GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

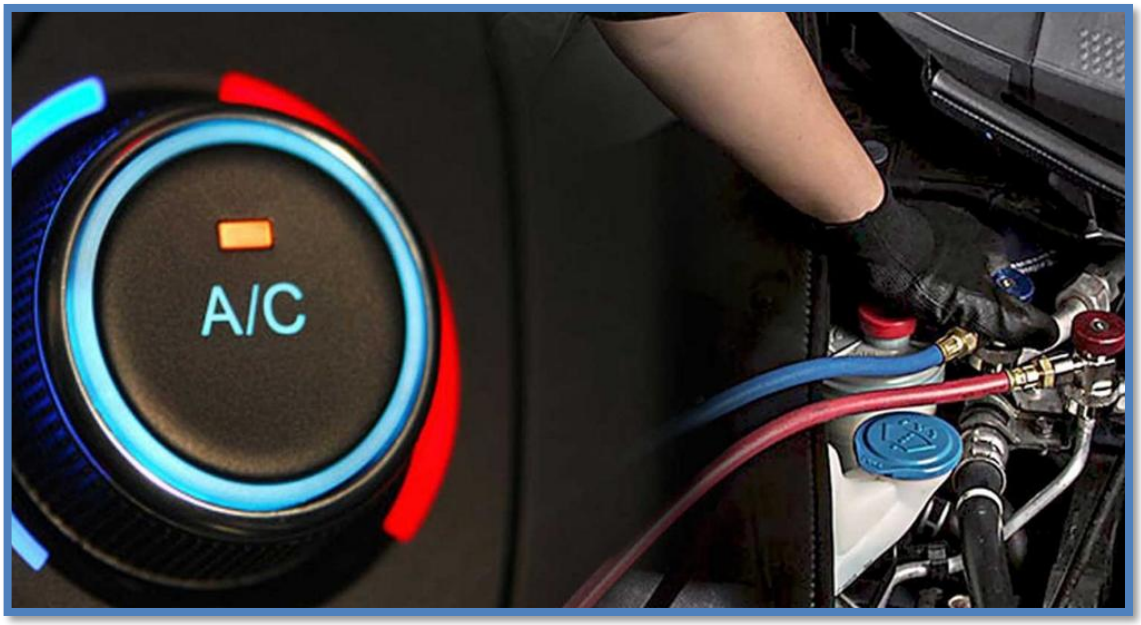
AUTOMOTIVE AIR-CONDITION MANUFACTURING TECHNICIAN

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi-MoU)

NSQFLEVEL- 4



SECTOR – AUTOMOTIVE

Directorate General of Training

AUTOMOTIVE AIR-CONDITION MANUFACTURING TECHNICIAN

(Designed in 2024)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

Under Flexi-MoU

NSQF LEVEL- 4

Developed By

Subros Limited Manesar

&

Government of India

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

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CONTENTS

1. COURSE INFORMATION

Flexi- MoU is one of the pioneer programmes under DGT on the basis of the MoU in between DGT & Subros Limited for propagating vocational training to allow industries to take advantage of various schemes for conducting training programme in higher employment potential courses according to needs of industries. The concept of Flexi- MoUs was introduced in June-July 2014. DGT and Subros Limited have decided to sign this memorandum of understanding to provide an opportunity to the youth to acquire skills related to Automobile and Manufacturing industry through specially designed "Learn and Earn" approach consisting a mix of theoretical and On-the-Job Training (OJT) components and hence improve their employability potential & to contribute in the overall growth of Automobile and Manufacturing industry by creating a pool of skilled resources.

The content broadly covers skills in manufacturing process of Automotive AC components and automobiles in today's automobile industry. The year wise course coverage is categorized as below:

FIRST YEAR:

In the first year, the contents covered are safety aspects related to trade, familiarization with automobile AC systems and components and basic automobile AC manufacturing process such as basic fitting operation (marking, filling, sawing, chiseling), basic brazing/welding operation using Gas, MIG (but joint, lap joint, T-joint). This year also covers practical training starting with practice with tools & measuring instruments viz. Vernier calliper, micrometer, height gauge, dial gauge, slip gauge, feeler gauge, go-no go gauges etc. This is followed by on job training in practice in Plastic and ECM Manufacturing and different assembly lines including line inspection and final testing.

SECOND YEAR:

In the second year of course, the training covers Cutting of hoses in req. lengths, Hose insertion in connectors, Crimping of Hoses, Drying of Hoses, Bracket & Parts assy. of Assembly and manufacturing of Condenser Assy. – Core Assy, Aluminum Brazing, Leakage testing of cores, Bracket & Parts Assy on cores. This is followed by on job training in practice Hose Assembly and Condenser Assembly lines including line inspection and final testing.

The trainee also undergoes project work and Industrial visit/ In plant training at the end of each year which gives them more practical exposure and helps to build up confidence level.

2. TRAINING SYSTEM

2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development and Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/labor market. DGT is futuristic in preparing the prospective Indian workforce in building skills and capabilities as per the needs of the industry. In this quest, it has changed the paradigm of growth to a job-oriented training by partnering with industry to be an enabler of responsible, sustainable and inclusive growth. Towards this objective, DGT signed this MOU with Industrial Training Partner (ITP).

Automotive Air Condition Manufacturing Technician trade under CTS (Flexi-MoU) is of two years' duration. It mainly consists of Domain area and Core area. The Domain area (Trade Theory and Practical) imparts professional skills and knowledge, while Core area (Employability Skills) impart requisite core skill, knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by DGT under Flexi-MoU which is recognized worldwide.

Industrial Training Partner (ITP) shall conduct courses at the Industry Partner's location. On the job training will be conducted inside the Plant premises. It will also ensure the eligible trainees take up Apprenticeship / higher education in suitable streams and shall also guide the students to become Entrepreneurs. Industrial Training Partner (ITP) will strictly follow the policy guidelines for Flexi-MoU as in place from time to time. No deviation for the same would be permitted. Admission and Exam for trades run under Flexi-MoU at training locations of Industrial Training Partner. Theory content is provisioned to be 25% and practical content is provisioned to be 75%.

Trainees broadly need to demonstrate that they are able to:

- Read and interpret technical parameters/documents, plan and organize work processes, identify necessary materials and tools.
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations.
- Apply professional skill, knowledge and employability skills while performing jobs.
- Check the job/assembly as per drawing for functioning identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can join industry as Automotive AC manufacturing Technician and will progress further as Senior Technician, Supervisor and can rise up to the level of Manager.
- Can become Entrepreneur in the related field.
- Can appear in 10+2 examination through National Institute of Open Schooling (NIOS) for acquiring higher secondary certificate and can go further for General/Technical education.
- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

2.3 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during period of two-years:

S No.	Course Element	Notional Training Hours	
		1st Year	2nd Year
1	Professional Skill (Trade Practical)	330	390
2	Professional Knowledge (Trade Theory)	240	240
3	Employability Skills	120	60
4	On the job Training	840	840
5	Project Work	60	60
	Total	**1590**	**1590**

2.4 ASSESSMENT AND CERTIFICATION

The trainee will be tested for his skill, knowledge and attitude during the period of course through formative assessment and at the end of the training programme through summative assessment as notified by the DGT from time to time.

a) The Continuous Assessment (Internal) during the period of training will be done by Formative Assessment Method by testing for assessment criteria listed against learning outcomes. The training institute has to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in.

b) The final assessment will be in the form of summative assessment. The All-India Trade Test for awarding NTC will be conducted by Controller of examinations, DGT as per the guidelines. The pattern and marking structure is being notified by DGT from time to time. The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS REGULATION

For the purposes of determining the overall result, weightage of 100% is applied for six months and one-year duration courses and 50% weightage is applied to each examination for two years courses. The minimum pass percent for Trade Practical and Formative assessment is 60% and for all other subjects is 33%. There will be no grace marks.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/ wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE (Occupational Safety and Health Environment) and self-learning attitude are to be considered while assessing competencies.

Assessment will be evidence based, comprising the following:

- Job carried out in labs/workshop
- Record book/daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and Punctuality
- Assignment

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a)Weightage in the range of 60-75% to be allotted during assessment	
For performance in this grade, the candidate should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those Demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasionalsupport in completing the project/job.
(b)Weightage in the range of above 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices.	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish • Little support in completing the project/job.
(c)Weightage in the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

Evaporator Sub-Assembly Technician; Mechanical Sub-Assembly Technician assembles to gather the mechanical subsystems. The individual at work is responsible for assembling Evaporator core and Pipe sub assy., Brazed components to produce the final mechanical Evaporator subassembly of the AC System.

Assembler, HVAC; Assembler (Automobile AC) assembles different parts and units of automobile HVAC installs them on frame and makes necessary connections, adjustment, settings etc. according to specifications. Assembles Evaporator core, Heater core, Blower fan and air dampers etc. individually according to specifications and ensures their stipulated performance. Assists Assy of HVAC components. Fits Cam, Lever, Servo motor etc in HVAC. Collects various components and parts from sub assembly or from nearby bin sand fits them to body as appropriate. Lifts assembled HVAC or equipment carefully, places It over Inspection gauge. and makes necessary settings and adjustments. Gathers such parts like Heater, Evaporator, Air dampers etc. from nearby sub-assembly line and fits them to HVAC.

Assembler, Compressor; Assembler, Assy. of a Compressor assembles with finished components, tunes Compressor and tests performance. Checks condition and cleaning of various Compressor parts such as Swash plate, Cylinder block, Valves, pistons, guides, spring etc. and measures appropriate parts to assess serviceability, reconditioning or replacement as necessary. assembles pistons with Swash plate and fits in cylinder block, piston assemblies, valves etc. according to design in order of sequence using hoisting device, stand, special tools and other implements ensuring necessary movement and clearance specified. Sets Clutch gap, and fastens cylinder head with gasket on cylinder block. Assembles and fits electro-megnatic clutch, etc.

Assembler, MF Condenser; Assembler, **MF Condenser** components, makes adjustments, sets alignments, clearances etc. and ensures stipulated performance. Places Condenser core on jig or other fixture. Fits or assembles various parts of Condenser such as Fins, Tubes, Side plates RD bottle etc.

Assembler, Refrigerator and Air Conditioning Unit assembles and installs refrigerator and air-conditioning units by connecting pipes, insulating, lagging, connecting compressor, etc. and ensures attainment of desired temperature. Assembles frame or body of refrigeration or air-conditioning equipment by tightening respective parts with nuts, bolts, rivets, hinges, etc. Insulates frame and tank with insulating material such as glass wool, cork, etc. fabricates evaporator coils to required size and shape depending on type and nature of air-conditioning unit handled. Fits various controls and accessories like expansion valve and refrigerant controls as detailed. Connects copper or iron pipes to different units of segments and charges refrigerator with gas or liquid as freezing medium. Ensures conformity with specifications and prescribed performance of assembled unit. Installs assembled unit at premises and gives power connection to unit by fitting necessary gadgets and adjusting various controls to suit required freezing or cooling temperature. May repair and overhaul air-conditioning and refrigerator equipment. May install commercial airconditioning

equipment to premises and rooms and make necessary changes to buildings to ensure air tightness

Reference NCO-2015:

8211.0400 - Assembler, Refrigerator and Air Conditioning Unit

Reference NOS:

I. ASC/N9521
II. ASC/N9522
III. ASC/N9523
IV. ASC/N9524
V. ASC/N9525
VI. ASC/N9526
VII. ASC/N9527
VIII. ASC/N9528
IX. ASC/N9529
X. ASC/N9530
XI. CSC/N9401
XII. CSC/N9402

4. GENERAL INFORMATION

Name of the Trade	**Automotive Air-condition Manufacturing Technician (Flexi MoU)**
NCO–2015	8211.0400
Mapped NOS	ASC/N9521, ASC/N9522, ASC/N9523, ASC/N9524, ASC/N9525, ASC/N9526, ASC/N9527, ASC/N9528, ASC/N9529, ASC/N9530, CSC/N9401, CSC/N9402
NSQF Level	Level-4
Duration of Craftsmen Training (Instructional Hours)	Two year (3180 Hours)
Entry Qualification	Passed 10th class examination or its equivalent.
Minimum Age	18 years as on first day of academic session.
Unit Strength (No. Of Student)	20
Space Norms	192 Sq.m.
Power Norms	6.82 KW
Instructors Qualification for	
(i) Automotive Air-Condition Manufacturing Technician Trade	B.Voc/ Degree in Automobile/ Mechanical Engg. (with specialization in Automobile) from AICTE/ UGC recognized Engineering College/ university with one-year experience in the relevant field. **OR** Three years Diploma in Automobile/ Mechanical (specialization in automobile) from AICTE recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/NAC in the related trades with 3 years' experience in the relevant field. **Essential Qualification:** Relevant National Craft Instructor Certificate (NCIC) in any of the variants under DGT. ***NOTE: Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC***

	qualifications. However, both of them must possess NCIC in any of Its variants.
(ii) Workshop Calculation and Science	B.Voc./Degree in Engineering from AICTE/UGC recognized Engineering College/University with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE/recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/NAC in any one of the engineering trades with three years' experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC)in relevant trade **OR** NCIC in RoDA or any of its variants under DGT
(iii) Engineering Drawing	B.Voc./Degree in Engineering from AICTE/UGC recognized Engineering College/University with one-year experience in the relevant field. **OR** 03 years Diploma in Engineering from AICTE/ recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with two years' experience in the relevant field. **OR** NTC/NAC in any one of the Electrical groups (Gr-II) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with three years' experience. **Essential Qualification:** National Craft Instructor Certificate (NCIC)in relevant trade **OR** NCIC in RoDA/D'man (Mech/Civil) or any of its variants under DGT.
(iv) Employability Skill	MBA/BBA/Any Graduate/ Diploma in any discipline with Two years' experience with short-term ToT Course in Employability Skills (Must have studied English/Communication Skills and Basic Computer at 12th/Diploma level and above) **OR** Existing Social Studies Instructors in it is with short term ToT Course

	in Employability Skills
(v) Minimum age for Instructor	21 years
List of Tools and Equipment	As per Annexure-I

5. LEARNING OUTCOME

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

LEARNING OUTCOMES

FIRST YEAR

1. Recognize & comply safe working practices, environment regulation and housekeeping. (NOS: ASC/N9521)
2. Recognize & comply Health, Safety & Environment practices in a vehicle AC manufacturing Plant. (NOS: ASC/9521)
3. Identify & explain about automobile AC industry in India, different types of vehicle Model, and performon job training in various Process. (NOS: ASC/N9522)
4. Perform & Maintain hand & power tools and equipment used in a workshop & vehicle AC manufacturing plant and develop skills to assemble components using fasteners on conveyor line. (NOS: ASC/N9523)
5. Recognize HVAC parts & components, their functions and assemble components on manufacturing lines. (NOS: ASC/N9524)
6. Demonstrate elements of HVAC manufacturing process and perform to make components in Molding. (NOS: ASC/N9525)
7. Plan & organize to perform plastic case assembly. (NOS: ASC/N9526)
8. Plan & organize to perform noise and air leakage testing. (NOS: ASC/N9527)
9. Plan & prepare for assembling HVAC components and perform components assembly work in different assembly processes. (NOS: ASC/N9524)
10. Read and apply engineering drawing for different application in the field of work. (Mapped NOS: CSC/N9401)
11. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (Mapped NOS: CSC/N9402)

SECOND YEAR

12. Plan & organize work and assemble condenser interior components viz. Core, Fine, Tube, RD bottle Fan, side plate etc. on different process. (NOS: ASC/N9528)
13. Perform condenser core Assembly using appropriate Tools. (NOS: ASC/N9528)
14. Perform condenser components using appropriate Tank Assembly and Tank cooking. (NOS: ASC/N9528)
15. Select proper tools and explain & perform NBF and HLT Process. (NOS: ASC/N9528)
16. Recognize the harmful effect of pollution in general & pollution generated by AC. (NOS: ASC/N9529)
17. Perform different types of quality control & inspection process on assembly line and tester line and conduct final inspection & testing. (NOS: ASC/N9530)

18. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)
19. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)

6. ASSESSMENT CRITERIA

Learning Outcomes	Assessment Criteria
FIRST YEAR	
1. Recognize & comply safe working practices, environment regulation and housekeeping. (NOS: ASC/N9521)	Perform Safe disposal of waste materials like cotton waste, metal chips/burrs etc.
	Hazard identification and avoidance.
	Identify Safety signs for Danger, Warning, caution & personal safety message.
	Preventive measures for electrical accidents & steps to be taken in such accidents.
	Use of Fire extinguishers.
	Safe use of tools andequipment used in the trade.
2. Recognize & comply Health, Safety & Environment practices in a vehicle AC manufacturing Plant. (NOS: ASC/N9521)	Demonstrate precautions to be followed while working in assembly line.
	Safe use of equipment generally used in assembly line with operating standard.
	Demonstrate class of fire and be able to operate fire Extinguishers.
	Practical use of PPEs.
3. Identify & explain about automobile AC industry in India, different types of vehicle Model, and perform on job training in various Process. (NOS: ASC/N9522)	Identification of different types of Vehicle AC.
	Identification of Vehicle Model Number
	Identification of different types of AC components.
	Plant and personal safety demonstration.
	Familiarization with different components in the AC.
	On the job training in various production to get acquainted to the AC manufacturing process.
	Hands on training on conveyor line and sub assembly.
4. Perform & Maintain hand & power tools and equipment used in a workshop & vehicle AC manufacturing plant and develop skills to assemble	Working with tools used in vehicle AC assembly
	Working with pneumatic tools, Use of Vernier caliper, Micrometer and height gauge
	Working with hand drill, hammer punches and chisel
	Practical with wrench screwdriver and pliers
	Use of Allen key
	Understanding of types and sizes of fasteners and picking of defined number of fasteners

components using fasteners on conveyor line. (NOS: ASC/N9523)	Gap setting and checking with feeler Gauge
	Operating of TIG welding guns and other welding machines
	Different types of Conveyors.
5. Recognize HVAC parts & components, their functions and assemble components on manufacturing lines. (NOS: ASC/N9524)	Identifying various components their function assembly and fitment procedure.
	Structure of HVAC
	Component installation in HVAC
	Construction of various HVAC components in power train
6. Demonstrate elements of HVAC manufacturing process and perform to make components in Molding. (NOS: ASC/N9525)	Perform Mould loading.
	Perform Mix material segregation.
	Perform P Tank fitting.
	Perform Cycle time study.
	Single minute exchange of die
7. Plan & organize to perform plastic case assembly. (NOS: ASC/N9526)	Perform Plastic case assembly:
	• Case opening.
	• Expansion valve assembly.
	• Docking assembly process.
	• Leaver force testing.
8. Plan & organize to perform noise and air leakage testing. (NOS: ASC/N9527)	Carry out noise testing:
	• Acoustic chamber
	• Vibration machine
	• Air leakage testing
9. Plan & prepare for assembling HVAC components and perform components assembly work in different assembly processes. (NOS: ASC/N9524)	Demonstrate automotive AC Assembly process in plant
	Perform different Assembly processes in workshop

10. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	Read & interpret the information on drawings and apply in executing practical work.
	Read & analyze the specification to ascertain the material requirement, tools and assembly/ maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
11. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study. (NOS: CSC/N9402)	Solve different mathematical problems
	Explain concept of basic science related to the field of study
SECOND YEAR	
12. Plan & organize work and assemble condenser interior components viz. Core, Fine, Tube, RD bottle Fan, side plate etc on different process. (NOS: ASC/N9528)	Install following components:
	• Fin forming
	• Core Building
	• Crimping
	• NBF process
	• VBF process
	• HLT process
13. Perform condenser core Assembly using appropriate Tools. (NOS: ASC/N9528)	Install following components in the condenser:
	• Fin manufacturing
	• Tube loading
	• Plate header assembly
	• Side plate and plate header
	• Wire binding
14. Perform condenser components using appropriate Tank	Install following components in the condenser:
	• Fin Fixed on feters
	• Tank Assembly

Assembly and Tank cooking. (NOS: ASC/N9528)	• Fix tank assembly • Bracket cooking
15. Select proper tools and explain & perform NBF and HLT Process. (NOS: ASC/N9528)	Carry out NBF and HLT Process in condenser assembly: Fin, Core, RD bottle and Side plate fix with breezing martial. NBF Process Leakage testing Back pressure testing. Final Testing.
16. Recognize the harmful effect of pollution in general & pollution generated by AC. (NOS: ASC/N9529)	Installation of components in the AC along with refrigerant Refrigerant Impact in environment. Cleaning and breezing solutions Impact in environment.
17. Perform different types of quality control &inspection process on assembly line andtester line and conduct final inspection & testing. (NOS: ASC/N9530)	Carry out Quality Control and Inspection: • Testing of HVAC • Fan balancing • Air flow • Leakage testing • Lock testing
18. Read and apply engineering drawing for different application in the field of work. (NOS: CSC/N9401)	Read & interpret the information on drawings and apply in executing practical work. Read &analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
19. Demonstrate basic mathematical concept and principles to perform practical operations.	Solve different mathematical problems Explain concept of basic science related to the field of study

Understand and explain basic science in the field of study. (NOS: CSC/N9402)	

SYLLABUS – Automotive Air-Condition Manufacturing Technician (FLEXI-MoU)			
FIRST YEAR			
Duration	**Reference Learning Outcomes**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 25 Hrs. Professional Knowledge 05 Hrs. On the job training 60 Hrs.	Recognize & comply safe working practices, environment regulation and housekeeping.	**Workshop Safety** 1. Practice of tools & Machinery identification. 2. Identification and use practice of Personal Protective Equipment (PPE). 3. Safe disposal of waste materials like cotton waste, metal chips/burrs etc. 4. Hazard identification and avoidance practice 5. Practice of Safety signs for Danger, Warning, caution & personal safety message. 6. Practice of preventive measure for electrical accidents & steps to be taken in such accidents. 7. Use of Fire extinguishers. 8. Practice and understand precautions to be followed while working in fitting jobs. 9. Safe use of tools and equipment used in the trade.	**Workshop Safety** • All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. • Soft Skills, its importance and Job area after completion of training. • Importance of safety and general precautions observed in the in the industry/shop floor. • Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. • Response to emergencies e.g.; power failure, fire, and system failure. • Importance of housekeeping & good shop floor practices. Introduction to 5S concept & its application. • Occupational Safety & Health**:** Health, Safety and Environment guidelines, legislations & regulations as applicable. • Basic understanding on Hot work, confined space work

			and material handling equipment.
Professional Skill 25 Hrs. Professional Knowledge 05 Hrs. On the job training 60 Hrs.	Recognize & comply Health, Safety & Environment practices in a vehicle AC manufacturing Plant.	**Health and safety in Manufacturing Environment** 10. Practice and understand precautions to be followed while working in assembly line 11. Safe use of equipment generally used in assembly line with operating standard. 12. Practice of operating fire extinguishers. 13. Practical use and understanding of PPEs.	**Health and safety in Manufacturing Environment** • Precautions to be followed while working in assembly Line • Safe use of equipment generally • used in assembly line • Maintaining health and safety for workers in assembly line • Emergency and evacuation procedures to be • followed in the assembly line • First-Aid, nature and causes of injury and utilization of first-aid. • Safety: - its importance, classification, personal, general, workshop and machine safety. • Safety signs and norms. • Fires: - types, causes, classes • Use of personal protective Equipment (PPE), standardization
Professional Skill 50 Hrs. Professional Knowledge 40 Hrs. On the job training 60 Hrs.	Identify & explain about automobile AC industry in India, different types of vehicle Model, and perform on job training in various Process.	**Basics of Automobile and Manufacturing Process** 14. Identify different types of Vehicle AC. 15. Identify Vehicle Model Number. 16. Identify different types of AC components. 17. Practice Plant and personal safety.	**Basics of Automobile and Manufacturing Process** • Knowledge about automobile AC industry • Basic automotive terms and familiarization to various types of vehicles AC • Basics of Vehicle AC manufacturing process • Basics of end forming

		18. Work with different components in the AC. 19. On the job training in various production to get acquainted to the AC manufacturing process. 20. Hands on training on conveyor line and sub assembly.	process • Basics of bending process • Basics of Breezing process • Basics of HLT process • Basics of Assembly process • Basics of Vehicle AC Inspection and testing process • Introduction to Tools and equipment used in AC vehicle manufacturing • Conveyors types • Pneumatic tools • Electric tools • Sealant application guns • Special tools and equipment
Professional Skill 40 Hrs. Professional Knowledge 20 Hrs. On the job training 90 Hrs.	Perform & Maintain hand & power tools and equipment used in a workshop & vehicle AC manufacturing plant and develop skills to assemble components using fasteners on conveyor line.	**Tools and Workshop Equipment** 21. Practice working with tools used in vehicle AC assembly. 22. Practice working with pneumatic tools, Use of Vernier caliper, Micrometer and height gauge 23. Working with hand drill, hammer punches and chisel. 24. Practical with wrench screwdriver and pliers. 25. Use of Allen key. 26. Identify types and sizes of fasteners and picking of defined number of fasteners 27. Perform Gap setting and checking with feeler Gauge. 28. Operate TIG welding guns	**Tools and Workshop Equipment** Common tools and material used in assembly Process • Types and sizes of spanners and screw drivers and Allen keys Taps wrenches and dies • Gauges • Files • Drilling machines and drills • Cutting machines • Pneumatic guns • Measuring instruments • Special purpose tools • Fasteners • General equipment in weld shop • Grinding, boring machines and screw jack • Hydraulic presses

		and other welding machines. 29. Practice on different types of Conveyor.	• Special purpose machines • Conveyor types
Professional Skill 15 Hrs. Professional Knowledge 15 Hrs. On the job training 90 Hrs.	Recognize HVAC parts & components, their functions and assemble components on manufacturing lines.	**Structure of HVAC** 30. On the job training on the actual manufacturing lines and identifying various components their function assembly and fitment procedure.	**Structure of HVAC** • Structure of HVAC • Component installation in HVAC • Cooling Unit, Heater Core, Damper etc. • Suspension components • Construction of various HVAC components in power train
Professional Skill 40 Hrs. Professional Knowledge 20 Hrs. On the job training 120 Hrs.	Demonstrate elements of HVAC manufacturing process and perform to make components in Molding.	On the job training Hands On training in 31. Practice Mould loading. 32. Practice Mix material segregation. 33. Practice P Tank fitting. 34. Practice Cycle time study. 35. Single minute exchange of die	**Elements of HVAC manufacturing process** • Molding Machine • Molds • EOT Crain
Professional Skill 40 Hrs. Professional Knowledge 20 Hrs. On the job training 120 Hrs.	Plan & organize to perform plastic case assembly.	36. Perform Plastic case assembly • Case opening • Expansion valve assembly • Docking assembly process • Leaver force testing	**Elements of HVAC manufacturing process** • Door assembly • Core fixing • Motor assembly in case
Professional Skill 40 Hrs. Professional Knowledge 20 Hrs.	Plan & organize to perform noise and air leakage testing.	37. Carry out noise testing • Working in Acoustic chamber • Working on Vibration machine • Working on Air leakage testing	**Elements** • Isolate chamber • Vibration sensor • Anemometer • Defrost meter

On the job training 120 Hrs.			
Professional Skill 55 Hrs. Professional Knowledge 35 Hrs. On the job training 120 Hrs.	Plan & prepare for assembling HVAC components and perform components assembly work in different assembly processes.	Assembly 38. Practice on Automotive AC Assembly process in plant. 39. Hands On training on different Assembly processes in workshop.	**Assembly** • Various assembly processes • Pneumatic tools and electrical tools • Torque wrenches • Types of assembly conveyors • Filling and testing equipment • HVAC Inspection and testing • Tester line equipment • Testing parameters and its
ENGINEERING DRAWING: 30 HRS.			
Professional Knowledge ED- 30 Hrs.	Read and apply engineering drawing for different application in the field of work.	Introduction to Engineering Drawing and Drawing Instruments – Conventions Sizes and layout of drawing sheets Title Block, its position and content Drawing Instrument Lines- Types and applications in drawing Free hand drawing of – Geometrical figures and blocks with dimension Transferring measurement from the given object to the free hand sketches. Free hand drawing of hand tools and measuring tools. Drawing of Geometrical figures: Angle, Triangle, Circle, Rectangle, Square, Parallelogram. Lettering & Numbering – Single Stroke. Dimensioning Types of arrowhead Leader line with text Position of dimensioning (Unidirectional, Aligned) Symbolic representation – Different symbols used in the related trades. Concept and reading of Drawing in Concept of axes plane and quadrant Concept of Orthographic and Isometric projections Method of first angle and third angle projections (definition	

		and difference) Reading of Job drawing of related trades.
WORKSHOP CALCULATION AND SCIENCE: 30 HRS		
Professional Knowledge WCS- 30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**Unit, Fractions** Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, substraction, multiplication & division Decimal fractions - Addition, subtraction, multilipication & division Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** Square and suare root Simple problems using calculator Applications of pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage Precentage - Changing percentage to decimal and fraction **Material Science** Types metals, types of ferrous and non ferrous metals Physical and mechanical properties of metals **Mass, Weight, Volume and Density** Mass, volume, density, weight and specific gravity, numerical related to L,C,O section only Related problems for mass, volume, density, weight and specific gravity **Speed and Velocity, Work, Power and Energy** Speed and velocity - Rest, motion, speed, velocity, difference between speed and velocity, acceleration and retardation Speed and velocity - Related problems on speed & velocity Work, power, energy, HP, IHP, BHP and efficiency **Heat & Temperature and Pressure** Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Concept of pressure - Units of pressure, atmospheric pressure, absolute pressure, gauge pressure and gauges used for measuring pressure

		Basic Electricity Introduction and uses of electricity, electric current AC, DC their comparison, voltage, resistance and their units **Mensuration** Area and perimeter of square, rectangle and parallelogram Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder Finding the lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels **Levers and Simple machines** Simple machines - Effort and load, mechanical advantage, velocity ratio, efficiency of machine, relationship between efficiency, velocity ratio and mechanical advantage Lever & Simple machines - Lever and its types **Trigonometry** Measurement of angles Trigonometrical ratios Trigonometrical tables
Project work 60 Hrs.	a) Make a chart showing different HVAC model. b) Make chart explaining the HVAC. c) Prepare models of different types of HVAC. d) Prepare working model of HVAC.	
Note: The duration of Professional skills (Trade practical), Professional knowledge (Trade theory) and On the Job Training are indicative only. The Training Institute has the flexibility to adopt suitable training duration for effective training.		

SYLLABUS – AUTOMOTIVE AIR CONDITION MANUFACTURING TECHNICIAN (FLEXI MoU)			
SECOND YEAR			
Duration	**Reference Learning Outcomes**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 60 Hrs. Professional Knowledge 30 Hrs. On the job training 150 Hrs.	Plan & organize work and assemble condenser interior components viz. Core, Fine, Tube, RD bottle Fan, side plate etc. on different process.	**Condenser assembly** 40. Install following components; • Fin forming • Core Building • Crimping • NBF process • VBF process • HLT process	**Condenser assembly** Understanding the construction of the following components and system • Core Fin • Tubes • Side Plate • RD bottle
Professional Skill 60 Hrs. Professional Knowledge 30 Hrs. On the job training 150 Hrs.	Perform condenser core Assembly using appropriate Tools.	41. Install following components in the condenser; • Fin manufacturing • Tube loading • Plate header assembly • Side plate and plate header • Wire binding	components using appropriate core assembly Understanding the function and construction of the following components and system • Fin quile loading • Fin set is caset
Professional Skill 80 Hrs. Professional Knowledge 40 Hrs. On the job training 150 Hrs.	Perform condenser components using appropriate Tank Assembly and Tank cooking.	**Tank Assembly and Tank cooking** 42. Install following components in the condenser; • Fin Fixed on feters • Tank Assembly • Fix tank assembly • Bracket cooking	**components using appropriate Tank Assembly and Tank cooking** **Understanding the function and construction of the following components and system** • NBF process • VBF process • HLT process
Professional Skill 80 Hrs.	Select proper tools and explain & perform NBF and HLT Process.	43. Carry out NBF and HLT Process in condenser assembly • Fin, Core, RD bottle and Side plate fix with	**NBF and HLT Process in condenser assembly** • NBF machine Temperature seating process. • Back pressure testing

Professional Knowledge 40 Hrs. On the job training 150 Hrs.		breezing martial. • NBF Process • Leakage testing • Back pressure testing. • Final Testing.	seating process.
Professional Skill 50 Hrs. Professional Knowledge 10 Hrs. On the job training 150 Hrs.	Recognize the harmful effect of pollution in general & pollution generated by AC.	**AC Pollution & Control** 44. Installation of components in the AC along with refrigerant 45. Refrigerant Impact in environment. 46. Cleaning and breezing solutions Impact in environment.	**AC Pollution & Control** • Importance of Refrigerant to control pollution. • Factors influencing AC system • Measurement techniques
Professional Skill 60 Hrs. Professional Knowledge 30 Hrs. On the job training 90 Hrs.	Perform different types of quality control & inspection process on assembly line and tester line and conduct final inspection & testing.	47. Carry out Quality Control and Inspection • Testing of HVAC • Fan balancing • Air flow • Leakage testing • Lock testing	**Quality Control and Inspection** • Different types of quality control processes used in automotive AC manufacturing shop • Statistical Process Control (SPC) • Functions of various departments in quality control procedures • Product development department • Production department • Quality Department • Marketing Department • Inspection Process • Final Audit Tests • QR Code
ENGINEERING DRAWING: 30 HRS.			
Professional Knowledge ED- 30 Hrs.	Read and apply engineering drawing for different	Reading of Electrical, Electronic & Mechanical Sign and Symbols used in Automobile. Sketches of Electrical, Electronic & Mechanical components used in Automobile.	

	application in the field of work.	Reading of Electrical wiring diagram and Layout diagram used in Automobile. Drawing of Electrical circuit diagram used in Automobile. Drawing of Block diagram of Instruments & equipment of trades
WORKSHOP CALCULATION AND SCIENCE: 30 HRS.		
Professional Knowledge WCS-30 Hrs.	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**Friction** Friction - Advantages and disadvantages, simple problems related to friction Friction - Lubrication **Estimation and Costing** Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade Estimation and costing - Problems on estimation and costing
Project work 60 Hrs.	a) AC circuit design b) Air flow testing circuit c) Zero defect line designed	
Note: The duration of Professional skills (Trade practical), Professional knowledge (Trade theory) and On the Job Training are indicative only. The Training Institute has the flexibility to adopt suitable training duration for effective training.		

SYLLABUS (CORE SKILLS)
Employability Skills (Common for all CTS trades) (120 Hrs.+ 60 Hrs.)

Learning outcomes, assessment criteria, syllabus and tool list of core skill subjects which are common for a group of trades, provided separately in www.bharatskills.gov.in / www.dgt.gov.in

ANNEXURE-I

List of Tools and Equipment			
Automotive Air-Condition Manufacturing Technician (for batch of 20 candidates)			
Sl. No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
TOOLS, EQUIPMENT, MACHINERIES AND VEHICLES			
1.	Spinning & Buldeging		5 Sets
2.	Swaging tool, punch type, set of size,	for tube 4.7 to 16 mm OD	2 Sets
3.	Swaging tool, screw type, with adapter set of size	for tube 4.7 to 16 mm OD	2 Sets
4.	Bending spring external type	for copper tube 3 to 6 mm. Dia	2 Sets
5.	Pipe culler miniature	for copper tube 3 to 16 mm Dia.	5 Sets
6.	Piercing pliers	6-18 mm & piercing valves both with access fittings	2 Sets
7.	spanner, double ended	4.7 mm to 16 mm.	3 Sets
8.	Spanner, double ended	19 mm to 31.8 mm.	1 Set
9.	Ring spanner	off set 4.7 mm to 16 mm.	3 Sets
10.	Ring spanner	off set 19 mm to 31.8 mm.	1 Set
11.	Box spanner,	off set 19 mm to 31.8 mm.	2 Sets
12.	Wrench adjustable	length 150 mm.	4 Sets
13.	Wrench adjustable	length 200 mm.	4 Sets
14.	Wrench adjustable	length 225 mm.	2 Sets
15.	Pipe wench	size 150 mm.	2 Sets
16.	Pipe wench	size 250 mm.	2 Sets
17.	Torque wrench	300 mm. 12.7 mm. square drive right and left hand	1 Set
18.	Valve key -t, handle -4.7 &6.4 mm. sq.		4 Sets
19.	serviceman thermometer in metal case	30TO+30 deg C	2 Sets
20.	Scissor gasket cutting stainless steel	LENGTH 25MM	2 Sets
21.	Allen key set	SIZE 1.5 TO 6.4 MM	2 Sets
22.	Allen key set	SIZE 5/32& 1/8	2 Sets
23.	Screw drive plastic handle	6mm tip length 100.150mm	2 Sets
24.	Screw drive plastic handle	10mm tip length 200.250mm	5 Sets
25.	Pipe combination insulated	Length 200 mm	4 Sets
26.	Tape measuring 10m graduation in mm.		1 Set
27.	Tape measuring 2m graduation in mm.		2 Sets
28.	Hack Saw Tubular Metal Frame Adjustable		4 Sets

29.	Centre punch	Lenth 100mm	4 Sets
30.	File fiate medium double cut	Length 200mm	4 Sets
31.	File half round medium double cut	Length 200 mm	4 Sets
32.	File half round fine double cut	Lenth 150mm	4 Sets
33.	File round fine double cut	Lenth 150mm	4 Sets
34.	File flat fine double cut	Lenth 150mm	4 Sets
35.	File square fine double cut	Lenth 150mm	4 Sets
36.	Vernier caliper	Lenth 150mm	1 Set
37.	Micrometer outside	Measurement 0- 25 mm	2 Sets
38.	Vernier height gauges	150mm	1 Set
39.	Bench vice	75mm jaw	2 Sets
40.	Bench vice	100mm jaw	2 Sets
41.	Flaring drill portable witch chuck and key	Capacity 6.4 mm	2 Sets
42.	Piercing machine	200 to 2500rpm capacity 20mm	1 Set
43.	Pedestal grinder double ended wheel	Dia 200mm 3000rpm	1 Set
44.	Tong Tester	0-10-30amps 0-500 volts (Clampon multimeter)	4 Sets
45.	Megger	1000 volt	1 Set
46.	Multimeter digital type		3 Sets
47.	Tachometer digital multi range	0 to 3000rpm portable, small size in leather case.	1 Set
48.	Stop watch		1 Set
49.	Hand grinder small		1 Set
50.	Filler gauge	0.05mm - 1mm	1 Set
51.	Evacuating & Refrigerant charging station comprising rotary two stage vacuum pump and motor (with gas ballast & anti suck back) Manifold with gauges & valves and capable of pulling vacuum upto 50 microns of Hg and with provision of connecting to a micro level vacuum gauges graduated charging cylinder with provision for temperature correction and all necessary isolating valves Evacuating & charging station as above but fitted with weighing scale (up to 2kg in leiu of (b) above and with accuracy of +/- 1gm for charging hydrocarbon.		1 no
52.	Anemometer (Vane Type)		1 no
53.	Air compressor two stage for oil less dri	pressure10kg/s cm	1 no.

	air with rest proof tank assembly. heater and control max.		
54.	Refrigerator compression type	165 litter/170 litter capacity	2 nos.
55.	Refrigerator compression type 300 litters double door. double compressor system		2 nos.
56.	Deep freezer	165 liters - 18 c 1/4 hp	1 no.
57.	Window air conditioner	capacity 3000kcl/hr	2 nos.
58.	Split air conditioner	capacity 4500kcal/hr	2 nos.
59.	Water cooler instantaneous type		2 nos.
60.	Air conditioner plant direct system with air cooled condenser, complete with all controls including.		1 no.
61.	Air conditioner plant in direct system with water cooled condenser chiller cooling twor complete with air controls		1 no.
62.	Working trainer model/ simulator including humidity control etc capacity 15000 kcl/hr		
63.	Condensing unit with open type compressor air cooled condenser controls etc.	capacity 3000 kcal/ hr	1 no.
64.	sensor thermometer (digital)		2 nos.
65.	134a refrigerant cylinders		2 nos.
66.	File extinguisher powder type		1 no.
67.	Two-way manifold with gauges		
68.	Small car a/c kit with driving arrangements		1 no. each
69.	Components of car AC system Wobble plate compressor with mounting brackets, serpentine evaporator parallel flow condenser hoses, tube, receiver, expansion valve, electrical components and siring harness.		1 no. each

Note: -

1. *All the tools and equipment are to be procured as per BIS specification.*
2. *Internet facility is desired to be provided in the class room.*

ABBREVIATIONS

CTS	Craftsmen Training Scheme
ATS	Apprenticeship Training Scheme
CITS	Craft Instructor Training Scheme
DGT	Directorate General of Training
MSDE	Ministry of Skill Development and Entrepreneurship
NTC	National Trade Certificate
NAC	National Apprenticeship Certificate
NCIC	National Craft Instructor Certificate
LD	Locomotor Disability
CP	Cerebral Palsy
MD	Multiple Disabilities
LV	Low Vision
HH	Hard of Hearing
ID	Intellectual Disabilities
LC	Leprosy Cured
SLD	Specific Learning Disabilities
DW	Dwarfisms
MI	Mental Illness
AA	Acid Attack
PwD	Person with disabilities