



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**  
**Subject Code: 3171112**  
**SUBJECT NAME: Automotive Electronics**  
**B.E. SEMESTER-VII**

**Type of course:** Open Elective Course

**Prerequisite:** Basic knowledge of electronics components and sensors, Knowledge of microprocessor/microcontroller, basic familiarity of automobile functions.

**Rationale:** Electronics system is integral part of Automobile. Embedded system is used in automobile for many operations like engine control, cruise control, transmission control, lighting, central locking system, battery management, fuel indication, ABS, parking assistance, on board diagnostics and alarms. This course will cover fundamental knowledge about the electronics system used in Automobile.

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
2	0	2	3	70	30		30		20	150

### Content:

Sr. No.	Content	Total Hrs
1	<b>Introduction to Automotive Electronics:</b> Introduction to modern automotive systems, Evolution of automotive electronics, Need for electronics in automobile, Introduction of electronics systems used in automobile at different places.	2
2	<b>Basics of Electronic engine control:</b> Motivation for electronic engine control, Input to controller, output from controller, Definition of engine performance terms: Torque, Power, Fuel Consumption, Engine Overall Efficiency, Calibration, Engine Mapping, Effect of Air/Fuel Ratio on Performance, Effect of Spark Timing on Performance, Effect of Exhaust Gas Recirculation on Performance, Electronic Fuel Control Systems, Ideal speed control, Electronic ignition. Digital Engine control.	7
3	<b>Sensors and Actuators:</b> <b>Sensors:</b> Airflow rate sensor, Pressure measurements, strain gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Hall effect Position Sensor, Optical	7



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	<p>Crankshaft Position Sensor, Manifold Absolute Pressure (MAP), Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Air Bag Sensors, Magnetic Reluctance position sensor, Exhaust gas oxygen sensor, knock sensor.</p> <p><b>Actuators:</b> Automotive Ignition Control Actuators, Fuel Injector Actuator, Solenoids, Various types of piezoelectric force generators, Relays (Solid State relays and Electromechanical relays). Electro-Pneumatic: Pneumatic Motors, Electro Hydraulic Valves, Variable valve timings, Electric motor actuators: Brushless DC motor, Stepper motor, Ignition coil operations</p>	
4	<p><b>Vehicle motion controls, diagnostic and protection systems:</b> Digital Cruise Control, Hardware Implementation Issues, Throttle Actuator, Cruise control electronics, Antilock braking system, Electronics Suspension system, Electronic steering control, Four wheel steering, On board diagnosis, Automotive alarms, Lighting, Central locking and electric windows, Climatic Control, Driver information, Parking, occupant protection systems</p>	8
5	<p><b>Battery and electrical wiring:</b> Battery types and maintenance, Alternators in vehicles, Electrical circuits and wiring in vehicles, vehicle network and communication buses, Introduction to battery operated electric vehicles.</p>	6

### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	15	10	10	5

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create 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] Bosch, "Automotive Electrics and Automotive Electronics. System and components, Networking and Hybrid drive", Fifth edition, Springer view 2014
- [2] Najamuz Zaman, "Automotive Electronics Design Fundamental" first edition, Springer 2015.
- [3] Hillier's, "Fundamentals of Motor Vehicle Technology on Chassis and Body Electronics", Fifth Edition, Nelson Thrones, 2007.
- [4] William B. Ribbens, "Understanding Automotive Electronics" Seventh edition, Elsevier



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### Course Outcomes:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in today's automotive industry.	30%
CO-2	Use available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive system design.	30%
CO-3	Recognize different control systems in automotive	20%
CO-4	Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems.	20%

### List of Experiments:

**(General guidelines.. Institute may change list of experiments based on laboratory set up available)**

- Demonstration and experiment on automotive dashboard instruments.
- Demonstration, experiment and diagnosis on ignition system
- Experiments on sensor used in modern automotive system
- Experiments on actuators used in modern automotive system
- Understand different color code system used in automotive wiring system.
- Demonstration and study of Battery Ignition System and their parts used in Automobile Vehicles

### Major Software and Equipment:

- Hardware-in-the-loop (HIL) Simulation Technique for an Automotive Electronics (MATLAB/SCILAB)
- Demonstration Board Of Electronic Ignition System, Of An Automobile Four Wheeler
- Horn Relay Circuit Of Four Wheeler
- Wiper Circuit (For actuator experiments)
- Digital Multimeter
- Sensors and actuators used in automobile