MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI - 51

<table>
<tr><td>1</td><td>Name of Course</td><td>C.C.in Auto Electrical, Electronics & Air-Conditioning in Automobiles (306113)</td></tr>
<tr><td>2</td><td>Max.Nos. of Student</td><td>25 Students</td></tr>
<tr><td>3</td><td>Duration</td><td>6 Months</td></tr>
<tr><td>4</td><td>Type</td><td>Full Time</td></tr>
<tr><td>5</td><td>Nos Of Days / Week</td><td>6 Days</td></tr>
<tr><td>6</td><td>Nos Of Hours /Days</td><td>7 Hrs</td></tr>
<tr><td>7</td><td>Space Required</td><td>Laboratory = 1000 Sq feet
Class Room = 200 Sq feet
TOTAL = 1200 Sq feet</td></tr>
<tr><td>8</td><td>Entry Qualification</td><td>S.S.C.</td></tr>
<tr><td>9</td><td>Objective Of Syllabus/ introduction</td><td>Awareness of Safety precautions.
Awareness of Various Types of Electronics control in Automobiles.
Awareness of various Controls in Engines.
Awareness of Air-Conditioning in Automobile.
Awareness of Servicing & Overhauling of Air-Conditioning in Automobile.
Awareness of Repair & Maintenance of Electrical & Electronics Control in Automobiles.</td></tr>
<tr><td>10</td><td>Employment Opportunity</td><td>The trainee will either to be able to take up jobs with agencies which Develop, maintain and repair such Auto Electrical Electronics & Air-Conditioning in Automobiles or with working experience will be in a position to start his own independent Business.</td></tr>
<tr><td>11</td><td>Teacher’s Qualification</td><td>Diploma in Mechanical/Automobile Engineering</td></tr>
<tr><td>12</td><td>Training System</td><td>Training System Per Week
<table><tr><th>Theory</th><th>Practical</th><th>Total</th></tr><tr><td>12 Hours</td><td>30 Hours</td><td>42 Hours</td></tr></table></td></tr>
<tr><td>13</td><td>Exam. System</td><td><table><tr><th>Sr. No.</th><th>Paper Code</th><th>Name of Subject</th><th>TH/PR</th><th>Hours</th><th>Max. Marks</th><th>Min. Marks</th></tr><tr><td>1</td><td>30611311</td><td>Auto Electrical , Electronics & Air-Conditioning in Automobiles</td><td>TH-I</td><td>3 hrs</td><td>100</td><td>35</td></tr><tr><td>2</td><td>30611321</td><td>Basic Electricity & Electronics</td><td>PR-I</td><td>3 hrs</td><td>100</td><td>50</td></tr><tr><td>3</td><td>30611322</td><td>Auto Electrical Electronics & Air-Conditioning in Automobiles</td><td>PR-II</td><td>6 hrs</td><td>200</td><td>100</td></tr><tr><td></td><td></td><td>Total</td><td></td><td></td><td>400</td><td>185</td></tr></table></td></tr>
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SYLLABUS

Auto Electricals, Electronics & Air Conditioning in Automobiles

Practical – II	Theory - I
> Measuring Voltage, current, resistance in different circuits in a vehicle. > Battery electrolyte preparation, charging and testing > Circuit tracing in a vehicle - horn circuit, brake lamp circuit, wiper motor circuit, indicators and npower windows circuits.	■y Overview on electrical power, electric charge, factors affecting on resistors, types of resistors/thermisters (PTC & NTC) and calculating effective resistance in different circuits. ■y Methods of generating voltage - through electro chemical process, battery constructions and working principle, battery rating and testing and maintenance - through induction using light - using the distortion of crystals - hall effect principle - construction and working principle of oxygen sensor ■y Symbols, colour codes and cable specifications used in wiring diagram. ■y Method of circuit tracing
> Checking of circuit breakers and relays > Construction of simple circuit by using relay > Charging system tests - alternator output voltage, circuit voltage drop, trouble shooting in a charging system. > Dismantling alternators and components tests - diodes, rotor condition, rotor winding insulation rotor condition.	✓ Circuit protectors. ■y Magnetism - temporary and permanent magnet, magnetic fields and magnetic reluctance. ■y Electromagnetism, forming a conductor into a coil and lowering the reluctance of the coil. ✓ Electromagnetic devices:- Types of relays, solenoids, transformers, parts of alternator ■y Working principle of alternator, rectifier, electronic regulator and checking procedure
> Tracing starter circuit in a vehicle > Checking starter motor - diagonise the faults > Dismantling starter and checking of each components > Repairing the faults, assembling and checking starter motor on a test rig. > Checking spark plugs, HT leads, ignition coil and condenser > Setting ignition timing.	■y Components of starting system circuit - starting and ignition systems. ✓ Starter construction/design and operation. ■y Components of starter motor - armature, field coils, brushes, drive assembly/mechanism, solenoid and overrunning clutch ✓ Starter motor performance check procedure ■y Coil ignition system and procedure for setting ignition timing. ✓ Spark plug - types and construction ✓ Radio interference suppression.

> Checking ignition coil of E-DIS (Electronic Distributorless Ignition system) > Checking ground connection > Checking sensors using engine scanner and DMM > Checking actuators using engine scanner and DMM > Construction of simple electronic circuits > Checking the different modes/strategies of ECA (Electronic Control Assembly) > Resetting of keep alive memory/ECA	■y Overview of operation, symbols and checking procedure of diodes, transistors, capacitors and their applications in automobiles. ■y Working E-DIS (Electronic Distributorless Ignition system) ■y Importance of earthing ■y Working principle of instruments and gauges ■y Working principle of sensors - throttle position (Potentiometer), Air temperature (Thermistor), Engine coolant temperature, manifold absolete pressure (Piezo-resistive & Piezo-electric type), Camshaft and crank shaft position sensors (magnetic pick up type) ■y Construction and working principle of actuators - idle air control valve and injectors ✓ Basic structure and operation of a microcomputer ■y Explanation of simple electronic circuits ■y Different strategies/modes available in the ECA
AIR CONDITIONING	Fundamentals of air conditioning
> Fault finding > Dismantling > Rectification	Refrigeration cycles, simple air condition circuit diagram Gases used for air conditioning & their characteristics & applications Air conditioning system & components
AIR CONDITIONING > Assembling > Testing	Effect of air conditioning on fuel economy Air distribution of air conditioning system Compression system used for vehicle air conditioning Fault finding & rectification in vehicle air conditioning

Basic Electricity and Electronics

Practical - I
Familiarization with shop layout, hand tools and machines, safety precautions and first aid. Insulation stripping and cutting of wire. Making joints on simple strapped conductors, sieving or taping with insulation tape, Measurement of conductor using wire gauge.
Soldering practice on wire joints, Soldering and crimping of lugs with wire ends Measurement of resistance of wire would resistors using ohmmeter. Connect two or three resistors in parallel and in series and measure total circuit resistance, Build a simple electrical circuit using a battery and resistors, Connect voltmeter to measure battery voltage and voltage drop across resistors, Connect ammeter to measure current, reconcile Ohm's law.
Build a simple earth return lamp circuit using battery, lamp, switch, a fuse, connecting wires and frames for return current, Practice of connecting voltmeter and ammeter. Checking blowing of fuse with wires short-circulated. Identify various electrical equipments on the mock up wiring board i.e. starter motor, dynamo control box etc., Follow up starting system wiring, Identify marking on terminal joints, Remove and repeat connections, Similar practice on charging system wiring.
Practice in removing and fitting the batteries, Cleaning and maintenance of batteries, Testing the batteries with Hydrometer and cell tester, Topping of battery with distilled water, Connect batteries for charging.
Demonstration and use of simple devices such as transistors, Thyristors, Triac, Diac, etc. Assembling and study of rectifier circuits and power supplies, use of measuring instruments, study of electronic system in modern automobiles
Demonstration of digital kits, Development of simple digital circuits using logic gates, Study of input and output relationships in logic circuits.

List of tools, machineries & equipments

Sr. No	Item	Qty.
a) Trainee's Tool Kit		
01	Ball Peen Hammer 0.75 Kg	10 Nos.
02	Cold Flat Chiesel 19mm	10 Nos.
03	Centre Punch 10 mm dia x 100mm	10 Nos.
04	Insulated Screw driver 30 cm x 9mm blade	10 Nos.
05	Insulated Screw driver 20 cm x 9mm blade	10 Nos.
06	Steel rule 30mm	10 Nos.
07	Plier combination 15cm	10 Nos.
08	Steel tool box with lock & key (folding type) size 400x200x150mm	10 Nos.
09	Hand file 20 cm second cut	10 Nos.
10	Ring spanner set of 12mm	10 Nos.

b) Shop Outfit & Measuring Instruments		
11	Electric testing screw driver	4 Nos.
12	Hand vice 37 mm	2 Nos.
13	Allen key set of 12 pieces (2mm - 14 mm)	4 sets
14	Circlip plier (External and Internal) 150mm & 200mm	8 sets
15	Philips Screw Driver set of 5 pieces 100mm - 300mm	4 sets
16	Star Allen key	4 sets
17	Prick punch 15 cm	2 Nos.
18	Chisel cross cut 200mm x 6 mm	1 No.
19	Ball Peen Hammer 0.5 Kg	2 Nos.
20	Hammer copper 1 Kg with handle	1 No.
21	Hack saw frame for 30 cm blade	4 Nos.
22	Hollow punch 6,7,8,9,10 and 12 mm set	1 set
23	Double open ended spanner set (10.5mm x 12 mm; 10.5mm	1 set
24	Flat File 35 cm bastard	2 Nos.
25	Flat File 25 cm second cut	2 Nos.
26	Micrometer Outside 0-25mm, 25-50mm	1 each
27	Soldering iron 120 watts	2 Nos.
28	Nose Pliers (round and straight) 150 mm and 200mm	2 each
29	Circlip pliers	1 No.
30	Thread pitch gauge	1 No.
31	Stud remover	1 No.
32	Spanner T. flocks for screwing up and up-screwing inaccessible positions	1 No.
33	Cleaning tray 45 x 30cm	16 Nos.
34	Oil cane 0.5 litres	1No.
35	Smp (straight & bent)	1 No.
36	General purpose puller	1 set
37	Stud extractors	1set
38	Poker	2 Nos.
39	Double ended Spanner 6 to 32 mm - set of 12 nos.	1 set
40	Double ended off-set Spanner(W.W) - 3 to 13.5 mm -set of 7 nos.	1 set
41	Double open ended ignition spanner set (of BA-0 x 1to 8x9 set of 5)	1 set
42	Spanner Clyburn 15 cm	1 No.
43	Adjustable spanner 20 cm	1 No.
44	Spark plug spanner 14 mm	1 No.
45	Magneto spanner set with 8 spanners	1 set
46	Socket spanner set with handle, T-bar and ratchet	2 Nos.
47	Drift copper (10 mm x 150 mm)	1 No.
48	Starter motor axial type, pre-engagement type & Co-	1 each