GUJARAT TECHNOLOGICAL UNIVERSITY

AUTOMOBILE ENGINEERING
AUTOMOTIVE ELECTRICAL SYSTEMS
SUBJECT CODE: 2150208
B.E. 5th SEMESTER

Type of course: Fundamental.

Prerequisite: Basic knowledge of electrical systems

Rationale: The course aims to impart basic skills and understanding of automotive electrical systems, equipments and their working details.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Automobile Electrical Systems and electronics system: 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.	4	10
2	Battery system: Various Types of Automotive batteries. Principles, Construction & working of lead acid battery, dry battery & Alkaline battery. Designations & Rating of Batteries. Performance tests: Battery Capacity, Efficiency, Gravimetric test and efficiency. Battery failures. Recharging: Electronic circuits, battery charging current, charging methodology & precautions.	5	12
3	Starting system – Principle, 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.	6	14
4	Charging system – Need. Charging circuit, Types of charging system: D.C. dynamo, AC dynamo, flywheel magneto charging system and Alternator (more emphasis on Alternators). 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.	6	14
5	Ignition system – Requirements. Types of Ignition systems: Ballast Resistance, Ignition coil characteristics, Cam angle & contact angle gap, spark advance mechanism, spark plug, ignition timing, multi-cylinder distributor, Distributor (contact breaker ignition system), limitations of	7	17

	coil ignition system, electronic ignition systems. Voltage and current required for Spark. Spark Plug, characteristics, material, types, plug fouling.		
6	Lighting 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.	6	14
7	Horns- AC & DC 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 indictor, direction indicators.	5	12
8	Electrical Equipments & Accessories - Windscreen wipers, windscreen washers, power windows, doors locks, Rear wind shield glass heating system. Rear view mirror Adjusting, Day light regulating system. Central Locking system. Convertible Mechanism.	3	07

Suggested specification table with marks (Theory)

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
14	16	15	15	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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. Automobile Electrical and Electronics, by A. L. Statini, Delmar Publications
2. Automotive Electrical Equipments, by P. L. Kohli, Tata McGraw Hill Pub. Co. Ltd.
3. Automobile Electrical & Electronic Systems, by Tom Denton, Allied Publishers Pvt. ltd., Chennai.
4. Automobile Electrical & Electronic Equipments, by Young, Griffithe, The English Language Book Co., London.
5. Automotive mechanics by W. Crouse, TMH

Course Outcome:

After learning the course the students should be able to:

1. Understand the basic auto electrical systems.
2. Understand the layout of wiring and connections of electrical systems in automobiles.
3. Understand the working of different electrical components used in automobiles.

List of Experiments:

1. Introductory study of automobile electrical systems.
2. Study 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 automobile lighting system.
7. Study of different types of gauges, sensors and meters of an automobile.
8. Study of various electrical equipments like Windscreen wipers, power windows, Rear wind shield glass heating system, Central Locking system.

Design based Problems (DP)/Open Ended Problem:

1. Working model of Wiper mechanism which can cover maximum glass area for cleaning
2. Sensor based central lock system
3. Effect of replacement of convention lights with LEDs.
4. System to improve the battery charging.

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:

http://www.nptel.ac.in/courses/108103009/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should be submitted to GTU.