SHORT TERM VOCATIONAL
CERTIFICATE COURSE

CAR AC TECHNICIAN COURSE

(6 months Duration)

Prepared by

P. SAMBAIAH
Junior Lecturer in AET, GVJC, Nampally
Hyderabad

&

G. VAMSI KRISHNA
Faculty in AET, GJC Malkajigiri,
Hyderabad

Course Coordinator:
Dr. R. JYOTHSNA RANI
Principal & Lecturer SIVE,
O/o Director of Intermediate Education, Hyderabad

STATE INSTITUTE OF VOCATIONAL EDUCATION

O/o Director of Intermediate Education, Hyderabad
HYDERABAD, TELANGANA

NAME OF THE COURSE : **CAR AC TECHNICIAN**

SECTOR : Engineering

COURSE CODE : CACT

ENTRY QUALIFICATION: 8th Class (above 18 years)

DURATION: 6 Months (40 Hours: English + Course: 200 Hours)

PRE-REQUISITES: Basic Knowledge in English reading and writing.

TERMINAL COMPETENCE: After completing this course, student will be able to work as a technician for maintaining, diagnosing, and repairing Car AC.

INTRODUCTION OF THE COURSE: A Car AC Technician course is designed to equip individuals with the skills and knowledge necessary to become proficient in servicing and repairing automotive air conditioning systems. In today's automotive industry, air conditioning systems are integral components of vehicles, ensuring passenger comfort and safety in varying weather conditions.

OBJECTIVES: The Car AC Technician course aims to produce skilled and knowledgeable professionals capable of meeting the demands of the automotive industry while contributing to customer safety, comfort, and satisfaction.

SKILLS: In an AC Technician course, students can learn a diverse set of skills that are essential for diagnosing, repairing, and maintaining air conditioning systems in various settings. Some of the skills typically covered in this course include Technical Knowledge, System Diagnosis, Component Identification and Functionality, Repair and Replacement, Refrigerant Handling, System Maintenance, Electrical Skills, Customer Service. These skills collectively prepare students to work as competent AC technicians in automotive repair shops, dealerships.

CAREER OPPORTUNITIES: Completing a Car AC Technician course opens up various career opportunities in the automotive industry and related sectors as Car AC Technician.

COURSE SYLLABUS

THEORY (60Hrs) **Total Marks: 80**

S.No	THEORY SYLLABUS	Hours	Marks			TOTAL MARKS
			LAQ	SAQ	MCQ	
1	**Introduction to Car Air Conditioning:** Overview of automotive HVAC systems Basic principles of refrigeration and thermodynamics Importance of air conditioning in vehicles Construction and working of key components like a Compressor, Condenser, Evaporator, Expansion valve, Refrigerant lines.	4 Hrs	-	1Q (5M)	2Q (2M)	7
2	**Refrigeration Cycle and Refrigerants:** Explanation of the refrigeration cycle in automotive AC systems. Understanding pressure-temperature relationships. Phase changes of refrigerants. Types of refrigerants used in automotive applications.	16 Hrs	1Q (10 M)	2Q (10M)	2Q (2M)	22
3	**Diagnosis, Troubleshooting, Repair and Maintenance Procedures:** Common AC system problems and their symptoms. Use of diagnostic tools such as manifold gauges and leak detectors. Techniques for identifying leaks, compressor issues, electrical problems, etc. Hands-on training in repairing and replacing AC system	14Hrs	1Q (10 M)	1Q (5M)	2Q (2M)	17

	components. System flushing procedures. Recharging refrigerant and performing evacuation and recharge procedures. Routine maintenance tasks to ensure optimal system performance.					
4	**Electrical Systems:** Understanding electrical components in AC systems, such as relays, switches, and motors. Troubleshooting electrical issues. Safety precautions when working with electrical systems. Discuss the differences between traditional automotive AC systems and those found in hybrid or electric vehicles.	14 Hrs	1Q (10 M)	1Q (5M)	2Q (2M)	17
5	**Safety and Environmental Regulations:** Workplace safety practices. Environmental regulations related to refrigerant handling and disposal. Safety precautions for handling and storing refrigerants. Personal protective equipment (PPE) requirements. Steps would you take to ensure customer satisfaction when servicing their vehicle's AC system?	12Hrs	1Q (10 M)	1Q (5M)	2Q (2M)	17

ON THE JOB TRAINING AND PRACTICAL: 140 Hrs

Maximum Marks: 100 (External Exam: 40-Project-10- Internship/ OJT : 50)

S.No.	Name of the topic for OJT/Practical	Time in Hrs
1.	**Tools & Equipment** Identifying Basic tools, special tools, power tools. Identifying suitable grades of grease, selecting appropriate components/parts	10
2.	**Safety precautions in workshop** To understand and follow the basic precautions in workshop, Do's & Don'ts, Understanding manufacturer's 3S & 5S rules.	10
3.	**Evaluating And Diagnosing Car AC** Selecting suitable Refrigerant Checking HP & LP valves Checking for leakages and perform leakage test on entire system. Able to fill refrigerant at Suitable pressure. Refrigerant Charging Refrigerant Charge Refrigerant Overcharge Air in the Refrigerant Circuit Moisture in the Refrigeration Circuit Insufficient Air from the Vents Smell and Odours AC Makes Noise Air Conditioning Goes from Cold to Hot Common Problems with Compressors and Clutches Common Problems with Condensers Common Problems with Evaporators Common Problems with Metering Common Problems with Receiver/Dryer or Accumulator/Dryer	120

SCHEME OF INSTRUCTION/MODULE:

1. **Communicative English: 40 hours (per module)**
2. **Course: 200 hours (6 months)**

Duration of Course	Theory		On the Job Training		Total	
	Hours	weightage	Hours	weightage	Hours	weightage
1 Module (06 months)	60	30%	140	70%	200	100%

LIST OF EQUIPMENT

List of tools and equipment commonly used by car AC technicians:

1. **Manifold Gauge Set:** Used for measuring refrigerant pressure and temperature in the AC system.

2. Refrigerant Recovery Machine: Used to remove refrigerant from the AC system for servicing or disposal.

3. Vacuum Pump: Used for evacuating air and moisture from the AC system before recharging with refrigerant.

4. Leak Detection Tools: Including electronic leak detectors, ultraviolet (UV) dye kits, and fluorescent dye leak detection lamps to locate refrigerant leaks in the system.

5. Refrigerant Charging Station: Used for adding or recharging refrigerant in the AC system to manufacturer specifications.

6. AC Service Ports and Adapters: Various fittings, adapters, and service ports for connecting equipment to different components of the AC system.

7. AC Service Valve Core Removal Tool: Used for removing and replacing valve cores in the service ports.

8. AC Compressor Clutch Tool: Used for removing and installing the clutch assembly on AC compressors.

9. AC System Flush Kit: Used for flushing out debris, contaminants, and old refrigerant from the AC system during servicing.

10. AC System Sealant and Leak Stop: Chemical additives used for sealing small leaks in the AC system.

11. Thermometer and Hygrometer: Used for measuring ambient temperature and humidity during system diagnosis and performance testing.

12. Multimeter: Used for electrical troubleshooting and testing of AC system components, such as sensors, switches, and relays.

13. AC System Oils: Various types of lubricating oils used for lubricating compressor bearings and seals.

14. AC System Pressure Test Kit: Used for testing system pressure and leak detection.

15. AC Hose and Tube Cutter: Used for cutting and trimming AC hoses and tubing during installation or repair.

16. AC Hose Crimper and Fittings: Used for crimping fittings onto AC hoses and tubing.

17. AC System Flush Solvent: Chemical solvent used for flushing contaminants from AC system components.

18. Safety Equipment: Including gloves, safety glasses, and respiratory protection for handling refrigerants and chemicals safely.

19. Workshop Equipment: Such as a workbench, vise, and storage cabinets for organizing tools and equipment.

20. Diagnostic Software and Scan Tools: For advanced diagnostics and troubleshooting of electronic components in modern AC systems.

Qualifications of Teaching Faculty:

Engineering Graduate from Mechanical or Automobile Engineering from any recognized university with an aggregate of 55% marks.

DIVISION OF MARKS:

Theory: 100 Max. Marks

1. Communicative English: 20 marks
2. Short Questions: 6 x5m = 30 marks
3. Long Questions: 4x10 = 40 marks
4. Multiple Choice Questions: 10x1=10 marks

Practical: 100 Max. Marks

1. External: 40 marks
2. Record/ Mini Project & Viva: 10 marks
3. Internship (OJT): 50 marks

MODEL QUESTION PAPER

Time : 3hrs **Max. Marks : 100**

I. **Section – I (Language)**
(Communicative English) **20M**

Section – II (Subject)

II. Answer any Six of the following: **6 x 5 = 30M**

1. Explain the importance of proper refrigerant charge in an AC system.
2. Describe the basic refrigeration cycle and its components.
3. Outline the steps you would take to diagnose a refrigerant leak in an automotive AC system.
4. How would you troubleshoot a malfunctioning compressor in an AC system?
5. What maintenance tasks should be performed regularly to ensure the efficient operation of an AC system?
6. Describe how you would troubleshoot an electrical issue causing the AC compressor not to engage.

III. Answer any Four of the following: **4 x 10 = 40M**

1. What safety precautions should be followed when handling refrigerants in an automotive repair shop?
2. What steps would you take to ensure customer satisfaction when servicing their vehicle's AC system?
3. What are the primary components of an automotive air conditioning system, and what are their functions?
4. How does the phase change of refrigerant occur in an AC system, and why is it important?
5. What are the different types of refrigerants commonly used in automotive AC systems, and what are their properties?
6. Explain the process of evacuating and recharging refrigerant in an automotive AC system.

Section – III (Objective)

IV. Multiple Choice Questions: **10 x 1 = 10M**

1. Which component is responsible for compressing the refrigerant in an automotive AC system?
   1. Condenser 2. Compressor 3. Evaporator 4. Expansion valve
2. What is the primary function of the evaporator in an automotive AC system?
   1. To cool the refrigerant 2. To compress the refrigerant
   3. To release heat from the refrigerant 4. To regulate the flow of refrigerant
3. During which phase of the refrigeration cycle does the refrigerant absorb heat from the vehicle's cabin?
   1. Condensation 2. Evaporation 3. Compression 4. Expansion
4. Which component of an automotive AC system is responsible for rejecting heat to the ambient air?
   1. Compressor 2. Evaporator 3. Condenser 4. Expansion valve
5. Which refrigerant is commonly used in modern automotive AC systems due to its lower environmental impact?
   1. R12 2. R22 3. R134a 4. R410a
6. What environmental concern is associated with refrigerants containing chlorofluorocarbons (CFCs)?
   1. Ozone depletion 2. Acid rain 3. Greenhouse effect 4. Smog formation
7. Which tool is commonly used to detect refrigerant leaks in an automotive AC system
   1. Multimeter 2. Leak detector 3. Pressure gauge 4. Vacuum pump
8. If the AC system is blowing warm air, which component is most likely to be malfunctioning?
   1. Compressor 2. Evaporator 3. Condenser 4. Expansion valve
9. What is the purpose of evacuating the AC system before recharging it with refrigerant?
   1. To remove moisture and air from the system 2. To increase system pressure
   3. To lubricate system components 4. To decrease refrigerant flow rate
10. Which maintenance task helps prevent refrigerant leaks in an automotive AC system?
   1. Flushing the system with water 2. Adding excess refrigerant
   3. Regularly checking and replacing seals 4. Increasing system pressure

****

PRACTICAL QUESTION BANK

Time: 3Hrs Maximum Marks : 50

Section – I 2 x 10 = 20 Marks

Note: Answer any two of the following.

1. Conduct a practical demonstration of how to use a refrigerant leak detector to locate leaks in an automotive AC system.
2. Set up a demonstration to perform a system pressure test on an automotive AC system.
3. Explain the importance of proper refrigerant recovery and disposal procedures.
4. Show how to charge an automotive AC system with the appropriate amount of refrigerant using a charging station.
5. Use a multimeter to diagnose the problem, identifying faulty components or wiring issues.
6. Discuss the troubleshooting process and the steps taken to resolve the electrical issue.
7. Perform routine maintenance tasks, such as checking and replacing filters, lubricating moving parts, and inspecting seals.
8. Conduct a performance test on an automotive AC system to assess its cooling capacity and efficiency.
9. Use thermometers and gauges to measure inlet and outlet temperatures, system pressures, and airflow rates.
10. Evaluate the results and identify any areas for improvement or further attention.

Section – II 1 x 20 = 20 Marks

Note: Answer any one of the following.

1. Discuss the equipment needed and the procedure for conducting the pressure test.
2. Demonstrate the process of recovering refrigerant from an automotive AC system by using a recovery machine.
3. Perform an evacuation of the system to remove moisture and air, using a vacuum pump.
4. Conduct a demonstration of how to replace a faulty component, such as a compressor or condenser, in an automotive AC system.

Section – III

Record / Mini Project & Viva 10 Marks

Internship/OJT - 50 Marks