Peripheral systems.	4a. Explain importance of application of peripheral systems in automobiles. 4b. Explain advanced peripheral system in automobile with neat sketch.	4.1 Security Systems. Remote keyless entry, Anti-theft system, Alarm system. 4.2 Entertainment and peripheral systems. Integrated communications, Proximity sensors 4.3 Global positioning satellites(GPS)
Unit– V Advance Safety Equipments.	5a. Explain an importance of safety with respect to automobile vehicle. 5b. Describe various safety features and equipments used in automobile.	5.1 Seat Belts, Seat Belts pre-tensioners, Smart seatbelt reminder. 5.2 Concepts of Crash test, Crash sensors. 5.3 Air bags Introduction of air bags, Duel stage air bags, Side Airbags. 5.4 Tire pressure monitoring system 5.5 Pedestrian Protection & Night vision with pedestrian detection.
Unit– VI Modern Features in Automobile.	6a. Explain requirement of modern features in automobiles. 6b. List various modern features for better functioning of vehicle.	6.1 Power Sliding doors. 6.2 Electronic stability / Skid-control system, Traction control system. 6.3 Telescopic steering wheel / adjustable pedals. 6.4 Rear mounted Radar & Cameras. 6.5 Electromagnetic suspension and levitation. 6.6 Automatic Lift Axle. 6.7 Regenerative Braking Systems. 6.8 Continuous Variable Transmission. 6.9 Intelligent Parking Assist System, Self Parking

6. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Applications of Transducers / Sensors & Actuators.	15	07	07	07	21
2.	Advance Ignition system	5	03	03	01	7
3.	Advancement in Engine and related components.	10	06	06	02	14
4.	Modernization in Peripheral systems.	7	03	03	01	7
5.	Advance Safety Equipments.	7	03	03	01	7

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
6.	Modern Features in Automobile.	12	06	06	02	14
	Total	56	28	28	14	70

Legends: R = Remember, U = Understand, A= Apply and above Level (Bloom's revised 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.

7. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme

S. No.	Unit No.	Practical/Exercises (Course Outcomes in Psychomotor Domain) (Any Seven)	Approx Hours Required
1	I	Measure shaft speeds by using Speed measurement device.	4
2	I	Use strain gauge as sensing element for different types of sensors.	4
3	I	Identification and demonstration of different sensors and actuators.	4
4	I	Study and demonstrate use of various sensors and actuators for multi cylinder modern vehicle.	4
5	III	Study of Hybrid motor vehicle.	4
6	V	Demonstration of Peripheral system.	4
7	V	Identify and demonstrate various safety systems used in vehicle	4
8	VI	Study of various modern features used in vehicle. Also prepare write up regarding benefits of these features.	4

8. SUGGESTED LIST OF PROPOSED STUDENT ACTIVITIES

Following is the list of proposed student activities such as:

- Seminar by students on various modern technologies in automobile like automatic dipper system, night vision with pedestrian detection, GPS, DTSI, TDI, TSI, TFSI, CVT etc.
- Preparation of display boards or charts for various electronic components like LED, sensors, actuators etc.
- Assembly/ disassembly/ connections of various electronic components with automobile actuating mechanisms for understanding principle of operation and control.

- iv. Individual or group-based projects to prepare working model of various modern mechanisms such as solar car, hybrid car, regenerative brakes, automatic dipper system, CVT etc.
- v. Teacher guided self learning activities to prepare report as an assignment from industrial survey/internet/library/or group discussion on any of the modern automobile technology.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If any)

- i. Arrange visit to garages of advance/high hand four wheeler manufacturers and demonstrate functioning of advance technologies/systems used in the vehicles.
- ii. Show video/animation films on functioning of advance/modern systems being used in vehicles.
- iii. Assignment on comparison of popular brands of vehicles on the basis of advanced/modern systems being used for different purposes in these vehicles (Students may be asked to do market survey or visit the websites of the manufacturers to collect data)

10. SUGGESTED LEARNING RESOURCES

A. List of Books

Sr. No.	Author	Title of Books	Publication
1	Tom Denton	Automobile Electrical and electronic systems	Arnold ISBN-0750662190
2	Theraja BL	Fundamentals of Electrical and Electronics Engineering	Nlrja Construction & Development Co Ltd.
3	P L Kohli	Automotive Electrical Equipments	Tata Mc-Graw Hill
4	A K Sawney	Electrical and Electronics measuring Instruments	Dhanpat Rai and sons.
5	John turner	Automotive Sensors	Momentum press, LLC NEW YORK ISBN- 9781606500095 ISBN- 1606500090
6	Barbara J. Peters, George A. Peters	Automotive Vehicle Safety	SAE International and Taylor & Francis ISBN - 978-0-7680-1096-1
7	J. Marek, H.-P. Trah, Y.Suzuki, I. Yokomor	Sensors for Automotive Technology	ISBN – 3527295534 Wiley-vch , weinheim
8	Jeff Daniels	Modern Car Technology	Haynes Publishing

B. List of Major Equipment/ Instrument

- a. Charts for various electronic components like sensors, diodes, LEDs etc.
- b. Display board of various electronic components like sensors, diodes, LEDs etc.

- c. Working model of various automotive mechanisms operated through modern technology.

C. List of Software/Learning Websites

Links for Literature:

- 1 http://en.wikipedia.org/wiki/Mass_flow_sensor mass flow rate sensor
- 2 http://en.wikipedia.org/wiki/Oxygen_sensor exhaust gas o2 sensor
- 3 http://en.wikipedia.org/wiki/Crankshaft_position_sensor crank shaft position
- 4 http://en.wikipedia.org/wiki/Engine_coolant_temperature_sensor coolant temp sensor
- 5 http://en.wikipedia.org/wiki/MAP_sensor MAP sensor
- 6 http://en.wikipedia.org/wiki/Wheel_speed_sensor vehicle speed sensor
- 7 http://en.wikipedia.org/wiki/Rain_Sensor rain sensor
- 8 http://en.wikipedia.org/wiki/Ignition_system diff between electrical and electronics
- 9 http://en.wikipedia.org/wiki/Wasted_spark modern ignition system
- 10 http://en.wikipedia.org/wiki/Hybrid_Synergy_Drive hybrid drive system
- 11 http://en.wikipedia.org/wiki/Compressed_air_car compressed air engine
- 12 http://en.wikipedia.org/wiki/Air_engine compressed air engine
- 13 http://en.wikipedia.org/wiki/Solar_car
- 14 http://en.wikipedia.org/wiki/Direct-Shift_Gearbox
- 15 http://en.wikipedia.org/wiki/Dual-clutch_transmission
- 16 http://en.wikipedia.org/wiki/Turbocharged_Direct_Injection
- 17 http://en.wikipedia.org/wiki/Gasoline_direct_injection
- 18 <http://auto.howstuffworks.com/question122.htm/printable>
- 19 <http://wot.motortrend.com/toyota-confirms-400-hp-awd-hybrid-r-concepts-yaris-roots-396083.html>
- 20 http://en.m.wikipedia.org/wiki/On-board_diagnostics
- 21 http://www.powershow.com/view/bc1fe-Mzg4N/Energy_Storage_Systems_For_Advanced_Power_Applications_powerpoint_ppt_presentation
- 22 http://www.sae.org/servlets/product?PROD_TYP=PAPER&PARENT_BPA_CD=GV&TECH_CD=SI
- 23 http://en.wikipedia.org/wiki/Intelligent_Parking_Assist_System

Links for Video

- i. <http://www.youtube.com/watch?v=g5d-74913Kw> (Video on Solar Car Assembly)
- ii. <http://www.youtube.com/watch?v=40dOyZIVIPw> (Video on How to make Solar Car)
- iii. <http://www.youtube.com/watch?v=W2R-0DQ8gi8> (Video on Solar Toy Car - Hindi)
- iv. <http://www.youtube.com/watch?v=tyo21ghGD5M> (Video on Audi V6 TDI Technology)
- v. <http://www.youtube.com/watch?v=kJ5opH5qgj0> (TSI engine with Active Cylinder Management Technology)
- vi. <http://www.youtube.com/watch?v=20qqavckWdw&list=TL6h-rxUo5sjdowaUfxVw83XSMro9OIvkR> (Video for VW TSI twincharger)
- vii. <http://www.youtube.com/watch?v=wmHxiY2J8Ok> (Ford EcoBoost Animation)
- viii. <http://www.youtube.com/watch?v=H-fij4bnmDw> (Video on TFSI Engine in Action)
- ix. <http://www.youtube.com/watch?v=BICUhzxsxQo&list=PL57B331239D8F5F0D>
- x. <http://www.youtube.com/watch?v=iRh6SxwTc2g&list=PL57B331239D8F5F0D> (Video of Hyundai new engine 1.6 GDi)
- xi. <http://www.youtube.com/watch?v=uotknd6hlxk> (What is GPS?)
- xii. http://www.youtube.com/watch?v=v_6yeGcpoyE (GPS Constellation)
- xiii. <http://www.youtube.com/watch?v=Z3Pm3HHUyzk> and <http://www.youtube.com/watch?v=PLjld-edVj8> (How GPS works)
- xiv. <http://www.youtube.com/watch?v=RUIWz6FQfXN0> (Global Mini Tracking Device GSM GPRS GPS-for Mini Project)
- xv. <http://www.youtube.com/watch?v=xITyQsirIvA> (Pedestrian Detection in Darkness)
- xvi. <http://www.youtube.com/watch?v=XEGdrLjTyjs> (Wireless Pedestrian Detection Technology)

- xvii. <http://www.youtube.com/watch?v=mj0EwLHualM> (Pedestrian detection and tracking using stereo vision techniques)
- xviii. <http://www.youtube.com/watch?v=NrpW1e8IFeA> (Simulation of a Signalized Pedestrian Crossing)
- xix. <http://www.youtube.com/watch?v=DojthARCO6k> (Bosch Night Vision - Night Vision plus)
- xx. <http://www.youtube.com/watch?v=9IodzwsdGKM> (Working principle of Hybrid Synergy Drive (HSD))
- xxi. www.youtube.com/watch?v=zgt1DBYR9GE (Electromagnetic suspension and levitation in automobiles)
- xxii. <http://www.youtube.com/watch?v=y8jRAwIzPTM> (Bosch Regenerative Braking)
- xxiii. <http://www.youtube.com/watch?v=jffePCHt11A> (How the CVT Transmission Works)
- xxiv. <http://www.youtube.com/watch?v=c47caRqbbnE> (Continuously Variable Transaxle Operation)
- xxv. <http://www.youtube.com/watch?v=8an3Bt4MXJg> (Video for Nissan Quest - Sliding Doors)
- xxvi. <http://www.youtube.com/watch?v=wNLfwOQ6mPw&list=TLuawUd0DfNwvjBcdEQWGeNqIaJ2JFA4UH> (Toyota Prius Intelligent Parking Assist demonstration)

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. D. A. Dave**, H.O.D., Automobile Engineering Department, Sir Bhavsinhji Polytechnic Institute, Bhavnagar.
- **Prof. S. V. Trivedi**, H.O.D., Automobile Engineering Department, Parul Institute of Technology, Po. Limda, Ta. Waghodia, Di. Vadodara.
- **Prof. A. C. Suthar** Lecturer, Automobile Engineering Department, M. L. Institute of Diploma Studies, Bhandu
- **Prof. Sulay Patel**, I/C H.O.D., Automobile Engineering Department, L. J. Polytechnic, Ahemdabad.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. C. K. Chugh**, Professor, Department of Mechanical Engineering.
- **Dr. K. K. Jain**, Professor, Department of Mechanical Engineering