



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Automobile Engineering

Course / Subject Code: DI03002041

Course / Subject Name: Automobile Electrical and Electronic System

w. e. f. Academic Year:	2024-25
Semester:	3 rd
Category of the Course:	PCC

Prerequisite:	
Rationale:	Most components of earlier generation vehicles were mainly mechanical in nature and operation. Over time components started operating electrically/electronically and microprocessor-based systems. Nowadays the most automotive components and new accessories have an electric function for ease of operation and precision control. Hence the fundamental knowledge of automotive battery, ignition system, starting & charging system and electronics are most essential. This course is helpful to learn to understand fundamental knowledge of electrical and electronic basic working principles & applications. This course is pre-requisite for maintenance and service-III.

Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes	RBT Level
01	Explain basic electrical principles & applications of electronics in automotive systems.	R & U
02	Interpret the purpose, construction and working of various types of automotive battery.	U & A
03	Explain construction and working of various automotive ignition systems.	U & A
04	Interpret necessity, construction & operation of various types of starter motor and charging system's components.	R & U
05	Explain construction and working of various electrical auxiliaries' systems.	U & A

*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)	
3	0	2	4	70	30	20	30	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	1.1 State Ohm's law. -Effects of current flow, and definition of electrical quantities like resistance, voltage, current, and power. -Differences between Conductors, insulators and semiconductors, -Basics of Magnetism, electromagnetism, Electromagnetic induction, Mutual induction. -Differences between electron flow and conventional flow. 1.2 State Faraday's law of electromagnetic induction. -Introduction & application of various measuring Instruments. - Series and Parallel Circuits - Transition from mechanical to electronic systems 1.3 Introduction to basic electrical and electronics components - Resistor, Capacitor, Inductor, Diode, Transistor, Integrated circuits, Amplifiers, Concept of Digital-to-analogue and Analogue-to-digital conversion, Logic gates. 1.4 Introduction of Microprocessor systems. - Ports, Central processing unit (CPU), Types of Memory, Buses, A typical microprocessor, Microcontrollers. - Integration of microcontrollers in automobiles	11	24%
2.	2.1 Vehicle batteries -Various types of battery, Requirements of the vehicle battery, Choosing the correct battery, parameters affecting battery performance. 2.2 Lead-acid batteries. -Construction, working, chemical reaction during charging and discharging, Battery rating and efficiency, 2.3 Lithium-ion batteries -Construction, working, comparison between lead acid batteries and lithium-ion batteries. 2.4 lead-acid battery Waste, - battery disposal, battery handling and storage.	08	18%
3.	3.1 Necessity and requirement of Ignition system in automobile vehicles.	08	18%



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	3.2 Construction and working of breaker point ignition system, electronic ignition system and distributor less ignition system. 3.3 Construction, working and types of Spark plugs. 3.4 Working of Non-Contact-type Ignition Triggering devices. 3.5 Construction and working of Capacitive Discharge Ignition.		
4.	4.1 Necessity and requirements of the starting system. 4.2 Basic working of Starting system circuits. 4.3 Describe D.C motor characteristics. 4.4 Constructional and working principle of different starter motor - Pre-engaged starters, - Permanent magnet starters, - Various drive mechanisms of starter motor. 4.5 Necessity and requirements of the charging system - Basic operating principles, - Alternator characteristics, - Construction and working of Alternator, - Requirement of regulators, - Working of regulators.	08	18%
5.	5.1 Fundamentals of automotive wiring, terminals, cables, color codes, harness design, fuses, relay and circuit breakers, and switches. 5.2 Construction and working of various electrical auxiliaries' systems - Windscreen washers and wipers, - Signaling circuits, - Horns, - Engine cooling fan motors, - electric window. 5.3 Construction and working of analog and digital gauges such as - Tachometers - Odometers - Speedometers - Oil pressure gauges - Coolant temperature gauge - Fuel level gauge 5.4 Types of Automotive Lighting. - Headlight reflectors & Lenses - LED DRLs headlights	10	22%



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	- HID & Laser headlights		
	Total	45	100

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)

References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Automobile Electrical and Electronic Systems	Tom Denton	Routledge, 2017, 5th edition, ISBN:978-0415725774
2	Automotive Electricity and Electronics	James Halderman	Pearson, 2016, 5th edition, ISBN:978-0134073644
3	Automotive Electrical Equipment	P. L. Kohli	McGraw Hill Education, 2017, ISBN: 978-0074602164
4	Automotive Electrical and Electronics	A. K. Babu	Khanna Publishing, 2018, ISBN: 978-9382609698
5	Automobile Mechanics	William Crouse	Tata Mc-Graw Hill Publication ISBN-13:978-0-07-063435-0

(b) Open-source software and website:

- <https://www.howacarworks.com>
- <https://swayam.gov.in>
- <https://auto.howstuffworks.com>
- <https://nptel.ac.in>
- <https://tinyurl.com/3ruk3xa> for video link



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f) <https://tinyurl.com/bdck9bdz> for web link

Suggested Course Practical List:

S. No	Practical Outcomes (PrOs)		Unit No.	Approx. Hrs. required
1	Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope.	Any two	I	04
2	Understanding of various safety precautions for electrical installations.		I	04
3	To study different types of capacitors, diode, resistors, transistor.		I	04
4	Introduction to AC-DC & Series – Parallel circuit.		I	04
5	Perform battery state-of-charge test in different real-time vehicle load conditions.	Any one	II	04
6	Prepare SOP (standard operating procedure) and perform visual inspection procedure for identifying various battery rates and conditions.		II	04
7	Experiment related to identify, inspection of modern ignition system or prepare line diagram related to ignition system for demonstration purpose.		III	04
8	Differentiate various spark plugs by constructional features & rating.		III	02
9	Dismantle/Assemble the given starter motor, enlist the parts, and explain the working of each component.	Any one	IV	04
10	Dismantle/Assemble the given alternator, enlist the parts and explain the working of each component.		IV	04
11	Identify various fuse ratings as per given specification.	Any two	V	04
12	Draw and explain any one automotive wiring diagram of a given vehicle electric & electronic system.		V	04
13	Interpret any one circuit diagram of wiring system among given auxiliary system & accessories.		V	04
14	Identify and perform joining procedure of automotive wiring circuit with its cable size, color code and symbols used in available vehicle electric & electronic system.		V	04
	Total Hrs.			30



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List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Multimeter - (AC Voltage Range: 600mV-1000V, DC Voltage Range: 600mV-1000, AC Current Range: 660 μ A-10A, DC Current Range: (Amp) 660 μ A-10A, Resistance Range: (Ohm) 600 Ω -66M Ω , Capacitance Range: (F) 6.6nF-66mF, Frequency Range: (Hz) 66Hz-66MHz)	01 to 13
2	AC to DC converter (0-30V) and (0-30A)	01 to 13
3	Executive Auto Electrical tool kit	01 to 13
4	Portable Battery Tester with Consist of Dc Voltmeter, Load Resistor and Testing Clip (Rated Voltage of Battery to Be Tested: 2, 6, 12V DC, Rated Capacity of Battery to Be Tested: 4 - 500ah)	05,06
5	Digital ignition timing gun (stroboscope) with LED display (Accurate to 8,000rpm, 12V)	07
6	Clamp Multimeter (DC current 60A/600A)	07
7	Various features of Spark plug having nickel chromium finishing	08
8	Any one Starter motor for disassemble.	09
9	Any one Alternator for disassemble	10
10	Typical wiring of a vehicle (Including all lighting systems, all gauges, wiper motor, starter motor, alternator, ignition system with proper power supply)	12,13

Suggested Project List:

1.	Study and compare any two types of vehicles wiring harness color coding data.
2.	Draw basic layout of fuse box of any three vehicles and compare each item with fuse - Amp detail.
3.	Prepare a report on Initiatives taken by CPCB for collection, recycling, scrap, and handling of batteries namely lead acid, nickel-cadmium, nickel metal hydride and Lithium-ion batteries



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4.	Prepare an SOP of battery scrap needs to be followed by Scrap vendor during scrap of vehicle.
5.	Visit authorized battery dealer shop and prepare a report on tools equipment usage, with manufacturer techno commercial detail and safety norms followed in shop.
6.	Prepare and understand the layout of the Ignition system used in vehicle with each component specification.
7.	Prepare and compare specification chart of starter motors and alternator of any five vehicles.
8.	Calculate current and resistance of starter system of any vehicle.
9.	Calculate current and resistance of charging system of any vehicle.
10.	Visit any vehicle scrap yard, authorized dealer near area and collect scrap sensor and do checking of voltage drop test and continuity test for the same.

Suggested Activities for Students: If any

Other than the classroom and laboratory learning, the 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 groups and prepare reports of each activity. They should also collect/record physical evidence for their (student's) portfolio which will be useful for their placement interviews:

- Charts can be prepared.
- Small report on any topic given by concern faculty.
- Small groups of students can be formed for assigned work. Assigned work should be such that it covers market survey, teamwork, presentation, time management, quality development.

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