

**MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI**

1	Name of Syllabus	Certificate course in Automobile Air Conditioning (306107)																																								
2	Max. Nos of Student	25 Students																																								
3	Duration	6 Month																																								
4	Type	Part Time																																								
5	Nos Of Days / Week	6 days																																								
6	Nos Of Hours /Days	4 hrs.																																								
7	Space Required	1) Workshop = 400 sqfeet 2) Class Room = 200 sqfeet ----- TOTAL = 600 sqfeet																																								
8	Entry Qualification	9 <sup>th</sup> Passed																																								
9	Objective Of Syllabus/ introduction	Successful candidate would be able to Repairing of Auto Air Conditioning System																																								
10	Employment Opportunity	Self Employment / May get job in Establishment																																								
11	Teacher’s Qualification	Diploma in Automobile, Diploma in mechanical/ I.T.I./ N.C.V.T.(MMV) With one year experience																																								
12	Training System	<table><tr><th colspan="7">Training System Per Week</th></tr><tr><td></td><td>Theory</td><td></td><td>Practical</td><td></td><td>Total</td><td></td></tr><tr><td></td><td>6 hrs</td><td></td><td>18 hrs</td><td></td><td>24 hrs</td><td></td></tr></table>						Training System Per Week								Theory		Practical		Total			6 hrs		18 hrs		24 hrs															
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13	Exam. System	<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>Mini. Marks</th></tr><tr><td>1</td><td>30610711</td><td>Auto Air Conditioning</td><td>TH-1</td><td>3 Hrs</td><td>100</td><td>35</td></tr><tr><td>2</td><td>30610721</td><td>Checking of equipments</td><td>PR-I</td><td>3 Hrs</td><td>100</td><td>50</td></tr><tr><td>3</td><td>30610722</td><td>Assembling and dismantling of Air Conditioner</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>						Sr. No.	Paper Code	Name of Subject	TH/PR	Hours	Max. Marks	Mini. Marks	1	30610711	Auto Air Conditioning	TH-1	3 Hrs	100	35	2	30610721	Checking of equipments	PR-I	3 Hrs	100	50	3	30610722	Assembling and dismantling of Air Conditioner	PR-II	6 Hrs	200	100			TOTAL			400	185
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## Theory - I - Auto Air Conditioning

1. Safety precautions and first aid. Handling of refrigerants. Proper Use, Care and maintenance of tools & equipment
2. Signs and symbols used in Air conditioning system
3. **Fundamentals of air conditioning:**
  - a. Introduction – purpose, basic operation of refrigeration cycle, basic components & circuits (with fixed orifice tube & thermal expansion valve-Mechanical & Electrical circuits), use of thermometer and pressure gauges,
  - b. Definition of technical terms – pressure, temperature, heat(heat, quantity, specific heat & heat transfer), Humidity, change of state & pressure temperature relation.
  - c. Refrigeration cycle – high pressure side & low pressure side
  - d. characteristics of R12 & R134a.
  - e. lubrication.
  - f. cooling load and capacity.
  - g. a/c systems – car air conditioning types & features(dash type, all season type & dual air conditioner type), heater-cooler independent system, reheat air condition system, semi air-mix type, full air-mix type, automatic temperature control systems
4. **Electrical basics:** Ohm's law – Current, Potential difference, Resistance & their units. Use of multi-meter, Brief on Magnetism.
5. Semiconductor & application (only brief)
6. Description/working principles, types, uses, location & checking of – switches, Circuit protectors, relays, solenoids, resistors, diodes & Heater Control Module
7. Working principle of sensors – throttle position (Potentiometer), Air temperature (Thermistor), Engine coolant temperature (NTC type), crank shaft position / engine speed sensors (magnetic pick up type) – importance of these sensors for air conditioning system
8. Construction and working principle of actuators – coolant diversion valve(for heating the cabin) & idle air control valve (Electronic controlled engines ) & duty cycle
9. Description / Reading of wiring diagram
10. Description & operation of Main Functional parts–Compressor, Condenser, Evaporator, and Expansion Device/valve - Different types of above components
11. Description & operation of Other Functional parts – magnetic clutch, receiver/drier, blower motor, condenser fan, thermostat, pressure switches & magnetic valve(for dual air conditioner)
12. Procedure for evacuating / draining the system, finding the leak & charging the system
13. Procedure for Fault finding (Trouble shooting charts) & rectification in car air conditioning
14. Procedure for dismantling, checking, assembling different components of the system
15. Difference between manual & automatic air conditioning / climate control systems
16. Air distribution of air conditioning system & different types of actuation of distribution doors

## **Practical - I - Checking of equipments**

1. Practice Health & Safety – familiarize, select, use, maintain & store – tools, equipments, consumables & clothing safely .
2. Identify various components of air condition system on the mockup board
3. Identify various electrical equipments i.e. junction box, ground connections, switches, modules & sensors on vehicle.
4. Measure voltage, resistance & continuity in different lines for air conditioning system (climate control)– reconcile Ohm's law.
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6. Check sensors & actuators using engine scanner / DMM .
7. Check duty of idle air control valve with ac on & off with different engine RPM

## **Practical - II - Assembling and dismantling of Air Conditioner**

1. Remove compressor from the vehicle, dismantles, check, rectify the defect, assemble & refit to the vehicle.
2. Remove expansion valve from the system, dismantle, check, rectify the defect, & refit into the system
3. Remove evaporator & heater cores from the vehicle, dismantle, check, rectify the defect, assemble & refit to the vehicle.
4. Check condenser on the vehicle, & rectify the defect
5. Check the drive system & adjust if required
6. Check Belt tension
7. Check Gap in electromagnetic clutch
8. Remove & refit heater control module
9. Test the system for leaks
10. Evacuate/drain the system
11. Charge / fill the system
12. Find the Faults & rectify in the climate control system

## TOOLS & EQUIPMENT( Suggested )

s.n	Item	s.n	Item
1	Screw driver	18	DMM
2	File	19	2 sets of accumulator / drier
3	Crimping Tool	20	Mock-up board with semi-automatic air conditioning system
4	Hacksaw	21	Service units with set of Compound pressure gauges-Recovery Machine & charging Unit
5	DE Spanner Set	22	Leak detectors – electronic & UV lamp
6	Vice	23	Drilling Machine
7	Hammer	24	2 sets of condensers
8	Pliers,	25	2 sets of compressors of different types
9	Pipe Wrench	26	2 sets of expansion valves of different types
10	Screw Wrench	27	2 sets of evaporators of different types
11	Ring Spanner Set	28	2 sets of air distribution doors of different types
12	Hydraulic jack	29	2 sets of coolant control valves (heater control)
13	2 Torque wrenches of different capacity	30	2 sets of A/C control assemblies of different types
14	Solder Iron	31	2 sets of switches of different types (HP & LP Switches)
15	Inspection lamp with guard and wandering lead of 100 ft	32	2 sets of Thermistors
16	Tripod axle stand adjustable 1500 kg capacity	33	Heater control modules(E & C Unit)
17	Vehicle with dual air conditioning system along with special tools for removing and refitting air conditioning system & work shop manuals	34	2 sets of blower motor
		35	2 sets of receiver/drier

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