



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code:3160209

AUTOMOTIVE ELECTRICAL AND ELECTRONICS

6<sup>th</sup> SEMESTER

**Type of course:** Fundamental.

**Prerequisite:** Basic knowledge of electrical systems

**Rationale:** The course aims to impart basic skills and understanding of Automotive Electrical and Electronic components, systems, and their working details.

### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

### Content:

Sr. No.	Content	Total Hrs
1	<b>Automobile Electrical Systems:</b> Storage, Distribution systems & Generation of electric energy, Lighting system, 12 Volt & 24 Volt systems. Insulation and earth (negative and positive earthing) system, types of cables used, color codes, cable connectors, wiring, fuse system, circuit breakers, Relays, Switches. Layout and Wiring diagram for 2, 3 and 4 wheeler vehicles, Buses and Commercial vehicles. Wiper System and Trafficator, power windows, Central Locking system. Convertible Mechanism.	8
2	<b>Batteries and Starting system:</b> Various types of Automotive batteries. Principle, Construction & working of lead acid battery, dry battery & Alkaline battery. Designation & Rating of Batteries. Performance tests: Battery Capacity, Efficiency, Gravimetric test and efficiency. Battery failures. Recharging: Electronic circuits, battery charging current, charging methodology & precautions. Principle of Starting system, Starting torque, engine resistance torque, and power required for starting of engine. Starter motor and its circuit. Types of drive mechanisms: bendix drive, pinion type, axial sliding armature starter. Slipping and overrunning of clutches, automatic switches for starting, cold starting devices: Glow plug & choke.	12
3	<b>Charging system and Lighting Auxiliaries:</b> Need of Charging circuit, Types of charging system: D.C. dynamo, AC dynamo, flywheel magneto charging system and Alternator, Charging system controlling & regulator system: Relay/cut-out, voltage and current regulator, compensated voltage and current regulator, electronic regulator, regulator characteristics. Drive for Charging system. Lighting system of vehicle: head lamp, tail lamp, brake lamp, parking lamp etc, other types of lamps used. Reflector purpose and design, head lamp angle and position, fog lamp, side indicator lamp, warning lights and flashers, instrument panel lights, body interior lights. Safety indicator lights. Engine compartment & Rear boot lamps.	14
4	<b>Electronic Fuel Injection and Ignition Systems:</b> Introduction, Feedback carburetor systems (FBC), Throttle body injection and multi-port or point fuel injection, Fuel injection systems, injection system controls, Types of solid state ignition systems and their principle of operation Contactless electronic ignition system, Electronic spark timing control.	6



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5	<b>Electronic Systems:</b> Current Trends in Automotive Electronic Engine management system, Types of EMS: Electromagnetic interference Suppression, Electromagnetic Compatibility, Electronic dashboard instruments, onboard diagnostic system, Security warning system infotainment and Telematics.	6
6	<b>Sensors and Actuators:</b> Introduction, basic sensor arrangement; types of sensors such as - oxygen sensors; Crank angle position sensors - Fuel metering /vehicle speed sensor and detonation sensor - Altitude sensor, flow sensor Throttle position sensors, solenoids, stepper motors, relays	8
7	Horns- A.C. & D.C. horns, wind tone horn/air horns, electronic horn, reverse horn. Horn relay. Warning buzzer. sensors - Instrument cluster panel, fuel gauges, oil temperature gauge, warning light sensors, coolant temperature gauge, speedometer, Odometer, tachometer, trip meter, oil level indicator, parking brake indicator, direction indicators.	6

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

R Level	U Level	A Level	N Level	E Level	C Level
14	16	15	12	10	3

**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. Automotive Electrical Equipments, by P. L. Kohli, Tata McGraw Hill Pub. Co. Ltd.
2. Automobile Electrical & Electronic Systems, by Tom Denton, Allied Publishers Pvt. Ltd., Chennai.
3. Automobile Electrical and Electronics, by A. L. Statini, Delmar Publications
4. Automobile Electrical & Electronic Equipments, by Young, Griffiths, The English Language Book Co., London
5. Understanding Automotive Electronics, William B. Riddens, " 5th Edition, Butterworth, Heinemann Woburn, 1998.
6. Understanding Automotive Electronic, Bechtold., SAE, 1998.

**Course Outcome:** After learning the course the students will able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the basic electrical systems and working of different electrical components used in automobiles.	17
CO-2	Evaluate, characteristics and maintenance of battery, lighting system, charging system and starting system.	34
CO-3	Categorize and select ignition system sensors and actuators in automobile systems	28
CO-4	Appraise electronic system components controls , instrumentation of automobile	21



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## List of Experiments

1. Study of automobile electrical systems.
2. Performance testing of automobile battery System.
3. Study of electrical engine starting system.
4. Study of different types of battery charging system.
5. Study of different types of ignition systems.
6. Study of different colour code system used in automotive wiring system
7. Study of different types of gauges, sensors, actuators and meters of an automobile.
8. Study of automobile electronic systems.
9. Study of various electrical equipment such as Windscreen wipers, power windows, Rear wind shield glass heating system, and Central Locking system.
10. Demonstration and experiment on lighting system of two wheeler and Four Wheeler.
11. Demonstration and experiment on automotive dashboard instruments.

## Major Equipment:

1. Layout model of automobile wiring system
2. Demonstration model of Battery charging mechanism
3. Different types of Ignition systems

## List of Open Source Software/learning website:

1. <http://nptel.ac.in>