

## **GENERAL INFORMATION**

1. Name of the Trade : Central Air condition plant Mechanic
2. NCO Code No. : N.A
3. Qualification Pack Code :
4. Duration of Craftsmen Training : Two Year (Four Semester)
5. Entry Qualification : Passed 10<sup>th</sup> Class under 10+2 system.
6. Unit Strength : 20 trainees per unit + 30% supernumeraries = 26 trainees per unit
7. Space Norms : 120 Sqm
8. Power Norms : 3 KW (20000 lumen)
- 9 Job Role : To repair any type of Refrigeration & air condition Plant
10. Instructor's Qualification : NTC/NAC in the relevant trade with 3 years' post qualification experience  
OR  
Diploma/Degree in Mechanical Engg/ Electrical Engineering .  
with 2/1 years post qualification experience respectively.
11. Desirable Qualification : CITS

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

**FIRST YEAR: -Two semester. SECOND YEAR:- Two semester**

<b>BASIC</b>	<b>NAME OF THE BASIC MODULE</b>	<b>DURATION IN WEEKS</b>	<b>PAGE NO</b>
RAC – COE-Ist Semester	BASIC WORKSHOP PRACTICES BASIC ELECTRICITY, ELECTRONICS AND ELECTRO-MECHANICS	25 WEEKS	2-7
RAC – COE-IInd Semester	<b>Domestic,commercial Refrigerator &amp; Air conditioner system</b>	25WEEKS	8-10
RAC – COE-IIIrd Semester	1.CarA/C,,Cold Storage ,Chillerplant,Mobile refrigeration,Package A/C,Computer education	25 WEEKS	11-14
RAC – COE-IVTh Semester	CENTRAL PLANT SERVICING,MAINTENANCE	25 WEEKS	15-17

**GENERIC MODULES**

RAC – Semester-I	ENGINEERING DRAWING	2 HRS. PER WEEK	
RAC – Semester-I	WORKSHOP CALCULATION & SCIENCE	2 HRS. PER WEEK	
RAC – Semester-III	TOTAL QUALITY MANAGEMENT	2 HRS. PER WEEK	
RAC – Semester-IV	ENTERPRENEURSHIP AND COMMUNICATION SKILLS / SOCIAL STUDIES		1 HRS.

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

**Week wise content index of first semester**

S.No	Week No.	Contents Heading		Duration
		Practical/Theory		
1.	01-03	Fitting Work Related Practical	Fitting Work Related Theory	3 weeks
2.	04-05	Sheet metal Work related Practical	Sheet metal Work related theory	2 week
3.	06	Carpenter Work related Practical	Carpenter Work related theory	1 weeks
4.	07-08	Welding, Brazing different MSJoint Related Practical[Gas & Arc]	Welding, Brazing different MSJoint Related theory[Gas & Arc]	2Weeks
5	09	Cooper & Aluminium related joint, bending Practical	Cooper & Aluminium related joint, bending Theory	1 Week
5.	10-13	Electrical Basic, Motor Control related Practical	Electrical Basic, Motor Control related theory	4 Week
6.	14-15	Electronic& Electronic Mechanic Basic, Components Circuit design Practical	Electronic, Electronic Mechanic Basic, Components Circuit design theory	2Weeks
7.	16-20	Basic refrigeration, Components service related, Joint related Practical	Basic refrigeration, Components service related, Joint related theory	5 weeks
8.	21	Oil charging Importance of Dry Nitrogen Handling procedure Chemical cleaning of Ref. Cycle& flush out with Dry Nitrogen Practical	Oil charging Importance of Dry Nitrogen Handling procedure cleaning of Ref cycle , such as chemical cleaning, Flushing theory	1 week
9.	22-23	Industrial visit		2weeks
10.	24	Revision		1 week
11.	25	Theoretical & Practical test		1week

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
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<b><u>Week wise content index of Second semester</u></b>				
S.No	Week No.	Contents Heading		Duration
		Practical/Theory		
1.	01	About Global warming action taken ,Effect Related Practical	About Global warming action taken ,Effect Related Theory	1 week
2.	02	Recovery of refrigerant Different refrigeration system related theory Practical	Recovery of refrigerant ,Different refrigeration system related Theory	1 week
3.	03 -05	Circuit Diagram Repairing common defect, Rectify of Refrigerator fault related Practical	Circuit Diagram ,Repairing common defect, Rectify of Refrigerator fault related Theory	3week
4.	06	Cooper tube operation & Joint related Practical	Cooper tube operation & Joint related Theory	1 week
5.	07-08	Importance of flushing in evaporator and condenser, necessity of replacing capillary and drier Related Practical	Importance of flushing in evaporator and condenser, necessity of replacing capillary and drier Related Theory	2 week
6.	09-10	Dry Servicing water immersion testing of evaporator & condenser coils Related Theory Practical Evacuating & gas charging Performance Testing faults, Causes and their remedyRelated Theory Practical	Dry Servicing water immersion testing of evaporator & condenser coils Related Theory Evacuating & gas charging Performance Testing faults, Causes and their remedyRelated Theory	2 weeks
7	11-15	Testing all weather air conditioners. Trouble shooting. VRV Sytem,VRFSYSTEM FROST FREE REFRIGERATOR Installation of Window A/C,	Testing all weather air conditioners. Trouble shooting. VRV Sytem,VRFSYSTEM FROST FREE REFRIGERATOR Installation of Window A/C, Normal Split A/C Related Theory	5Weeks

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		Normal Split A/c Related Theory <b>Practical</b>		
<b>8</b>	<b>16-17</b>	Installation of Duct able A/C, Cassette A/C Water cooler construction(Installation and storage) b)fitting refrigeration cycle, electrical circuit, working and control, Related Theory <b>Practical</b>	Installation of Duct able A/C, Cassette A/C Water cooler construction(Installation and storage) e) b)fitting refrigeration cycle, electrical circuit, working and control, Related <b>Theory</b>	2 Weeks
<b>9</b>	<b>18-19</b>	A)Insulation and Energy conservation Checking- and servicing visi cooler, deepfreezer, Preventive maintenance and Trouble Shooting Retrofitting with Hydrocarbons and HFC 134a Related theory <b>Practical</b>	A)Insulation and Energy conservation Checking- and servicing visi cooler, deepfreezer, Preventive maintenance and Trouble Shooting Retrofitting with Hydrocarbons and HFC 134a Related <b>Theory</b>	2 Weeks
<b>10</b>	<b>20-21</b>	Chest type bottle coolers, Deep Freezers and visi coolers Description, Construction and function substituting R-22 with R-134a or Hydrocarbon (Montreal protocol) <b>Practical</b>		2 Weeks
<b>11</b>	<b>22-23</b>	<b>Industrial Visit</b>		<b>2 weeks</b>
<b>12</b>	<b>24</b>	<b>Revision</b>		<b>1 Week</b>
<b>13</b>	<b>25</b>	<b>Theoretical &amp; Practical test</b>		<b>1 Week</b>

**Week wise content index of Third semester**

S.No	Week No.	Contents Heading		Duration
		Practical/Theory		
1.	01	Car A/C related theory including working principle Practical	Car A/C related Practical including working principle Theory	1 week
2.	02 -03	MobileA/C related theory including working principle Practical Package A/C related Practical	MobileA/C related Practical including working principle Theory Package A/C related Practical Theory	2 week
3.	04	Split package A/C related Practical	Split package A/C related Theory	1weeks
4.	05	Ice Candy Plant, related Practical	Ice Candy Plant, related Theory	
4.	06-08	Cold storage Related Practical	Cold storage Related Theory	3 week
5.	09-12	Indirect chiller system Related theory Such as components installation Practical	Indirect chiller system Related Theory Such as components installation	4 weeks
6.	13 -18	Heat ventilation And air condition related Practical calculation Drawing Plant related calculation Related Practical	Heat ventilation And air condition related Theory calculation Drawing Plant related calculation Related Theory	6week
7.	19-21	Computer related work Excell, Word.Net related Practical	Computer related work Excell, Word. Net related Theory	3week
8.	22-23	Plant visit & observe how to work in plant in Industry.		2Week
9.	24	Revision		1Weeks

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
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10.	25	<b>Theoretical &amp; practical test</b>	1Week
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**Week wise content index of Forth semester**

S.No	Week No.	Contents Heading		Duration
		Practical/Theory		
1.	01-02	<b>Commercial Compressor Related Practical</b>	<b>Commercial Compressor Related Theory</b>	2 weeks
2.	03-05	<b>Psychometric related Practical Servicing of related components</b>	<b>Psychometric related Practical Servicing of related components Theory</b>	3weeks
3.	06-07	<b>Duct, air filter related Practical Direct DX- System Related Practical</b>	<b>Duct, air filter related theory Theory Direct DX- System Related Theory</b>	2week
4.	08-09	<b>Central &amp; Industrial A/C Related Practical</b>	<b>Central &amp; Industrial A/C Related Theory</b>	2week
6.	10-21	<b>Central plant servicing, components ,installation fault find out,Replce ment installation compressor Related Practical</b>	<b>Central plant servicing, components ,installation fault find out,Replce ment installation compressor Related Theory</b>	12weeks
7.	22-23	In plant Training		2 Week
8	24	Revision		1 week
9	25	<b>Theoretical &amp; practical test</b>		1 week

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
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MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

**Semester : -1**

Week No.	PRACTICAL	THEORY
1	<b>Basic Fitting</b> : Marking on flat surfaces as per given drawing by using different marking tools and medias, Punching & hacksawing, Filing surfaces flat & square. Marking on flat & cylindrical objects.	Workshop & Personal Safety - Introduction to basic workshop tools & operations like measuring, marking, hacksawing & cutting. Tools used, their identification & classification, use care & maintenance, direct & indirect measurements, marking medias.
2	Filing flat surfaces of mild steel / cast iron. Checking for flatness, straightness & square ness. Filing & Fitting of male & female joints within accuracy of $\pm 0.2$ mm. Using a spirit level and dial test indicator. Measurements by precision instruments.	Introduction to files, their types and uses, care & maintenance, Bench & pipe vice, their constructional details & uses. Spirit levels & their uses, straight and angular measurements, Bevel Protractors. Introduction to precision measuring & least count. Micrometers, Verniers & Height gauges,
3	Drilling, reaming & tapping as per given drawings. External thread cutting on pipes. Fitting of two parts with the help of fastener such as key cotters Nut & Bolt. Select Exercise involving all the operation	Constructional details, 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.



UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

4 & 5	<p><b>Sheet Metal Work :</b> Use of protective safety devices on shop floor. Identification of Tools &amp; Equipment. Practice in Scribing of straight line, Bisection of straight lines with marking tools. Practice in cutting sheet metal to different shapes using various types of snips. Folding/Bending sheet metal to 90° using wooden mallet. Practice on hard soldering method (Lead &amp; Tin). Forming simple sheet metal articles like funnels, cylindrical vessels, boxes &amp; buckets. Making holes on sheet metal by punching &amp; riveting. Straight &amp; oblique cutting.</p>	<p>Introduction to sheet metal work &amp; its applications, materials used for sheet metal work. Hand tools, measuring tools &amp; gauges used in sheet metal work. Different sheet metal operations, their necessity &amp; applications. Sheet metal joining processes, Sheet metal machinery, shears, forming &amp; folding machines, bending &amp; shearing machines seaming &amp; nibbling machines. Development of surfaces for simple objects like boxes, cylinders, cones, prism &amp; pyramids. Riveting practice, practice on removing dents on spherical &amp; hemi spherical articles.</p>
6	<p><b>Carpentry:</b> Jobs involving various carpentry applications, like marking, sawing, planing, chiselling &amp; drilling. Making joints &amp; simple frames used in A.C. work.</p>	<p>Timber, its classification &amp; sources, seasoning of timber. Plywood &amp; alternative materials. Carpentry tools, their uses, care &amp; maintenance, simple carpentry operations &amp; commonly used joints. Glues &amp; adhesives, polishing &amp; varnishing.</p>
7	<p><b>Basic Welding :</b> Setting beading practices, striking &amp; maintaining an arc setting up an oxy-acetylene flame. Laying short , straight line &amp; weaved beads on M.S. plates, Fillet welds in open corner, Tee &amp; Lap Joint, fusion runs with &amp; without filler rods. Preparing different joints with gas welding.</p>	<p>Workshop &amp; personal safety - Metal joining processes. Introduction to gas &amp; arc welding, advantages &amp; disadvantages. Different hand tools used in welding. Oxy-Acetylene gas welding plant. Welding accessories like regulators, nozzles cylinders etc. Handling ,setting of pressure Identification of gas welding, equipments &amp; accessories, setting up of a)AIR-LPG, b)O<sub>2</sub>-LPG c) O<sub>2</sub>-C<sub>2</sub>H<sub>2</sub>. Familiarization with the practice of 1)Oxy Acetylene Gas welding, brazing and cutting on thin sheet metal. 2) Safety in handling of Oxy Acetylene Cylinders, Regulators etc.,</p>

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

8	<p><b>Basic Welding :</b> Setting beading practices, striking &amp; maintaining an arc setting up Selection of current in Arc welding Laying short , straight line &amp; weaved beads on M.S. plates, Fillet welds in open corner, Tee &amp; Lap Joint, Preparing different joints with Arc welding. Over head welding</p>	<p>Welding machines &amp; welding transformers , Welding processes &amp; positions, welded joints, welding symbols, weld depositions, &amp; electrodes, their types &amp; selection, care &amp; maintenance. Distortion in welding, welding defects, their causes &amp; remedial measures.</p>
9	<p><b>Basic Brazing:-Swaging, Flaring with proper method, Preparation before Brazing.Joining of Cooper to cooper joint. Cooper to steel. Cooper to Aluminium On difference size pipe. 'T' Joint. Cross Joint angle, Reducer joint all with above</b></p>	<p>Preparation before brazing ,Swaging method, Flaring method filler rods, Fluxes, types &amp; application. Importance of brazing joint in R&amp;A/C sector Selection of nozzle, Setting of line pressure. Importance of Right temperature of Brazing. PPE required when brazing.</p>
10	<p><b>BASIC ELECTRICITY:-</b> Demonstration of use of Safety equipments and artificial respiration. Use of hand tools. Measuring of Voltage current ampere .Identification of Neutral ,Phase, Earth , Proper size cable as per load. Joining Practice with single and multi-stand conductors. Joining practice of bare conductors, Different types of resistances. Earthing and fuses. Types, grades and sizes of insulated wire and cables – their selection and use.</p>	<p>Safety - in electrical shops. Introduction of A.C,D.C Current Static &amp; current Electricity, Description, specification, general care &amp; maintenance of common electrical hand tools. Wires &amp; cables -conductors, Insulators &amp; semiconductors, their shapes, sizes with respect to low, medium &amp; high voltage. Different fluxes for different purposes on metals, Crimping equipment - Single &amp; Multistranded conductors joining . Selected letters symbols and sign as per I. S. I. Rules for medium voltage.</p>
11	<p>Demonstration &amp; practice on soldering the Aluminum conductor, cable joints. Use of Aluminum flux and Alca 'P' solder. Demonstration and practice of crimping of various wires, Electrical symbols Making a simple circuit with a lamp and battery. Study and use of Multimeters measurement of current, voltage, resistance in DC/AC circuits. Demonstration &amp; verification of ohm's law- Series circuits - Parallel circuits. Demonstration &amp; Practice on connecting &amp; replacement of common electrical accessories in circuits - Use of tong tester and megger</p>	<p>Resistance, Voltage, Current, open circuit and short circuits-Ohm's law - Voltage drop in series &amp; parallel circuits, Power &amp; energy relations, Electrical measuring Instruments, Multimeters, Insulation Testers. Common electrical accessories used in Industries, Bus-bars, Relays, Contactors, Circuit Breakers, etc.. Fuses and their ratings, materials used. Earthing &amp; its importance. Preventive maintenance, routine &amp; periodical tests</p>

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

12	<p>Simple wiring practice with distributionboards, Junction Boxes, Main Switch 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 &amp; testing of cells for a specified voltage &amp; current - Preparation of battery charging, Drawing simple panel board wiring diagrams. List of material for wiring. Switches.</p>	<p>Induction principles - Electro-magnetism - Faraday's Laws. Single phase &amp; Poly phase system 3 phase star-delta connections, Impedance &amp; power factor - Principles &amp; Applications of DC Motors, Series, Shunt &amp; compound motor - AC Motors. Transformers their types and applications. Chemical effect of electric current - Rechargeable batteries - Care &amp; maintenance of cells. AC Motor starting with DOL Starter and Star - Delta Starter. Panel boards &amp; their designing.</p>
13	<p>Formation of simple electrical circuit, series circuit and parallel circuit, measuring insulation resistance &amp; earth resistance. Verification of Ohm's law in D.C Circuit, Fixing and connecting electrical switches, holders fuses, plug sockets on T. W. Board and testing. A.C. Motor, starters and transformer. Their working principles, specification &amp; use. Care &amp; safety. Run/start capacitors and PTCs. Motor Protection devices. Temperature rise of windings. Rewiring of existing motor wiring.</p>	<p>Use of electrical Control Instruments. Joints on single and stranded conductors and soldering. Care &amp; maintenance and running of A. C. Single and poly phase motor, starters and transformer. Single phase motor starting methods like RSIR, PSC, CSIR &amp; CSCR and the use of Current and Potential relays. Measurement of current, voltage, power and energy by voltmeter, Ammeter, wattmeter &amp; energy meter. Measurement of resistance with Ohm meters Formation of simple electrical circuit, series circuit and parallel circuit, measuring insulation resistance &amp; earth resistance. Verification of Ohm's law in D.C Circuit, Fixing and connecting electrical switches, holders fuses, plug sockets on T. W. Board and testing.</p>
14&15	<p><b>BASIC ELECTRONICS:-</b> 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 &amp; Silicon Controlled Rectifier ICs etc. Soldering &amp; de soldering practice - Demonstration on Rectifiers - Identification of ICs, Full wave &amp; bridge rectifier circuits, voltage regulators,</p>	<p><b><u>ELECTRONICS</u></b> Introduction to Electronics. Basic Principles of semiconductors, Principles and application of Diodes. Identification of resistance value as colour code. Tools &amp; Equipments used in Electronic trade. Fundamentals of electron theory - passive components semiconductor devices - Symbols - specifications - Diodes, Transistors, Uni-junction Transistor, Field</p>

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

	<p>construction of low voltage power supply, construction of transistor, amplifier circuits .Multi vibrator circuits, CR circuits for wave shaping, wiring of SCR, UJT for motor control. Full wave and bridge rectifier circuit, voltage regulators. Construction of low voltage Power Supply. Construction of transistor amplifier circuit. <b>BASIC ELECTRO-MECHANICS:-</b> Testing solid state thermostats, PTCR, remote controls. Operating &amp; testing contactors, relay, pressure controls ,timer, solenoid, heater, pressure controls, Identification of keys &amp; display of microprocessor trainer kit</p>	<p>effect Transistor Silicon Controlled Rectifier &amp; ICs. Half wave, full wave &amp; 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, multi vibrations CR &amp; LR circuits, SCRs, UJTs &amp; ICs. Multi-vibrator circuits and RC wave shaping circuits. Wiring of SCR, UJT for power control circuits, applications of OP –AMP, Applications of photo transistor. Thermistor, RTDs, Electronic thermostat, principle of remote control &amp; controllers. Use &amp; specifications of contactors, starter &amp; crankcase heater etc., Introduction to Microprocessors</p>
16&17	<p><b>BASIC REFRIGERATION.</b></p> <p>Familiarization &amp; use of general and special tools used in refrigeration work practice.</p> <p>Familiarization of refrigeration tools, instruments, equipments. Care and Maintenance. Measuring Temperature, Pressure, Humidity in atmosphere Identification of refrigerant measuring Bottle pressure. Practically identification such as constructional details of a refrigerator. Functions of refrigeration system components i.e condensers, evaporators and capillary tube.</p> <p>Compressor, its types &amp; working principle. Reciprocating compressors. Comparative study of sealed &amp; open type compressors, Internal construction of a sealed compressor, its part &amp; their functions.</p>	<p>Introduction to basic refrigeration, job opportunities, Safety precautions and first aids, Applications and History of Refrigeration and Air conditioning principle &amp; need. Fundamentals of Refrigeration, units and measurements, Pressure &amp; its Measurements</p> <p>Introduction to refrigeration Tools &amp; equipment, Heat and temperature. Types of heat and its measurement. Thermometers &amp; thermometric conversions. Atmosphere, air &amp; its constituents. Properties of gases &amp; gas laws. Measurement of pressure. Pressure gauges. Humidity, relative humidity &amp; dew point temperature. constructional details of a refrigerator. Functions of refrigeration system components i.e condensers, evaporators and capillary tube. Compressor, its types &amp; working principle. Reciprocating compressors. Comparative study of sealed &amp; open type compressors, Internal construction of a sealed compressor, its part &amp; their functions.</p>

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

18	Practical :-Following Theory Electrically & mechanically testing of refrigerator component. i.e condensers, evaporators and capillary tube,Relay, OLP, Compressor Terminal find out, defective compressure identification & remady	Electrically & mechanically testing of refrigerator component. i.e condensers, evaporators and capillary tube,Relay, OLP, Compressor Terminal find out, defective compressure identification & remady
19&20	Joining practice using proper tool, Bending,Swaging,Flaring with brazing & Flaring nut & stud 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.	Difference type of joint Such as HOT,Cold Procedure, Temporary, Semipermanent,permanent. Brazing Processes. Defects& remedial measures Introduction to soldering & brazing, their applications. Brazing Vs welding. Advantages &disadvantages.. maintenance of tool , instruments and equipments.
21	<b>Oil Charging,Cleaning &amp; flushing of the sealed &amp; Open unit. Use of OFDN with Two stage regulator.</b>	Compressor lubrication method. Lubricants & theirproperties. Selecting of lubricant for refrigerant sector. Ceaning & flushing of system with chemical cleaning & flushing with OFDN . Special about safety while work with OFDN & Chemical
<b>22-23</b>	<b>Industrial visit</b>	
<b>24</b>	<b>Revision</b>	
<b>25</b>	<b>Theoretical &amp; Practical test</b>	

**ACHIVEMENT:-** After complete the session able to know about.

1. Safety in work Shop.
2. Mechanicalwork such as fitting,Sheet metal work,Welding,& brazing.
3. Basic electrical ,Electronic work with safety.
4. Handling of OFDN,Chemical used in refrigeration field.

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

Semester:-II

Week No.	PRACTICAL	THEORY
1	Global warming, Ozone depletion Movie, Practical ozone depletion, Global warming effect checking.	Environmental effect of refrigerant, Action taken, Alternative refrigerant
2	Recovering CFC / HCFC / HFC by using recovery machine .	Status & states of the refrigerant in every spot of the cycle Recovery, recycling of refrigerant & their procedure
3	Types of Refrigeration systems, Study the construction and working of vapor compression cycle, low side & high side components of vapour compression system like , compressor, condenser, expansion valve and evaporator, functions and applications of above components.	Types of Refrigeration systems, Study the construction and working of vapor compression cycle, low side & high side components of vapour compression system like , compressor, condenser, expansion valve and evaporator, functions and applications of above components.
4	Electrical circuit diagram of refrigeration cycle Refrigerator, Freezer, Bottle cooler	Electrical circuit diagram of refrigeration cycle Refrigerator, Freezer, Bottle cooler
5	Repairing rewiring & servicing of a refrigerator. Carrying with R-134 a Leak testing in the system Evacuation & gas charging of a refrigerator. Trouble shooting of electrical & mechanical faults Stripping the components of Frost Free Refrigerator, tracing electrical circuits & defrost heater, Inspection & testing.	Repairing rewiring & servicing of a refrigerator. Carrying with R-134 a Leak testing in the system Evacuation & gas charging of a refrigerator. Trouble shooting of electrical & mechanical faults Study of Frost Free Refrigerators, Refrigeration system of Frost Free Refrigerators, components & their functions, electrical components, wiring, automatic defrost
6	Working on soft copper tubing like, cutting, bending, flaring, swaging, pinching & preparing flare joints. Brazing of tube joints (Cu to Cu, Cu to Steel, Cu to Brass) using (i) Air-LPG (ii) O2-LPG (iii) O2-C2 H2 set up & use of the above gases with the right torches, Brazing Filler Rods. Distinguishing good joints from bad joints.	Working on soft copper tubing like, cutting, bending, flaring, swaging, pinching & preparing flare joints. Brazing of tube joints (Cu to Cu, Cu to Steel, Cu to Brass) using (i) Air-LPG (ii) O2-LPG (iii) O2-C2 H2 set up & use of the above gases with the right torches, Brazing Filler Rods. Distinguishing good joints from bad joints.
07-08	Importance of flushing in evaporator and condenser, necessity of replacing capillary and drier. Evacuation, leak testing, gas charging method in Window A/C.	Cleaning, Flushing, replacing capillary and drier, fault rectification, Advantage of proper evacuation, leak testing, gas charging in window A/C Refrigerant charging.
09	Dry Servicing & brought down servicing of Air conditioners. Brazing & water immersion testing of evaporator & condenser coils. Retrofitting of HFC filled appliances with Non HFC refrigerant HC blend. Use of sealed components replace Such as Refrigerator, Deep freezer, Bottle cooler.	Air cleaning :Filters, their types and specifications. Air flow measurements Use of velocity meters. Performance Testing criterion. Scope and methodology of retrofitting HFC appliances with HC blend refrigerants, study of refrigerator components using HC refrigerants. Comparative study of

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(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

		performance of refrigerators using different refrigerants. Comparative study of appliances available in the market
10	Dismantling & Assembly of an Air conditioner Window type, study of different components, their functions & specifications. Calculating Relative Humidity by using sling psychometric. Check air circulation	Introduction to Air conditioning window type , 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.
11	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. Role of each part. Window A. C its constructional details, comparison with window air conditioner advantages & Disadvantages. Air cooled condensers : Constructional details & selection.
13	Study & testing of thermostatic relay, capacitors, OLP, blower motor. Inspecting & testing condenser & evaporator coil. Checking of electrical wiring by CSR method. PSC circuits in Split type A.C.	Study of mechanical & electrical components of Split type A. C. Role of each part. Split type A. C its constructional details, comparison with window air conditioner advantages & Disadvantages. Air cooled condensers : Constructional details & selection.
14	Evacuating & gas charging of an Air conditioner. Performance Testing for Air Velocity, grill & condenser temperature & smooth running of fan motor. Study the faults, Causes and their remedy	Principles of pipe sizing & study of services valves for charging at site. Principle of working of infra red remote control, study of electronic circuits.
15	Testing all weather air conditioners. Trouble shooting electrical & mechanical faults. VRV Sytem, VRFSYSTEM FROST FREE REFRIGERATOR (DOUBLE AND THREE DOOR ) Study the construction and working, testing methods, trouble shooting, timer function, defrost heater, PTC Relay Function etc..	Testing all weather air conditioners. Trouble shooting electrical & mechanical faults. VRV Sytem, VRFSYSTEM FROST FREE REFRIGERATOR (Double and Three door) Identify faults, rectify defects, installation method, study wiring circuit , evacuation, leak testing & gas charging and installation.
16-17	Installation of Window A/C, Normal Split A/C Cutomer orientation service report preparation, Dealing with customer Installation of Duct able A/C, Cassette A/C	Proper Installation procedure of Window A/C, Normal Split A/C Cutomer orientation service report preparation, Dealing with customer Proper Installation procedure of Duct able A/C, Cassette A/C
18-19	A) Insulation and Energy conservation Checking- and servicing visi cooler, deep freezer, Preventive maintenance and Trouble Shooting Retrofitting with Hydrocarbons and HFC 134a	Types of insulation U-Value EER calculation as star rated calculation Checking and servicing Preventive maintenance and Trouble Shooting. Retrofitting with Hydrocarbons and HFC134a

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

	a)Watercoolerconstruction(Installationand storage) b)fitting refrigeration cycle, electrical circuit, working and control, soldering of copper tubeswith stainless steel, Trouble shooting ofcommonly faced problem like condenser FanFailure, corrosion etc Study the construction and its working. Care and maintenance, installation method.	a) Water storage, distribution and drainage b)Refrigeration system using R-22 and components in lieu of R-12, Retrofitting with HFC-134a & HCs c) Electrical and control system working and control, soldering of copper tubeswith stainless steel, Trouble shooting ofcommonly faced problem like condenser FanFailure, corrosion etc.
20-21	Chest type bottle coolers, Deep Freezers and visi coolers Description, Construction and function substituting R-22 with R-134a or Hydrocarbon (Montreal protocol)	Deep Freezers description, Construction and function, Low temperature thermostat, different type of deep freezer construction. Substituting R-22 with R-134a or Hydrocarbon (Montreal protocol)
22-23	Industrial Visit	
24	Revision	
	TEST Theoretical & Practical	

**ACHIVEMENT:- After complete the session able to know about Repair of.**

1. Direct cool Refrigerator Frost free ,Multi flow Refrigerator.
2. Installation, Servicing of A/C's.
3. Circuit diagram of A/C's,Refrigerator's,.
4. Performance testing of A/C's,Refrigerator's .

Semester:-IIIrd

Week no	Practical	Theory
<b>1</b>	<b>CAR AIR CONDITIONING</b> Identifying various components, electrical circuits, testing components, fault detection, leak testing, evacuation, gas charging, Installation, trouble shooting, testing magnetic clutch, regular maintenance, compressor overhauling, condenser de scaling, add refrigerant.	<b>CAR AIR CONDITIONING</b> Study various components, electrical circuits, testing components, fault detection, leak testing, evacuation, gas charging, Installation, trouble shooting, Magnetic clutch operation, free wheeling
<b>2</b>	<b>MOBILE Refrigeration</b> Repair and maintenance of Mobile refrigeration system, servicing, testing magnetic clutch operation, compressor overhauling, leak testing, evacuation, gas charging, oil charging. Testing	<b>MOBILE Refrigeration</b> Study the refrigeration cycle in MobileRefrigeration, its Construction, w Magnetic clutch operation, freewheeling. Planning for Preventive



UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

	wiring system. Studying / Execution of Repair and Preventive maintenance of different MOBILE Refrigeration units at site	maintenance and scheduling of maintenance activities MOBILE Refrigeration
<b>3</b>	<b>PACKAGE A.C</b> Identifying various components, electrical circuits, testing components, fault detection, leak testing, evacuation, gas charging, Installation, Trouble shooting.	<b>PACKAGE A.C</b> Study Package AC, types, construction and working principle, trouble shooting, various applications. Duct system, AHU,. Care and maintenance, installation method, application, capacity calculation.
<b>4</b>	<b>SPLIT PACKAGE</b> Identifying various components, electrical circuits, testing components ,fault detection, leak testing, evacuation, gas charging, Installation, Trouble shooting. Controls used in Packaged AC systems, trouble shooting.	<b>SPLIT PACKAGE</b> Construction and working principle, types, trouble shooting Controls used in AC system, Electromechanical, pneumatic and electronic.
<b>5</b>	Ice Candy Plant, refrigeration circuit, electricalcircuit, working and control, Preventivemaintenance and Trouble Shooting (Better to visit establishment for maintenance part) Repairing & maintenance of Condensing unit water cooled unit including water circulation system Cleaning including De-Scaling	Ice Candy Plant, Refrigerant used, Brine agitator, Expansion Device; used, Electrical Motor Controls etc. Repairing of Repairing & maintenance of Condensing unit water cooled unit including water circulation system
<b>6</b>	<b>COLD STORAGE</b> Identify parts, Controls & accessories Specification, Servicing of Cold storage plant. involving Electrical controls, cooling system, components & controls, add oil, add refrigerant, test leak, evacuation, gas charging, plant operation.	<b>COLD STORAGE</b> Study of cold storage plant, parts, Construction, applications, controls & electrical diagram used in cold storage plant. Food preservation spoiling agents- controlling of spoiling agents, preservation by refrigeration system, maintaining temperature in different places. Types of cold storage and its details.
<b>7</b>	Installing compressor. Use of vibration eliminator and shock absorber, electrical wiring of the compressor and checking the wiring system of the plant.	Cold storage- type construction, capacity and specification. Method of installing compressor vibration eliminator and shock absorber there type and application. Study the lay out and electric wiring of the storage plant .Mobile refrigeration in transport vehicles.
<b>8</b>	Cold storage pressure testing, evacuation, charging & performance& efficiency testing of the unit. Cold storage plant operation and its	Method of pressure testing, evacuation & charging to the system and testing efficiency. Cold storage

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

	maintenance.	plant operation, its common trouble & remedies. Deep freezing, freezing tunnel, blast freezer its function and working, its application.
<b>9</b>	<b>INDIRECT/CHILLER SYSTEM</b> Identifying various components, electrical circuits, testing components, fault detection, leak testing, evacuation, gas charging, Installation, Trouble shooting..	<b>INDIRECT/CHILLER SYSTEM</b> Understanding central station AHU and FCU, <b>Air washers</b> used in chilled water system, understanding lay out, modulating valves for temperature control. Expansion tanks
<b>11</b>	Chilled water piping and insulation. Servicing of FCU and water controls valves. Mixing dampers, bypass dampers checking.	Study of Humidification & De-humidification. And Humidifier's & De-humidifier's.
<b>12</b>	Servicing and trouble shooting of direct, indirect A.C Plant, erection of commercial type condensing unit, vibration eliminator, water proofing insulation. Repairing & maintenance of Shell & tube type Condenser & Evaporator	Construction and study of commercial A.C plant, package chiller, screw chiller, reciprocating chiller. Proper Repairing & maintenance of Shell & tube type Condenser & Evaporator
<b>15</b>		
<b>13-18</b>	Heat ventilation & Air condition, Duct designing 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.	Heat ventilation & Air condition, Duct designing 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.
<b>19&amp;20</b>	Booting The Computer, Opening Windows Menus, using the mouse, refresh computer desktop using right click of the mouse, create a directory in XP and Linux, format a floppy, create a file using notepad, save the file in Floppy, copy the file into hard disk, copy a file from hard disk to floppy, create a directory in floppy, create a directory in hard disk, use my documents, use start menu for opening an application, to open a document recently written, change control panel settings for	Introduction To Computer Fundamentals And Its Parts, Familiarizing With Disk Drives, Booting Of A Computer System, Using The Mouse, Right Click, Left Click And Use Of Operating Systems Like Windows XP, Linux, Menu System, Tool Bars, File Structures, Directories, Moving And Copying A File From Floppy To Hard Disk, Hard Disk To Floppy Disk, Creating

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

	<p>display, change the volume name of the hard disks using system properties.,Familiarize with Keyboard and Keys.Techniques of Changing desktop wall paper,changing Desktop Screen properties, ControlPanel, User Accounts, customizing icons, writing a sample text using Notepad, Using Paint for drawing figures to get accustomed with mouse. Saving a file. Using Windows Explorer, Install a software, Remove a Software, Add new hardware to the system (like a Printer, Change the system date and Time, Date Format, Using Start Menu, Creating Desktop Short Cuts Open internet explorer, Open MS WORD, Create a new file, Save a file, open an existing file, Save as a text file, type a paragraph, Set for left and right margins, change the letters from upper to lower case, vice versa, cut a paragraph, copy a paragraph, setup tab positions, set hanging indents, draw a simple table, insert rows, insert columns, erase rows, erase columns, search the document for spelling corrections, print the letter in a printer attached, in portrait and landscape. Open Excel, and work out the following to understand the theory commands: Prepare a salary bill for ABC organization with Column A for names, column B for Basic Salary, Column C for DA, Column D for addition of B &amp; C to get the full salary. Add the Column D into a new cell as TOTAL amount.</p>	<p>Directories. Formatting Floppy Disk. Use of desktop , control panel settings, Explorer, regional settings, creating shortcuts, Use of Simple applications like Paint, Notepad, Study of Internet Explorer, Modem, Settings in the IE and Modem, Dial Up and Broadband connections, Outlook Express, Viewing Email from the web site and Outlook Express, Creating email Accounts, using search engines, Video conferencing, MS Chat</p>
<p><b>21</b></p>	<p>change the settings in IE, customize Internet Explorer for default applications, change these security settings, setup an internet connection, user ID and password saving in the computer for future usage, setup outlook express for an e-mail account, receive and send emails from the account. Search using Yahoo and Google for certain topics, download a file from the internet, save the downloaded file.</p>	<p>Creating sample documents using MS WORD. Text wrapping, Text Formatting, Changing Letters to different case, drawing table, Mail Merging, Page formatting, Using different Font Types, Printing a document. Using Excel as spread Sheet, Familiarizing with Cells, Formulae, Text, Numbers, and date, Using shortcuts for entering date and Numbers in Progressive cells, Copying Formulae, Text and Numbers, Using borders, Merging Cells, Changing Cell width, Row height, Printing an area of the sheet, Options of Printing like fit to paper, shrinking, etc, Using different Sheets in a work book, changing Colour of cells, fonts, text</p>

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

<b>22-23</b>	Industrial Vsit
<b>24</b>	Revision
<b>25</b>	Theory & Practical Test

**ACHIVEMENT:-** After complete the session able to know about knowledge of.

1. **Mobile A/Conditioner & Refrigeration**
2. **Installation, Servicing of Ice candy plant.**
3. **Installation, Servicing of chiller,&cold store.**
4. **Computer application**

**SEMESTER:-IV**

Week No	PRACTICAL	THEORY
1	<b>COMMERCIAL COMPRESSOR:-</b> Dismantling of Commercial type reciprocating compressor, centrifugal compressor, checking of components & accessories. Checking & servicing valve plate and piston assembly, lapping valve plate etc. Preparing gasket, check belt tension and replacing.	<b>COMMERCIAL COMPRESSOR:-</b> Types, Construction & applications of Open type compressor and working,  Performance of reciprocating compressor volumetric efficiency, Capacity control, factor influencing volumetric efficiency.
2	Checking lubricating system, servicing oil pump, Checking and servicing of capacity control of the compressor	Selection of lubricant, Function and characteristic of lubricant, types of lubrication methods such as splash, forced feed.
3	<b>PSYCHROMETRY:-</b> .Find DBT, WBT,RH & other properties by using psychometric chart. Use of psychometer.	Central Air Conditioning fundamentals, requirements of comfort A.C, study of psychometric terms, DBT, WBT, RH, enthalpy, dew point, and specific humidity. Comfort air conditioning.
4	Use of Anemometers for measuring Air flow, use of monometers, measuring air flow, pivot tube for air flow measurement.	Types of Central air conditioning (Direct and indirect system)Construction, working, components, faults, care and maintenance,
5	Servicing of Fans & blowers, motors,	Description of blowers& fans, function and types,

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

	used in Air conditioning system.	static and velocity pressure measurements.
6	<b>DUCT:-</b> Installation of ducts, construction of ducts, understanding Duct lay out drawings, selection of ducts, insulation in ducts. Longitudinal and transverse joints. <b>AIR FILTERS:-</b> Servicing and maintenance of different filters, Installation of filter	<b>DUCT:-</b> Function, types, materials, duct designing, duct insulation, air distribution methods, air flow, AHU, fan, blower. <b>AIR FILTERS:-</b> Function of air filters, types, construction, maintenance, effect of choked Air filter.
7	<b>DIRECT EX.SYSTEM</b> Identifying various components, electrical circuits, testing components, fault detection, leak testing, evacuation, gas charging, Installation, Trouble shooting. Operation & Maintenance of Central AC plant.	<b>DIRECT EX.SYSTEM</b> Understanding Direct expansion system. Operation & Preventive Maintenance Schedule of central AC plant.
8&9	<b>CENTRALISED/INDUSTRIAL AIRCONDITIONING.</b> Identifying various components, electrical circuits, testing components, fault detection, leak testing, evacuation, gas charging, Trouble shooting. Installing compressor and other components, electrical wiring in central AC and .Checking HVAC	<b>CENTRALISED/INDUSTRIAL AIRCONDITIONING.</b> Construction and working principle, types, maintenance of Industrial Air-conditioning plant. Humidification and dehumidification methods. Introduction to heat load calculation in AC building. Sensible & latent heat load. Basic of HVAC and its applications
10	Use of dry & wet bulb thermometer, sling psychrometer Using psychrometric chart to plot processes. Rough checking of the performance of A.C. equipment	Fundamental of Central AC Plant Comfort Air conditioning – Comfort Air-conditioning conditions. Psychrometrics Dry and wet bulb. Dew point temperature. Introduction to psychrometric charts.
11	Use of Anemometers of measuring Air-flow Use of inclined tube manometer for measuring Air pressure, pivot tube for air-flow measurement.	Various types of central A.C. heat pumps like All air, All water, Air water and unitary AC assessing air- flow requirements and distribution.
12	Routine maintenance, overhauling preventive maintenance of large AC plants, Maintenance, log book and record keeping	Planning for preventive maintenance and scheduling of Maintenance activities in large AC and Refrigeration plants.
13	Duct material and standard, reading and understanding duct layout drawings sheet metal duct work. Longitudinal and transverse joints	Duct systems – Principle of locating outlets, ducts and equipment. Basic of duct sizing. Duct Designing and duct arrangement.
14	Service & maintenance of various types	Basic of Indoor air quality particles, vapours and

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

	of Air filters. Noise control and isolation of piping, ducting, AHU Room and apply of acoustic material	gases. Types of filters- pe-filter flat and V type, pleated type, Electrostatic, HEPA, Electronics filters acoustic materials.
15	Installing compressor and other system component, verifying airflow and distribution. Operation of electrical and mechanic components	Introduction to load calculation in A.C. building. Sensible and latent heat, cooling load calculation.
16	Pull and verify deep vacuum. Perform leak checks and make repairs. Check system operation whilst following all safety procedures.	Method of leak detection, evacuation, charging gas, testing system.
17	Operation of A.C.plant. check for system leaks and check and clean heat exchanger. Check out sample for acidity, check superheat	System service and problem analysis. a) Proper temperature and pressures at various location. b) Thermostat settings c) Noises d) Electrical measurements e) Methods of measuring superheat and sub cooling f) Effects of overcharge and undercharge
18	Dismantling of commercial type reciprocating compressor	Performance of reciprocating compressor Volumetric efficiency
19	Checking and servicing valve plat and piston assembly tapping	Commercial type Reciprocating compressor their type Construction and application. Installation of Ducts/AHUs.
20	Checking servicing bearing, shaft seal cutting gasket and assemble of compressor testing efficiency	Multi stage compressor, their function, centrifugal compressor, construction and function refrigerant used.
21	Servicing of cooling tower –its care and maintenance installation Servicing of water softening and removing paint its care and maintenance Routine maintenance, overhauling preventive maintenance of large AC plants, Maintenance, log book and record keeping	Cooling tower – its principle, type capacity construction and disadvantage of different types of cooling towers. Selection of site efficiency. Wet bulb temp and cooling tower approach, range, drift loss etc. Water conditioning scale and deposit control corrosion and its control Planning for preventive maintenance and scheduling of Maintenance activities in large AC and Refrigeration plants
22-23	Industrial visit	
24	Revision	
25	Theoretical & Practical test	

**ACHIVEMENT:- After complete the session able to Servicing & Repairing of A/Condition Plant.**

1. Repair of open type compressor
2. Installation, Servicing of A/C plant .

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

3. Installation, Servicing of AHU.
4. Performance checking of A/C Plant

For all the Module Of Refrigeration & Air Conditioning Individual set is required

Sr.No.	Description	Quantity
1	Instructor chair and table	1 no.
2	Dual Desk	10 nos.
3	Suitable work table with 4 vice	1 no.
4	Suitable work table	1 no.
5	Stools	20 nos.
6.	Tool cabinet	2 nos.
7	Trainee's lockers	2 nos.
8.	First Aid Box	1 no.
9.	Book shelf (glass panel)	1 no.
10.	Storage rack	2 nos.

**Trade: Mechanic( Refrigeration and Air-Conditioning)**

**LIST OF TOOLS & EQUIPMENT**

**A. TRAINEES TOOL KIT FOR 20 TRAINEES**

SL.NO	Name of tools	Broad specifications	Quantity
1.	File flat rough double cut	200mm	20 nos.
2.	File, half round, fine double cut,	length 150mm	20 nos.
3.	File, round, fine double cut	length 150mm	20 nos.
4.	File flat, fine double cut,	length 150mm	20 nos.
5.	File square, fine double cut,	length 150mm	20nos.
6.	File triangular fine double cut	length 150mm	20nos.
7.	Scriber	150mm length	20nos.
8.	Centre punch	length 100mm	20nos.
9.	Try square	150 mm	20nos.
10.	Divider spring joint	length 150mm	20nos.
11.	Caliper spring joint in side	length 150mm	20 nos.
12.	Caliper, odd leg, spring joint	length 150mm	20 nos.
13.	Hammer ball pain	220 gms	20nos.
14.	Cold Chisel flat and cross cut	length 150mm	20 nos.
15.	Engineers rule	300mm long	20 nos.
16.	Tape measuring	10m graduation in mm	20nos.
17.	Pliers combination insulated	length 200mm	20 nos.
18.	Pliers long nose	200 mm	20 nos.
19.	Pliers flat nose	150mm	20 nos.

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

20.	Line tester	500 v heavy duty	20 nos.
21.	End cutting nipper	15cm	20 nos.
22.	Tweezers	10 cm	20 nos.
23.	Gloves for welding[Treated as consumable]		20 nos
24.	Leather Apron [Treated as consumable]		20 nos.
25.	Surface plate	45 x45 cms	1no.
26.	Oil can	500 ml	5 nos.
27.	Surface Gauge universal	150 mm	5 nos.
28.	Bench vice	300mm jaw	10 nos.
29.	Hack saw tubular metal frame adjustable	300mm	10 nos.
30.	Snip sheet metal straight nose	200 mm	10 nos.
31.	Snip sheet metal curved nose	200 mm	10 nos.
32.	Anvil	100X200mm	1no.
33.	Stakes [ different Types]	100mm	1 no each
34.	Tin smith	400mm	1 No.
35.	Wooden mallet /Nylon mallet	500 gm good finish	5 Nos.
36.	Round Punch	3mm,4mm,6mm	5 Nos. each
37.	Grover set	4mm forming	1 set
38.	Electrical drill portable drill with chuck and key,	capacity 6.4mm	5 nos.
39.	Tape measuring graduation in mm	2 m	5nos.
40.	Screw driver, plastic handle,	6mm TIP length 100mm to 150mm	6nos.
41.	Screw driver, plastic handle, Flat tip	10mm TIP length 200mm & 250mm	6 nos. each
42.	Philips screw driver –	complete set in leather case	5 nos.
43.	Screw driver, plastic handle, Flat tip	handle 3mm TIP length 100mm to 150mm insulated	5 nos.
44.	Soldering iron exchangeable copper tip	65 watts	10 nos.
45.	Knife folded stainless steel –	150mm	10 nos.
46.	Tong tester (clamp on multi meter)	0-10-30 amps 0-500 v	5 nos.
47.	Voltmeter, AC/DC portable precision grade Digital Panel board type	0 to 500 volt	5nos.
48.	Ammeter, AC/DC portable precision grade Digital Panel board type	belt 0 to 5 amp	5nos.
49.	Ammeter, AC/DC portable precision grade Digital Panel board type	0 to 30 amp	5nos.



UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

50.	Megger	1000v	5nos.
51.	Wattmeter multi-range up to	1 KW	1no.
52.	Multi meter digital type		5nos.
53.	Tenon saw	250 mm	5nos.
54.	Firmer chisel	6,12,25mm	2 nos.
55.	Rawal plug tool	6 mm	2 nos.
56.	K.W. meter	0 -1 K w	4 no.
57.	Fire extinguisher	ABC dry powder type2 kg capacity	1 no.
58.	Fire buckets	10 Litre	1 no.
59.	D.E spanner	6-32 mm	5 set
60.	Ring spanner	6 -32 mm	5 set
61.	Diagonal cutter	15 cm	5 nos.
62.	Service Oscillator		1 no.
63.	C.R.O Single beam	5 MHZ	2 nos.
64.	C.R.O Dual trace/ Double beam	60 MHZ	2 nos.
65.	A.F.O Oscillators		2 nos.
66.	Tong, Close mouth and pick up		1 no.
67.	Welding table for gas/Arc	1200x760	1each
68.	Flaring tool set, single type for tube.	4.7mm to 16mm O.D	5 nos.
69.	Swaging tool, punch type, set of size for tube.	4.7mm to 16mm O.D	5sets
70.	Swaging tool, screw type with adaptor set of size for tube	4.7mm to 16mm O.D.	5sets
71.	Bending spring external type, for copper tube	3mm to 16mm DIA	5sets
72.	Pipe cutter miniature for copper tube	3mm to 16mm DIA	5sets
73.	Pinch of tool, for copper tube,	6mm to 18mm DIA	5sets
74.	Ratchet spanner of	6.4 sq.mm reversible	5sets
75.	Capillary plug gauge		5sets
76.	Pinch of pliers/crimping pliers tool	6mm - 18mm DIA	5sets
77.	Piercing pliers & reversing valve with access fitting	6-18mm	5sets
78.	Spanner double ended	4.7mm to 16mm	5sets
79.	Ring spanner off set	4.7mm to 16mm	5sets
80.	Wrench adjustable	length 150mm	5sets
81.	Wrench adjustable	length 200mm	5sets
82.	Wrench adjustable	length 250mm	5sets
83.	Valve key handle[Treated as consumable]	- 4.7mm & 6.4mm sq.	5sets
84.	Pressure gauge Digital type	diameter 63mm with recalibration set	5sets
85.	Compound gauge,	diameter 63mm, with	5sets

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

	Digital type	recalibration set screw, scale vacuum 76mm. Pressure 15 Kg/sq.cm	
86.	Service man thermometer in metal case	- 30 C to +30 C	5sets
87.	Scissor, gasket cutting stainless steel	length 25mm	5sets
88.	L-Allen key	set size 1.5mm to 6.4mm	5 sets
89.	T-Allen key set	size 5/32" to 1/8"	5sets
90.	Pipe cutter with built in reamer and space cutter, for copper tube	3mm to 32mm	5nos.
91.	Pipe /Tube bender lever type	3-16 mm	1 no each
92.	Spanner double ended	19mm to 31.8 mm	5nos.
93.	Pipe wrench	size 50mm to 150mm	5nos.
94.	Electronic leak detector for HFC,HC,R-22		5nos.
95.	Sling psychro meter mounted on aluminum back,	scale 50 C to +50 C	5nos.
96.	Lapping plate	250mm x 200mm	2nos.
97.	Hammer ball peen	450 gms	5nos.
98.	Puller 3 legged with flexible arm	300mm	5nos.
99.	Hand blower portable complete	1/10 HP	2nos.
100.	Spirit level precision metallic	200mm	2nos.
101.	Stop watch		2nos.
102.	Tap set with matching drills	3 mm to 16mm	3nos.
103.	Tap set with matching drills	¼" to 5/8"	3nos.
104.	Refrigerant cylinder	2.5 Kg	3nos.
105.	Vernier caliper	length 250mm	2nos.
106.	Micrometer outside measurement	0 to 25mm	2nos.
107.	Heating kit with infrared bulb	(200 w capacity)	2nos.
108.	Plumbing hammer weight	200 gm	2nos.
109.	Multi meter analogue type		5nos.
110.	Tachometer digital, multi range	0 r m p to 3000 r m p. Portable small size in leather case	2nos.
111.	Micron vacuum gauge	capable of reading up to 20 microns	2nos.
112.	Sensor thermometer (digital)	-50 degree Celsius to 150 degree Celsius	2nos.
113.	Fin straightened/fin comb.	With strong steel wire based combing on wood	3nos.
114.	Filler gauge	0.05 mm – 1 mm	3nos.
115.	Wire gauge metric and with worth	Steel plate embossing converse of British & Metric	2nos.

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

116.	Dial thermometer remote control, armored capillary dial	75mm – 50C to +50 C	3nos.
117.	Anemometer Digital type		1no.
118.	Compressors testers for small hermetic compressors	Fixed with electrical input/ output indicating facilities	2nos.
119.	Electrical accessories [Treated as consumable]	current and potential relays, start & run capacitors, PTCs overload protectors', relays contactors	As required
120.	Engineers square	150mm with 5' tolerance	5nos.
121.	Digital thermometer [Treated as consumable]	Graduated disc analogy type	1no.
122.	Temperature & Humidity recorder	Capacity to record 24 hrs record	1no.
123.	Electronic leak detector Digital type	Capable to detect of R134a, HC, R-22	2nos.
124.	Instrumentation screw driver set	100mm	5nos.
125.	Digital weighing machine	20 kg capacity Accuracy 1 gm	1no.
126.	Recycling unit		1 no.
127.	Quick couplers/Self sealing coupler [Treated as consumable]	1/4 - 3/8"	2 pairs for each
128.	Schrader valve [Treated as consumable]		1 each
129.	Cylinder 134 a	5 kg	1 no.
130.	Recovery Cylinder-R-22	10 Kg Capacity	2 Nos
131.	Recovery & recycling machine	Suitable for R-22	1 No
132.	Gas charging Station suitable for- 22 along with 10 kg capacity digital weighing balance L.C 1 Gm	Vacuum pump High efficiency Blanking 50 Micron	1 No

***B. General Machinery Shop Outfit***

Sl. No	Name of Equipment	Broad specifications	Quantity
1.	Split phase induction motor	¼ hp, 230 V	1 no.
2.	Capacitor start induction motor	½ Hp, 230 V	1 no.
3.	AC 3 Phase motor, 400/50 Hz	2 Hp	1 no.
4.	Star delta starter	2 hp	1 no.
5.	Auto Transformer starter	3 hp	1 no.
6.	D.O.L Starter	2 hp	1 no.
7.	Portable air – LPC brazing kit	2 kg. LPC cylinder, torches, houses, stand	1 no.

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

		make	
8.	Oxy-acetylene welding set complete	cylinders, regulators welding torches with difference nozzles	1 no.
9.	Refrigerator	165L carrying with HFC-134a, & HC	2 Each
10.	Frost free refrigerator	200L carrying with HC blend	2 nos.
11.	Three/four door refrigerator	300L carrying with HC R-600a	2 nos.
12.	Bench Drilling machine	20 mm capacity, 200-2500rpm	1 no.
13.	Grinding Machine	200mm, 3000rpm, Double ended 1/2 hp	1 no.
14.	<p>Evacuating and refrigerant charging station, consist of</p> <p>a) Rotary two stage vacuum pump and motor (with gas ballast and anti such back)</p> <p>b) manifold with gauges and valves and capable of pulling vacuum up to 50 microns of Hg and with provision of connecting to a microns level vacuum gauge</p> <p>b) Graduated charging cylinder with provision for temperature correction and all necessary isolating valves</p> <p>II) Evacuating and charging station as above but fitted with weighing scale</p>	<p>(CAP. 2 kg. In lieu of (b) above and with accuracy of +/- 1 g for charging hydrocarbons)</p>	<p>1 no.</p> <p>1 no.</p>
15.	Two stage rotary vacuum pump	capacity approx. 60 – 100rmp capable of evacuating to 50 microns of Hg and fitted with gas ballast, anti such back valve and single phase motor	1 no.
16.	Air compressor,	two stage for oil – less dry air, with rush proof tank assembly, heater and controls max. pr. 10	1 no.

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

		kgs /sq.m Capacity 45 ltr. Motor 1 hp.	
17.	Reciprocating compressor	provision of capacity control etc. for demonstration. Capacity 9000Kcal/hr. semi hermetic open type.	1 no.
18.	Dry N2 in cylinder	2 stage regular or commercial N 2 in cylinder with drier unit and 2 stage regular 7meter cube	1 no.
19.	Window A.C	1 Ton with R-22 or HFC Blend reciprocating compressor	2 nos.
20.	Split A.C	1.5 Ton with R134a or R-22 reciprocating compressor	2 nos.
21.	Duct able split A.C 1.5 ton	1.5 Ton with R134a or R-22 reciprocating compressor	1 no.
22.	Recovery unit with cylinders	CFC & 134 a	1 each
23.	Heat pump	3000 Kcal/hr	1 no.
24.	Cassette Air conditioner	4500 kcal/hr with R-404 .	1 no.
25.	De scaling pump set	with stainless steel impeller and housing complete with motor 1/2 hp and accessories	1 no.
26.	Small capacity shell and tube condenser	5 Ton with Cu tubing only	1 no.
27.	Fan coil unit	with water valves (2 & 3 way)	1 no.
28.	Shell and tube, DX chillers (small)	5 Ton with Cu tubing only	1 no.
29.	Circulating water pump (small)	0.5 H.P with stainless steel tank capacity 20 liters with in let/ outlet provision.	1 no.
30.	Shell and tube type condenser	5 Ton	1 no.
31.	Rotary hermetic compressor	2 Ton	1 no.
32.	Screw compressor	5Ton	1 no.
33.	scroll compressor	1Ton	1
34.	Bottle cooler visible	200 L carrying with HFC-134a& reciprocating compressor	1 no.

UPGRADATION OF ITI'S INTO CENTRE OF EXCELLENCE  
(C.O.E)  
MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

35.	Deep freezer	200 L carrying with HFC-134a& reciprocating compressor	1 no.
36.	Water cooler storage type	200 L carrying with HFC-134a& reciprocating compressor	1 no.
37.	Ice candy plant	2 ton with capacity to make 32 ice candy at a time with Forma tray, stainless steel tank on trolley	1 no.
38.	Walk in cooler	3 Ton cap. with open type compressor, water cooled condenser, providing with PUF insulated room sealed proof size 8X8X10Ft maintain 0 - 5 degree centigrade.	1 no.
39.	Air-conditioning, direct and indirect water chiller.	Complete with all controls including humidity control capacity 15000Kcal/hr	1 no.
40.	Package A/C	7.5 ton capacity, Water cooled type with open type compressor reciprocating type	1 no.
41.	Car A.C components(full kit) a) Wobble plate compressor with mounting brackets. b) Serpentine Evaporator c) Parallel Flow Condenser d) Hoses, tubes, Receiver, Ex. valve. e) Electrical components & wiring Harness		1 Set
42.	CAR AC tutorial model		1 set

**WORKSHOP FURNITURE**

SL.	Name of Furniture	Broad specifications	Quantity
1.	Class room table	One table for each trainee size of 2.5 provisions with open rack. Frame square conduit of 1". top ½" sun mica ply board	10 nos.
2.	Work bench	2000 x 1000 x 700 mm with 2" pipe frame. Top with teak slab and fixing with ¾" good quality rubber sheet.	6 nos.
3.	Almirah	195 x 90 x 48 cm outer sheet 20 SWG inner partition with four selves of 22 Swg	4 nos.
4.	Lockers	195 x 90 x 48 set six locker in one structure	2 nos.
5.	Glass board portable	2.5' X 4' with stand	2 nos.
6.	Instructor table	4' X 2' X 2.5' with steel tubular frame & sun mica top	1 no.
7.	Instructor chair	Standard revolving with wheel	1 no.
8.	Computer table	Standard with drawers & self to accommodate UPS & CPU	1 no.
9.	Computer chair	Revolving type metal based & metal wheel standard one	1 no.
10.	White board	4' X 3' ferrous base sheet to hold magnetic duster with white finish surface.	1 no.
11.	Chart stand	6' X 3' providing with hanging clip top & bottom plate	1 no.
12.	Computer latest version with printer	Ddr-3 -1333Mega Hz, GB -6, hard disc - 1 terabyte, processor-I5	1 no.

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		second generation, laser get ,LED monitor 32"	
13.	LCD PROJECTOR / LED / LCD TV	Big Size	1 no.
14.	Laptop	Latest version	1 no.
15.	UPS	650 VA	1 sets
16.	Stool		As required
17.	Book Self with glass panel		1 No.
18.	Storage rack		As required
19.	Storage shelf		As required