MECHANIC REFRIGERATION AND AIR CONDITIONING

NSQF LEVEL- 6

SECTOR- CONSTRUCTION

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

GOVERNMENT OF INDIA
Ministry of Skill Development & Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

MECHANIC REFRIGERATION AND AIR CONDITIONING

(Engineering Trade)

SECTOR – CONSTRUCTION

(Revised in 2019)

Version 1.1

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Developed By
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1. COURSEOVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructors' Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960's by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course of one year duration. "Mechanic Refrigeration & Air Conditioning" CITS trade is applicable for Instructors of "Mechanic Refrigeration & Air Conditioning" Trade only.

The main objective of Craft Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal http://www.nimionlineadmission.in. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

2.2 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:

S No.	Course Element	Notional Training Hours
1.	**Trade Technology**	
	Professional Skill (Trade Practical)	640
	Professional Knowledge (Trade Theory)	240
2.	**Engineering Technology**	
	Workshop Calculation & Science	80
	Engineering Drawing	120
3.	**Training Methodology**	
	TM Practical	320
	TM Theory	200
	Total	**1600**

2.3 PROGRESSION PATHWAYS

- Can join as anInstructor in vocational training Institute/ technical Institute.
- Can join as a supervisor in Industries.

2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment(Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. 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 Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS CRITERIA

Sl. No.	Subject		Marks	Internal Assessment	Full Marks	Pass Marks	
						Exam	Internal Assessment
1.	Trade Technology	Trade Theory	100	40	140	40	24
		Trade Practical	200	60	260	120	36
2.	Engineering Technology	Workshop Cal. & Sc.	50	25	75	20	15
		Engineering Drawing	50	25	75	20	15
3.	Training Methodology	TM Practical	200	30	230	120	18
		TM Theory	100	20	120	40	12
	Total Marks		**700**	**200**	**900**	**360**	**120**

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%.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 the assessment.While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the 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 of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

Evidences of internal assessments are to be preserved until forthcoming yearly examination for audit and verification by examining 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 be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Averageengagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a***reasonable standard*** of crafts instructorship with ***little*** **guidance** and	• Demonstration of ***good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average engagement of students for learning and achievement of goals while

engage students by demonstrating good attributes of a trainer.	undertaking the training on specific topic. • A***good*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a***high standard*** of crafts instructorship with ***minimal or no support*** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Goodengagement of students for learning and achievement of goals while undertaking the training on specific topic. • A ***high*** level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**REFRIGERATION & AIR CONDITIONING-CITS**
Trade Code	DGT/ 4010
NCO – 2015	7127.0100, 2356.0100
NSQF Level	Level-6
Duration of Craft Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	Degree in Mechanical Engineering from AICTE/UGC recognized University. OR Diploma in Mechanical Engineering from AICTE/ recognized board / Institution. OR NTC/NAC passed in the Mechanic Refrigeration & Air Conditioning and related trade.
Minimum Age	18 years as on first day of academic session.
Space Norms	120 Sq. m
Power Norms	10 KW
Instructor's Qualification for	
1. Mechanic Refrigeration & Air Conditioning -CITS Trade	B.Voc/Degree in Mechanical Engineering from AICTE/UGC recognized University with two years experience in relevant field. OR 03 years Diploma in Mechanical Engineering from AICTE/recognized Board/ Institution or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field. OR NTC/ NAC passed in the **Mechanic Refrigeration & Air Conditioning** trade with seven years experience in relevant field. **Essential Qualification**: National Craft Instructor Certificate (NCIC) in **Mechanic Refrigeration & Air Conditioning** trade, in any of the variants under DGT.
2. Workshop Calculation & Science	B.Voc/Degree in any Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant

	field. OR NTC/ NAC in any Engineering trade with seven years experience in relevant field. **Essential:** National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT.
3. Engineering Drawing	B.Voc/Degree in Engineering from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. OR 03 years Diploma in Engineering from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years' experience in the relevant field. OR NTC/ NAC in any one of the 'Mechanical group (Gr-I) trades categorized under Engg. Drawing'/ D'man Mechanical / D'man Civil' with seven 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
4. Training Methodology	B.Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/ teaching field. OR Diploma in any discipline from recognized board / University with five years experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years experience in training/ teaching field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.
5. Minimum Age for Instructor	21 Years

Distribution of training on Hourly basis: (Indicative only)

Total Hrs /week	Trade Practical	Trade Theory	Workshop Cal. & Sc.	Engg. Drawing	TM Practical	TM Theory
40 Hours	16 Hours	6Hours	2 Hours	3 Hours	8 Hours	5 Hours

4. JOB ROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools&equipments of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

Refrigeration and Air Conditioning Mechanic; Refrigeration and Air Conditioning Mechanic Instructor is able to impart training and supervise domestic and commercial refrigeration and air conditioning machines such as refrigerator, water cooler, bottle cooler, deep freezer, visi cooler, ice candy, ice cube machine, ice plant, window air conditioner, split Air conditioner, package Air conditioner, VRV/VRF AC, cold storage, Central Air Conditioning plant, Auto mobile air conditioning such as car, bus, train, marine refrigeration and air conditioning and Air craft air conditioning.

Reference NCO 2015&QP/NOS:

(i) 7127.0100 Mechanic, Refrigeration and Air Conditioning
(ii) 2356.0100 Manual Training Teacher/Craft Instructor

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.

5.1 TRADE TECHNOLOGY

1. Produce fitting components, sheet metal joints and perform different types of gas welding operations ensuring their functionality & following best safety practices.
2. Check & Test single and three phase motor/transformer & construct half wave rectifier.
3. Monitor & check leakage, evacuation, gas charging in refrigerator and demonstrate various thermodynamic processes in vapour compression cycle optimizing effective utilization of resources.
4. Test & review electrical components and wiring in refrigerator, bottle cooler, water cooler, window A.C, Split AC, Visi Cooler, Deep freezer & overhauling of compressor.
5. Test, service & retrofit various types of compressor, condenser, evaporator, expansion valves and capillary tubes used in domestic refrigeration appliances & apply various secondary refrigerants and make use of lubricants & insulating materials.
6. Plan & Prepare the layout of AC Plant, Ice plant, Cold storage plant & Automobile AC.
7. Operate, check & service various non-conventional refrigeration systems, compressor, water/air cooled condenser, water treatment plant etc ensuring their effective repair & maintenance.
8. Check &Observe different refrigerant controls, floats, Solenoid Valves, Safety switches, Pressure stats, Water flow Valve, Level Master Control.
9. Plan & Prepare layout, assess technical specification, capacity of various food preservation systems, servicing of ice candy plants/ Mini cold storage plant. Charge refrigerants & check the performance.
10. Review Installation, Testing and servicing in Cassette Type Systems, Inverter A/C's, Ductable Package AC, Central Air Conditioning Plants and Floor standing AC.
11. Assess and evaluate measurement of the Psychrometric properties, Static and dynamic pressure of duct, calculation of heat of the building and adjustment of air balancing.
12. Demonstrate Erecting, Commissioning, heat balancing and Evaluation of Central Air Conditioning System, Ice plant & cold storage.

6. COURSE CONTENT

SYLLABUS FOR MECHANIC REFRIGERATION &AIR CONDITIONING– CITSTRADE			
TRADE TECHNOLOGY			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Practical 48Hrs Theory 18Hrs	Produce fitting components, sheet metal joints and perform different types of gas welding operations, ensuring their functionality &following best safety practices.	1. Identification of refrigeration and air conditioning tools, instruments and equipment's. 2. Demonstrate Handling procedure of different gas cylinder, HC refrigerant cylinder abiding by safety observation. 3. Practice for safe method of using firefighting equipment's. 4. Make V notchand grooved joint in MS Flat. 5. Operate the gas welding machine and make joints.	Importance of the trade in domestic, industrial & commercial fields. Industrial safety & fire fighting, occupational health & safety. Allied trade knowledge. Basic fitting, welding, sheet metal work. Concept of shop floor layout of the trade.
Practical 32Hrs Theory 12Hrs	Check & test single and three phase motor/transformer & construct half wave rectifier.	6. Test and run split phase induction motor, capacitor start capacitor run motor and capacitor start induction motor. 7. Trace out the terminals of 3 phase induction motor. 8. Start squirrel cage induction motor by using DOL starter. 9. Start squirrel cage induction run motor by using star delta starter. 10. Identify, check and find values of different types of resistors, capacitor and rectifier diodes. 11. Construct and test half wave rectifier, centre tapped full wave rectifier, and bridgerectifier.	AC Induction Motor - single phase (split phase, capacitor, shaded pole, repulsion) & three phases (squirrel cage & slip ring). Transformer - single phase (auto transformer & Current transformer, Potential transformer) and three phase. Inverter controls EER motors. Basic Electronics. Concept of Semi conductor, Rectifier, Transistor, FET, MOSFET, Bipolar Transistors, IGBT(IntegatedBi-polar Transistor), IC, Thermister, transducer,function. Concept of Microprocessor, PLC, and Regulated Power supplies, SMPS.
Practical 32Hrs	Monitor & check leakage,	12. Make Wiring in conventional refrigerator, frost free	Fundamentals and different terminology of RAC

Theory 12Hrs	evacuation, gas charging in refrigerator and demonstrate various thermodynamic processes in vapour compression cycle optimizing effective utilization of resources.	refrigerator and gas charging. 13. Measure the temperature and pressure of the system. 14. Observe various thermodynamic processes and calculate the refrigeration capacity (TR).	machineries. Laws of Thermodynamics, Gas laws, Carnot cycle and reverse Carnot cycle, Methods of Refrigeration-Ice refrigeration, Dry ice, Steam jet, Gas throttling, Liquid Gas, Air refrigeration, Vapour absorption, Vapour compression, Thermo electric, magnetic, Thermo acoustic, Pulse tube, Vortex tube.
Practical 32Hrs Theory 12Hrs	Test & review electrical components and wiring in refrigerator, bottle cooler, water cooler, window A.C, Split AC, Deep freezer& overhauling of compressor.	15. Make Wiring in bottle cooler, water cooler and deep freezer. 16. Make Wiring in window air conditioner and split air conditioner. 17. Check the controls used in bottle cooler, water cooler, deep freezer, window air conditioner and split air conditioner. 18. Identify and test different types of compressor. 19. Dismantling and assembling a rotary compressor.	Types of refrigeration systems and cycles. Capacity of RAC machineries, applications in domestic, commercial and industrial fields. Description of major components used in RAC systems. Function, construction, application of domestic and commercial applications.
Practical 160Hrs Theory 60Hrs	Test, service & retrofit various types of compressor, condenser, evaporator, expansion valves and capillary tubes used in domestic refrigeration appliances & apply various secondary refrigerants and make use of lubricants & insulating materials.	20. Dismantling and assembling a reciprocating compressor. Check the parts of compressor. 21. Check and service air cooled, water cooled and evaporative condenser& evaporator. 22. Check the heat transfer through condenser. 23. Identify and test different types of expansion valve. 24. Check the bore of capillary tube. 25. Measure the super heat of the system. 26. Practice of Cu-Al brazing technique. 27. Identify the types of refrigerants& cylinder. 28. Replace and fix drier in	Types of compressor used in domestic appliances Reciprocating Rotary Scroll screw etc. Types of condenser used in domestic appliances Water cooled, Air cooled Evaporative etc. Expansion Device-types, construction, working, adjustments & application Evaporator -types (domestic & Commercial), construction, working (Direct & Indirect systems), DX Chiller, Flooded, Types & application. Refrigerants description, Function, composition, application & types.

		system. 29. Leak testing, evacuation, gas charging& performance testing.	Environmental impact of different refrigerants. Alternatives of cfcs. Thermodynamic properties & characteristics of ideal refrigerants. Azeotropic and Zeotropic blends. Description ODP, Retro fitting, filter, drier
		30. Prepare brine solution and measure eutectic temperature.	Secondary Refrigerants, Properties of brines & glycols. Application of various brines ,Inhibitor& other secondary refrigerants
		31. Identify different types of oil and its grade. 32. Charge oil in compressor.	Basic concepts of Tribology Lubricants & Lubrication in RAC compressors, properties of lubricants. Thermal insulation types & function Properties of insulating materials.
		33. Prepare PUF mixing procedure for filling. 34. Identify different types of heat insulations.	Thermal insulation types, Selection of insulating material, Duct insulation & Properties of insulating materials.
		35. Retrofit CFC fill domestic refrigerator with HFCs. 36. Retrofit CFC fill domestic refrigerator with Hydrocarbon refrigerants. 37. Test electrical components of HC refrigerator. 38. Test electric components of window and split AC. 39. Installing of IDU and ODU of split A/C. 40. Gas charging in split air conditioning.	Conventional Refrigerator, frost free refrigerator, Water cooler, Deep Freezer etc. Window AC, Split,& Package AC description, advantage & application.
Practical 32Hrs Theory 12Hrs	Plan &Prepare the layout of AC Plant, Ice plant, Cold storage plantand Automobile AC.	41. Draw a Layout of cold storage plant and Ice plant. 42. Draw a Layout of central air conditioning plant. 43. Identify and test all components in car air conditioning system. 44. Test leak , evacuate and gas charging in car A/C.	Introduction about commercial plants Automobile AC, Function of individual components. Refrigerants used & retrofitting of old car / Mobile AC's

Practical 80Hrs Theory 30Hrs	Operate, check & service various non-conventional refrigeration systems, compressor, water/air cooled condenser, water treatment plant etc ensuring their effective repair & maintenance.	45. Observe various processes in non-conventional refrigeration system. 46. Observe various processes in lithium bromide-vapour absorption system. 47. Calculate the **COP** in a vapour compression cycle. 48. Identify and test resistor,diode, transistors and ICs. 49. Identify and test control circuit of micro controller and IGBT. 50. Service of remote control circuit boards. 51. Checking variable frequency drive and its circuits. 52. Construct and test half wave rectifier, bridge rectifier and centre tapped rectifier. 53. Operate CRO.	Non-conventional Refrigeration System:- Thermo-Acoustic, Magnetic, Vortex-tube, Pulse-Tube Refrigeration & Lithium Bromide-Vapour Absorption System. PTC & NTC function & applications, Rectifications in single phase and three phase AC to DC, Variable Frequency Drive (VFD), Starters-DOL, Star Delta Starter, Inter locking. IC's, PWM (Pulse Width Modular) controller, Micro processor, Micro controller, CRO.
		54. Identify, check and operate Scroll compressor. 55. Dismantle and Assemble multi cylinder reciprocating compressor. 56. Identify and test the parts of reciprocating compressor. 57. Check and service Shell and tube condenser. 58. Check thepressure regulator valve, water regulating valve, pressure relief valve.	Commercially used Compressors Digital Scroll Compressor, Centrifugal Compressor, and Capacity control of commercially used compressor. Commercial Used Condenser, Air cooled, Water cooled, Evaporative, its description, types and Condenser Capacity.
		59. Check and service cooling tower. 60. Measure cooling tower approach, range and efficiency. 61. Check and service centrifugal water pump. 62. Check cavitations and perform priming. 63. Check, adjust and service of float valve, fans, and bearings. 64. Service water treatment plant.	Fiber Reinforced Plastic (FRP) Cooling Tower Description & Types construction, application and function. Descaling Procedure. Cooling tower capacity, terms etc. Water Treatment Plant/Softening Plant pH value of water recycling regeneration, Description, Types, Construction, Function and Application.

		65. Measure PH value of water.	
Practical 16 Hrs Theory 06 Hrs	Check & Observe different refrigerant controls, floats, Solenoid Valves, thermostats, Pressure stats, Water flow Valve, Level Master Control.	66. Identify, check and adjust refrigerant controls, solenoid valve, pressure stats and thermostat. 67. Check thermostatic equalizer connection, measure super heat and adjust super heat screw and thermal bulb.	Refrigerant Controls for Commercial Plants, description, types of Expansion Valves, Electronic Expansion Valve, Level Master Control &Equalizer. Its construction, function & application.
		68. Check chilled water system, anti-freeze thermostat and heat insulation. 69. Measure chilled water inlet and out temperature. 70. Check chilled water pump operation and its leaking.	Chilled Water System-DX and Flooded chiller.
Practical 16 Hrs Theory 06 Hrs	Plan & prepare layout, technical specification, capacity of various food preservation systems, Servicing of ice candy plants/ Mini cold storage plant. Charge refrigerants &evaluate the performance.	71. Draw layout of cold storage and Ice candy plant. 72. Prepare technical specification of cold storage and ice candy plant. 73. Service the cold storage and ice candy plant.	Food preservation systems: Cold storage, milk chilling, ice plant- pasteurizing , Description, Types, Construction, Function and Application.
Practical 96Hrs Theory 36Hrs	Review Installation, Testing and servicing in Cassette Type Systems, Inverter A/C's, Ductable AC, Package AC, Central Air Conditioning Plantsand Floor standing AC.	74. Prepare the list of ODP and GWP of various refrigerants and recover and gas charging. 75. Calculate the TEWI of refrigerants. 76. Identify the different types of lubricating oil. 77. Install and test Inverter AC. 78. Check and wire package AC. 79. Charge gas in split AC.	Refrigerant and Lubrication Variable Refrigerant Flow System (VRF),with Micro controller controlling. Cassette Type Systems, Inverter A/C's,Ductable AC, Package AC, Ceiling Suspended split A/C, Floor standing Type.
		80. Check and service Central AC plant. 81. Prepare technical specification of Central AC plant.	Precision Air Conditioning System. Comfort Air Conditioning System. Hospital Air Conditioning system and Unitary systems.
		82. Check and wire in central AC plant with interlockingall	Central Air Conditioning Plants. Starting and stopping

		controls.	procedure of central air conditioning plant.
		83. Check and service Reverse cycle Air conditioner. 84. Check the wiring of Reverse cycle Air conditioner.	HVAC systems. Different heating systems. Calculating the tonnage of heating system.
Practical 64Hrs Theory 24Hrs	Assess and evaluate measurement of the Psychrometric properties, Static and dynamic pressure of duct, calculation of heat of the building and adjustment of air balancing.	85. Make a duct for Air circulation and fix heat insulation material. 86. Check air flow and adjust air balancing. 87. Check velocity, static and total pressure of the duct. 88. Measure the sound and air flow of the duct.	Air Distribution System:-Duct. Designing, material, classifications, applications and Fabrication. Air filtering, classifications and applications. Air outlets, fans and blowers. Acoustic and air washer. Application of clean rooms. Air curtain. AHU and FCU. Heat recovery wheel (HRW) for maintaining IAQ (Indoor Air Quality). CAV(constant air Volume) and VAV (Variable Air Volume)
		89. Measure the DBT, WBT, Dew Point, RH by using sling psychrometer and Chart 90. Find psychrometric properties such as cooling, heating, humidification, dehumidification, cooling with dehumidification. 91. Calculate the heat load for a building for Air conditioning. 92. Perform Commissioning procedure of central Air-conditioning plant.	Psychrometry:- Properties of air, Preparation of chart, processes, Relations, Different systems, Heating, Cooling, Humidifying, De-humidifying. Cooling Load Calculations and Design of Air Conditioning Systems, Different Heat source and Heat load, Bypass Factor.
Practical 32Hrs Theory 12Hrs	Demonstrate Erecting, Commissioning, heat balancing and Evaluation of Central Air Conditioning System, Ice plant &cold storage.	93. Perform Starting and stopping procedure of central Air-conditioning plant. 94. Prepare log book for commercial Air-conditioning plant.	Erection, Commissioning, heat balancing and Evaluation (parameters of Controlling Device) of Central Air Conditioning System. System performance, Plant operation , Maintain Log Book, Preventive Maintenance of Commercial Plants, Trouble Shooting etc.
		95. Identify, check and operate Ice plant and cold storage.	Transport Air conditioning:- Introduction, Bus, Railway,

		96. Identify Railway coach AC, Aircraft AC, Marine refrigeration and AC and Milk Cold storage.	Marine, Air craft—Types Function, Construction, Types Capacity Application of Central Air conditioning system.

SYLLABUS FORCORE SKILLS
1. Workshop Calculation &Science(Common for all Engineering CITS trades) (80 Hrs)
2. Engineering Drawing (Group I) (120Hrs)
3. Training Methodology (Common for all trades) (320Hrs + 200Hrs)

Learning outcomes, assessment criteria, syllabus and Tool List of above Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY	
1. Produce fitting components, sheet metal joints and perform different types of gas welding operations ensuring their functionality & following best safety practices.	Identify the RAC tools and equipment.
	Demonstrate effective Safety precautions.
	Assess Demonstration of First aid.
	Demonstrate effective use of fire fighting.
	Analyse the job as per drawing by filing.
	Bend the sheet and make a duct as per drawing & fitting plans.
	Check Joining of metals by using gas welding.
2. Check & Test single and three phase motor/transformer & construct half wave rectifier.	Trace and test motor terminals.
	Check Starting of the motors by using starters like DOL/Delta/Star.
	Construct & test half wave rectifier/Centre tapped full wave rectifier/bridge rectifier.
	Review transformer and AC induction motor both single phase and three phase.
3. Monitor & check leakage, evacuation, gas charging in refrigerator and other electrical appliances and demonstrate various thermodynamic processes in vapour compression cycle optimizing effective utilization of resources.	Check wiring in conventional refrigerator, frost free refrigerator and gas charging.
	Evaluate measurement of temperature and pressure of the system.
	Analyse& apply various Thermodynamic processes and calculate the Refrigeration capacity.
	Check the controls used in bottle cooler/water cooler/ deep freezer/ visi cooler/ window air conditioner/ and split air conditioner.
	Recognise&check different parts of Car AC.
	Test leakage , evacuation and gas charging in Car AC.
4. Test & review electrical components and wiring in refrigerator, bottle cooler, water cooler, window A.C, Split AC, Visi Cooler, Deep freezer & overhauling of compressor.	Check & review electrical components of refrigerator/ bottle cooler/ water cooler/ Split AC.
	Monitor controls used in bottle cooler/water cooler/ window AC/ Split AC.
	Supervise wiring done in bottle cooler/ water cooler/ deep freezer and visi cooler wiring in refrigerator/ Window AC/ Split AC.
	Plan & organize dismantling and assembling of reciprocating compressor/ rotary compressor.
5. Test, service & retrofit various types of	Check & monitor proper functioning of thecondenser coil/different parts of compressor.

compressor, condenser, evaporator, expansion valves and capillary tubes used in domestic refrigeration appliances & apply various secondary refrigerants and make use of lubricants & insulating materials.	Check & review the servicing of air cooled/ water cooled & evaporative condenser & evaporator.
	Monitor heat transfer through condenser.
	Identify & select different types of expansion valve/ refrigerants.
	Recover old gas and analyze measurement of super heat of the system.
	Analyze retrofit CFC fill domestic refrigerator with HCFs/ Hydrocarbon refrigerants.
	Test & assess leakage/evacuation and charging of gas in refrigerator.
	Plan & Prepare PUF mixing procedure for filling.
	Check & Test electrical components of HC refrigerator/window AC/Split AC.
	Monitor different gas charging procedures in split air-conditioning.
	Identify & apply different heat insulating materials as per the requirement of the appliances.
	Review installation of IDU/ODU of split AC.
6. Plan &Prepare the layout of AC Plant, Ice plant, Cold storage plant& automobile AC.	Identify the parts of AC Plant, Ice plant and Cold storage plant & ensure their proper functioning.
	Analyze the technical document.
	Plan & draw the layout of AC Plant/Ice Plant/Cold storage plant as per the given specifications.
	Assess and evaluate the technical specifications of the drawing.
	Finalize & approve the drawing as per the given standards.
7. Operate, check & service various non-conventional refrigeration systems, compressor, water/air cooled condenser, water treatment plant etc ensuring their effective repair & maintenance.	Review & rectify the various non-conventional refrigeration systems.
	Check and test the operation of lithium bromide vapour absorption system & its analysis.
	Evaluate Calculation of the COP of refrigeration system.
	Observe &analyse the various processes in a refrigeration cycle/ Carnot cycle.
	Evaluate calculation of Calculate the cop in a vapour compression cycle.
	Monitor Charging Oil in compressor.
	Analyse Testing of bi-pass valve, cylinder unloading mechanism, Valve lifting mechanism.
	Testing of bi-pass valve, cylinder unloading mechanism, Valve lifting mechanism.

	Check Servicing of remotes circuit boards.
	Review the Dismantling of multi cylinder compressor reciprocating compressor.
	Monitor Assembling of multi cylinder reciprocating compressor.
	Check & assess piston assembly &remove piston pin.
	Plan & organize operations on CRO.
	Identify and test resister and transistor & demonstrate their applications.
	Test control circuit of micro controller and IGBT.
	Check & diagnose a Variable frequency drive (VFD) & its circuits.
	Check and review servicing of water-cooled condenser/ cooling tower,
	Check and rectify cavitation and priming.
	Check the operation of float valve controls.
	Monitor Descaling of water-cooled condenser.
8. Check &observe different refrigerant controls, floats, Solenoid Valves, Safety switches, Pressure stats, Water flow Valve, Level Master Control.	Check and adjust refrigerant controls/ solenoid valve/ pressure stats/ thermostat.
	Check & test thermostatic equalizer connection.
	Assess the measurement of superheat and adjust super heat setting for effective & efficient outcome.
	Check and adjust thermal bulb of thermostatic expansion valve.
	Evaluate the measurement of chilled water inlet & out temperature.
	Check Chilled water pump operation and its leakage.
9. Plan & prepare layout, technical specification, capacity of various food preservation systems, Servicing of ice candy plants/ Mini cold storage plant. Charge refrigerants &evaluate the performance.	Analyse technical document.
	Plan & draw the layout of Ice plant/ cold storage/ AC Plant.
	Assess & prepare the specifications of above plant.
	Check and service the Ice plant/cold storage / AC Plant.
	Charge the refrigerant in Ice plant/ cold storage / AC Plant.
10. Review Installation, Testing and servicing in Cassette Type Systems, Inverter A/C's, Ductable Package	Monitor Installation of a Cassette type Air conditioner.
	Check, installation and servicing of an inverter AC.
	Check the performance of a floor standing AC.
	Review testing and wiring of a package AC.

AC, Central Air Conditioning Plantsand Floor standing AC.	Demonstrate different Operation of the Central AC plant efficiently.
	Construct a wiring circuit system of a Central AC plant with effective utilization of resources.
	Check and service Reverse cycle Air Conditioner.
	Analyse effective troubleshooting in a central AC
11. Assess and evaluate measurement of the Psychrometric properties, Static and dynamic pressure of duct, calculation of heat of the building and adjustment of air balancing.	Construct a square/ rectangle/ round duct as per given specification.
	Train in Checking and adjustment of air balancing in duct.
	Check Cleanliness of the air filters.
	Assess the measurement of Static and dynamic pressure using pitot tube and manometer.
	Analyse measurement of the sound by using of decibel meter.
	Evaluate calculation of the total heat load of a building.
12. Demonstrate Erecting, Commissioning, heat balancing and Evaluation of Central Air Conditioning System, Ice plant & cold storage.	Check Installation, testing, commissioning of a Central AC plant.
	Review maintenance of logbook for commercial plant.
	Plan & prepare a maintenance schedule for a central AC plant.
	Examine the chilled water pipes of a Central AC.
	Check & test the parts of a cold storage plant for proper functioning.

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR MECHANIC REFRIGERATION AND AIRCONDITIONING (CITS)			
For batch of 25 candidates			
A. TRAINEES TOOL KIT			
S no.	**Name of the Tool &Equipment**	**Specification**	**Quantity**
1.	Flaring tool set, single type for tube	4.7to 16 mm OD	12 Sets
2.	Swaging tool, punch type, set of size, for tube	4.7 to16 mm OD.	4Sets
3.	Swaging tool, screw type, with adapter set of size for tube	4.7 to 16 mm OD.	4 Sets
4.	Bending spring external type, for copper tube	3 to 6 mm. Dia	4 Sets
5.	Mechanical Tube/ Pipe bender	1/4th, 3/8th , ½, 5/8th (in inches)	2 Nos. Each
6.	Pipe cutter miniature for copper tube	3 to 16 mm. Dia	12 Nos.
7.	Pipe cutter with built-in reamer and space cutter, for copper tube	3 to 32 mm.	8 Nos.
8.	Pinch off tool, for copper tube	6 to 18 mm.dia	8 Nos.
9.	Ratchet spanner of reversible	6.4 mm. sq.	8 Nos.
10.	Capillary plug gauge		4 Nos.
11.	Pinch off pliers/crimping pliers tool	6-18 mm.dia	4 Nos.
12.	Piercing pliers & piercing valves both with access fittings	6-18 mm.	8Nos.each
13.	Spanner, double ended	4.7 mm to 16 mm.	6 sets
14.	Spanner, double ended	19 mm to 31.8 mm.	2 sets
15.	Ring spanner, off set	4.7 mm to 16 mm.	6 Sets
16.	Ring spanner, off set	19 mm to 31.8 mm.	2 sets
17.	Box spanner	size 6.4 to 10 mm.	4 sets
18.	Wrench adjustable	length 150 mm.	4 Nos
19.	Wrench adjustable	length 200 mm.	8 Nos.
20.	Wrench adjustable	length 225 mm.	4 Nos.
21.	Pipe wrench	size150 mm.	4 Nos.
22.	Pipe wrench	size 250 mm.	4 Nos.
23.	Torque wrench square drive right and left hand	300 mm. 12.7 mm.	2 sets
24.	Valve key -T handle	4.7 & 6.4 mm. sq.	8 sets
25.	Socket set, ratchet, reversible 12.7 mm. square drive with extension,	4.7 to 31.2 mm.	4 sets
26.	Socket set, ratchet, reversible, 1/2 square drive with extension	3/16 to 11/4 BSW & SR	2 Sets
27.	Pressure gauge, diameter 63 mm. with recalibration set screw	0 to 35 kg/sq.cm.	12 Nos.

28.	Compound gauge, diameter 63 mm. with recalibration set screw	vacuum 76 mm. pressure 15 kg/sq.cm.	12 Nos.
29.	Serviceman thermometer in metal case	(-30 to+30 Deg. C)	4 Nos.
30.	Sling psychrometer	(-50 Deg. c. to +50 Deg. C).	4 Nos.
31.	Gas leak detector	halogen gas	4 Nos.
32.	Lapping plate	250x200 mm.	2 Nos.
33.	Punch hole for cutting gasket	4.7 to 16 mm. dia	4Nos.
34.	Scissor, gasket cutting stainless steel	length 250 mm.	4 Nos.
35.	L -Allen key set	size 1.5 to 6.4 mm.	4 sets
36.	T -Allen key set	size 5/32 & 1/8 Inch	4 sets
37.	Screw driver, plastic handle	6 mm. tip length 100,150mm.	10 each
38.	Screw driver, plastic handle,	10 mm. tip length 200,250mm, 300mm.	10 each & only 2 Nos. of 300mm
39.	Philips screw driver	complete set in case	4 sets
40.	Screw driver, plastic handle	3 mm. tip length 100 and 150mm. insulated	4 sets
41.	Pliers combination insulated	length 200 mm.	8 Nos.
42.	Pliers long nose	length 200mm.	4Nos.
43.	Pliers flat nose	length 150mm.	4 Nos.
44.	Hammer ball peen	450 gms.	4 Nos.
45.	Hammer ball peen	220 gms.	4 Nos.
46.	Hammer nylon	300 gms.	4 Nos.
47.	Tape, measuring	10 m graduation in mm.	2 Nos.
48.	Tape, measuring	3 m graduation in mm.	4 Nos.
49.	Chisel flat	length 150 mm.	4 Nos.
50.	Hack-saw tubular metal frame adjustable	300 mm	8 Nos.
51.	Centre punch	length 100 mm.	8 Nos.
52.	Oil can pressure type	1/4thlitre	4 Nos.
53.	File, flat medium double cut	length 200 mm.	8 Nos.
54.	File, half round medium, double cut	length 200 mm	8 Nos.
55.	File, half round, fine double cut	length 150 mm.	8 Nos.
56.	File, round, fine, double cut	length 150 mm.	8 Nos.
57.	File flat, fine double cut	length 150 mm.	8 Nos.
58.	File square, fine double cut	length 150 mm.	8 Nos.
59.	Soldering Iron exchangeable copper tip .	65 watts.	10 Nos.
60.	Pipe bending tool, lever type with degree indicator, for tube	OD 6.4 to 16 mm.	4 Sets
61.	Puller 3 legged, with flexible arm	120 mm.	2 Nos.
62.	Puller 2 legged, with flexible arm	300 mm.	1 No.
63.	Hand blower portable complete motor & other attachments.	1/10 HP	2 Nos.

64.	Snipper sheet metal straight nose	200 mm.	2 Nos.
65.	Vernier Caliper	length 250 mm.	2 Nos.
66.	Micrometer, outside measurement	0-25 mm.	4 Nos.
67.	Vernier height gauge	250 mm.	2 Nos.
68.	Bench vice	75 mm. jaw	4 Nos.
69.	Bench vice	120 mm. jaw	4 Nos.
70.	Electrical drill portable with chuck and key	capacity 12 mm.	4 Nos.
71.	Pillar drilling machine 200 to 2500 rpm.	capacity 20 mm.	2 Nos.
72.	Pedestal grinder, double ended	Wheeldia 200 mm. 3000 rpm.	2 Nos.
73.	Oxy- Acetylene welding set	Complete with cylinders, regulators,hose, weldingtorches with difference nozzles.	2 sets
74.	Gas cylinder truck	Two wheel type	2 Nos.
75.	Line tester, Heavy duty.	500 volt	8 Nos.
76.	Tong-tester	0-10-30 amps. 0-500 volts (Clamp on Multimeter)	8 Nos.
77.	Voltmeter AC/DC portable, precision grade	0 to 300Volts/0-500Volts	10 Nos.(5 each).
78.	Ammeter AC/DC portable, precision grade	0 to 5 amp/ 0-10 amp/0-30amp.	12 Nos.(4 each)
79.	Megger	1000 Volt.	2 Nos.
80.	Variac input 230 volt output 400 volt. amp. portable complete with meters and controls.	230 volt output 400	2 Nos.
81.	Wattmeter, multi range	1 KW	2 Nos.
82.	Wattmeter, multi range	up to 5 KW	2 Nos.
83.	Multimeter	Analog type	6 Nos.
84.	Multimeter	Digital type	6 Nos.
85.	Tachometer	Digital, multi range 0 to 3000 rpm. Portable, small size in case.	2 Nos.
86.	Transistor tester		2 Nos.
87.	R.L.C. Bridge		2 Nos.
88.	Stop watch		2 Nos.
89.	Hand grinder	Small capacity	2 Nos.
90.	Filler gauge	0.05 mm. -1 mm.	2 Sets.
91.	Wire gauge	Metric and Whitworth	2 Sets.
92.	Refrigerant cylinder	2.5 Kg.	4 Nos.
93.	Refrigerant cylinder	20 Kg.	4 Nos.
94.	Refrigerant cylinder	5 Kg/10Kg.	4 Nos.
95.	Evacuating & refrigerant charging station	Comprising Rotary two stage vacuum pump and motor (with gas ballast & anti suck	2 Sets.

		back) Manifold with gauges &valves and capable of pulling vacuum up to 50 microns of Hg and with provision of connecting to a micro level vacuum Gauge. Graduated charging cylinder with provisions for temperature correction and all necessary isolating valves. Evacuating & charging station as above but fitted with weighing scale (up to 2 kg. in lieu of (b) above and with accuracy of +/- 1gram, for charging hydrocarbons.	
96.	Dial thermometer remote control, armored capillary dial 75 mm.-50	-50 Deg. C to + 50 Deg. C.	2 Nos.
97.	Two stage rotary vacuum pump	Capacity approx 60-100 L/min., capable of evacuating to 50 microns of Hg and fitted with gas ballast, anti suck back valve and single phase motor.	2 Nos.
98.	Anemometer (Vane type)	Digital	2 Nos.
99.	Air compressor	Two stage for oil-less dry air, with rust proof tank assembly. Heater and control max. Pressure. 10 kg/sq. cm cap. 45 litre, Motor 1 HP	2 Nos.
100.	Scraper, triangular blade removable	60 mm.	4 Nos.
101.	Descaling pump set with stainless steel impeller and housing complete with motor	1 HP and accessories.	2 Nos.
102.	Spray outfit, 'V' twin, with motor V HP. delivery up to 120 liter free air pressure up to 3 Kg/sq.cm. with spray gun and fitting.		2 Nos.
103.	Pressure testing tank with lighting arrangement, pressure gauge	(0 to 35 kg/sq.cm.) double stage	2 Nos.
104.	Heating kit with infra red bulb	(200 watt capacity)	2 Sets
105.	Refrigerator, compression type	165 /185 litre capacity	4 Nos.
106.	Refrigerator compression type 300 litters double door, double compressor system.	300 litre	2 Nos.
107.	Deep freezer	165 litre -18 °C, 1/4 HP	2 Nos.
108.	Window Air Conditioner	3000 Kcal/Hr	4 Nos.

109.	Window Air Conditioner (Remote Control).	4500 Kcal/Hr	4 Nos.
110.	Split Air Conditioner	4500 Kcal/Hr	4 Nos.
111.	Split Air Conditioner inverter control	4500 Kcal/Hr	4 Nos.
112.	Split Air Conditioner (Ductable)	6000 Kcal/Hr (Ductable)	2 Nos.
113.	Bottle Cooler	110 litres, 1/6Hp	2 Nos.
114.	Water Cooler Instantaneous type		2 Nos.
115.	Water cooler Storage type	30 litre storage Capacity	4 Nos.
116.	Ice Candy Unit complete with stainless steel tank, Mould Box, Thermocole insulated sun mica body, agitator compressor, motor etc. Temperature and Pressure gauges, motor and pipe fittings etc. working trainer model/simulator.	3000 Kcal/Hr	1 No.
117.	Prefab PUF insulated panel for cold room 6X4.5X8 cft. Maintaining temperature0 °C to +5°C. Condensing unit complete with semi sealed compressor duly mounted on base plate and charged R-22 gas. Evaporating unit complete with expansion valve and other accessories. Electrical control panel complete with digital temperature and pressure indicators and other electrical controls. Fabrication ,erection, Insulation completed by supplier.		1 complete set.
118.	Air conditioning Plant, Direct system with Air cooled condenser, complete withall controls including humidity control etc. capacity 15000 Kcal/hr or working trainer model/simulator. Alternatively, a packaged Air-conditioner of similar capacity.	5 Ton Capacity	1 No.
119.	Air conditioning plant, Indirect system with Water cooled condenser, chiller, cooling tower, complete with all controls including humidity control etc. or working trainer model/ simulator.	Range 10 – 15 Ton Capacity.	1 No.
120.	Condensing unit with open type compressor air cooled condenser controls etc.	capacity 3000 kcal/hr.	1 No.
121.	Condensing unit with open type compressor evaporative condenser and controls etc.	capacity 3000 Kcal/hr, trainer model	1 No.

122.	Reciprocating compressor with provision of capacity control etc. for demonstration.	capacity 9000 Kcal/hr.	1 No.
123.	Micron vacuum gauge	Capable of reading up to 20 microns	2 Nos.
124.	Sensor Thermometer (digital)	100 to -20 degree centigrade	4 Nos.
125.	Fin Straightener/fin comb		4 Nos.
126.	HC refrigerant cylinders / disposable containers		4 Nos.
127.	134a refrigerant cylinders	3 Kg	4 Nos.
128.	Recovery unit for 134a refrigerants with recovery cylinder.		2 Nos.
129.	Recovery unit for CFC refrigerants with recovery cylinder		2 Nos.
130.	Reverse cycle AC/Heat pump	3000 Kcal/hr or 4500 kcal/hr	1 No.
131.	Refrigerator 170 litre using 134a refrigerant	170 Litre	4 Nos.
132.	No Frost refrigerator 300 litre capacity using HC refrigerant	300 litre	2 Nos.
133.	Automatic Ice cube machine	capacity 5 Kg/hr.	1 No.
134.	Fire extinguisher	powder type	4 Nos.
135.	Dry Nitrogen gas cylinder with drier unit and 2 stage pressure regulator		2 Nos.
136.	Two way manifold with gauges		2 Nos.
137.	Four way manifold with gauges		2 Nos.
138.	Small car A/C kit with driving arrangements		1 No.
139.	Components of Car A/C systems . Wobble plate compressor with mounting brackets, serpentine evaporator, parallel flow condenser hoses, tubes, receiver, expansion valve, electrical components and siring harness.		1 No each.
140.	Small capacity shell and tube condenser	5 Ton	2 Nos.
141.	Fan Coil unit with water valves(2 & 3 way)	2 Ton	2 Nos.
142.	Shell and tube DX chillers (small)	5 Ton	2 Nos.
143.	Circulating water pump(small)	0.5 -1 Hp	2 Nos.
144.	Schraeder valve core removal tool		2 Nos.
145.	Pitot tube & inclined tube manometer		2 Nos.
146.	Hermetic compressors	(1/6hp)	4 Nos.
147.	Hermetic compressors	(1/2hp)	2 Nos.
148.	Semi-hermetic compressor	1 TR	2 Nos.
149.	Rotary compressor	1 TR	2 Nos.
150.	Quick couplers, process tube adapters	for 1/4", 3/8" tubes	2 pairs for

			each tube.
151.	VRV/VRF package unit with 2 indoor(casset) units 2.5 TR each and 05 TR capacity out door unit complete with air cooled condenser and all accessories &controls	2 Indoor (casset) units 2.5 TR each and 05 TR Out door unit.	01 unit complete
B.FURNITURE,ACCESSORIES AND AUDIO VISUAL AIDS FOR TRADE THEORY AND TRADE PRACTICAL			
152.	Almirahs	195 X 90 X 49 cm	4 Nos.
153.	Lockers of eight compartments	195 X 90 X 49 cm	2 Nos.
154.	White board portable	6x4 ft	1 No.
155.	Desktop table and two chairs.		1 Set.
156.	Work bench	1000X600X800 mm. high.	2 Nos.
157.	Over head projector		01 No.
158.	LCD projector		01 No.
159.	Computer	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM:-4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 17 Inch.) Licensed Operating System and Antivirus compatible with trade related software	01 No.
160.	UPS		As required
161.	Photo copy machine		01 No.
162.	Laser printer		01 No.
163.	Scanner		01 No.
164.	Interactive Board		01 No.
165.	Computer Table		01 No.
166.	Computer Chair		01 No.
167.	Students Chair with folding writing pad		25 Nos.
168.	Air Conditioner	2 Ton	As required
169.	T.O's Table	6ftX4ft	1 No.
170.	T.O's chair		1 No.

ANNEXURE – I

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

List of experts attended a workshop to revise syllabus of **Mechanic Refrigeration & Air Conditioning** under CITS.

SNo.	Name & Designation Sh /Mr./Ms	Organization	Remarks
1.	Prof. NirjharDhang. (H.O.D)	Dept. of Civil Engg. IIT Kharagpur	Chairman
2.	Co l. N. B. Saxena.	Construction Skill Development Council of India (CSDCI)	Member
3.	Satish Gottipati. (M. D.)	Preca Solutions (E)	Member
4.	Meena Raghunathan. (Director, Community Science.)	GMRU Foundation, Hyderabad.	Member
5.	D. K. Chattopadhayay. (Training Officer.)	ATI, Kolkata. Dasnagar, Howrah.	Member
6.	S. R. Vhatkar. (Training Officer.)	ATI, Kolkata. Dasnagar, Howrah.	Member
7.	A. K. Naskar. (Training Officer.)	ATI, Kolkata. Dasnagar, Howrah.	Member
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10.	Arpana Singh. (T.O.)	N.V.T.I (W) Noida.	Member
11.	P. Karithashankar. (T. O.)	N.V.T.I (W) Noida.	Member
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