

030 – AUTOMOBILE ELECTRICAL WORKS

EXAMINATION STRUCTURE

The trade consists of the following related courses:

191 – Metal Work

193 – Building/Engineering Drawing.

194 – Basic Electricity

The trade shall also be examined under the following components or subject grouping.

031 – Basic Motor Vehicle Technology, Batteries Charging and Maintenance (CAE 11, 12, 13, 14 & 15)

032 – Auto Battery Charging Wiring/Lighting, and Accessories (CAE 16 & 17)

EXAMINATION SCHEME

31 – Basic Motor Vehicle Technology

This subject grouping consists of two papers:

- 31-1 – PAPER I : This will consists of two sections, viz Section A (Objectives) and Section B (Essay).
SECTION A: will comprise forty (40) multiple choice objective questions to be answered in 40 minutes. This section carries forty (40) marks.
SECTION B: will comprise seven Essay questions and students are to answer five questions in 2½ hours. This Section carries sixty marks.
- 31-2 PAPER II: This will comprise of two Practical questions for 3 hours. This paper will attract 100 marks.

32 – Auto Battery Charging Wiring/Lighting, and Accessories

This subject grouping consists of two papers i.e. Papers I and II

- 32-1 – PAPER I : This will comprise of forty (40) multiple choice objective questions to be answered in 40 minutes. This paper carries forty marks.
- 32-2 – PAPER II: This will comprise of seven Essay questions and students are to answer five questions in 2 hours. This paper carries 60 marks.

031 – BASIC MOTOR VEHICLE TECHNOLOGY

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
1.	<p><u>Engine Layout</u></p> <p>1. With the aid of a diagram, explain the working principles, operations of 2/4 stroke-cycle engines and give examples and machine that use these principle.</p>	<ol style="list-style-type: none"> 1. Principle components/system of a motor vehicle 2. Principles operation of 2/4 stroke-cycle engines. 3. Block diagram of 2/4 stroke-cycle engines and examples. 4. Simple four cylinder engine. 5. Cross-Sectional view showing the main parts positions from pistons to crankshaft. 6. Need for the use of more than one cylinder in an automobile. cylinder engine. Types and functions of piston, rings and gudgeon pin. 	<ol style="list-style-type: none"> 1. Examine 2/4 stroke-cycle engine. 2. Dismantle, examine and identify the main parts position of a cylinder engine from the piston to crank shaft. 3. Explain the need for the use of more than one cylinder in an automobile. State the differences between single and multi-cylinder engines.
2.	<p><u>Cooling System</u></p> <p>1. With the aid of schematic diagram, describe various cooling systems.</p> <p>2. Describe the action of the water pump and thermosyphon cooling element in an auto-cooling system.</p>	<ol style="list-style-type: none"> 1. Functions of cooling system in an automobile. 2. Cooling methods schematic diagrams showing: <ol style="list-style-type: none"> i. air cooling ii. water cooling 3. a) Types of automobile that use: <ol style="list-style-type: none"> i. air cooling ii. water cooling b) Advantages of one system over the other 4. Concepts of simple thermosyphon cooling element. 5. Principle of operation of a water pump in an auto cooling system. 	<ol style="list-style-type: none"> 1. Interpret schematic diagram of a cooling system showing: <ol style="list-style-type: none"> i. air cooling ii. water cooling 2. Identify automobiles that use: <ol style="list-style-type: none"> i. air cooling ii. water cooling 3. Examine and identify the cooling systems. 4. Examine and identify thermo system cooling element.
3.	<p><u>The Transmission System</u></p> <p>Identify the main units of an automobile transmission system and describe their functions.</p>	<ol style="list-style-type: none"> 1. Transmission system in an automobile functions. 2. Functions of main units of an automobile transmission system: <ol style="list-style-type: none"> i. Clutch ii. Gear iii. Propeller iv. Drive shafts v. Final drive 	<p>Dismantle the transmission system of an automobile and examine the different units e.g. clutch, gear, propeller, drive shafts, final drive etc.</p>
4.	<p><u>Fuel Supply System</u></p> <p>Draw a schematic diagram and explain the functions of the fuel (petrol) system in an automobile engine.</p>	<ol style="list-style-type: none"> 1. Function of fuel (petrol) system in an automobile engine. 2. Dismantle a mechanical/electrical fuel pump and identify its various parts. 3. Schematic diagram of fuel system showing main units and their functions. <ol style="list-style-type: none"> i. Indicator ii. Tank and float unit iii. Fuel pump iv. Fuel filter v. Carburetor 4. Block diagram of a fuel (petrol) system showing: <ol style="list-style-type: none"> i. Float unit ii. Fuel pump (electrical and 	

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		mechanical) and carburetor	
5.	<u>Braking System</u> Enumerate the types, identify and state the functions of the braking system in an automobile.	<ol style="list-style-type: none"> 1. Functions of the brake in an automobile. 2. Types of braking systems. 3. Schematic diagram of the braking system. 4. Functions of the main units of the braking system. 	<ol style="list-style-type: none"> 1. Discuss different types of braking system. 2. Interpret schematic diagrams and identify the main units of the braking system. 3. Demonstrate how to install a starter motor unto a vehicle and test for normal working.
6.	<u>Coaxial Type Starter Motor</u> <ol style="list-style-type: none"> 1. Bench test axial type starter motor with bench testing machine. 2. Dismantle, service reassemble and test coaxial type starter motor noting the relative positions of its compound parts for normal operations. 	<ol style="list-style-type: none"> 1. Bench testing coaxial starter motor using: <ol style="list-style-type: none"> i. Stall test ii. No load test iii. Load test 2. Dismantling of coaxial type starter motor noting the relative positions of its component parts. 3. Testing starter motor components using: <ol style="list-style-type: none"> i. Armature coil open circuit/ground test ii. Brush continuity test. iii. Field coil continuity test. 4. Servicing of coaxial starter motor including: 5. Principles of operation of a solenoid circuit. 6. Servicing the starter solenoid by: <ol style="list-style-type: none"> i. dismantling starter solenoid ii. clean and replace badly pitted iii. contact point of the solenoid iv. testing solenoid winding for continuity. 7. Coaxial motor drive reassembling. 	<ol style="list-style-type: none"> 1. Demonstrate how to bench test a coaxial starter motor using stall test, no load test etc. 2. Demonstrate how to dismantle coaxial type starter motor and note the relative positions of its component parts. 3. Diagnose and test a faulty starter motor using the: <ol style="list-style-type: none"> i. armature coil open circuit test. ii. Armature coil short, circuit/ground iii. Brush continuity test etc. 4. Show how to service a coaxial starter motor. 5. Interpret the schematic diagram of a solenoid circuit. 6. Demonstrate how to service a starter solenoid 7. Demonstrate how to reassemble a coaxial motor drive.
7.	<u>Axial Starter Motor</u> <ol style="list-style-type: none"> 1. Bench test axial type starter motor. 2. Trouble shoot/service axial starter motor 	<ol style="list-style-type: none"> 1. Bench testing axial starter motor using: <ol style="list-style-type: none"> i. stall test ii. no-load-test iii. load test 2. Trouble – shooting and serving of axial starter motor by: <ol style="list-style-type: none"> i. Dismantling of axial starter motor ii. Testing the armature, coil, brush and field coil. iii. Dismantling, servicing, testing and reassembling the solenoid. iv. Skimming armature commutator v. Bedding the brushes. vi. Lubricating, reassembling and testing the serviced axial motor 	<ol style="list-style-type: none"> 1. Demonstrate how to bench test axial starter motor using the following methods. 2. Demonstrate how to trouble-shoot and service axial starter motor using the correct sequence including e.g. dismantling axial starter etc.

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		for normal operation.	
8.	<p><u>Spring Starter</u></p> <ol style="list-style-type: none"> Enumerate the precautions required in handling spring starter and explain the hazards involved in removing/dismantling them. Identify the tools for overhauling the spring starter and service a faulty one. 	<ol style="list-style-type: none"> Spring starter removal hazards Safety precautions in handling spring starter. <ol style="list-style-type: none"> Significance of colour codes Sequence in dismantling Position or posture. Tools for overhauling spring starter <ol style="list-style-type: none"> Spring clamp Roller ball inserter, sleeve etc. Servicing of faulty spring starter. 	<ol style="list-style-type: none"> Examine and identify various tools used for overhauling spring starter. Demonstrate how to service a faulty spring starter. Emphasis the need for safety precautions in handling spring starters.
9.	<p><u>Starter Motor Types</u></p> <p>Identify various types of starter motors and with the aid of a labeled diagram explain their operations and state their functions, and applications.</p>	<ol style="list-style-type: none"> Types of starter motors. <ol style="list-style-type: none"> axial/coaxial inertia pre-engaged Functions of the starter motor in a motor vehicle. Diagram of a starting system. Principles of operations of a starter motor. Principles of operation of: <ol style="list-style-type: none"> inertia pre-engaged spring starter Advantages and disadvantages of: <ol style="list-style-type: none"> inertia pre-engaged co-axial axial spring starter Types of starter drives <ol style="list-style-type: none"> In board Out board Roller clutch Self indexing ellipse Principles of operation of: <ol style="list-style-type: none"> in board out board roller clutch self indexing ellipse starter drives 	<ol style="list-style-type: none"> Identify the axial coaxial inertia and pre-engaged starters in an auto electrical workshop. Dismantle and examine a starter motor in the auto-electrical workshop. Examine and identify the following types of starter motors. <ol style="list-style-type: none"> Inertia Co-axial Spring starter axial Examine and identify different types of starter drives e.g. in board, out board, roller clutch, self indexing, ellipse.
10.	<p><u>Repair and Maintenance of Starter Motors</u></p> <ol style="list-style-type: none"> Identification of the various tools and equipment used in the service and maintenance of a starter motor. Trouble shoot, dismantle, reassemble, install and test a starter motor for 	<ol style="list-style-type: none"> Tools and equipment used in the service and maintenance of a starter motor. <ol style="list-style-type: none"> Screw drivers Spanners (assorted) Test lamp Lathe machine Bench testing machine Under cutting machine Armature testing growler Avometer etc. 	<ol style="list-style-type: none"> Identification of different types of tools and equipment used in the services and maintenance of a starter motor e.g. screw drivers, spanners, test lamp etc. Demonstrate how to trouble-shoot auto starting systems.

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	normal conditions	<ol style="list-style-type: none"> 2. Trouble shooting of auto starting system. <ol style="list-style-type: none"> i. visual inspection ii. testing the battery with the hydrometer etc. iii. test the starter motor with instrument iv. test the starter circuit with battery starter test (locked or torque test) 3. Types of starter motors. Removal by correct techniques using safety measures. 4. Components of the starter motors. <ol style="list-style-type: none"> i. dismantling ii. repairs 5. Methods of testing starter motor parts. <ol style="list-style-type: none"> i. armature growler test ii. motor brush test for continuity 6. Starter motor brushes – bedding. 7. Armature shaft of a starter motor - straightness. 8. Correctness of: <ol style="list-style-type: none"> i. commutator-end-bracket. ii. Drive-end bracket iii. Brushings for starter motor 	<ol style="list-style-type: none"> iv. visual inspection v. testing the battery with the hydrometer etc. 3. Demonstrate with the use of appropriate tools how to remove common types of starter motors from vehicle. 4. Emphasis should be laid on safety measures. 5. Dismantle and repair the component parts of a starter motor noting the relative position of parts. 6. Demonstrate the different methods of testing starter motor parts. 7. Demonstrate how to bed starter motor brushes. 8. Demonstrate how to straighten armature shaft of a starter motor. 9. Demonstrate how to re-assemble component parts of a starter motor. 10. Demonstrate how to bench-test starter motor.
11.	<p><u>Types of Batteries</u></p> <ol style="list-style-type: none"> 1. Identify and name various types of batteries commonly used for the supply of power to auto-electrical system and accessories. 2. Explain the term battery capacity and name factors that influence the capacity of batteries and carry out calculations to determine them. 	<ol style="list-style-type: none"> 1. Purpose of battery in the motor vehicle. 2. Types of batteries – lead-acid. 3. Composition and description of: <ol style="list-style-type: none"> i. lead-acid batteries ii. nickel-alkaline 4. Cross-sectional diagrams. 5. Principles of operation of: <ol style="list-style-type: none"> i. lead acid batteries. ii. Nickel-alkaline. 6. Battery capacity - ratings 7. Factors influencing the capacity of batteries: <ol style="list-style-type: none"> i. area of plate ii. number of plates iii. volume of electrolyte 8. Simple calculation involving: <ol style="list-style-type: none"> i. charging rate ii. capacity iii. efficiency 9. Battery connections <ol style="list-style-type: none"> i. series ii. parallel 	<ol style="list-style-type: none"> 2. Identify different types of batteries used in auto electrical systems and accessories. 3. Solve simple problems to determine: <ol style="list-style-type: none"> i. Capacity ii. Charging rate iii. Efficiency in a battery 4. Demonstrate how batteries are connected in series and parallel.
12.	<p><u>Lead Acid Batteries</u></p> <ol style="list-style-type: none"> 1. Name, identify and describe the use and operation of materials, tools, instruments and 	<ol style="list-style-type: none"> 1. Materials, tools, instruments and equipment used for battery charging testing and maintenance <ol style="list-style-type: none"> i. distilled water ii. hydrometer 	<ol style="list-style-type: none"> 1. Examine and identify different tools. Instruments and equipment used for battery charging, testing and maintenance.

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	<p>equipment used for battery charging, testing and maintenance.</p> <p>2. List the hazards that exist in a battery charging room and state the safety rules to be observed.</p> <p>3. Apply, maintain and state the purposes of wears for working in the battery charging room and name the protection achieved.</p> <p>4. Apply various first aid treatment for accidents found in a battery charging room and state the rules for the preparation of acid electrolyte to specification observing appropriate safety rules.</p> <p>5. Describe various methods of charging a battery and explain the charging and discharging processes of the lead acid batter.</p> <p>6. Determine the condition of full charge of lead-acid batteries.</p> <p>7. Care for and maintain lead-acid batteries.</p>	<p>iii. discharge tester etc.</p> <p>2. Use/operation of:</p> <p>i. distilled water</p> <p>ii. dilute sulphuric acid</p> <p>iii. hydrometer</p> <p>iv. hygrometer</p> <p>v. high rate discharge tester</p> <p>vi. Battery charger etc.</p> <p>3. Hazards in battery charging room:</p> <p>i. Acid spillage</p> <p>ii. Explosion</p> <p>iii. Electric shock</p> <p>iv. Burns</p> <p>v. Toxic fume etc.</p> <p>4. Safety rules.</p> <p>5. Maintenance of the battery charging equipment</p> <p>6. Working wears in a charging room:</p> <p>i. Rubber</p> <p>ii. Rubber gloves</p> <p>iii. Nose mask</p> <p>iv. Rubber boots</p> <p>v. Goggles etc.</p> <p>7. First aid treatment for:</p> <p>i. Acid spills</p> <p>ii. Burns</p> <p>iii. Electric shock</p> <p>iv. Cuts etc.</p> <p>8. Preparation of acid electrolyte safety rules</p> <p>9. Preparation of acid electrolyte.</p> <p>10. Acid electrolyte – Test with hydrometer</p> <p>11. Temperature correction in preparation of electrolyte</p> <p>12. Charging and discharging processes of the lead-acid battery.</p> <p>13. Methods of charging a battery:</p> <p>i. Constant current (series)</p> <p>ii. Constant voltage condition</p> <p>Determine, using:</p> <p>a. ammeter</p> <p>b. voltmeter, cadmium tester</p> <p>c. high rate discharge tester etc</p> <p>14. Battery connection.</p> <p>15. Battery connections to charger.</p> <p>16. condition of battery – ascertaining by:</p> <p>i. visual inspection</p> <p>ii. appropriate test</p> <p>17. Prevention of terminal corrosion.</p> <p>i. Visual inspection</p> <p>ii. Hydrometer test</p> <p>iii. Voltmeter test</p> <p>18. Battery disconnection from charge after charging.</p> <p>19. Caring and maintaining lead-acid</p>	<p>2. Discuss the safety rules to be observed in a battery charging room.</p> <p>3. Emphasize the hazards that exist in a charging room.</p> <p>4. Emphasize the need to observe safety rule in a battery charging room.</p> <p>5. Demonstrate how to maintain the battery charging room.</p> <p>6. Discuss the protection achievement of wearing the rubber gloves, rubber apron, nose mask, rubber boots and goggles.</p> <p>7. Emphasize the need to wear aprons, gloves etc. in the charging room.</p> <p>8. Demonstrate how to test acid electrolyte with hydrometer.</p> <p>9. Demonstrate how to determine the condition of a lead-acid battery using the ammeter, voltmeter cadmium tester etc.</p> <p>10. Demonstrate how to connect batteries for charging.</p> <p>11. Demonstrate how to set battery charger and how to connect battery to charger.</p> <p>12. Demonstrate how to ascertain the condition of a battery during charge.</p> <p>13. Demonstrate different methods of determining the condition of fuel charge of batteries.</p> <p>14. Demonstrate how batteries are disconnected from charger after charging.</p> <p>15. Demonstrate the caring and maintenance of lead-acid batteries by removing usurpation on the battery terminal parts and surroundings etc.</p> <p>16. Methods of determining the condition of full charge of batteries.</p> <p>17. Demonstrate how to prevent terminal corrosion.</p>

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		batteries. i. removal sulphation on the battery terminal parts and surrounding. ii. Clean and dry the top and outer surfaces of battery with appropriate solvent drier. iii. Repair/restructure of broken terminal post etc.	
13.	<u>Charging and Maintenance of Nickel Alkaline Batteries</u> 1. Prepare and state the composition of the electrolyte used in nickel-alkaline batteries observing appropriate safety measures. 2. Test nickel-alkaline battery electrolyte for correct specific gravity observing appropriate safety measures. 3. Carry out appropriate tests at intervals to ascertain the conditions of the nickel-alkaline batteries during charging process.	1. Electrolyte composition of a nickel-alkaline battery 2. Charging safety rules. 3. Preparation of electrolyte for nickel-alkaline battery using appropriate specification. 4. specific gravity of nickel alkaline battery electrolyte. 5. Charging and discharging processes of a nickel-alkaline battery. 6. Condition of a nickel-alkaline battery using appropriate testing instrument 7. connection of a nickel-alkaline battery to charger. 8. Condition of the nickel-alkaline battery – ascertain during charging process 9. Conditions for full charge of batteries. 10. Care/maintenance of nickel-alkaline batteries.	1. Demonstrate how to prepare electrolyte for nickel-alkaline battery. Show how to test for correct specific gravity of the electrolyte in a nickel-alkaline battery. 2. Demonstrate how to connect the nickel-alkaline battery to a charger. 3. Demonstrate how to test the condition of the nickel-alkaline battery during charging. 4. Show how to test for full charge of batteries. 5. Examine and identify different tools. Instruments
AUTO IGNITION AND CHARGING SYSTEMS (CAE 13 & 14)			
14.	<u>Coil Ignition</u> 1. Identify, draw a schematic diagram and explain the function of each component of the battery coil ignition system. 2. Identify the physical components, tools, instruments and equipment used for maintenance and test of ignition system and state their application. 3. Trouble-shoot faulty ignition coil and carry out static/dynamic ignition timing using test lamp and stroboscope.	1. Battery type ignition coil. 2. Functions of coil ignition system in an automobile. 3. Schematic diagram of the battery ignition system. 4. Functions of each component of the following coil ignition system. i. Ignition Coil ii. Distributors iii. Spark Plugs iv. Connecting Wires v. Battery Switch etc. vi. Ballast Resistor 5. Physical positions of the components of the battery coil ignition system. i. Ignition ii. Distributors iii. Spark plugs iv. connecting wires v. battery switch etc. vi. in an automobile vii. Condenser or Capacitor viii. Contact Breaker ix. Cam x. Rotor 6. Hazard involved in servicing the battery	1. Examine and identify the battery types ignition coil. 2. Interpret the schematic diagram of the battery coil ignition system. 3. Examine and identify the physical positions of the components of the battery coil ignition system. 4. Examine and identify tools, instrument and equipment used for maintenance and testing on the ignition system e.g. Spanners, screw drivers etc. 5. Demonstrate how to trouble-shoot faulty component parts of an ignition coil system using appropriate tools/instruments. 6. demonstrate how to test ignition output with the tact dwell volt-tester. 7. Demonstrate how to use

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		coil ignition system. i. fire ii. burns 7. Tools, instruments and equipment used for maintenance and test on the ignition system. i. spanners ii. screw drivers etc. 8. Safety precautions when working on an ignition system to prevent hazards like: i. fire ii. burns etc. 9. Trouble-shoot faulty component parts of an ignition coil system using appropriate tools/instruments for testing. i. ignition coil open and short circuit test with meggar. ii. Condenser – correct reading with condenser tester etc. 10. Test ignition output with the tack-dwell volt-tester. 11. Static ignition timing using test lamp. 12. Dynamic ignition timing using stroboscope (time light)	stroboscope (time light) on dynamic ignition timing.
1.	<u>Magneto Ignition System</u> 1. Identify, draw a schematic diagram of the magneto ignition systems and label its parts. Also outline the main difference between the magneto system and the battery coil system. 2. Diagnose, test clean up, adjust and repair each component of the magneto system and test the output with the appropriate instrument.	1. Magneto ignition system. 2. Schematic diagram of the magneto ignition system. 3. Difference between: i. magneto system ii. battery coil system 4. Faulty magneto ignition system. 5. Maintenance of the magneto system. 6. Coupling component parts of the magneto. 7. Ignition system. 8. Magneto ignition output 9. Static ignition timing using test lamp 10. Dynamic ignition timing using stroboscope	1. Dismantle a mageto ignition system and examine/identify its different component parts. 2. Interpret schematic diagram of the magneto ignition system. 3. Demonstrate how to disconnect essential components and diagnose faulty magneto ignition system from the engine. 4. Demonstrate how to maintain the magneto system. 5. Demonstrate how to couple back different component parts of the magneto ignition system. 6. Demonstrate how to test the magneto ignition output with appropriate instrument. 7. Demonstrate how to carry out static ignition timing using test lamp. 8. Demonstrate how to carry out dynamic ignition timing using stroboscope.
16.	<u>The Opus Distribution</u> 1. Name and identify	1. Types of distributors: i. Double	1. Examine and identify different types of

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	<p>various types of distributors and describe their principles of operation.</p> <p>2. Sketch and explain the operation of the vacuum advance unit and the centrifugal advance mechanism.</p> <p>3. Draw and label the schematic diagram of the OPUS current and remove/service the OPUS from the engine using a manual or a set of specific instructions.</p>	<p>ii. Oscillating pick-up systems</p> <p>2. Principles of operation of the distributors.</p> <p>3. Principle of operation of the vacuum advance mechanism.</p> <p>4. Principles of operation of the centrifugal advance mechanism.</p> <p>5. Vacuum advance unit for effective operation on engine-test.</p> <p>6. Centrifugal advance mechanism for effective operation-test.</p> <p>7. Adjustment of double contact distributors to specification using dwell tack meter.</p> <p>8. Schematic diagram of the OPUS circuit</p> <p>9. OPUS distributor – removal from engine.</p> <p>10. Servicing of OPUS distributor – using manual or specific instrument.</p>	<p>distributors.</p> <p>2. Demonstrate how to test the vacuum advance unit for effective operation on the engine with appropriate instrument.</p> <p>3. Demonstrate how to test the centrifugal advance mechanism for effective operation.</p> <p>4. demonstrate how to adjust a double contact distributor to specification using the dwell tack-meter.</p> <p>5. Interpret the schematic diagram of the OPUS circuit.</p> <p>6. Demonstrate how to remove the OPUS distributor unit using a manual or specific instructions.</p>
17.	<p><u>Transistor Controlled/ Assisted Ignition System</u></p> <p>1. Identify the various types of transistor controlled assisted ignition system and explain the operation of each type.</p> <p>2. Enumerate the advantages of the transistor controlled/assisted ignition over the conventional ignition system and outline their main differences.</p>	<p>1. Types of transistor controlled/assisted ignition system.</p> <p>i. contact controlled</p> <p>ii. magnetic controlled.</p> <p>iii. Transistor assisted ignition unit TAC4</p> <p>2. Operation of each of the transistor controlled/assisted ignition system.</p> <p>3. Differences between battery coil ignition system and transistor controlled types.</p>	<p>1. Examine and identify the various types of transistor controlled/assisted ignition system e.g. contact controlled TAC4.</p> <p>2. Interpret schematic diagram of the:</p> <p>i. Negative earth system</p> <p>ii. Positive earth system.</p> <p>3. Demonstrate how to service transistor controlled ignition system using a manual or a set of given instruments.</p>
18.	<p><u>The dynascope</u></p> <p>1. Identify a dynascope, showing its main features or controls and state their functions.</p> <p>2. Test engine efficiency with the dynascope and interpret the wave pattern observed on the dynascope to specification making necessary adjustments of the engine.</p>	<p>1. Controls and functions of a dynascope:</p> <p>i. on/off means switch</p> <p>ii. oscilloscope controls-raster, pattern and super-imposed pattern.</p> <p>iii. Voltmeter/armeter/chmeter controls.</p> <p>iv. Capacity leakage test control</p> <p>v. Built in stroboscope etc.</p> <p>2. Safety use of the dynascope – precautions</p> <p>3. Dynascope connection</p> <p>4. Engine efficiency using – dynascope</p> <p>5. Dynascope wave pattern.</p>	<p>1. Examine and identify the main features or controls of a dynascope.</p> <p>2. Emphasize the precautionary measure for the safe use of the dynascope.</p> <p>3. Demonstrate how to connect the dynascope to the engine correctly for testing.</p> <p>4. Demonstrate how to test engine efficiency with the dynascope.</p> <p>5. Interpret wave pattern observed on the dynascope to specification.</p>

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19.	<p><u>Generation of Electricity</u></p> <ol style="list-style-type: none"> Define induced current and voltage and use laboratory experiments to determine them. State Lenz's law and relate it to the experiments in induced current/voltage. Explain the electromagnetic principles of generation of electricity with the aid of diagrams. 	<ol style="list-style-type: none"> Induced current – definition Induced voltage – definition Induced E. F. and potential, difference (pd) – comparison Induced current and induced voltage – determine by laboratory experiment. Lenz's Law Application of Lenz's law to induced current, induced voltage. Electromagnetic principles of electricity generation – Diagrams Factors governing the amount of current produced by a generator. 	<p>Demonstrate in the laboratory experiment on how to determine:</p> <ol style="list-style-type: none"> induced current induced voltage
20.	<p><u>Generation Type Repair and Servicing</u></p> <ol style="list-style-type: none"> Identify various types of generators and explain their working principles. State the function of the generator in all automobile. Name and explain three methods of output control of generators and identify the rating or size of each type of generator. Detect, trouble shoot and service faulty charging system. Polarize a given generators and rewind armature coil to specification using armature rewinding machine method. 	<ol style="list-style-type: none"> Functions of a generator in an automobile. <ol style="list-style-type: none"> Functions of the different parts of an auto charging system. Schematic diagram of an auto charging system. Block diagram of the following generators showing their physical features: <ol style="list-style-type: none"> d.c. generator interpole bucking field split field. Generator rating. Methods of output control of generators. Methods of output control generators <ol style="list-style-type: none"> Armature reaction method Compensated voltage control current-voltage control. Faulty charging system Methods of trouble-shooting faulty charging systems <ol style="list-style-type: none"> Visual inspection for disconnections in the system AVO meter test for continuity and faulty components. Faulty charging systems – service with appropriate tools following correct sequence: <ol style="list-style-type: none"> Remove the generator from the engine of the automobile Dismantle the generator noting the relative positions of the component. Test generator armature, brushes and field coil with appropriate instrument. Skin armature commutator, etc. 	<ol style="list-style-type: none"> Dismantle, examine, identify and re-assemble the different parts of an auto charging system. Examine and identify the physical features of a generator. Examine and identify the rating of size of each of the generators as listed on the body of the machine. Demonstrate the different methods of output control of generators using the: <ol style="list-style-type: none"> armature reaction Compensated voltage control methods etc. Install and adjust fan belt to correct tension Demonstrate by dashboard method how to detect faulty charging system. Demonstrate different methods of trouble shooting faulty charging systems. Demonstrate how to serve faulty charging system with appropriate tools. Demonstrate how to polarize a generator. Demonstrate how to mount a generator to the engine and fix the fan belt correctly. Demonstrate how to start an engine and test a mounted generator for

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
		10. Generator polarizing process. 11. Generator polarization. 12. Process of generator mounting to engine and fixing of fan belt. 13. Rewinding armature coil using armature rewinding machine method.	normal working condition. 12. Demonstrate how to rewind an armature coil to specification using armature rewinding machine method.
21.	<u>The Alternator</u> 1. Identify and explain with the aid of labeled diagram, the working principles of the alternator. 2. Outline the working advantages, limitations and difference of the alternator in comparison with d.c. generator. 3. Detect/repair a faulty alternator and test the output of the alternator using appropriate instruments. 4. Explain the working principles of various types of alternator circuits and rectifiers and remove the rectifier unit from the alternator and reassemble it. 5. Explain the working principles and service various types if regulators/circuits associated with the automobile alternator using manufacturers manual specifications.	1. Automobile alternator – identification. 2. a) Working principles of an alternator, b) Block diagram of an alternator. 3. Alternator and d.c. generator – work comparison. 4. Advantages and limitation of the alternator and the d.c. generator – comparison. 5. a) Functions of main part/units of an alternator; b) Cross-sectional diagram showing main parts and units. 6. Fault detection in an alternator system i. visual inspection for loose parts. ii. Testing for faulty appropriate instruments. 7. Repair of fault alternator by: i. removing the alternator and its accessories from the automobile, ii. dismantling the alternator noting the relative positions of its working parts. iii. Cleaning the rotors of the alternator. iv. Cleaning the stator of the alternator etc. 8. Alternator output 9. Principles of the alternator rectifier. 10. Principle of the alternator circuits – Block diagram of the alternator circuits: i. self excited circuits; ii. battery excited circuits. 11. Dismantle and assemble the rectifier unit in the alternator. 12. Diode rectifier unit – test using the following instruments: i. Ohmmeter; ii. Test lamp. 13. Methods of replacing faulty diode in a rectifier unit using correct soldering technique. 14. Principles of regulators/circuit associated with automobile alternator system. Block diagram of the following regulators/circuits: i. built in regulators (transistorize); ii. external regulator (eransistorized) 15. Servicing/adjusting automobile regulator circuits using manuals.	1. Examine and identify an alternator in an automobile. 2. Interpret the cross-sectional view of an alternator showing the main parts/units. 3. demonstrate how to detect faults in an alternator system by: 4. Demonstrate how to repair a faulty alternator by: i. removing ii. dismantling iii. cleaning iv. replacing v. reassembling vi. mounting the alternator unto the engine and fix the fan belt correctly. 5. Demonstrate how to test the output of the alternator using appropriate instrument e.g. AVO meter. 6. Demonstrate how to remove the rectifier unit from the alternator and reassemble. 7. Demonstrate how to test the diode of the rectifier unit with Ohmmeter and test lamp. 8. Demonstrate how to replace faulty diode in a rectifier unit with a soldering iron. 9. Demonstrate how to service or adjust automobile regulators/regulator circuits using manufacturer’s manual or specifications.
22.	<u>Relays</u>	1. 6RA relay – identification	1. Examine and identify a

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
	<ol style="list-style-type: none"> 1. Identify, explain the working principles and state the functions of a relay in an automobile charging system. 2. Remove and fix back a relay from an auto electrical circuit. 	<ol style="list-style-type: none"> 2. Principles of a relay – using schematic diagram 3. Functions of relay in an auto charging system. 4. Cleaning and adjustment of relay in an auto electrical circuit. 5. Replacement of a relay in an auto electrical circuit. 	<ol style="list-style-type: none"> 2. Interpret the schematic diagram of a relay. 3. Explain the functions of a relay in an auto-charging system. 4. Demonstrate how to remove a relay from an auto electrical circuit for cleaning and adjustment. 5. Demonstrate how to fix back a relay in auto electrical circuit.

**032 – AUTO BATTERY WIRING/LIGHTING AND ACCESSORIES
CHARGING (CAE 16 & 17)**

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
1.	<u>Tools and Materials</u> Select, name and identify various tools and components used in wiring operations of auto-electrical. Systems. State the use of each.	<ol style="list-style-type: none"> 1. Tools used in wiring operations of auto electrical systems: <ol style="list-style-type: none"> i. Pliers (assorted); ii. Side-cutters iii. Cable stripper etc. 2. Components and material used in auto electrical wiring. <ol style="list-style-type: none"> i. switches (assorted); ii. cables (assorted); iii. fuses (assorted); iv. insulation tapes etc. 3. Uses of: <ol style="list-style-type: none"> i. switches; ii. cables fuses; iii. insulation tapes; iv. solder; v. protection grommet in auto electrical works. 	<ol style="list-style-type: none"> 1. Examine and identify different tools used in wiring operations of auto electrical systems. 2. Examine and identify various components and materials used in auto electrical wiring.
2.	<u>Soldering</u> Select various tools and materials for soldering joints in an electrical circuit, explain its importance and enumerate the hazards involved.	<ol style="list-style-type: none"> 1. Importance of soldering connection joints in a circuit. 2. Hazards in soldering: <ol style="list-style-type: none"> i. burns; ii. electric shock iii. damages etc. 3. Types of joints used in automobile electrical wiring: <ol style="list-style-type: none"> i. Loop joint; ii. Lap joint; iii. Tee joint etc. 4. Tools and materials used for soldering joints in an electrical circuit. 5. Joints soldering observing safety precautions. 6. Types of fluxes used on electrical connections. 	<ol style="list-style-type: none"> 1. Demonstrate how to make common types of joints in automobile electrical wiring. 2. Examine and identify various tools and materials used for soldering joints in an electrical circuit. 3. Demonstrate how to solder joints in an automobile electrical wiring circuit. 4. Demonstrate how to apply flux to the iron and joints.
3.	<u>Cable Colour Coding</u> Describe harnessing, identify cables/wires which are harnessed and explain its need.	<ol style="list-style-type: none"> 1. Harnessing 2. Need for harnessing 3. Harnessed cables or wires 4. Colour codes and sizes of cable identification 5. Different bulbs used in auto-mobile: <ol style="list-style-type: none"> i. fees for bulb; ii. Edison screw type bulb; iii. Wedge-based bulb iv. Pre-focus bulb etc. 6. Wiring diagram of a lighting circuit in an auto-electrical system. 7. Operation of the lighting circuit in an auto-electrical system. 	<ol style="list-style-type: none"> 1. Harnessing 2. Examine and identify cables or wires which are harnessed. 3. Examine and identify cables by their colour codes and sizes. 4. Examine and identify different bulbs used in auto mobile e.g. Edison screw type bulb etc. 5. Show how to wire a lighting circuit from a given auto electrical wiring diagram. 6. Demonstrate how to test

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
			the wiring of a lighting circuit in an auto-electrical system for good operation.
4.	<p><u>Wiring Circuit</u></p> <ol style="list-style-type: none"> Identify various lamps and state the regulations for motor vehicle lamps, colours and lighting systems. Explain the functions of various lighting circuits. Read and interpret the wiring diagrams of auto lighting systems from manufacturers' manual and select appropriate instruments for aligning vehicle head lamps. 	<ol style="list-style-type: none"> Regulations for motor vehicle lamps colour and lighting system. Lamps and colours and lamps used in lighting system. Functions of lighting circuit <ol style="list-style-type: none"> head, lamp circuit; side tail number plate and panel circuit; auto dazzle/fog lamps. Wiring of auto lighting systems. Difference between a driving lamp (off alignment) and a properly adjusted lamp. Importance of correct alignment of driving lamps. Instruments used for aligning vehicle head lamps or beam setter. Methods of setting driving lamp to specification – local method. 	<ol style="list-style-type: none"> Examine and identify various lamps and specify the colour to be used based on the regulation. Interpret the wiring diagram of auto lighting systems from manufacturers manual. Examine and identify various instruments used for aligning vehicle head lamps. Demonstrate how to set driving lamp to specification.
5.	<p><u>Insulated Return Wire</u></p> <ol style="list-style-type: none"> Prepare read and interpret the wiring diagram of an insulated return wire for an auto mobile. Name and identify various materials used for insulated return wire and outline kits importance Mark out position, drill and carry out installation of insulated return wiring circuit. Test the installation. 	<ol style="list-style-type: none"> Importance for insulated return wiring – elimination of fire outbreak on vehicle carrying inflammable liquids etc. Wiring diagram of an insulated return wire for an automobile. Preparation of wiring for an auto mobile. Materials used for insulated return wiring: <ol style="list-style-type: none"> conduit cable master switch lamp holders clips fuse box etc. Drilling and laying positions of accessories for an insulated return wiring. Installation of insulated return wiring circuit – testing. 	<ol style="list-style-type: none"> Explain the importance for insulated return wiring. Emphasize the importance of an insulated return wiring. Interpret the wiring diagram of an insulated return wiring for an automobile. Demonstrate how to prepare a wiring diagram for an insulated return wiring for an automobile. Examine and identify different materials used for insulated return wiring e.g. conduit, cable etc. Demonstrate how to mark out position for drilling and laying of the accessories for an insulated return wiring. Demonstrate how to drill and carry our installation of insulated return wiring. Demonstrate how to test insulated return wiring circuit installation.
6.	<p><u>Double Battery Single Charging System</u></p> <p>Identify various types of blocking diodes used in the double battery single charging</p>	<ol style="list-style-type: none"> Uses of double battery single charging system – police patrol van etc. Circuit diagram of a double battery unit using single charging system. Functions and operations of blocking 	<ol style="list-style-type: none"> Interpret the circuit diagram of a double battery unit using a single charging system. Examine and identify the

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
	system and explain their functions and operations.	<p>diode in the double battery unit using single charging system.</p> <ol style="list-style-type: none"> 4. Blocking diodes in the double battery unit using a single charging system – identification. 5. Types of block diodes used in the double battery single charging system: <ol style="list-style-type: none"> i. negative earth type ii. positive earth type 6. Installation of a double battery single charging system. 7. Installation of a double battery single charging system. 8. Installation of a double battery single charging system – Testing. 	<p>blocking diodes in double battery unit using a single charging system.</p> <ol style="list-style-type: none"> 3. Examine and identify different types of blocking diodes used in the double battery charging system. 4. Demonstrate how to install a double battery single charging system. 5. Demonstrate how to test the installed double battery single charging system.
7.	<p><u>Anti-Theft Circuit</u></p> <ol style="list-style-type: none"> 1. Prepare wiring circuit diagram, install and test anti-theft device and give examples of various types. 2. Trouble-shoot and rectify faulty anti-theft device circuit. 	<ol style="list-style-type: none"> 1. Examples of different types of anti theft devices used in automobile; 2. Wiring circuit diagram for a given anti-theft device. 3. Installation of anti-theft device. 4. Anti-theft device – Testing 5. Trouble shoot of a faulty anti-theft device circuit. 6. Faults in the anti-theft device – rectification. 	<ol style="list-style-type: none"> 1. Examine and identify different types of anti-theft devices used in automobile. 2. Show how to prepare wiring diagram for a given anti-theft device. 3. Demonstrate how to install an anti-theft device. 4. Demonstrate how to test anti-theft devices. 5. Show how to trouble shoot a faulty anti-theft device circuit. 6. Show how to rectify the faults in the anti-theft device.
8.	<p><u>Printed Circuit</u></p> <ol style="list-style-type: none"> 1. Identify and read printed circuit and state the need for its use. 2. De-solder and resolder components from and to a printed circuit without damaging the unit. 	<ol style="list-style-type: none"> 1. Need for a use of printed circuit in automobile electrical wiring. <ol style="list-style-type: none"> i. minimization of short circuits ii. reducing number of wiring and cost. 2. Printed circuit – identification. 3. Printed circuit diagram – reading 4. Printed circuits faults – diagnosis and rectification. 5. De-soldering and re-soldering of components from and to a printed circuit. 6. Printed circuit unit – removal and replacement. 	<ol style="list-style-type: none"> 1. Examine and identify a printed circuit. 2. Demonstrate how to read printed circuit diagram. 3. Demonstrate how to diagnose and rectify faults in a given printed circuit 4. Demonstrate how to de-solder and re-solder components from and to a printed circuit without damaging the unit. 5. Demonstrate how to replace a printed circuit unit.
9.	<p><u>Electric Horn</u></p> <ol style="list-style-type: none"> 1. Sketch an outline diagram and identify various types of electric horn and explain the working of the circuit. 2. Trouble shoot service, rectify adjust and install 	<ol style="list-style-type: none"> 1. Electric Horns 2. Principles of Horn system: <ol style="list-style-type: none"> i. Air or vacuum horn ii. Wind tone horn iii. High frequency horn 3. Working of the electric horn circuit – outline diagram of an electric horn. 	<ol style="list-style-type: none"> 1. Examine and identify various types of electric horns. 2. Interpret the outline diagram of an electric horn circuit. 3. Demonstrate how to install

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
	faulty electric horn system in an automobile using manufacturer's specification.	<ol style="list-style-type: none"> 4. Automobile electric horn system – installation using manufacturer's specification. 5. Electric horn circuit – rectification of faults by trouble shooting techniques. 6. Electric Horn – service and adjustment 	<p>an electric horn system in an automobile system using manufacturer's specifications.</p> <ol style="list-style-type: none"> 4. Demonstrate how to trouble shoot and rectify faults in a horn circuit. 5. Demonstrate how to service and adjust electric horn.
10.	<p><u>Windscreen Wipers</u></p> <ol style="list-style-type: none"> 1. Draw a schematic diagram and identify various types of windscreen wipers and explain its operations and functions. 2. Trouble shoot, service and install a faulty windscreen wiper circuit following given instructions. 	<ol style="list-style-type: none"> 1. Windscreen wipers (types) – identification: <ol style="list-style-type: none"> i. single stroke; ii. rack and pinion/linkage type; iii. vacuum type. 2. Operation of windscreen wiper and screen washer with the aid of a diagram. 3. Functions of the windscreen wiper – schematic diagram showing: <ol style="list-style-type: none"> i. control system; ii. wiper blades etc. 4. Windscreen wiper and washer system – installation to manufacturer's specification. 5. Windscreen wiper circuit – rectification of faults by trouble shooting techniques. 6. Windscreen wiper and washer – servicing and maintenance. 	<ol style="list-style-type: none"> 1. Examine and identify various types of windscreen wipers e.g. single strokes wiper, rack and linkage types etc. 2. Interpret schematic diagram of a wind screen wiper from the control to the wiper blades. 3. Demonstrate how to install a windscreen wiper/washer system to manufacturer's specification. 4. Demonstrate how to trouble shoot faulty windscreen wiper circuit and how to rectify the faults. 5. Demonstrate how to service and maintain windscreen wiper and washer.
11.	<p><u>Electric Fuel Pump</u></p> <ol style="list-style-type: none"> 1. Draw a schematic diagram and identify an electric fuel pump in a motor vehicle. Explain its working principles. 2. Trouble shoot, service and install faulty electric fuel pump system in a vehicle using manufacturer's manual or instructions. 	<ol style="list-style-type: none"> 1. Electric fuel pump in a motor vehicle identification. 2. Operational principles of an electric fuel pump. – with the aid of diagram. 3. Functions of the various parts of the electric fuel pump circuit. – with the aid of a schematic diagram. 4. Electric fuel pump system in a vehicle – installation using manufacturer's manual. 5. Electric fuel pump circuit – rectification of faults by trouble-shooting techniques. 6. electric fuel pump – service and maintenance using a manual. 	<ol style="list-style-type: none"> 1. Examine and identify an electric fuel pump in a motor vehicle. 2. Interpret the schematic diagram of an electric fuel pump circuit. 3. Demonstrate how to install electric fuel pump system in a vehicle using manual. 4. Demonstrate how to trouble-shoot faulty electric fuel pump circuit and rectify the fault. 5. Demonstrate how to service an electric fuel pump using a manual.
12.	<p><u>Direction Indicator</u></p> <ol style="list-style-type: none"> 1. With the aid of a schematic diagram, explain the working of a direction indicator system and locate its 	<ol style="list-style-type: none"> 1. Indicator control in an automobile – location and direction. 2. Operation of direction of indicator system in an automobile – illustrate with a schematic diagram. 3. Direction indicator system in an 	<ol style="list-style-type: none"> 1. Demonstrate how to locate the position of direction indicator control in an automobile. 2. Interpret schematic diagram of a direction

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
	<p>position in an automobile.</p> <p>2. Trouble-shoot, rectify and install faulty direction indicator system in an automobile using manufacturer's manual or instruction.</p>	<p>automobile – installation using system manufacturer's manual.</p> <p>4. Direction indicator circuit – rectification of fault by trouble shooting techniques.</p>	<p>indicator system of an automobile.</p> <p>3. Demonstrate how to install a direction indicator circuit system in an automobile using manual.</p> <p>4. Demonstrate how to trouble shoot faulty direction indicator circuit and how to rectify the faults.</p>
13.	<p><u>Cigarette Lighter</u></p> <p>1. With the aid of a schematic diagram, describe the working principles of the cigarette lighter.</p> <p>2. Locate its position on the dashboard of a motor vehicle</p>	<p>1. Cigarette lighter in a motor vehicle – location and position.</p> <p>2. Operational principle of the cigarette lighter.</p> <p>3. Auto cigarette lighter circuit – illustration by schematic diagram.</p> <p>4. Cigarette lighter circuit – rectification of fault by trouble shooting technique.</p>	<p>1. Show the location of a cigarette lighter on the dashboard of a motor vehicle.</p> <p>2. Interpret the schematic diagram of the auto cigarette lighter circuit.</p> <p>3. Demonstrate how to trouble-shoot faulty cigarette lighter circuit and rectify the fault.</p>
14.	<p><u>Gauge</u></p> <p>1. Describe the working principles of various types of gauges and locate their position on the dashboard.</p> <p>2. Trouble shoot and detect faults in the various gauges.</p>	<p>1. Location of gauges on an automobile dashboard.</p> <p>2. Operational principles of:</p> <p>3. a) oil pressure gauges b) temperature gauges – detection of faulty readings.</p> <p>4. a) oil pressure gauges b) temperature gauges – rectification of fault by trouble shooting techniques.</p>	<p>1. Show the location of various gauges on the dashboard e.g. oil pressure gauges/sensing unit including the oil switch etc.</p> <p>2. Demonstrate how to detect faulty readings in oil pressure and, temperature gauge etc.</p> <p>3. Demonstrate how to trouble shoot and rectify faults common to oil pressure and temperature gauges, etc.</p>
15.	<p><u>Heater System</u></p> <p>1. With the aid of diagrams explain the working of the automobile interior heater and locate the unit in an automobile.</p> <p>2. Trouble shoot service and install a faulty heating system in a motor vehicle to manufacturer's specification.</p>	<p>1. Interior heater unit – location</p> <p>2. Operation of interior heater in an automobile with the aid of diagrams.</p> <p>3. Heating system in an automobile-rectification of fault by trouble shooting techniques.</p> <p>4. Heating system in an automobile – installation using manufacturer's specification.</p> <p>5. Interior heater system – service and maintenance using given instructions.</p>	<p>1. Show how to locate the interior heater unit in an automobile.</p> <p>2. Demonstrate how to trouble shoot faulty heating system and how to rectify them.</p> <p>3. Demonstrate how to install a heating system in a motor vehicle to specification.</p> <p>4. Demonstrate how to service the interior heater system of a motor vehicle following given instructions.</p>
16.	<p><u>Cooling Fan Unit</u></p>	<p>1. Cooling fan unit in an motor vehicle.</p>	<p>1. Demonstrate how to locate</p>

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
	<ol style="list-style-type: none"> Describe the working of the cooling fan system and locate the unit in a motor vehicle. Trouble shoot, service, rectify cooling fan unit in a motor vehicle. 	<ol style="list-style-type: none"> Operations of cooling fan system – location. Cooling fan system in a motor vehicle – service and maintenance using specific instruction. Cooling fan system in a motor vehicle – installation. 	<ol style="list-style-type: none"> the cooling fan unit in a motor vehicle. Demonstrate how to service the cooling fan of a motor vehicle given a manual. Demonstrate how to install a cooling fan in a motor vehicle.
17.	<p><u>Car Radio</u> Locate and install the car radio with its antenna and associated gadgets.</p>	<ol style="list-style-type: none"> Car Radio <ol style="list-style-type: none"> location of antenna. Cassette deck Speakers etc. Car Radio <ol style="list-style-type: none"> sources of static interferences Components used to suppress all sources of static interferences in a motor vehicle. 	Demonstrate how to install a car radio with the antenna and associated gadgets in a motor vehicle.
18.	<p><u>Air Conditioner</u></p> <ol style="list-style-type: none"> Locate air conditioner unit in a car. Trouble shoot, detect, rectify leakage in auto air conditioner. 	<ol style="list-style-type: none"> Airconditioner unit in a motor vehicle – location. Auto airconditioner - repair by trouble-shooting techniques and replacement of the following components: <ol style="list-style-type: none"> compressor clutch condenser cooling clutch conditioner fan relays fuse switch. Auto airconditioner – detection of leaks by leak detectors etc. Auto airconditioner – rectification of leaks by: <ol style="list-style-type: none"> Tightening loose connections. Replacing rubber hoses or porous pipe. Discharging auto airconditioner unit. Charging of airconditioner unit using: <ol style="list-style-type: none"> ferron 12 compressor oil level check 	<ol style="list-style-type: none"> Identify airconditioner unit in a car. Demonstrate how to trouble shoot faulty auto airconditioner and how to replace faulty components e.g. compressor clutch, conditioner fan etc. Demonstrate how to detect leaks in auto airconditioner with the aid of leak detector. Show how to rectify leakage in auto air-conditioner by tightening loose connections, replacing rubber hoses of porous pipes etc. Show how to discharge auto airconditioner with discharging machine.
19.	<p><u>Stabilizer</u></p> <ol style="list-style-type: none"> Locate the voltage stabilizer unit in a motor vehicle. Detect, rectify and install faulty voltage stabilizer unit in an automobile. 	<ol style="list-style-type: none"> Voltage stabilizer unit in a motor vehicle – location Auto voltage stabilizer – Detection and rectification of fault. Voltage stabilizer unit in an automobile – installation. 	<ol style="list-style-type: none"> Identify the location of the voltage stabilizer unit in a motor vehicle. Demonstrate how to detect and rectify faults in auto vehicle stabilizer. Demonstrate how to install a voltage stabilizer unit in an automobile.
20.	<p><u>Miscellaneous Accessories</u></p>	<ol style="list-style-type: none"> Electrical Accessories in a motor vehicle 	<ol style="list-style-type: none"> Examine and identify the

S/N	TOPICS/OBJECTIVE	CONTENT	ACTIVITIES/REMARK
	<ol style="list-style-type: none"> 1. Identify and test the various components of electrical accessories used in motor vehicle. 2. Remove, repair and install the accessories. 	<ul style="list-style-type: none"> – identification of: <ol style="list-style-type: none"> i. electric window ii. electrically operated radio antenna. 2. Automobile accessories components – testing the components namely: <ol style="list-style-type: none"> i. electric window ii. electrically operated radio antenna. 3. Automobile accessories – removal, repair and installation of: <ol style="list-style-type: none"> i. electric window ii. electrically operated radio antenna. iii. motor driven seat adjuster iv. rear window screen wiper etc. 	<p>various electrical accessories used in motor vehicles e.g. electric windows, head lamp flaps etc.</p> <ol style="list-style-type: none"> 2. Demonstrate how to test the components of the accessories used in motor vehicles e.g. electric windows, electrically operated radio antenna, rear windows etc. 3. Demonstrate how to remove, repair and install the accessories e.g. electrically operated radio antenna, electric window etc. in a motor vehicle.

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