



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Automobile Engineering

Subject Code: DI04002031

Subject Name: Maintenance & Service - III

w. e. f. Academic Year:	2025-26
Semester:	4 th
Category of the Course:	PCC

Prerequisite:	-
Rationale:	Understanding and maintaining electrical systems in automobiles is crucial for aspiring automobile engineers due to their increasing reliance on these systems for various functions. Maintenance and service of automobile electrical systems provide students with hands-on experience in diagnosing, repairing, and maintaining electrical components, enabling them to identify and rectify potential safety hazards caused by faulty electrical components. Moreover, teaching maintenance and service of automobile electrical systems ensures that students stay up to date with the latest technologies and advancements in automotive technology, such as advanced electronics, ignition system, starting and charging system and autonomous features, making them better prepared to work on modern vehicles.

Course Outcome:

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

No	Course Outcomes	RBT Level
01	Identify automotive battery systems, components, and specifications with necessary safety precautions.	R, U, A
02	Check the ignition system based on the results of various tests conducted on ignition system components.	U, A
03	Analyze vehicle starting system according to test results and overhauling inspection.	U, A
04	Analyze vehicle charging system according to test results and overhauling inspection.	U, A
05	Describe vehicle auxiliary and sensor's performance according to On-Board Diagnosis (OBD) fault codes and interpretation.	R, U, A

*Revised Bloom's Taxonomy (RBT)



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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

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<p>Automotive Battery</p> <p>1.1 Battery Maintenance and safety precautions:</p> <ul style="list-style-type: none"> - Precaution steps taken while servicing battery. - Visually inspect for damage or corrosion. - Cleaning of battery terminals and connectors. - Topping up electrolyte (for lead acid battery) <p>1.2 Battery diagnosis and troubleshooting:</p> <ul style="list-style-type: none"> - Identifying common battery-related issues. - Symptoms of a weak or faulty battery. - Diagnosing battery drain or parasitic draw. - Different trouble causes and remedies of the battery. <p>1.3 Battery Testing:</p> <ul style="list-style-type: none"> - Various terminology is used for battery testing. - Voltage measurement using a multimeter, Load test, Hydrometer test, Cadmium test. - Testing via battery analyzer. - Interpreting battery test results. <p>1.4 Battery Charging and jump start:</p> <ul style="list-style-type: none"> - Various charging processes and their use. - Step-by-step process of connecting jumper cables correctly and safely. 	09	20%
2.	<p>Automotive Ignition system</p> <p>2.1 Maintenance of ignition system:</p> <ul style="list-style-type: none"> - Periodic maintenance of ignition system. (Spark plugs, ignition coil, control module, wiring system, triggering devices) - Safety precaution during Maintenance and service of ignition system. <p>2.2 Diagnosis of ignition system:</p>	09	20%



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	<ul style="list-style-type: none"> - Diagnostic Procedures for Identifying Ignition System Faults. - Troubleshooting Common Ignition System Issues and their remedies. <p>2.3 Testing of ignition systems:</p> <ul style="list-style-type: none"> - Checking and setting ignition timing. - Testing of ignition system using oscilloscope. - Testing of all components of ignition system. - Testing of spark plug. - Interpreting various test results. <p>2.4 Recycling and disposal of Ignition system.</p>		
3.	<p style="text-align: center;">Automotive Starting system</p> <p>3.1 Maintenance of Starting system.</p> <ul style="list-style-type: none"> - Safety precaution during Maintenance and service of Starting system. <p>3.2 Diagnosis of Starting system</p> <ul style="list-style-type: none"> - Diagnostic Procedures for Identifying Starting System Faults. - Troubleshooting Procedure and starting system problem with remedies and action plan. <p>3.3 Testing of Starting system</p> <ul style="list-style-type: none"> - Visual inspection test. - Control circuit test. - Starter circuit voltage drop test. - Starter amperage test. - Starter motor field coil, growler armature and runout test. <p>3.4 Overhauling of starting system.</p> <ul style="list-style-type: none"> - Disassembly and assembly with precise safety of starting system components. - Proper inspection and testing of each component i.e. solenoid, drive clearance, brush inspection, bench test. <p>3.5 Recycling and disposal of starting system.</p>	09	20%
4.	<p style="text-align: center;">Automotive Charging system</p> <p>4.1 Maintenance of Charging system</p> <ul style="list-style-type: none"> - Safety precaution during Maintenance and service of charging system. <p>4.2 Diagnosis of charging system.</p> <ul style="list-style-type: none"> - Diagnostic Procedures for Identifying Charging System Faults. - Troubleshooting Procedure and charging system problem with remedies and action plan. 	09	20%



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	<p>4.3 Testing of Charging system</p> <ul style="list-style-type: none"> - Charging voltage test. - Drive belt inspection and adjustment. - AC ripple voltage & current test. - Voltage drop test. - Alternator output test <p>4.4 Overhauling of Charging system</p> <ul style="list-style-type: none"> - Disassembly and assembly with precise safety of charging system components. - Various tests during overhauling i.e. testing of an alternator, rotor, stator, diode, and rectifier. <p>4.5 Recycling and disposal of Charging system.</p>		
5.	<p style="text-align: center;">Automotive Electronics and Auxiliary System.</p> <p>5.1 Sensor characteristics and specifications.</p> <p>5.2 Evolution of On-Board Diagnosis (OBD)</p> <p>5.3 Importance of Diagnosis Trouble Codes (DTCs) in Vehicle Diagnostics.</p> <ul style="list-style-type: none"> - Detailed information of various sensors OBD fault codes and its interpretation. - Engine related fault codes - Transmission system related fault codes. - Emission related fault codes - Passive restraint system related fault codes. <p>5.4 Diagnosis and troubleshooting of various vehicle electrical Auxiliary Systems.</p> <ul style="list-style-type: none"> - Windscreen washers and wipers, Signaling circuits, Horns, Engine cooling fan motors, electric window, lighting circuit <p>5.5 Recycling and disposal of Auxiliary system and electronics of automobile vehicle.</p>	09	20%
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
20	40	40	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



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References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Automotive Mechanics (10 th edition)	William Crouse, Donald Anglin	McGraw Hill Education Publication ISBN-10: 0070634351 ISBN-13: 978-0070634350
2	Automotive Electricity and Electronics (5 th edition)	James Halderman	Pearson Publication ISBN-10: 0134073649 ISBN-13: 978-013407364
3	Automotive Electrical and Engine Performance (8 th edition)	James Halderman	Pearson Publication ISBN-10: 0135224802 ISBN-13: 978-0135224809
4	Automobile electrical and electronic systems (5 th edition)	Tom Denton	Routledge Publication ISBN-10: 0415725771 ISBN-13: 978-0415725774
5	Automotive Wiring and Electrical Systems	Tony Candela	Cartech Ins Publication ISBN-10: 1932494871 ISBN-13: 978-1932494877
6	Automotive electrical equipment	P L Kohli	McGraw Hill Education Publication ISBN-13: 978-0074602164
7	Automotive Electrical and Electronics (2 nd edition)	A K Babu	Khanna Book Publishing ISBN-10: 9382609695 ISBN-13: 978-9382609698

(b) Open-source software and website:

- <https://www.howacarworks.com>
- <https://swayam.gov.in>
- <https://auto.howstuffworks.com>
- <https://nptel.ac.in>



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Suggested Course Practical List:

Sr. No	Practical Outcomes (PrOs)		Unit No.	Approx. Hrs. required
1	Conduct a load test using a battery load tester to evaluate the battery's performance under load.	Any two	I	4
2	Perform a jump start by connecting jumper cables between a charged battery and a discharged battery, following the correct sequence of connections and safety guidelines.			4
3	Diagnose battery drain or parasitic draw using a multimeter to identify excessive draw.			4
4	Conduct testing of the ignition system using multimeter/ohmmeter/oscilloscope to check condition of coil.	Any one	II	4
5	Perform specific tests for spark plugs to evaluate their condition.			4
6	Conduct testing of starter motor using multimeter to analyze condition and diagnose malfunction within it.	Any one	III	4
7	Overhaul and analyze Growler test of an armature.			4
8	Conduct testing of alternator-generator using multimeter to analyze condition and diagnose malfunction within it.	Any one	IV	4
9	Overhaul and analyze stator, rotor, and rectifier of an alternator.			4
10	Conduct testing of various sensors OBD fault codes and its interpretation.	Any one	V	6
11	Perform testing of various sensors using multimeter.			4
12	Perform testing of various motorized actuator using multimeter.			4
	Total Hrs.			30

List of Laboratory/Learning Resources Required:

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1	Battery load tester (12 V)	01



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2	10-gauge jumper cables (02 Nos.)	02
3	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)	All
4	Digital oscilloscope (8-36V Wide range of input voltage) (min. 2 channel)	04
5	Spark plug tester & cleaner (260 W)	05
6	Growler armature tester	07
7	Sensor working kit Sensor working kit (petrol engine, including fuel injector pulse and spark plug firing, and with sensor likes ECT, IAT, Light, TP, Distance, oxygen, MAP, vehicle speed)	10
8	Scan Tool: <ul style="list-style-type: none">- Screen 8" diagonal, daylight readable color LCD screen; 1280*800 pixel- Touch with Gloves Supported- Operating System Android system- CPU Quad-Core, 1.3GHz- Memory 2GB DDR3L- SSD Hard drive 32GB- Communication Interface Built-in WIFI 802.11 b/g Wireless LAN micro USB 2.0 OTG, USB 2.0 HOST standard Bluetooth 4.0 (10-20 m)- HDMI Yes- Camera 5 megapixels rear-facing- Battery 8000mAh, lithium-polymer battery. Chargeable via 5V AC/DC power supply- Protocols ISO 9141-2, ISO 14230-2(KWP2000), SAE J1850-PWM, SAE J1850-VPW, SAE J2740(GM UART), UART Echo Byte Protocol(SAE J2809、SAE J2818), Honda Diag-H Protocol, SAE J2610(SCI), ISO 11898, ISO 15765-4, KW81, KW82, GWM 3089 (Single Wire CAN), SAE J2819(TP2.0), SAE J3054(TP1.6), ISO 11898-3(Low Speed Fault-Tolerant CAN), SAE J2284 (High Speed CAN)- OBD2 Compatible with Indian cars	10



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Suggested Project List:

1) Create a DIY battery cleaning solution using household ingredients.
2) Design a low-cost battery terminal cleaning tool using everyday materials.
3) Generate a report comparing battery testing results obtained via a battery analyzer.
4) Develop a DIY ignition system cleaning kit using affordable materials such as brushes, cleaning agents, and protective coatings.
5) Create a troubleshooting report listing common ignition system issues, their symptoms, and the corresponding remedies.
6) Create a low-cost spark plug testing tool using a simple circuit to check for proper spark and firing.
7) Prepare head light tester from used headlight filament and reflector.
8) Prepare chart of specification about common sensor usage in different manufacturer vehicle.
9) Prepare a digital troubleshooting presentation listing common starting system issues with its real animated diagnosis recommendation and remedies.
10) Prepare a digital troubleshooting presentation listing common Charging system issues with its real animated diagnosis recommendation and remedies.
11) Design a preventive maintenance schedule for an automobile electrical system.

Suggested Activities for Students: If any

Other than the classroom and laboratory learning, 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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