MECHANIC (CENTRAL AIR CONDITIONING PLANT, INDUSTRIAL COOLING AND PACKAGE AIR CONDITIONING)

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – SERVICES INCLUDING REPAIR AND MAINTENANCE

सत्यमेव जयते

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

Directorate General of Training

Skill India
कौशल भारत-कुशल भारत

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(Revised in 2018)

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NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
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Kolkata – 700 091

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1. Godrej India Ltd., Mumbai

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Co-ordinator for the course: Sh. Nirmalya Nath., ADT CSTARI Kolkata

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1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

1.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

1.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.

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2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

Mechanic (Central Air Conditioning Plant, Industrial Cooling And Package Air Conditioning) trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, 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, core skills & employability skills while performing jobs and solve problem during execution.
- Document the technical parameters related to the task undertaken.

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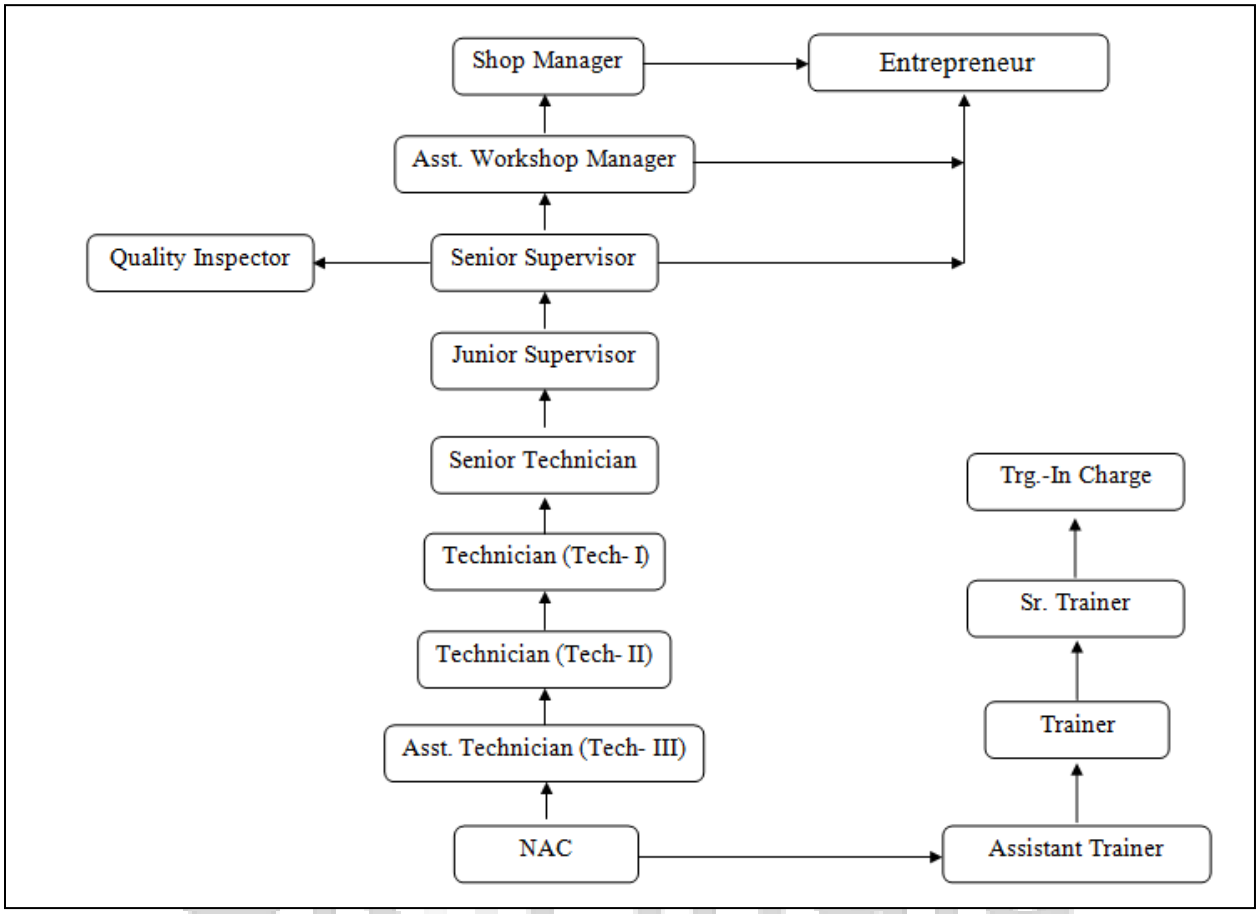
2.2 CAREER PROGRESSION PATHWAYS:

- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (*Basic Training and On-Job Training*): -

Total training duration details: -

Time (in months)	**1-3**	**4-12**	**13-15**	**16-24**
Basic Training	**Block– I**	**-----**	**Block – II**	**------**
Practical Training (On - job training)	**----**	**Block – I**	**------**	**Block – II**

Mechanic (Central Air Conditioning Plant, Industrial Cooling and Package Air Conditioning)

A. Basic Training

For 02 yrs. Engg. Course :-(**Total 06 months:** 03 months in 1st yr. + 03 months in 2nd yr.)

For 01 yr. Engg. course :-(**Total 03 months:** 03 months in 1st yr.)

Sl. No.	Course Element	Total Notional Training Hours	
		For 02 yrs. course	**For 01 yr. course**
1	Professional Skill (Trade Practical)	550	275
2	Professional Knowledge (Trade Theory)	240	120
3	Workshop Calculation & Science	40	20
4	Engineering Drawing	60	30
5	Employability Skills	110	55
	Total (including Internal Assessment)	**1000**	**500**

B. On-Job Training:-

For 02 yrs. Engg. Course :- (**Total 18 months:** 09 months in 1st yr. + 09 months in 2nd yr.)

Notional Training Hours for On-Job Training: 3120 Hrs.

For 01 yr. Engg. course :-(**Total 12 months**)

Notional Training Hours for On-Job Training: 2080 Hrs.

C. Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 02 Engg. yrs. course	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. Engg. course	500 hrs.	2080 hrs.	2580 hrs.

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2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline (section-2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India 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 (section-2.4.2) before giving marks for practical examination.

2.4.1 PASS REGULATION

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

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 team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

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
- Project work

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Evidences of internal assessments are to be preserved until forthcoming semester 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 with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b)Weightage in the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • 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% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

Air-Conditioning and Refrigeration Plant Attendant; Refrigeration System Operator operates air-conditioning or refrigeration system for preserving food, providing cooling or warming media for industrial processes, cooling or warming buildings, or for other purposes. Manipulates various switches, at central control board to start and stop electric motors, pumps, compressors, coolers and other related equipment of refrigeration and air-conditioning system; observes readings in various meters, gauges and instruments regarding temperature, pressure and voltage of system to ascertain working condition of plant; operates switches, thermostats, rheostats and other controls to maintain desired level of temperature; cleans and resets generator brushes, replaces burned fuses and defective devices, thaws frozen valves, cleans equipment and performs other tasks such as oiling, greasing, cleaning of air and water filters etc. to keep system in good running order. May keep records of temperatures produced. May assist Refrigeration Mechanic in dismantling equipment for repairs.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

Reference NCO: 3132.0900

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4. NSQF LEVEL COMPLIANCE

NSQF level for Mechanic (Central Air Conditioning, Industrial Cooling and Packaged Air Conditioning) trade under ATS: **Level 5**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. professional knowledge,
c. professional skill,
d. core skill and
e. Responsibility.

The Broad Learning outcome of Mechanic (Central Air Conditioning Plant, Industrial Cooling and Package Air Conditioning) trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context.	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and Learning and some responsibility for other's works and learning.

5. GENERAL INFORMATION

Name of the Trade	**Mechanic (Central Air Conditioning Plant, Industrial Cooling and Package Air Conditioning)**
NCO-2015	3132.0900
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Passed 10th class examination under 10+2 system of education or its equivalent.
Selection of Apprentices	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for Basic Training	As per related trades of ITI
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	01 year
CTS trades eligible for Mechanic (Central Air Conditioning Plant, Industrial Cooling and Package Air Conditioning) Apprenticeship	Mechanic (Refrigeration and Air conditioning)

Note:

- *Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.*
- *For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.*

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Mechanic (Central Air Conditioning Plant, Industrial Cooling and Package Air Conditioning) course of 02 years duration under ATS.

Block I & II:-

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

A. BLOCK – I

1. Use of dry & wet bulb thermometer, sling psychrometer, using psychrometric chart to plot processes. Rough checking of the performance of A.C. equipment
2. Use of Anemometers of measuring Air-flow Use of inclined tube manometer for measuring Air pressure, pivot tube for air-flow measurement.
3. Servicing & trouble shooting of package A.C.

4. Check Operation of package A.C. check for system leaks and leak repairs
5. Identify Electrical wiring of the compressor and check in the wiring system of package A.C. Checking & testing of H.P/L.O/O.P/cut out, solenoid valve, thermostat etc.
6. Duct material and standard, reading and understanding duct layout drawings sheet metal duct work. Longitudinal and transverse joints
7. Servicing & maintenance of various types of Air filters. Noise control and isolation of piping, ducting, AHU Room and apply of acoustic material.
8. Chilled water pining and insulation, servicing of focus and water control valves, mixing dampers face and by pass dampers.
9. Installing compressor and other system component, verifying airflow and distribution. Operation of electrical and mechanic components
10. Pull and verify deep vacuum. Perform leak checks and make repairs. Check system operation whilst following all safety procedures.
11. Check Operation of A.C. plant, check for system leaks and check and clean heat exchanger. Check out sample for acidity, check superheat.
12. Dismantling of commercial type reciprocating compressor
13. Checking and servicing valve plat and piston assembly tapping
14. Checking lubricating system, servicing of oil pump
15. Checking & Servicing capacity control of compressor fitting and testing
16. Checking servicing bearing, shaft seal cutting gasket and assemble of compressor testing efficiency
17. Servicing of water cooler condenser and receiver checking leakage
18. Servicing of evaporative condenser checking and repairing and testing
19. Servicing of cooling tower –its care and maintenance installation
20. Servicing of water softening and removing paint its care and maintenance
21. Servicing of water circulating pumps dismantling and reassembly
    Testing and adjusting of expansion devices
22. Servicing of water/brine chillers, Servicing of suction-liquid heat exchangers
23. Routine maintenance, overhauling preventive maintenance of large AC plants, Maintenance, log book and record keeping

B. BLOCK – II

24. Identify Operating Principles of Screw, Rotary and Scroll compressors.
25. Check Types of condensers, cooling towers, AHUs, chillers (D-X, / flooded)
26. Check environment friendly refrigerants viz. R134a, R407c, R410, R290, R32, their merits / demerits, system pressures and procedures for vacuuming, handling, operation and maintenance.

27. Check Basic fundamentals of Variable Frequency Drives (VFD)
28. Check Principles and Operation of Variable Refrigerant Volume (VRV) systems
29. Operation and maintenance of modulating devices for chilled water AC systems and Variable Air Volume (VAV) units used in air distribution systems.
30. Identify Basic operation of screw and scroll chillers
31. Identify Basic operation of Programmable Logic Controllers (PLC) / Plant Manager / Building Management Systems (BMS)
32. Measure Temperature by various types of RTD (Resistance Temp Detectors) and electronic sensors
33. Measure system performance parameters, calculate the energy efficiency and ascertain the performance of Air Conditioning Systems.

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

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7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	1. 2. Recognize and report all unsafe situations according to site policy.
	1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1. 5. Identify and observe site policies and procedures in regard to illness or accident.
	1. 6. Identify safety alarms accurately.
	1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1. 8. Identify and observe site evacuation procedures according to site policy.
	1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1. 10. Identify basic first aid and use them under different circumstances.
	1. 11. Identify different fire extinguisher and use the same as per requirement.
	1. 12. Identify environmental pollution & contribute to avoidance of same.
	1. 13. Take opportunities to use energy and materials in an environmentally friendly manner
	1. 14. Avoid waste and dispose waste as per procedure
	1. 15. Recognize different components of 5S and apply the same in the working environment.
2. Understand, explain different mathematical calculation & science in the field of study including basic	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.

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electrical and apply in day to day work.*[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation & earthing.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*	3. 1. Read & interpret the information on drawings and apply in executing practical work.
	3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments as per tool list.
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts

6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation
	8. 3. Communicate effectively with others and plan project tasks
	8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
<u>Block-I & II (Section:10)</u>	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **block – I & block – II** (section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	Safety: - its importance, classification, personal, general, workshop and job safety. Occupational health and safety. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Importance of housekeeping & good shop floor practices. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Fire& safety: Use of Fire extinguishers. Safety regarding working with different types of steam and its First-Aid.	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Institute system including stores procedures. Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE). Response to emergencies e.g.; power failure, fire, and system failure. Accidents- Definition types and causes. First-Aid, nature and causes of injury and utilization of first-aid. Introduction to 5S concept & its application. Fire: - Types, causes and prevention methods. Fire Extinguisher, its types. Define environment, environment Pollution, Pollutants, type of Pollution (Air pollution, water pollution, soil pollution noise pollution, thermal pollution, radiation. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2	**Basic Fitting :** Marking on flat surfaces as per given drawing by using different marking tools and medias, Punching & hacks a wing, Filing surfaces flat & square.	Introduction to basic workshop tools & operations like measuring, marking, hacks a wing & cutting. Tools used, their identification, use care & maintenance, measurements, marking

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	Checking for flatness, straightness & squareness. Filing & Fitting of male & female joints within accuracy of + 0.2mm. Using a sprit level and dial test indicator. Measurements by precision instruments. Drilling, reaming & tapping as per given drawings. External thread cutting on pipes.	medias. Introduction to files, their types and uses, care & maintenance, Bench & pipe vice, their uses. Sprit levels & their uses, straight and angular measurements, Bevel Protractors. Introduction to precision measuring & least count. Micrometers, Vernier & Height gauges, applications, care & maintenance. Dial gauge vernier & indicator. Drilling, tapping & reaming, types of drills & reamers, different drilling operations, dies & die stocks. Drilling machines, their types & uses, holding devices & fixtures. Types of fasteners, threads. Adhesives & their applications.
3	**Sheet Metal Work :** Practice in cutting sheet metal to different shapes using various types of snips. Folding/Bending sheet metal to 90^0 using wooden mallet. Practice on hard soldering method (Lead & Tin). Making holes on sheet metal by punching & riveting. Straight & oblique cutting, preparing A.C. ducts & components as per given drawings. Riveting practice, practice on removing dents on spherical & hemi spherical articles.	Introduction to sheet metal work & its applications, materials used for sheet metal work. Hand tools, measuring tools & gauges used in sheet metal work. Different sheet metal operations, their necessity & applications. Sheet metal joining processes, soldering brazing& welding. Sheet metal machinery, shears, forming & folding machines, bending & shearing machines seaming & nibbling machines. Development of surfaces for simple objects like boxes, cylinders, cones, prism & pyramids. Developing & forming A.C. ducts & components.
4	**Basic Welding :** Setting beading practices, striking & maintaining an arc. Setting up an oxy-acetylene flame. Laying short , straight line & weaved beads on M.S. plates, Fillet welds in open corner, Tee & Lap Joint, fusion runs with & without filler rods. Preparing different joints with gas welding. Soldering & brazing on sheet metal as per braze welding practice.	Metal joining processes. Introduction to gas & arc welding. Different hand tools used in welding. Welding accessories like regulators, nozzles cylinders etc. Welding machines & welding transformers, Oxy-Acetylene gas welding plant. Welding processes & positions, welded joints, welding symbols, weld depositions, filler rods & electrodes, their types & selection, care & maintenance. Fluxes, types &

	Brazing of different size of copper, steel, aluminum pipes with different brazing material. Use of sliver brazing by oxy-Ace process.	application. Distortion in welding, welding defects, their causes & remedial measures. Soldering & brazing, Different types of solder, composition and use of flux-their effect on metal, method of soldering and brazing, Braze welding procedure. Brazing fluxes - their properties, types, constituents of fluxes.
5	**Basic Electricity:** Use of hand tools. Joining practice with single and multi-stand conductors. Joining practice of bare conductors, cable joints. Use of Aluminum flux and Alca 'P' solder. Demonstration and practice of crimping of various wires, Electrical symbols. Use of Multimeters and measurement of current, voltage, resistance in DC/AC circuits. Series circuits - Parallel circuits. Demonstration & Practice on connecting & replacement of common electrical accessories in circuits - Use of tong tester and megger.	Electricity, Safety - in electrical shops& installations. General care & maintenance of common electrical hand tools. Wires & cables - conductors, Insulators & semiconductors, their shapes, sizes with respect to low, medium & high voltage. Crimping equipment -Single & Multistranded conductors joining and soldering. Resistance, Voltage, Current, open circuit and short circuits-Ohm's law - Voltage drop in series & parallel circuits, Electrical measuring Instruments viz., Multimeters, Testers. Common electrical accessories used in Industries, Bus-bars, Relays, Contactors, Circuit Breakers, etc.. Fuses and their ratings, materials used. Earthing& its importance. Preventive maintenance, routine & periodical tests
6	Simple wiring practice with distribution boards, Junction Boxes, Main Switches two way and intermediate Switches. Identification of different parts of DC generators- testing and measuring the field and Armature resistances. Identification of different parts of AC Motors - Testing and measurement on Induction motors - and generators. Identification and testing of transformers. Grouping & testing of cells for a specified voltage & current - Preparation of battery charging.	Induction principles - Electro-magnetism-Faraday's Laws. Single phase & Poly phase system 3 phase star-delta connections, Impedance &power factor -Principles & Applications of DC Motors, Series, Shunt & compound motor - AC Motors. Transformers their types and applications. Rechargeable batteries - Care & maintenance of cells. AC Motor starting with DOL Starter and Star - Delta Starter. Panel boards & their designing.

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7	Identification and testing of different types of electronic components, symbols. Testing of capacitors, Identification and Testing of assorted diodes, PNP/NPN Transistors - Uni - junction Transistor, Field effect, Transistor & Silicon Controlled Rectifier ICs etc. Soldering & de-soldering practice - Demonstration on Rectifiers - Identification of ICs Full wave & bridge rectifier circuits, voltage regulators, construction of low voltage power supply, construction of transistor, amplifier circuits. Multivibrator circuits, CR circuits for wave shaping, wiring of SCR, UJT for motor control.	Fundamentals of electron theory - passive components semiconductor devices - Symbols -specifications - Diodes, Transistors, Uni-junction Transistor, Field effect Transistor Silicon Controlled Rectifier & ICs. Half wave, full wave & Bridge rectifier with filters, DC Power supply. Rectification and Rectifiers, zener diode as voltage regulator, Transistor parameters-CB,CC,CE configuration, amplification, photo diodes, transistors, multivibrations CR & LR circuits, SCRs, UJTs &ICs.
8	Testing solid state thermostats, PTCR, remote controls. Operating & testing contactors, relay, pressure controls, timer, solenoid, heater, pressure controls, Identification of keys & display of microprocessor trainer kit.	The rmistor, RTDs, Electronic thermostat, principle of remote control & controllers. Use & specifications of contactors, starter & crankcase heater etc., Introduction to Microprocessors.
9	Introduction to operations on copper tubing like bending, flaring, swedging, pinching etc. & tools used. Study & sketch refrigerator parts, storing arrangement, Fitting refrigerator doors & hinges, Tube brazing. Safety in handling tools & equipment.	History of refrigeration, its principle & need. Introduction to refrigeration equipment, constructional details of a refrigerator. Heat and temperature. Types of heat and its measurement. Thermometers & thermometric conversions. Atmosphere, air & its constituents. Properties of gases & gas laws. Measurement of pressure. Pressure gauges. Humidity, relative humidity & due point temperature.
10	Refrigerator cleaning, inspection, testing of components in refrigeration system. Tracing the electrical components and testing relay, OLP, Thermostat, light assembly, door switch etc. To remove &refix refrigerator doors. To cut & fix door gaskets. Refrigerator installation, care & maintenance.	Functions of refrigeration system components i.e condensers, evaporators and capillary tube. Compressor, its types & working principle. Reciprocating compressors. Comparative study of sealed & open type compressors, Internal construction of a sealed compressor, its part & their functions. Introduction to soldering & brazing, their

		applications. Brazing Vs welding. Advantages & disadvantages. Brazing Processes. Defects & remedial measures.
11	Dismantling & assembly of a sealed compressor & value plates, lapping of valve plates & reeds Oil charging of a compressor Recovering CFC / HCFC / HFC by using recovery machines	Compressor lubrication method. Lubricants & their properties. Comparative study of compressors and other component used for R.12, R.134 a & HCs. Refrigerants & their properties Comparative study of refrigerants Ozone depletion & its causes, need for elimination of refrigerant emission through recovery recycling, phasing out of CFCs.
12	Repairing rewiring & servicing of a refrigerator. Leak testing in the system Evacuation & gas charging of a refrigerator. Trouble shooting of electrical & mechanical faults	Methods of leak testing & instruments used. Electronic leak detectors, their types & uses. Defect diagnosis with the help of problem trees
13	**Revision &Internal Assessment**	

Note: - *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

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BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	Tripping the components of frost Free Refrigerator, tracing electrical circuits & defrost, Inspection & testing. Retrofitting of CFC filled refrigerator with Non CFC refrigerant i.e.134a & HC 600. Use of sealed components.	Study of Frost Free Refrigerators, Refrigeration system of Frost Free Refrigerators, components & their functions, electrical components, wiring, automatic defrost & air duct system. Comparative study of refrigerators available in the market. Scope and methodology of retrofitting CFC appliances with HFC & HCS refrigerants, study of refrigerator components using HC refrigerants. Comparative study of performance of refrigerators using different refrigerants.
2	Dismantling & Assembly of an Air conditioner, study of different components, their functions & specifications. Calculating Relative Humidity by using sling psychometric.	Introduction to Air conditioning, its past, present & future. Air conditioning Fundamentals. Constructional details and functioning of room air conditioner. Air circulation system. Psychometric & psychometric charts, construction & use of sling psychrometer.
3	Study & testing of thermostatic relay, capacitors, OLP, blower motor. Inspecting & testing condenser & evaporator coil. Checking of electrical wiring by CSR method. PSC circuits in Room A.C.	Study of mechanical & electrical components of Window A. C. & Split A.C., Role of each part. Split A.C., its constructional details, comparison with window air conditioner advantages & Disadvantages. Air cooled condensers: Constructional details & selection.
4	Dry Servicing & brought down servicing of Air conditioners. Brazing & water immersion testing of evaporator & condenser coils. Evacuating & gas charging of an Air conditioner. Performance Testing for Air Velocity, grill & condenser temperature	Air cleaning: Filters, their types and specifications. Air flow measurements Use of velocity meters. Performance Testing criterion. Principles of pipe sizing & study of services valves for charging at site. Principle of working of infra red

	& smooth running of fan motor.	remote control, study of electronic circuits.
5	Testing all weather air conditioners. Trouble shooting electrical & mechanical faults.	Fault diagnosis in window & split A.C. units with the help of problem trees.
6	Water cooler construction (Instantaneous and storage) refrigeration circuit, electrical circuit, working and control, soldering of copper tubes with stainless steel, Trouble shooting of commonly faced problem like condenser Fan Failure, corrosion etc.	a. Water storage, distribution and drainage b. Refrigeration system using R-22 and components in lieu of R-12, b) Retrofitting with HFC-134a & HCs c) Electrical and control system d) Insulation and Energy conservation
7	Checking- and servicing visi cooler, deep freezer, Preventive maintenance and Trouble Shooting. Retrofitting with Hydrocarbons and HFC 134a.	Chest type bottle coolers, Deep Freezers and visi coolers Description, Construction and function substituting R-12 with R-134a or Hydrocarbon (Montreal protocol) Low temperature thermostat, different type of deep freezer construction.
8	Ice Candy Plant, refrigeration circuit, electrical circuit, working and control. Cold storage Plant, types of condenser cooling coil used, expansion devices, refrigerant used and electrical circuit study. Drawing out layout of a typical chilling plant.	Ice Candy Plant, Refrigerant used, Brine agitator, Expansion Device; used, Electrical Motor Controls etc. Cold storage plant construction, refrigeration system with condenser & coil type used, RCD device used, super heat concept, electrical devices used. Chilling plants constructional details, System of refrigeration.
9	Dismantling a pump unit from foundation. Checking the parts, servicing re-installing & testing the unit for performance & power consumption. Identifying parts of pumps & valves & note their functions. Preparing a problem tree for fault diagnosis.	Pumps, types & applications. Centrifugal pumps, their constructional details & applications. Working of a centrifugal pump. Calculations of heads, frictional losses, selection of pump. Valve, their types & applications. Sluice valve, butterfly valve, non return valves, constructional details & principle of working. Fault diagnosis.
10	Sketching & dimensioning the parts of a typical package unit and study its constructional & operational details. Operating a package unit for its working and performance. Study the installation	Package Air conditioners, their need, types & applications Ductable & non ductable units. Constructional details of a package unit. Electrical wiring & refrigerant system controls & electrical

	details & duct system of a package unit. Rewire a package unit. Mechanical, electrical & operational fault finding.	controls. Installation & operational details. Fault diagnosis with help of a problem tree. Comparative study of package units available in the market.
11	Installation, servicing & re-installing a car A.C. unit. To test, service & adjust different controls and switches. To check & test the total system for performance. Study of typical central A.C. system using vapour absorption system.	Automobile air conditioning, need & applications. Difference between a room A.C. and automobile A.C. Study the details of a typical automotive air conditioning system parts and their functions. Installation & operation of a Car A.C. Trouble shooting with the help of a problem tree. Vapour Absorption Refrigeration system. Typical refrigeration cycle. Amonia& Lithium Bromide absorption system. Advantages & disadvantages of vapour absorption refrigeration system. Air Refrigeration, steam jet refrigeration & non- conventional refrigeration.
12	Studying and drawing the layout & piping arrangement of the given Central A.C. Plant. Studying & drawing the chilling water & condensate water circuits. Studying different controls. Maintenance of pumps, compressors & controls. Studying & drawing the panel board connections &wiring. Testing, pumping down & re-testing the plant. Evacuating & gas charging the system. Designing Central A.C. systems for different applications.	Introduction to Central A.C. plants, selection & applications. Direct & Indirect cooling, Air & water as media for cooling. Central A.C. Plant system components, Compressor, condenser & chiller. Fan coiled units & Air handling units. Cooling Towers, their types, constructional details & operation. Cooling Tower installation & maintenance, make up water arrangements. Types of compressors used, loading and unloading arrangements. Ducting & its installation. Different switches & controls. Trouble shooting. Heat load calculations for different site conditions & applications.
13	**Revision & Internal Assessment**	

Note: - *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	Engineering Drawing: Introduction and its importance Different types of standards used in engineering drawing. Drawing Instruments: their uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.
2.	**Material Science** : properties -Physical & Mechanical, Types -Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	Lines : types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. **Drawing of Geometrical Figures:** Angle, Triangle, Square, Rectangle and Circle. **Letters: -** Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice
3.	**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	**Dimensioning**- Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. **Scales**:-Types use and construction. Representative factor of scale.
4.	**Speed and Velocity:** Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration & Retardation. Related problems. Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view
5.	**Ratio & Proportion** : Simple calculation on related problems.	**Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free

	Percentage: Introduction, Simple calculation.	hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand
6.	**Work, Power and Energy:** work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.	Projections: Concept of axes plane and quadrant. Orthographic projections Method of first angle and third angle projections (definition and difference) Symbol of 1st angle and 3rd angle projection as per IS specification. Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks

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Mechanic (Central Air Conditioning Plant, Industrial Cooling and Package Air Conditioning)

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	
2.	**Heat & Temperature:** Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.
3.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere. Surface area of solids -cube, cuboid, cylinder and Sphere. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks.	**Free hand Sketches for simple pipe line with general fittings.**
4.	**Basic Electricity:** Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthling.	**Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.**
5.	**Simple machines Transmission of power:** - Transmission of power by belt, pulleys & gear drive. **Heat treatment process: -** Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering.	**Simple exercises related to trade related symbols.** **Basic electrical and electronic symbols**
6.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. Finding height and distance by trigonometry.	**Free hand sketch of trade related components / parts /cutting tool indicating angles.**

	Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem.	
7.	**Concept of pressure** - **Definition**:-Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems	
8.	**Simple exercises related to trade related Test Papers. Solution of NCVT test papers.**	

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9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I (Duration – 55 hrs.)	
1. English Literacy	Duration : 20 Hrs. Marks : 09
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy	Duration : 20 Hrs. Marks : 09
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.

Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills	Duration : 15 Hrs. Marks : 07
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
Block – II **Duration – 55 hrs.**	
4. Entrepreneurship Skills	Duration : 15 Hrs. Marks : 06

Concept of Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.	
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
5. Productivity		Duration : 10 Hrs. Marks : 05
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.	
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.	
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.	
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
6. Occupational Safety, Health and Environment Education		Duration : 15 Hrs. Marks : 06
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.	
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety	

	measures.
First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in -house environment.
7. Labour Welfare Legislation	Duration : 05 Hrs. Marks : 03
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
8. Quality Tools	Duration : 10 Hrs. Marks : 05
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

10. DETAILS OF COMPETENCIES (ON-JOBTRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR MECHANIC (CENTRAL AIR CONDITIONING PLANT, INDUSTRIAL COOLING AND PACKAGE AIR CONDITIONING) TRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Making components observing different metal removing procedure and perform different fitting job.
4. Assembling of different components as per requirement and check functionality.
5. Carryout maintenance of different machines including hydraulics & pneumatics system.

Note: Actual training will depend on the existing facilities available in the establishments.

The **competencies/ specific outcomes** on completion of On-Job Training are detailed below: -

A. BLOCK – I

1. Use of dry & wet bulb thermometer, sling psychrometer, using psychrometric chart to plot processes. Rough checking of the performance of A.C. equipment
2. Use of Anemometers of measuring Air-flow Use of inclined tube manometer for measuring Air pressure, pivot tube for air-flow measurement.
3. Servicing & trouble shooting of package A.C.
4. Operation of package A.C. check for system leaks and leak repairs
5. Identify Electrical wiring of the compressor and check in the wiring system of package A.C. Checking & testing of H.P/L.O/O.P/cut out, solenoid valve, thermostat etc.
6. Duct material and standard, reading and understanding duct layout drawings sheet metal duct work. Longitudinal and transverse joints
7. Servicing & maintenance of various types of Air filters. Noise control and isolation of piping, ducting, AHU Room and apply of acoustic material
8. Chilled water pining and insulation, servicing of focus and water control valves, mixing dampers face and by pass dampers.
9. Installing compressor and other system component, verifying airflow and distribution. Operation of electrical and mechanic components
10. Pull and verify deep vacuum. Perform leak checks and make repairs. Check system operation whilst following all safety procedures.
11. Check Operation of A.C. plant, check for system leaks and check and clean heat exchanger. Check out sample for acidity, check superheat.
12. Dismantling of commercial type reciprocating compressor
13. Checking and servicing valve plat and piston assembly tapping

14. Checking lubricating system, servicing of oil pump
15. Checking & Servicing capacity control of compressor fitting and testing
16. Checking servicing bearing, shaft seal cutting gasket and assemble of compressor testing efficiency
17. Servicing of water cooler condenser and receiver checking leakage
18. Servicing of evaporative condenser checking and repairing and testing
19. Servicing of cooling tower –its care and maintenance installation
20. Servicing of water softening and removing paint its care and maintenance
21. Servicing of water circulating pumps dismantling and reassembly Testing and adjusting of expansion devices
22. Servicing of water/brine chillers Servicing of suction-liquid heat exchangers
23. Routine maintenance, overhauling preventive maintenance of large AC plants, Maintenance, log book and record keeping

B. BLOCK – II

24. Identify Operating Principles of Screw, Rotary and Scroll compressors.
25. Check Types of condensers, cooling towers, AHUs, chillers (D-X, / flooded)
26. Check environment friendly refrigerants viz. R134a, R407c, R410, R290, R32, their merits / demerits, system pressures and procedures for vacuuming, handling, operation and maintenance.
27. Check Basic fundamentals of Variable Frequency Drives (VFD)
28. Check Principles and Operation of Variable Refrigerant Volume (VRV) systems
29. Operation and maintenance of modulating devices for chilled water AC systems and Variable Air Volume (VAV) units used in air distribution systems.
30. Identify Basic operation of screw and scroll chillers
31. Identify Basic operation of Programmable Logic Controllers (PLC) / Plant Manager / Building Management Systems (BMS)
32. Measure Temperature by various types of RTD (Resistance Temp Detectors) and electronic sensors
33. Measure system performance parameters, calculate the energy efficiency and ascertain the performance of Air Conditioning Systems.

Note:

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.

2. In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

MECHANIC (CENTRAL AIR CONDITIONING PLANT, INDUSTRIAL COOLING AND PACKAGE AIR CONDITIONING)			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1.	Steel rule	300 mm	20 Nos.
2.	Outside spring caliper	150 mm	20 Nos.
3.	Inside spring caliper	150 mm	20 Nos.
4.	Hermaphrodite caliper	150 mm	20 Nos.
5.	Divider spring	150 mm	20 Nos.
6.	Hammer B.P.	0.5 kg.	20 Nos.
7.	Combination plier	150 mm	20 Nos.
8.	File flat bastard	300mm	20 Nos.
9.	File flat 2nd cut	250 mm	20 Nos.
10.	Engineers screw driver		20 Nos.
11.	File flat smooth	200 mm	20 Nos.
12.	Cold chisel flat	25 x 200 mm	20 Nos.
13.	Combination Pliers insulated	200mm	20 Nos.
14.	Screw Driver	100mm 200mm	20 Nos.
15.	Neon Tester pencil bit type	500V	20 Nos.
16.	Electrician Knife		20 Nos.
17.	Hammer ball peen	0.25kg	20 Nos.
18.	File round	150mm	20 Nos.
19.	Tweezers		20 Nos.
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
20.	Granite Surface plate grade 1	1000mm x 630mm	4 Nos.
21.	Metal stand table for surface plate	900 x 900 x 1200mm	4 Nos.
22.	Screw Driver Set (multiheads)		1set
23.	Scribing block universal	300mm	2 Nos.
24.	"V" Block universal	300 mm	2 Nos.
25.	Try square	150mm	2 Nos.
26.	Outside spring caliper	200 mm	2 Nos.

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27.	Divider spring	200 mm	2 Nos.
28.	Inside spring caliper	200 mm	2 Nos.
29.	Straight edge steel	1 meter	1No.
30.	Spirit level	2V 250, 05 meter	1No.
31.	Screwdriver, heavy duty with handle	300mm	4 Nos.
32.	Hammer lead	1 kg.	2 Nos.
33.	Combination set	300mm	2 Nos.
34.	Spindle blade screw driver	100mm	2 Nos.
35.	Allen hexagonal keys	2.5 to 12	2 Sets
36.	Spanner D.E.C.P. series 2	7 pcs. each	6 sets
37.	Adjustable spanner	12 Nos	3 Nos.
38.	Reduction sleeve MT as required		1set
39.	Angle palate size	200 x 100 x 200mm	2 Nos.
40.	Angle plate adjustable	250 x 150 x 175	2 Nos.
41.	Solid parallels in pairs (Different sizes) in metric		12 pairs
42.	Oil can pressure feed	500mg	6 Nos.
43.	Oil stone	150 x 50 x 25mm	2 Nos.
44.	Twist drills (Parallel Shank)	3mm to 13mm	1set
45.	Drill chuck 0-20 with taper shank		1No.
46.	Centre drill A1 to 5		2 sets
47.	Grinding wheel dresser (star type)		1No.
48.	Clamps C	100mm	2 Nos.
49.	Clamps C	200mm	2 Nos.
50.	Tap and die set in box metric pitch		1set
51.	Drill HSS taper shank		1set
52.	File H/R 2nd cut	250mm	4 Nos.
53.	File triangular smooth	200mm	4 Nos.
54.	Needle file set		1No.
55.	File square 2nd cut	250 mm	4 Nos.
56.	Reamer	6mm to 13mm by 1 mm	1set
57.	Hacksaw adjustable with blades	250-300 mm	8 Nos.
58.	Magnifying glass	75mm	2 Nos.
59.	Micrometer outside	0-25mm	4 Nos.
60.	Micrometer outside	25-70 mm	4 Nos.
61.	Micrometer outside	50-75mm	2 Nos.
62.	Micrometer depth gauge	0-150mm	8 Nos.

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63.	Direct reading Vernier caliper	0 to 300	4 Nos.
64.	Vernier height gauge	250mm	1No.
65.	Vernier bevel protractor with least count of 5 minutes		1No.
66.	Dial Gauge		4 Nos.
67.	Lever Type dial gauge		4 Nos.
68.	Dial gauge stand		4 Nos.
69.	Screw pitch gauge for metric	pitches (0.5 to 7mm)	2 sets
70.	Radius gauge metric set	(1-6mm)	1set
71.	Feeler gauge		1No.
72.	Sensitive Drilling machine pillar	12mm capacity with accessories	2 Nos.
73.	Drilling machine pillar	20mm capacity with accessories	1No.
74.	Planner wooden	18"	2 Nos.
75.	Handsaw	24"	6 Nos.
76.	Pedestal grinder		1No.
77.	Hand Drilling Machine Power	10mm	1Nos.
78.	Planner Wooden	9"	4 Nos.
79.	Steel Jack planner	9"	1No.
80.	Centre punch	100 mm	17 Nos.
81.	Ordinary Wooden Mallet	50mm	17 Nos.
82.	Cross Peen Hammer with handle	0.25 kg	17 Nos.
83.	Protractor with blade	150mm	17 Nos.
84.	Steel tape 2 meters		17 Nos.
85.	Hammer peaning with handle		4 Nos.
86.	Hammer creasing with handle		4 Nos.
87.	Hammer Planishing with handle		4 Nos.
88.	Hammer Block with handle		2 Nos.
89.	D.E. Spanner G.P. (set of 12 spanner)	6mm to 32 mm	2 Set
90.	Handvice	50mm	16 Nos.
91.	Steel wire Brush	50mm x 150mm	16 Nos.
92.	Gloves for welding (Leather and Asbestos)		16 Nos.
93.	Leather Apron		16 Nos.
94.	Tongs, Close mouth and pick up (1 each)		4pairs
95.	Portable Electric drill (single phase)		2 Nos.
96.	Round File 2nd cut	250mm	4 Nos.
97.	Triangular file smooth	250mm	4 Nos.
98.	Punch Round	3mm, 4mm & 6mm Dia	4 Nos.

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99.	Punch Round	4mm Dia	4 Nos.
100.	File Flat smooth	250mm	2 Nos.
101.	File half round smooth	300mm	2 Nos.
102.	Hand Groover	3mm, 4mm, 5mm	4 Nos.
103.	Grip Wrench	200mm	2 Nos.
104.	Ladle Dia	150mm	2 Nos.
105.	Hand Drill	0 to 6mm, 8mm, 10mm, & 12mm	2 Nos. each
106.	Liquefied Petroleum Gas (LPG) Cylinder, Regulator and Torch with Burner		2 Nos.
107.	D.E.Grinder Pedestal motorized	200 mm	1 No.
108.	LPG 2.5 kg Cylinder for swirl jet torch		4 Nos.
109.	Welding Transformer	200 to 400 amps	2 Nos.
110.	Slip roll former	1.6mm x 1000mm	1 No.
111.	Anvil with stand	50kgs	1 No.
112.	Swirl Jet Torch		4 Nos.
113.	Snip (Straight)	300mm	8 Nos.
114.	Snip (Straight)	150 mm	8 Nos.
115.	Shear (Straight)	450 mm	4 Nos.
116.	Shear (Straight)	600 mm	4 Nos.
117.	Stakes Half moon		2 Nos.
118.	Stake Hatchet		2 Nos.
119.	Stake funnel		2 Nos.
120.	Stake Anvil		2 Nos.
121.	Nylon Hammer with Handle	40mm Dia	8 Nos.
122.	Snip(Bend)	300mm	4 Nos.
123.	Snip (Straight)	300mm	8 Nos.
124.	Snip (Straight)	150 mm	8 Nos.
125.	Shear (Straight)	450 mm	4 Nos.
126.	Shear (Straight)	600 mm	4 Nos.
127.	Stakes Half moon		2 Nos.
128.	Stake Hatchet		2 Nos.
129.	Stake funnel		2 Nos.
130.	Stake Anvil		2 Nos.
131.	Nylon Hammer with Handle	40mm Dia	8 Nos.
132.	Snip(Bend)	300mm	4 Nos.
133.	Pliers side cutting	200mm	4 Nos.
134.	Pliers round nose	200mm	4 Nos.

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135.	Pliers fat nose	150mm	4 Nos.
136.	Pliers long nose	200mm	4 Nos.
137.	Firmer chisel	25mm	4 Nos.
138.	Hammer ball pein	1.0kg	1 No.
139.	Wall jumper octagonal	37mm x 450mm	1 No.
140.	Center punch	100mm	1No.
141.	Steel measuring tape	20mts	1No.
142.	Allen keys		1Set
143.	Spanner double ended set of 6		2 sets
144.	Electric soldering iron	35W	4 Nos.
145.	Electric soldering iron	125W	2 Nos.
146.	Rubber gloves	5000V	2Pairs
147.	Multimeter	0-5, 100, 200, 500 mill amperes 0-100-1000, 10000 ohms 0150, 300, 600V AC/DC	2 Nos.
148.	Bar magnet		1No.
149.	Horse shoe magnet		1No.
150.	Electric Drill Machine	6mm capacity universal type 250V	1No.
151.	D.C.Shunt motor (Laboratory type)	1 H.P. 250V	2 Nos.
152.	Universal motor	750W AC/DC 250V	2 Nos.
153.	Squirrel cage induction motor with DOL starter	1 H.P., 230V	1Nos.
154.	Transformer single phase	500 ma./250/12V	4 Nos.
155.	L.F.oscilloscope with Attenuation probes		1No.
156.	Star Delta starter (contact type 8 points)		1No.
157.	Tong Tester		1No.
158.	Megger		1No.
159.	DC Power Supply	0V-110V/5A	1No.
160.	Auto – transformer – varies	230v	1No.
161.	Crimping tools		1Set
C. General Shop Outfit, Machinery and Installation			
162.	Flaring tool set, single type for tube	4.7mm to 16mm O.D.	4 sets
163.	Electrical drill portable drill with chuck & key,	capacity 6.4mm.	2 Nos.
164.	Swaging tool, punch type,	set of size for tube 4.7mm to 16mm O.D.	4 sets
165.	Swaging tool, screw type, with adaptor	set of size for tube 4.7mm to 16mm O.D.	1 set

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166.	Gas cylinder truck two wheel type.		1 No.
167.	Bending spring external type, for copper tube.	3mm to 16mm DIA	4 sets
168.	Line tester heavy duty.	500 v.	4 Nos.
169.	Pipe cutter miniature for copper tube	3mm to 16mm DIA.	4 Nos.
170.	Tong tester	0-10-30 amps. 0 - 500 v.(clamp on multimeter.	4 Nos.
171.	Pipe cutter with built in reamer & space cutter, for copper tube	3mm to 32 mm.	1 No.
172.	Knife folded stainless steel -	150mm.x	4 Nos.
173.	pinch of tool, for copper tube,	6mm to 18mm DIA.	4 Nos.
174.	Voltmeter, AC/DC portable precision gread teak wood case leather belt	0 to 5 amp	2 each
175.	Ratchet spanner of reversible	6.4sq.mm	4 Nos.
176.	Ammeter, AC/DC portable, precision gread teak wood case leather belt	0 to 5 amp	2 Nos.
177.	Capillary plague gauge.		2 Nos.
178.	Megger -.	1000 v	1 No.
179.	Pinch of plier / crimping plier tool	6mm -18mm. DIA.	2 Nos.
180.	Wattmeter multirange	Up to 1 kw.	1 No.
181.	Piercing plier & reversing valve with access fitting.	6-18 mm	2 Nos. Each
182.	Multimeter analog type .		1 Nos.
183.	Spanner double ended	4.7mm to 16mm.	5 sets
184.	Multimeter digital type .		1 No.
185.	Spanner double ended	19mm to 31.8mm.	1 set
186.	Stop watch.		1 No.
187.	Ring spanner off	set 4.7mm to 16mm.	5 sets
188.	Filler gauge	0.05mm - 1mm.	1 Set
189.	Ring spanner off set	19mm to 31.8mm.	1 set
190.	Wire gauge metric &whitworth.		1 Set
191.	Box spanner size	6.4mm to 10mm.	2 sets
192.	Refrigerant cylinder	2.5 kg.	2 Nos.
193.	Wrench adjustable	length 150mm.	1 No.
194.	I) Evacuating & refrigerant charging station, compression. a) Rotary two stage vacuum pump & motor (with gas ballast & anti suck back) manifold with gauges & valves & capable of pulling vacuum upto 50		1 No.

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	microns of Hg & with provision of connecting to a microns level vacuum gauge. b) Graduated charging cylinder with provision for temperature correction & all necessary isolating valves. II) Evacuating & charging station as above but fitted with weighing scale (upto 2 kg. In licu of (b) above & with accuracy of +/-1g for charging hydrocarbons.		
195.	Wrench adjustable length	200mm.	2 Nos.
196.	Two stage rotary vacuum pump capacity approx. 60 - 100 rpm, capable of evacuating to 50 microns of Hg & fitted with gas ballast, anti suck back valve & single phase motor.		1 No.
197.	Wrench adjustable length	250mm.	2 Nos.
198.	Scraper triangular blade removable	60mm.	2 Nos.
199.	Pipe wrench	size 50 & 150 mm.	01 No. each
200.	Pressure testing tank with lighting arrangement, pressure gauge (0 to 35kg/sq.cm.) double stage.		1 No.
201.	Torque wrench	300mm, 12.7mm square drive right & left hand.	1 set
202.	Heating kit with infra red bulb	200 watt capacity.	1 No.
203.	Valve key -t handle -	4.7mm & 6.4mm.sq.	4 sets
204.	Refrigerator, compression type	165 litres	1 No.
205.	Socket set, reversible ratchet,	12.7mm square drive with extension4.7mm to 31.2mm.	2 sets
206.	Refrigerator, compression.	type 300 litres double door, double compressor system	1 No.
207.	Socket set, reversible ratchet,.	1/2" square drive with extension3/16" to 1/4" BSW & SR	1 set
208.	Work bench	1000mm x 600mm x 800mm. High.	2 Nos.
209.	Pressure gauge diameter with recalibration set	63mm	4 Nos.
210.	Portable air- LPG brazing kit with 2 kg. LPG cylinder, torches, houses, stand make. A) with straight flame. B) witheyelone/ swirl jet flame.		1 No.
211.	Compound gauge, diameter 63mm. with		4 Nos.

	recalibration set screw, scale vacuum 76mm. Pressure 15 kg/sq.cm.		
212.	Pliers flat nose.	150mm	1 No.
213.	Service man thermometer in metal	case - 30^0 C to +30^0 C	4 Nos.
214.	Tap set with matching drills	3mm to 16mm.	1 Set
215.	Gas leak detector for halogen gas.		2 Nos.
216.	Micron vacuum gauge capable of reading	upto 20 microns.	1 No.
217.	L-Allen key set	size 1.5mm to 6.4mm.	4 Sets
218.	Sensor thermometer (digital).		2 Nos.
219.	T-Allen key set	size 5/32" to 1/8".	4 Sets
220.	Fin straightener/fin comb.		4 Nos.
221.	Screw driver, plastic handle,	6mm TIP length 100mm to 150mm.	4 each
222.	HC refrigerant in cylinders / disposable containers.		2 Nos.
223.	Screw driver, plastic handle,	10mm TIP length 200mm to 250mm.	4 each
224.	134 A refrigerant in cylinders.		2 Nos.
225.	Philips screw driver - complete set in leather case.		2 sets
226.	Recovery unit one each for cfc &134A refrigerants with recovering cylinders		1 Nos.
227.	Screw driver, plastic handle,.	3mm TIP length 100mm to 150mm. Insulated	1 set
228.	Refrigerator170 lit. using 134a refrigerant		1 No.
229.	Pliers combination insulated	length 200mm.	2 Nos.
230.	Pliers long nose	200mm.	2 Nos.
231.	Fire extinguisher power type.		2 Nos.
232.	Hammer ball peen.	220 gms	4 Nos.
233.	Dry N2 in cylinder with 2 stage regulator or commercial N_2 in cylinder with drier unit and 2 stage regulator.		1 No.
234.	Hammer nylon	300 gms.	4 Nos.
235.	Trichloroethylene bottle.		1 No.
236.	Engineers rule	300mm long.	1 No
237.	Two way manifold with gauges.		1 No.
238.	Tape measuring 2m graduation in mm.		1 No.
239.	Four way manifold with gauges.		1 No.
240.	Chisel flat length	150mm.	4 Nos.

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241.	Filter driers for cfc - 12 &hfc - 134A for repairs - retrofits.		8 Nos.
242.	Hack saw tubular metal frame adjustable.		4 Nos.
243.	Sealed ex - proof components for use in hsappliances : thermostat, sealed olp's. solid state PTC's, door switches, lamp holders		4 Nos. each
244.	Centre punch length	100mm.	4 Nos.
245.	Safety gloves, eye protection glasses.		4 Nos.
246.	Oil can pressure type -	1 litre.	2 Nos.
247.	Schrader valve core removal tool.		1 No.
248.	File, flat medium, double cut	length 200mm.	4 Nos.
249.	Acid test kit.		1 No.
250.	File round , fine double cut	length 150mm.	4 Nos.
251.	Pop rivet gun.		1 No.
252.	File flat , fine double cut,	length 150mm.	4 Nos.
253.	Brazing alloy rods for 1/4"to7/8" tubes-Cu tocu, cu to steel, cu to brass & appropriate fluxes		1Set
254.	File square , fine double cut	length 150mm.	4 Nos.
255.	I) Hermetic compressors 1/8hp to 1/2hp) for use in repair work of appliances for CFCs&HFCs 1) Hermetic compressor for 134a		2/3 No. 1/2 No.
256.	Engineers square	200mm long.	2 Nos.
257.	Ball valves service valves, hand shut of valves of 1/4"to 7/8"		2 Nos. Each
258.	Soldering iron exchangeable copper tip	65 watts.	5 Nos.
259.	Quick couplers , process tube adaptors for 1/4",3/8"		2 pairs each
260.	Pipe bending tool, lever type with degree indicator, for tube O.D. 6.4mm to 16mm.		2 Sets
261.	Compressors testers for small hermetic compressors		1 No.
262.	Hand blower portable complete	1/10 HP.	1 No.
263.	Evaporator of direct cooled refrigerator with capillary heat exchanger		1 No.
264.	Tap & die set	3mm to 16mm size	1 Set
265.	Evaporator of frost free refrigerator		1 No.
266.	Tap set with matching drills 1/4" to 5/8".		1 Set

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267.	Bellow type thermostats, H.P.stat, L.P.stat, humid stat, solenoid valves		1 No. each
268.	Tape & die set	1/4" to 5/8" SAE size	1 Set
269.	Electrical accessories: current & potential relays, start & run capacitors, PTCs, overload protectors, relays, contactors		1 No. each
270.	Digital type clampmeter		1 No.
271.	Puller 3 legged, with flexible arm	300mm.	1 No.
272.	Bench vice jaw.	75mm	2 Nos.
273.	Electrical drill portable drill with chuck & key,	capacity 6.4mm.	2 Nos.
274.	Pedestal grinder, double ended wheel	dia 200mm. 3000rpm.	1 No.
275.	Oxy-Acetylene welding set complete with cylinders regulators welding torches with difference nozzles		1 No.
276.	Capillary plague gauge.		2 Nos.
277.	Voltmeter, AC/DC portable precision gread teak wood case leather.	belt 0 to 500 V	2 Nos.
278.	Ammeter, AC/DC portable, precision gread teak wood case leather	belt 0 to 30 V	2 Nos.
279.	Technometer digital, multirange. Portable small size in leather case.	0 rpm to 3000 rpm	1 No.
280.	Refrigerant cylinder	2.5 kg.	2 Nos.
281.	Dial thermometer remote control,	armoured capillary dial 75mm. - 50^0C to +50^0C.	2 Nos.
282.	Anemometer (Vane type)		1 No.
283.	Sling psycrometer mounted on aluminium back,	scale - 50 C to +50 C.	2 Nos.
284.	Pilot tube & inclined tube manometer		1 No.
285.	Hermetic compressors 1.5 (AC)		1 No.
286.	Sensor thermometer (digital).		2 Nos.
287.	Hammer ball peen	450 gms.	4 Nos.
288.	Scriber	150mm length	4 Nos.
289.	Puller 3 legged, with flexible arm	120mm.	1 No.
290.	frost free Refrigerator 260 liters use in H.C. Refrigerant		2 Nos.
291.	Cut section of semi-harmatic screw compressor		1 No.
292.	Ammeter, AC/DC portable, precision gread teak wood case leather belt	0 to 30 V	2 Nos.
293.	Variance input 230 v. output 400 v. Amp. Portable complete with metet& controls.		1 No.

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294.	R.L.C. bridge.		1 No.
295.	Wrench adjustable	length 200mm.	2 Nos.
296.	Air compressor, two stage for oil - less dry air, with rush proof tank assembly, heater & controls max. pr. 10kg/sq.cm. Capacity 45 litre, motor 1 hp.		1 No.
297.	Scraper triangular blade removable	60mm.	2 Nos.
298.	Lapping plate	250mm x 200mm.	2 Nos.
299.	Spray outfit, 'V' twin motor 1/2 hp. Delivery upto 120 litre free air pressure upto 3kg/sq.cm. With spray gun & fitting.		1 No.
300.	Punch hole for cutting gasket,	4.7mm to 16mmDIA.	4 Nos.
301.	Deep frizer	165 litres - 18^0C.,1/4 hp.	1 No.
302.	Scissor, gasket cutting stainless steel	length 25mm.	4 Nos.
303.	Bottle cooler	110 litres 1/6 hp.	1 No.
304.	Water cooler instantaneous type .		1 No.
305.	Water cooler storage type .		1 No.
306.	Ice candy unit complete with stainless steel tank, mould box, thermocol insulated sunmica body, agitator, compressor, motor ele. Temparature, pressure, refrigerant control gauges, motor, pipe fitting ele 3000kcal/hr. working trainer model/ simulator.		1 No.
307.	Cold storage plan complete with all controls & accessories including cooling tower &water treatment plant capacity 15000 kcal/hr. or working trainer model/ simulator.		1 No.
308.	Welding table	900mm x 900mm x 700mm high.	1 No.
309.	Micrometer outside measurement	0 to 25mm.	2 Nos.
310.	Tape measuring 10m graduation in mm.		1 No.
311.	Vernier height gauge	250mm.	1 No.
312.	Vernier Caliper gauge	250mm.	1 No.
313.	Sensor thermometer (digital).		2 Nos.
314.	Divider spring joint	length 150mm.	4 Nos.
315.	Caliper spring joint out side	length 150mm.	4 Nos.
316.	Caliper spring joint in side.	length 150mm	4 Nos.
317.	Caliper, odd leg, spring joint	length 150mm.	4 Nos.
318.	Filter driers for cfc - 12 & HFC - 134A for repairs - retrofits.		8 Nos.
319.	Small capacity shell & tube condenser.		1 No.

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320.	Fan coil unit with water valves (2 & 3way).		1 No.
321.	Marking block, universed spindle	200mm.	2 Nos.
322.	Shell & tube, DX chillers (small).		1 No.
323.	V - block with clamp	75mm.	2 Nos.
324.	Circulating water pump (small).		1 No.
325.	Surface plate with stand	600mm x 450mm.	1 Set
326.	Angle plate,	120^0 C 100mm 90^0 C.	1 No.
327.	Safety shoes (optional).		NIL
328.	Pipe threading dies protection glasses.		1 No.
329.	Refractometer(optional).		1 No.
330.	Hand formers & lock former.	20 g capacity	1 No.
331.	Plumb weight	200g.	1 No.
332.	Snipper sheet metal straight nose		1 No.
333.	Visi cooler		1 No.
334.	Desktop Personnel Computers Intel Pentium-IV-CPU, 17" Monitor, Key Board, FDD, HD 80 GB, Window XP Professional Operating System		8 Nos.
335.	UPS	600 VA	8 Nos.
336.	Suitable Computer Tables		As per required
337.	Shoe Rack		As per required
338.	Computer Chairs		17 Nos.
339.	Vacuum cleaner		1 No.
340.	Spanner double ended	4.7mm to 16mm.	5 sets
341.	Descaling pumpset with stainless steel impeller & housing complete with motor 1 hp& accessories.		1 No.
342.	Micron vacuum gauge capable of	reading upto 20 microns.	2 Nos.
343.	Components for car AC systems.		1 each
344.	A) Wobble plate compressor with mounting		
345.	B) Serpentine evaporator.		
346.	C) Parallel flow condenser.		
347.	D) Hoses, tubes, receiver, expansion valve.		
348.	E) electrical components & wiring harness.		
349.	Air compressor, two stage for oil - less dry air, with rush proof tank assembly, heater & controls max. pr. 10kg/sq.cm. Capacity 45 ltr, motor 1 hp.		1 No.

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350.	Air conditioning, direct & indirect water chiller. Complete with all controls including humidity control ele capacity 15000kcal/hr. or working trainer model/ simulator. Alternatively, a packaged air -conditioner of similar capacity.		1 No.
351.	Reciprocating compressor with provision of capacity control etc. for demonstration. Capacity 9000kcal/hr. semi hermetic open type.		1 No.
352.	Recovery unit one each for cfc &134A refrigerants with recovering cylinders		1 No.
353.	Condensing unit with open type compressor air-cooled condenser, controls cap.3000 k.cal/ hr.		1 No.
354.	Condensing unit with open type compressor, evaporative condenser, with electric control cap.3000 k.cal/hr.		1 No.
355.	Working model of absorption system of Refrigeration cap. 3000 k.cal/hr.		1 No.
356.	Air-velocity meter (Digital type)		1 No.
357.	Testing machine for calibration & testing fo electrical starter, relay, contractor, solenoid valve. LP, HP, Oil pressure cut out.		1 No.
358.	Package A/C Water cool type	7.5 ton cap.	1 No.
359.	Package A/C Air cooled type	3 ton	1 No.
360.	Small capacity shell & Tube type condenser		1 No.
361.	Fan coil unit with water valve (2 & 3 way)		1 No.
362.	Shell & tube type Dx chiller (Small)		1 No.
363.	Thermostatic Exp. Valve		1 No.
364.	Solenoid valve		1 No.
365.	HP, LP, Oil pressure cut out switch		1 each
366.	Cut section of Dxchiiler		1 No.
367.	Cut section of Shell & tube type condenser		1 No.
368.	Cut section of Hermatic Scroll comp		1 No.
369.	Cut section of Hermatic Reciprocating compressor		1 No.
370.	Table model of vapur absorption system		1 No.
371.	Screw compressor (open type)		1 No.

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कौशल भारत-कुशल भारत

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: MACHINIST (GRINDER)

LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1.	Draughtsman drawing instrument box		20+1 set
2.	Set square celluloid 45^o	(250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30^o-60^o	(250 X 1.5 mm)	20+1 set
4.	Mini drafter		20+1 set
5.	Drawing board IS: 1444	(700mm x500 mm)	20+1 set
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board		20
2	Models : Solid & cut section		as required
3	Drawing Table for trainees		as required
4	Stool for trainees		as required
5	Cupboard (big)		01
6	White Board (size: 8ft. x 4ft.)		01
7	Trainer's Table		01
8	Trainer's Chair		01

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TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
Sl. No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2.	UPS - 500VA	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.		

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ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :			**Year of Enrollment :**
Name & Address of ITI (Govt./Pvt.) :			**Date of Assessment :**
Name & Address of the Industry :			**Assessment location: Industry / ITI**
Trade Name :	**Semester:**		**Duration of the Trade/course:**
Learning Outcome:			

Sl. No	**Candidate Name**	**Father's/Mother's Name**	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA	**Total internal assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														

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