

UPGRADATION OF ITIS INTO CENTRE OF EXCELLENCE (C.O.E)

GROUP/SECTOR:- REFRIGERATION & AIR CONDITIONING

ADVANCED MODULE IN REFRIGERATION & AIR CONDITIONING

S.No.	ADVANCE MODULE
1.	Domestic, Commercial Refrigeration & Air Conditioning .
2.	Central Air Conditioning Plant, Industrial Cooling and Package A.C .
3.	Cold Storage, Ice-plant and Ice-Candy Plant

Upgradation of ITIs into Centres of Excellence-
Broad guidelines for implementation of Advanced Module of Sector
“Refrigeration & Air Conditioning”.

These Centres will be providing multiskill training to meet the skill requirement of particular sector of industry with their active involvement in all aspects of training. The training will be provided in three parts as given below:

- ◆ Training in Basic skill areas for a period of one year.
- ◆ Training in Advanced modules of six months duration after Broad based basic Training(BBBT)
- ◆ Testing & Certification both for the Broad Based Basic Training & Advanced Module Training during subsequent six months will be conducted under the aegis of NCVT .
- ◆ Training in specialized modules mainly by the industry (The course curricula, duration etc will be designed in consultations with the IMC/local industry). The trade testing & certification for specialized module will be done jointly by the State Government & Industry. Said certificate will have recognition from NCVT
- ◆ As per the recommendations of the EFC, Training in the shop floor should constitute atleast 25-40% of the curriculum.

The training programme will have multi-entry and multi-exit provisions as given below:

- trainee can opt to go to the labour market after completing broad based basic training of one year duration or after completing advanced module/s.
- multi-entry and multi-exit provisions would enable a trainee to take admission for advanced/ additional advanced /specialized module as per his/her need .

Guidelines for Training in Advanced modules

- › A minimum of three modules would be essentially needed , so as to ensure that all the 96 trainees are accommodated in the three modules may be selected in consultation with IMC for which in two shifts .
- › If it is felt that available modules for which the course curricula has been developed at National Level are not sufficient to cater to the needs of local industry in a particular state, States are free to select module as per need in consultation with industry . They may develop suitable module(s) accordingly in consultations with the industry clearly indicating tool & equipment list , instructor qualifications , space norms etc. & forward the same to DGE&T for seeking approval of NCVT.
- › A trainee at a time can opt only for one Advanced Module .
- › Admission Criteria, Space requirement, Qualification of instructor of the various modules of “**Refrigeration & Air Conditioning**” sector are attached herewith.

Admission to Advanced Module for the graduates of ITI in related trades:

There is a provision for lateral entry for graduates of ITIs (NTC /NAC passed out from conventional system) of the related trades subject to availability of seats in Advanced Module. Trades of conventional system mentioned against each advanced module in the enclosed statement, could be offered admission in Advanced Module .

MODULE NO.	NAME OF THE MODULE	Admission criteria	Space requirement	Duration In Weeks	Qualification/Status Of Instructor
RACAT-01	Domestic , Commercial Refrigeration & Air Conditioning	Completed BBT in R&AC OR NTC/NAC R&AC OR Diploma in Mechanical Engineering	80 sq m	24 weeks	Degree in Refrigeration/Mechanical Engineering with minimum three years teaching/industrial experience in the relevant field OR Diploma in Refrigeration/Mechanical Engineering with min five years teaching/industrial experience in the relevant field
RACAT-02	Central Air Conditioning Plant, Industrial Cooling & Package A.C.	Completed BBT in R&AC OR NTC/NAC R&AC OR Diploma in Mechanical Engineering			
RACAT-03	Cold Storage, Ice Plant & Ice-Candy Plant	Completed BBT in R&AC OR NTC/NAC R&AC OR Diploma in Mechanical Engineering			

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

Advance Module in Domestic, Commercial Refrigeration and Air Conditioning
Duration : 6 Weeks

Week	Practical	Theory
1	<p>Dismantling & Assembling of compressor</p> <p>Servicing of compressor parts, checking components</p> <p>Checking pumping and repairing Gasket Cutting</p> <p>Checking Lubricating system</p> <p>Oil Charging in Hermetic compressor</p> <p>Lapping of compressor parts</p>	<p>Safety aspect of workshop/welding brazing/Electrical/refrigeration safety cascade systems, types & application</p> <p>Vortex tube-Principle and Application</p> <p>Cryogenic refrigeration – range of temperature, application</p> <p>Thermo electric refrigeration – Principle, application and design.</p> <p>Difference in common and various refrigerants, types of compressor</p> <p>Hermetic or sealed their function, construction and application etc.</p> <p>Method of Lubrication</p> <p>Splash</p> <p>Properties of Lubricating Oil and Importance of oil cooling system in hermetic compressor</p>
2	<p>Servicing/flushing of condenser</p> <p>Importance of keeping condenser clean</p> <p>Remove and Replacement of Drier/filter</p> <p>Remove and replace capillary Tube</p> <p>Servicing/flushing of evaporator</p> <p>Leak Testing and repairing of evaporator .</p>	<p>Definition, function, constant, application of condenser</p> <p>Role and operation of condenser</p> <p>Condenser, types of condenser</p> <p>Air cooled condenser</p> <p>Desuperheating and sub cooling in condenser</p> <p>Study of different types of Driers/filters etc</p> <p>Use of Desiccants in drier, their properties</p> <p>Capillary Tube and their sizes</p> <p>Advantages and disadvantages</p> <p>Types of evaporator, their construction</p> <p>Function and application</p> <p>Plate and tube type</p> <p>Plate type</p> <p>Find and tube type etc.</p>

		Role of Accumulator Importance of superheat
3	<p>Handling and taking care of refrigerant cylinders Transfer of refrigerant from storage to service cylinder Refrigerant cylinders identification of Refrigerant safety in handling of Refrigerants</p> <p>Safe handling of Refrigerant cylinders & values Testing of Relay, capacitors & O.L.Ps Testing & Adjusting of Thermostat</p>	<p>Definition, Types & Application of refrigerants Properties of an ideal Refrigerant and effects F22, R-134a, H.C.(blend) & HCs etc. Refrigerant cylinders and their colour codes Refrigerant-Historical development till today Physical and chemical properties and environmental hazards of CFCs & HFCs Montreal Protocol and India's CFC/HCFC phase out schedule. Ozone Rules –2000 substitute Refrigerant in lieu of CFC and their properties and comparison with CFC and HFCs & HCs. Component changes flammability etc. Relay, capacitors, O.L.P etc., Solenoid valve, condenser and evaporator fan motors Their types, construction, function and application Thermostat & their types, function, construction and application etc.</p>
4	<p>Accessing sealed system using piercing plier and valves/use recovery machine to recover CFC/HCF/HFCs: Basic tests for equality of recovered component needing change. Clean/flush with dry N₂ chemicals Trichloroethylene, safety in handling, safety in handling N₂ cylinder with 2 stage regulator, Replacement of component and brazing and sealing system, Leak testing with dry N₂ Pressure Test.</p> <p>Evacuation using 2 stages Rotary vacuum pump. Use of Micron level vacuum gauge to ensure proper vacuum level charging</p>	<p>Need for elimination of refrigerant, through recovery/recycling, Good Brazed joints, proper leak testing before charging refrigerant. Importance of evacuation of Moisture and Non-condensable. Gases from a refrigeration system and the need for Rotary 2 stage Vacuum pumps to reach the needed vacuum levels. Understanding of units used to define vacuum levels.</p> <p>Effects of the pressure on system before charging refrigerant. Do's & Don't's of refrigeration systems.</p>
5	<p>(a) Retrofitting of a CFC filled commercial and Domestic Refrigerator with Hydrocarbons/HFCs using sealed components in (b) Repair/Service of HC Refrigeration</p>	<p>Changes in components & practices while retrofitting CFC Appliances with HC and HFC a) HCs</p>

	<p>system using correct technique and ensuring safety, Direct cooled Domestic refrigerator stripping</p> <p>Direct cooled Refrigerator & Cleaning/Inspection/Testing of components in the</p>	<p>b) HFCs</p> <p>Study construction of Refrigerator and Components like door, gasket, PUF etc. electrical component and Cost of retrofits</p> <p>Good serving practices.</p>
6	<p>Fault finding of Direct cooled Refrigerator, Rectification of faults etc.</p> <p>Frost free refrigerator – Stripping of components, tracing electric circuit, thermostat, Bi-metallic, Defrost heater, Timer, Air-ducting, fan motor, Air purifiers</p>	<p>Fault & Remedy of Direct cooled Refrigerator.</p> <p>Types of defrosting methods of refrigerator.</p> <p>Study, construction of frost. Frost free (2 or 3 door)</p> <p>Refrigerator parts</p> <p>Thermal insulation material – their types and properties.</p>
7.	<p>Trouble shooting, common problems in Refrigerators like</p> <ul style="list-style-type: none"> a) No cooling b) Poor cooling c) High Current d) Electrical leak <p>Various observations of pressure, temperature, current and noise etc.</p> <p>Study of water cooler construction & water filters cleaning (instant & storage)</p> <p>Water circuit, electrical circuit working and controls</p> <p>Leak test, evacuation & Gas charging</p> <p>Making test jigs for fault finding</p>	<p>Theory behind the causes of problem and Analytical approach to trouble shooting need for right Instruments & tools</p> <ul style="list-style-type: none"> a) Explanation of water storage, distribution and drainage b) Electrical component testing c) Insulation material d) Study construction, function and water purifier <p>Properties of a healthy refrigeration system</p>
8.	<p>Trouble shooting of commonly faced problem of water cooler like condenser fan failures Study of Bottle cooler, construction Electrical circuit</p> <p>Leak Test, Evacuation & Gas charging</p> <p>Making of test board</p>	<p>Fault & Remedy of water cooler</p> <p>Types of Bottle cooler and Blood protector</p> <p>Construction, function and application of bottle cooler</p> <p>Electrical components</p> <p>Refrigerated container</p>
9.	<p>Trouble shooting of commonly faced problem of Bottle Cooler like condenser fan, failures, corrosion etc.</p> <p>Repair & maintenance of deep freezer, visicooler, electrical circuit</p> <p>Leak Testing, Vacuuming & Gas charging of Deep freezer, Visicooler</p> <p>Trouble shooting of commonly faced problem of Deep freezer and visicooler</p>	<p>Fault and Remedy of bottle cooler</p> <p>Description, function and cont. of Deep freezer, visicooler</p> <p>Fault & Remedy of Deep freezer and visicooler various ISO & IS study of refrigeration/AC etc.</p>

10.	Retrofitting of Refrigerator with HFC 134a Retrofitting of water cooler, Deep cooler, visicooler & Limits on charge of HCs.`	Bureau of Indian Standard (BIS) test for water cooler/Bottle cooler/deep freezer, refrigerator Steps needed during retrofitting component changes, performance variations with Retrofitting and cost of retrofit.
11.	Repairing of refrigerator cabinet & spray painting Electrical components testing, leak repairing, leak testing, vacuuming and gas charging of ice cuber.	Method of spray painting and application elements of powder coating and exterior surfaces, ice cuber, constructing, function, application, hot gas by pass defrosting. Study & types of plastics etc.
12.	Electrical components testing, leak repairing, leak testing, vacuuming & gas charging of juice dispenser	Juice dispenser, construction, function, application
13.	Measuring of dry bulb & wet bulb temperature, using of sling psychrometer study and use of psychrometric chart. Stripping , Cleaning, Inspection Testing of components like outer wrapper, Grills, Blower motor, condenser fan, portion, eva & Cond. Venture , sweep mechanism , Rotary switch & thermostat , electrical components like capacitors , PTCs electrical wiring , check of earth & continuity reassemble & test	Fundamental of A.C. Comfort conditioning, psychrometric properties and processes, Air cleaning and Air filters, effect of dust on health, selection of air filters, odour removal. Study of Split Acs , Window AC & condensing unit, Principles of pipe sizing & study of service valves for charging at sites. Function of window & Split A.C. Role of each component ,principle of working. Evaporative cooling of condenser & Air cooler condenser & its capacity.
14.	Servicing and repairing of Air-coolers/desert cooler Stripping of Room and condensing unit Identifying and cleaning, Inspection Testing of components & re-assembly Split AC	Air cooler, Desert cooler, construction, function and application etc. Study of split and Room AC.S and condensing unit. Thermal insulation materials-properties, factors affecting thermal capacity, heat transfer through insulation used for air-conditioning, economical thickness of heat insulation, importance of R.H.for the selection of insulation, Refrigeration pipe line insulation, compressor lubricating oil and its properties.
15.	Operation of tangential blower sweep and	Working principle of inframed remote

	swing mechanism, electrical and electronics component and testing, including special function like Autocool , sleep dry etc. wiring and pining room and condensing unit. Servicing and trouble shooting of split AC	control and understanding electrical & electronics circuitry. Condensate removal from rwm units need for trap. Construction & study of split AC.
16.	Window A.C installation, inspection, testing Electrical components testing, wiring diagrams	Installation, inspection, testing method of window AC. Information about electrical components of window AC e.g. relay capacitor, selector of switch, OLP Thermostats sweep mechanism etc.,.
17	Servicing of window AC Leak Test, Vacuuming, Gas charging of window AC Trouble shooting, also use of correct instruments and tools	Method of servicing care and safety, handling of window AC Leak testing, vacuuming and gas charging procedure. Testing pressure and temp. fault and remedy of window AC
18	Split AC installation, inspection, testing Electrical components, testing, wiring diagrams	Installation, inspection, testing method of split AC Information about electrical components of split AC
19	Servicing of Split AC Leak Test, Vacuuming, Gas charging of split A.C. Safety aspect	Method of servicing care and safety, Handling of split A.C. Procedure of leak testing, vacuuming, Gas charging and safety aspect.
20.	Trouble shooting, also use of correct instruments & Tools Servicing of blower, fan motors and cooling coils	Testing pressure and temp. fault and remedy of split A.C. Types of fan, blowers and description Construction and function, cooling load calculation.
21.	Dismantling and assembling of wobble plate comp. Used in Auto A.C. compressor Car/Auto AC:- Mounting Brackets on Engine blocks and compressor on Brackets and adjustment of belt tension. Types of “O” Ring compression pipe joints and flared joints in after market systems. Hot water systems and missing valves for Temperature control.	Wobble plate comp. used in Auto A.C. understanding the working of Lubrication System Shaft seal in compressor. Compressor Lubrication Oil and their properties. Study of Refrigeration systems in Auto AC and Air flow and direction control in evaporator. How performance varies with compressor/engine speed. Difference in R-12 & R-134a system temperature control.
22.	Operation of electromagnetic clutches on compressors. Air flow and direction	Temperature control in the cab Electrical/Electronic wiring diagram

	control. Protection through HP-LP switches receivers, fast idle control devices vacuum tracing of wiring based on diagrams, identification and function of key components like thermostat electrically operated valves, fuses connectors, HP/LP switches compressor clutch, alternator/battery	Theory behind the problems listed under trouble shooting and analytical approach. Vehicle/Automobile A/C. Function and construction etc.
23.	Repairing Evacuation and charging of Auto A.C. systems. Trouble shooting of common a) No cooling b) Poor cooling c) Reduced air supply d) Engine overheating e) High compressor noise Repairing, evacuation, Gas charging of Oil Charging etc.	Theory behind the problems listed under trouble shooting and analytical approach. Procedure of gas charging of Car/Auto A.C.
24.	Retrofitting of CFC car A.C. system with HFC 134a & HC Industrial visits	Steps need during retrofitting component charges Performance variations after retrofit cost of retrofit. Railway A/C. Marine A/C and Air Craft A/C, construction, operation and fault & remedies.

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Advance Module in Domestic, Commercial Refrigeration & Air Conditioning

LIST OF TOOL'S EQUIPMENT

Sr.No.	Names of the tools and equipments	Quantity
	Tool's Trainee Kit & Shop Out Fit	
1.	Flaring tool set, single type for tube 4.7mm to 16mm O.D.	5 sets
2.	Swaging tool, punch type, set of size for tube 4.7mm to 16mm O.D.	5 sets
3.	Swaging tool, screw type with adaptor set of size for tube 4.7mm to 16mm O.D.	5 sets
4.	Bending spring external type, for copper tube 3mm to 16mm DIA	5 sets
5.	Pipe cutter miniature for copper tube 3mm to 16mm DIA	5 Nos.
6.	Pinch of tool, for copper tube, 6mm to 18mm DIA	5 nos.
7.	Ratchet spanner of 6.4 sq.mm reversible	5 Nos.
8.	Capillary plague gauge	5 set
9.	Pinch of plier/crimping plier tool 6mm – 18mm DIA	5 Nos.
10.	Picreing plier 6-18mm & revercing vlave with access fitting	5 Nos. each
11.	Spanner double ended 4.7mm to 16mm	5 sets
12.	Ring spanner off set 4.7mm to 16mm	5 sets
13.	Wrench adjustable length 150mm	5 nos.
14.	Wrench adjustable length 200mm	5 nos.
15.	Wrench adjustable length 250mm	5 nos.
16.	Valve key handle – 4.7mm & 6.4mm sq.	5 sets
17.	Pressure guage diameter 63mm with recalibration set	5 nos.
18.	Compound gauge, diameter 63mm, with recalibration set screw, scale vacuum 76mm. Pressure 15 Kg/sq.cm	5 nos.
19.	Service man thermometer in metal case – 30 C to +30 C	5 nos.
20.	Scissor, gasket cutting stainless steel, length 25mm	5 nos.
21.	L-Allen key set size 1.5mm to 6.4mm	5 sets
22.	T-Allen key set size 5/32” to 1/8”	5 sets
23.	Screw driver, plastic handle, 6mm TIP length 100mm to 150mm	5 each
24.	Screw driver, plastic handle, 10mm TIP length 200mm to 250mm	5 each
25.	Philips screw driver – complete set in leather case	5 sets
26.	Screw driver, plastic handle 3mm TIP length 100mm to 150mm insulated	5 set
27.	Pliers combination insulated length 200mm	5 nos.
28.	Pliers long nose 200 mm	5 nos.
29.	Pliers flat nose 150mm	5 nos.

30.	Hammer ball pein 220 gms	5 nos.
31.	Hammer nylon 300 gms	5 nos.
32.	Tape measuring 2 m graduation in mm	5 nos.
33.	Chisel flat length 150mm	5 nos.
34.	Hack saw tubular metal frame adjustable	5 nos.
35.	Soldering iron exchangeable copper tip 65 watts	5 nos.
36.	Knife folded stainless steel – 150mm	5 nos.
37.	Line tester 500 v heavy duty	5 nos.
38.	Pipe cutter with built in reamer and space cutter, for copper tube 3mm to 32mm	5 nos.
39.	Spanner double ended 19mm to 31.8 mm	5 sets
40.	Ring spanner off set 19mm to 31.8mm	5 sets
41.	Box spanner size 6.4mm to 10mm	5 sets
42.	Pipe wrench size 50mm to 150mm	5 nos. each
43.	Torque wrench 300mm 12.7mm square drive right drive right and left hand	2 set
44.	Socket set, reversible ratchet, 12.7mm square drive with extension 4.7mm to 31.2mm	2 sets
45.	Socket set, reversible ratchet, ½ ” mm square drive with extension 3/16” to ¼” BSW & SR	2 sets
46.	Gas leak detector for halogen gas	2 nos.
47.	Sling phycrometer mounted on aluminium back, scale 50 C to +50 C	5 nos.
48.	Lapping plate 250mm x 200mm	5 nos.
49.	Punch hole for cutting gasket, 4.7mm to 16mm DIA	5 nos.
50.	Hammer ball pein 450 gms	5 nos.
51.	Engineers rule 300mm long	5 nos.
52.	Tape measuring 10m graduation in mm	2 nos.
53.	Oil can pressure type – 1 litre	2 nos.
54.	File flat medium double cut length 200mm	2 nos.
55.	Scriber 150mm length	5 nos.
56.	Divider spring joint length 150mm	5 nos.
57.	File, half rounq medium double cut, length 200mm	5 nos.
58.	Caliper spring joint in side length 150mm	5 nos.
59.	Caliper, odd leg, spring joint length 150mm	5 nos.
60.	Centre punch length 100mm	5 nos.
61.	Pipe being tool, lever type with degree indicator, for tube O.D 6.4mm to 16mm	2 nos.
62.	File, half round, fine double cut, length 150mm	5 nos.
63.	File, round, fine double cut, length 150mm	2 nos.
64.	Puller 3 legged, with flexible arm 120mm	5 nos.
65.	File flat, fine double cut, length 150mm	5 nos.
66.	File square, fine double cut, length 150mm	5 nos.
67.	Snipper sheet metal straight nose 200 mm	5 nos.
68.	Bench vice 75mm jaw	5 nos.

69.	Electrical drill portable drill with chuck and key, capacity 6.4mm	2 nos.
70.	Tong tester 0-10-30 amps 0-500 v (clamp on multimeter)	5 nos.
71.	Blow lamp capacity ½ liter	2 nos.
72.	Voltmeter, AC/DC portable precision gread teak wood case leather belt 0 to 500 volt	5 nos.
73.	Ammeter, AC/DC portable precision gread teak wood case leather belt 0 to 5 amp	5 nos.
74.	Blow lamp capacity 1 liter	2 nos.
75.	Ammeter, AC/DC portable precision gread teak wood case leather belt 0 to 30 amp	5 nos.
76.	Megger – 1000v	2 nos.
77.	Puller 3 legged with flexible arm 300mm	1 no.
78.	Hand blower portable complete 1/10 HP	2 nos.
79.	Spirit level precision metallic 200mm	2 nos.
80.	Wattmeter multi-range up to 1 KW	2 nos.
81.	Multimeter digital type	5 nos.
82.	Stop watch	1 set
83.	Tap set with matching drills 3 mm to 16mm	1 set
84.	Tap set with matching drills ¼’’ to 5/8’’	1 set
85.	Tap & die set ¼’’ to 5/8’’ SAE size	1 set
86.	Refrigerant cylinder 2.5 Kg	4 nos.
87.	Tape and die set 3mm to 16mm size	1 set
88.	Vernier caliper length 250mm	1 no.
89.	Micrometer outside measurement 0 to 25mm	1 no.
90.	Bench vice 120mm jaw	1 no
91.	Heating kit with infra red bulb (200 w capacity)	
92.	Variac input 230v output 400v Amp. Portable complete with metet & controls	1 no.
93.	Multimeter analog type	2 nos.
94.	Work bench1000m x 600mm x 800mm High	4 nos.
95.	Almirahs 195cms x 90cm x 49 cm	2 nos.
96.	Technometer digital, multirange 0 rmp to 3000 rmp. Portable small size in leather case	2 nos.
97.	Micron vacuum gauge capable of reading upto 20 microns	4 nos.
98.	Transistor tester	5 nos.
99.	R.L.C bridge	5 nos.
100.	Sensor thermometer (digital)	5 nos.
101	Fin straightener/fin comb.	5 nos.
102	Filter gauge 0.05 mm – 1 mm	5 nos.
103	Hc refrigerant in cylinders/disposable containers	5 nos.
104	134 A refrigerant in cylinders	2 nos.
105	Wire gauge metric and whitworth	2 sets
106	Refrigerant cylinder 30 Kg	2 nos.
107	Dial thermometer remote control, armoured capillary dial 75mm – 50C to +50 C	2 nos.

108	Anemometer (Vane type)	2 nos.
109	Trichloroethylene bottle	2 nos.
110	Scaper triangular blade removable 60mm	2 nos.
111	Two way manifold with gauges	2 nos.
112	Pressure testing tank with lighting arrangement, pressure gauge (0 to 35Kg/sq.m.) double stage	1 no.
113	Filters driers for cfc – 12 & hfc – 134 A for repairs – retrofits	8 nos.
114	Sealed ex – proof components for use in hs appliances – thermostate, sealed lop’s solid state PTC’s door switches, lamp holders, evaporator fan motor, Bi metallic, Defrost Heater, Timer etc.	5 nos. each
115	Ball valves service valves, hand shut of valves of ¼’’ to 7/8’’	5 nos.
116	Evaporator of direct cooled refrigerator with capillary heat exchanger	1 no.
117	Evaporator of frost free refrigerator	1 no.
118	Fire extinguisher power type	2 nos.
119	Digital type clamp meter	4 nos.
120	Four way manifold with gauges	4 nos.
121	Schrader valve core removal tool	4 nos.
122	Acid test kit	1 no.
123	Silver and copper brazing alloy rods for ¼’’ to 7/8’’ tubes – Cu tocu, cu to steel, cu to brass and appropriate fluxes	5 sets
124	Pilot tube and inclined tube manometer	2 nos.
125	Quick couplers, process tube adaptors for ¼’’ to 3/8’’	5 nos.
126	Compressors testers for small hermetic compressors	2 nos.
127	Electrical accessories -: current and potential relays, start & run capacitors, PTCs overload protectors, relays contactors	5 nos. each
128	D.B. meter	2 nos.
	MACHINERY	
129	Spray outfit, ‘V’ twin motor ½ hp. Delivery upto 120 litre free air pressure upto 3 Kgs/sq. cm. With spray gun and fitting	2 nos.
130	Refrigerator, compression type 300 litres double compressor system	2 nos.
131	Refrigerator 170 lit. using 134a refrigerant	2 nos.
132	No frost refrigerator 300 litre capacity using HC refrigerant	2 nos.
133	Frost free refrigerator 230 litre capacity using HFCs 134a refrigerant	2 nos.
134	Deep frizer 165 litres – 18 C ¼ hp	2 nos.
135	Bottle cooler 110 litres 1/6 hp	2 nos.
136	Water cooler instantaneous type	2 nos.
137	Water cooler storage type	5 nos.
138	Two stage rotary vacuum pump capacity approx. 60 – 10rpm capable of evacuating to 50 microns of Hg and fitted with gas ballast, anti such back valve and single phase motor	1 no
139	Dry N ₂ in cylinder with 2 stage regular or commercial N ₂ in cylinder with drier unit and 2 stage regular	1 no.
140	Air compressor, two stage for oil – less dry air, with rush proof tank	1 no.

	assembly, heater and controls max. pr. 10 kgs/sq.m Capacity 45 ltr. Motor 1 hp.	
141	Window air conditioning capacity 4500 Kcal/Hr	2 nos.
142	Window air conditioning capacity 4500Kcal/hr (with remote control)	2 nos.
143	Split type AC 4500Kcal/hr. with indoor unit and outdoor units and electronics remote control	2 nos.
144	Hermetic compressors 1/8hp to 1/2hp for use in repair work of appliances for CFCs and HFCs Hermetic compressor for 134a	2 nos.
145	Recovery unit one ach for cfc and 134a refrigerants with recovering cylinders	2 nos.
146	Reverse cycle AC/Heat pump 3000 kcal/hr.or 4500kcal/hr	1 no
147	Visi cooler 250ltrs	2 nos.
148	Portable air – LPC brazing kit with 2 kg. LPC cylinder, torches, houses, stand make A) with straight flame B) with eyelone/swirl jet flame	2 nos.
149	Oxy-acetylene welding set complete with cylinders, regulators welding torches with difference nozzles	1 no
150	Recycling unit (optional)	2 nos.
151	Ice cuber	2 nos.
152	Juice dispenser	2 nos.
153	Thermoelectric refrigerator	2 nos.
154	Components for car AC systems A) Wobble plate compressor with mounting brackets B) Serpentine evaporator C) Parallel flow condenser D) Hoses, tubes, receiver expansion valve E) Electrical components and wiring harmless	2 nos. each
155	Vertex tube	2 nos.
156	Hermetic compressors 1.5 (AC)	2 nos.
157	Window A/C 1.5 ton with remote control	5 nos.
158	Air cooler/Desert cooler	4 nos.
159	See through model of direct cooled refrigerator	1 no
160	See through model of frost free refrigerator	1 no
161	Evacuating and refrigerant charging station, compression a) Rotary two stage vacuum pump and motor (with gas ballast and anti such back) manifold with gauges and valves and capable of pulling vacuum upto 50 microns of Hg and with provision of connecting to a microns level vacuum gauge b) Graduated charging cylinder with provision for temperature correction and all necessary isolating valves II) Evacuating and charging station as above but fitted with weighing scale (upto 2 kg. In lieu of (b) above and with accuracy of +/-1 g for charging hydrocarbons)	2 nos. 2 nos.
162	Working model of vapour absorption system	1 no.
163	Cut section of Hermetic reciprocating compressor	1 no.

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Advance Module in Domestic, Commercial Refrigeration & Air Conditioning
Other requirements

Sr.No.	Description	Quantity
1	Instructor chair and table	1 no.
2	Dual Desk	8 nos.
3	Suitable work table with 4 vice	1 no.
4	Suitable work table	1 no.
5	Stools	17 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.

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**Module-II Advance Module in Central Air conditioning plant,
Industrial cooling package A.C.**

Week	Practical	Theory
1	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.
2	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.
3	Servicing & trouble shooting of package A.C.	Construction and study of package A.C. system. Role of each component, Principle of working of condenser and cooling Tower, servicing.
4	Operation of package A.C. check for system leaks and leak repairs	Method of leak detection, evacuation, charging gas, testing system
5	Electrical wiring of the compressor and check in the wiring system of package A.C. Checking & testing of H.P/L.O/O.P/cut out, solenoid valve, thermostat etc.	Study layout and electrical wiring of package A.C. study of electrical components. Electrical motor starting devices and safety devices. Function, construction of H.P/L.P/O.P thermostat and solenoid valve and anti freeze thermostat, humidistat, humidifier and dehumidifier
6	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.
7	Service & maintenance of various types of Air filters. Noise control and isolation of piping, ducting, AHU Room and apply of acoustic material	Basic of Indoor air quality particles, vapours and gases. Types of filters- pe-filter flat and V type, pleated type, Electrostatic, HEPA, Electronics filters acoustic materials.
8	Chilled water piping and insulation, Servicing	Understanding central Station, AHUs

	of focus and water control valves. Mixing dampers face and by pass dampers.	and FCUs using chilled water, understanding chilled water layout and modulating valves for temperature control, expansion tanks.
9	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.
10	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.
11	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
12	Dismantling of commercial type reciprocating compressor	Performance of reciprocating compressor Volumetric efficiency
13	Checking and servicing valve plat and piston assembly tapping	Commercial type Reciprocating compressor their type Construction and application. Installation of Ducts/AHUs.
14	Checking lubricating system, servicing of oil pump	Compressor lubrication, types of lubrication splash and force-feed
15	Checking & Servicing capacity control of compressor fitting and testing	Compressor capacity control different method
16	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.
17	Servicing of water cooler condenser and receiver checking leakage	Condenser and its types, capacity of water cooled condenser, selection of condenser
18	Servicing of evaporative condenser checking and repairing and testing	Evaporative condenser-their function construction and application
19	Servicing of cooling tower –its care and maintenance installation	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.
20	Servicing of water softening and removing paint its care and maintenance	Water conditioning scale and deposit control corrosion and its control
21	Servicing of water circulating pumps dismantling and reassembly Testing and adjusting of expansion devices	Principal of working of a water pump. Causes of commonly faced problems, refrigerants control devices their types functions, construction and application etc.
22	Servicing of water/brine chillers Servicing of suction-liquid heat exchangers	Water/Brine chiller, types of Brines used as secondary refrigerants, properties of secondary refrigerants. Suction liquid Heat Exchangers their function construction application and advantages
23	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.
24	Industrial visit	Industrial visit.

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

**Advance Module in Central Air Conditioning Plant, Industrial cooling and package
A.C.**

LIST OF TOOL'S & EQUIPMENT

Sr.No.	Names of the tools and equipments	Quantity
	Tool's Trainee Kit & Shop Out Fit	
1.	Flaring tool set, single type for tube 4.7mm to 16mm O.D.	5 sets
2.	Swaging tool, punch type, set of size for tube 4.7mm to 16mm O.D.	5 sets
3.	Swaging tool, screw type with adaptor set of size for tube 4.7mm to 16mm O.D.	5 sets
4.	Bending spring external type, for copper tube 3mm to 16mm DIA	5 sets
5.	Pipe cutter miniature for copper tube 3mm to 16mm DIA	5 Nos.
6.	Pinch of tool, for copper tube, 6mm to 18mm DIA	5 nos.
7.	Ratchet spanner of 6.4 sq.mm reversible	5 Nos.
8.	Capillary plague gauge	5 set
9.	Pinch of plier/crimping plier tool 6mm – 18mm DIA	5 Nos.
10.	Picreing plier 6-18mm & revercing vlave with access fitting	5 Nos. each
11.	Spanner double ended 4.7mm to 16mm	5 sets
12.	Ring spanner off set 4.7mm to 16mm	5 sets
13.	Wrench adjustable length 150mm	5 nos.
14.	Wrench adjustable length 200mm	5 nos.
15.	Wrench adjustable length 250mm	5 nos.
16.	Valve key handle – 4.7mm & 6.4mm sq.	5 sets
17.	Pressure guage diameter 63mm with recalibration set	5 nos.
18.	Compound gauge, diameter 63mm, with recalibration set screw, scale vacuum 76mm. Pressure 15 Kg/sq.cm	5 nos.
19.	Service man thermometer in metal case – 30 C to +30 C	5 nos.
20.	Scissor, gasket cutting stainless steel, length 25mm	5 nos.
21.	L-Allen key set size 1.5mm to 6.4mm	5 sets
22.	T-Allen key set size 5/32” to 1/8”	5 sets
23.	Screw driver, plastic handle, 6mm TIP length 100mm to 150mm	5 each
24.	Screw driver, plastic handle, 10mm TIP length 200mm to 250mm	5 each
25.	Philips screw driver – complete set in leather case	5 sets
26.	Screw driver, plastic handle 3mm TIP length 100mm to 150mm insulated	5 set
27.	Pliers combination insulated length 200mm	5 nos.
28.	Pliers long nose 200 mm	5 nos.
29.	Pliers flat nose 150mm	5 nos.

30.	Hammer ball pein 220 gms	5 nos.
31.	Hammer nylon 300 gms	5 nos.
32.	Tape measuring 2 m graduation in mm	5 nos.
33.	Chisel flat length 150mm	5 nos.
34.	Hack saw tubular metal frame adjustable	5 nos.
35.	Soldering iron exchangeable copper tip 65 watts	5 nos.
36.	Knife folded stainless steel – 150mm	5 nos.
37.	Line tester 500 v heavy duty	5 nos.
38.	Pipe cutter with built in reamer and space cutter, for copper tube 3mm to 32mm	5 nos.
39.	Spanner double ended 19mm to 31.8 mm	5 sets
40.	Ring spanner off set 19mm to 31.8mm	5 sets
41.	Box spanner size 6.4mm to 10mm	5 sets
42.	Pipe wrench size 50mm to 150mm	5 nos. each
43.	Torque wrench 300mm 12.7mm square drive right drive right and left hand	2 set
44.	Socket set, reversible ratchet, 12.7mm square drive with extension 4.7mm to 31.2mm	2 sets
45.	Socket set, reversible ratchet, ½ ” mm square drive with extension 3/16” to ¼” BSW & SR	2 sets
46.	Gas leak detector for halogen gas	2 nos.
47.	Sling phycrometer mounted on aluminium back, scale 50 C to +50 C	5 nos.
48.	Lapping plate 250mm x 200mm	5 nos.
49.	Punch hole for cutting gasket, 4.7mm to 16mm DIA	5 nos.
50.	Hammer ball pein 450 gms	5 nos.
51.	Engineers rule 300mm long	5 nos.
52.	Tape measuring 10m graduation in mm	2 nos.
53.	Oil can pressure type – 1 litre	2 nos.
54.	File flat medium double cut length 200mm	2 nos.
55.	Scriber 150mm length	5 nos.
56.	Divider spring joint length 150mm	5 nos.
57.	File, half rounq medium double cut, length 200mm	5 nos.
58.	Caliper spring joint in side length 150mm	5 nos.
59.	Caliper, odd leg, spring joint length 150mm	5 nos.
60.	Centre punch length 100mm	5 nos.
61.	Pipe being tool, lever type with degree indicator, for tube O.D 6.4mm to 16mm	2 nos.
62.	File, half round, fine double cut, length 150mm	5 nos.
63.	File, round, fine double cut, length 150mm	2 nos.
64.	Puller 3 legged, with flexible arm 120mm	5 nos.
65.	File flat, fine double cut, length 150mm	5 nos.
66.	File square, fine double cut, length 150mm	5 nos.
67.	Snipper sheet metal straight nose 200 mm	5 nos.
68.	Bench vice 75mm jaw	5 nos.

69.	Electrical drill portable drill with chuck and key, capacity 6.4mm	2 nos.
70.	Tong tester 0-10-30 amps 0-500 v (clamp on multimeter)	5 nos.
71.	Blow lamp capacity ½ liter	2 nos.
72.	Voltmeter, AC/DC portable precision gread teak wood case leather belt 0 to 500 volt	5 nos.
73.	Ammeter, AC/DC portable precision gread teak wood case leather belt 0 to 5 amp	5 nos.
74.	Blow lamp capacity 1 liter	2 nos.
75.	Ammeter, AC/DC portable precision gread teak wood case leather belt 0 to 30 amp	5 nos.
76.	Megger – 1000v	2 nos.
77.	Puller 3 legged with flexible arm 300mm	1 no.
78.	Hand blower portable complete 1/10 HP	2 nos.
79.	Spirit level precision metallic 200mm	2 nos.
80.	Wattmeter multi-range up to 1 KW	2 nos.
81.	Multimeter digital type	5 nos.
82.	Stop watch	1 set
83.	Tap set with matching drills 3 mm to 16mm	1 set
84.	Tap set with matching drills ¼’’ to 5/8’’	1 set
85.	Tap & die set ¼’’ to 5/8’’ SAE size	1 set
86.	Refrigerant cylinder 2.5 Kg	4 nos.
87.	Tape and die set 3mm to 16mm size	1 set
88.	Vernier caliper length 250mm	1 no.
89.	Micrometer outside measurement 0 to 25mm	1 no.
90.	Bench vice 120mm jaw	1 no
91.	Heating kit with infra red bulb (200 w capacity)	
92.	Variac input 230v output 400v Amp. Portable complete with metet & controls	1 no.
93.	Multimeter analog type	2 nos.
94.	Work bench 1000m x 600mm x 800mm High	4 nos.
95.	Almirahs 195cms x 90cm x 49 cm	2 nos.
96.	Technometer digital, multirange 0 rmp to 3000 rmp. Portable small size in leather case	2 nos.
97.	Micron vacuum gauge capable of reading upto 20 microns	4 nos.
98.	Transistor tester	5 nos.
99.	R.L.C bridge	5 nos.
100.	Sensor thermometer (digital)	5 nos.
101.	Fin straightener/fin comb.	5 nos.
102.	Filter gauge 0.05 mm – 1 mm	5 nos.
103.	134 A refrigerant in cylinders	2 nos.
104.	Wire gauge metric and whitworth	2 sets
105.	Refrigerant cylinder 30 Kg	2 nos.
106.	Dial thermometer remote control, armoured capillary dial 75mm – 50C to +50 C	2 nos.
107.	Anemometer (Vane type)	2 nos.

	A) with straight flame B) with eyelone/swirl jet flame	
131	Oxy-acetylene welding set complete with cylinders, regulators welding torches with difference nozzles	1 no.
132	Dry N ₂ in cylinder with 2 stage regular or commercial N 2 in cylinder with drier unit and 2 stage regular	1 no.
133	Small capacity shell and tube condenser	1 no.
134	Fan coil unit with water valves (2 & 3 way)	1 no.
135	Shell and tube, DX chillers (small)	1 no.
136	Circulating water pump (small)	1 no.
137	Package A/C 3 ton capacity, Air cooled type	1 no.
138.	Package A/C 7.5 ton capacity, Water cooled type	1 no.
139	Hermatic compressor 3 ton capacity	1 no.
140.	Cut Section of Shell and tube type condenser	1 no.
141	Cut Section of Chiller	1 no.
142	Cut Section of Rotary hermatic compressor	1 no.
143	Cut Section of Screw compressor	1 no.
144	Cut section of scroll compressor	1 no.

UPGRADATION OF ITI'S INTO
CENTRE OF EXCELLENCE (C.O.E)
NAME OF SECTOR – REFRIGERATION & AIR CONDITIONING

MODULAR TRAINING IN REFRIGERATION AND AIR CONDITIONING

**Advance Module in Central Air Conditioning plant, Industrial cooling and package
A.C.**

Other requirements

Sr.No.	Description	Quantity
1	Instructor chair and table	1 no.
2	Dual Desk	8 nos.
3	Suitable work table with 4 vice	1no.
4	Suitable work table	1 no.
5	Stools	17 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.

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

Advance Module in Cold Storage, Ice-plant and Ice-candy plant

Week	Practical	Theory
1	Servicing of cold-store cooling system. Control and Instrument, Operating of cold storage plant	Food preservation, Processing, Methods of food preservation, spoilage of food types food transportation and cold-storage – type, construction, capacity and application and Specification, Product load calculation, types of load etc.
2	Dismantling of commercial type reciprocating compressor, checking component parts.	Performance of reciprocating compressor, Volumetric efficiency, factor influencing volumetric efficiency.
3	Checking, servicing valve plate and piston assembling, lapping valve plate etc. Fitting and testing	Commercial type reciprocating compressor-their type construction and application
4	Compressor capacity control lubrication system	Method of compressor capacity control & compressor load and unload mechanism. Lubrication – types characteristics of lubricant.
5	Servicing of water cooled condenser and descaling of condenser Oil separator Non Return Valve Vibration eliminator & shock absorber	Condenser – its types & capacity Oil separator Non Return Valve Vibration eliminator & shock absorber
6	Servicing of cooling tower. Its care and maintenance	Cooling Tower – its principle, type, construction, and function, capacity and disadvantage. Tower approach, range etc.
7	Servicing of water circulating pump	Principle of working of water pump, types, construction and function
8	Water piping using G.I. steel pipes, Hard copper tubing	Introduction of standard, fittings valves etc. used in chilled water, condenser water and drain lines.
9	Test and adjust of refrigerant control devices and safety devices	Types construction, function and application of refrigerant control devices and safety devices.
10	Servicing of extended surface forced Air-evaporators study of servicing of defrost system	Types of cooling coil, plates and tube force air DX evaporators. Types of defrosting methods use in cold storage

		system.
11	Servicing of water brine chillers, brine tank	Water brine chillers, Types of brines used as secondary refrigerants.
12	Servicing of sub-liquid Heat Exchangers	Sub liquid Heat Exchanger, their function, construction application and advantages.
13	Servicing of electrical controls in cold storage	Study of controls and electrical wiring diagrams, motor starting devices.
14	Electrical wiring of compressor and checking the wiring system of plant	Study of layout and electric, wiring diagrams, motor starting devices.
15	Pressure testing leak Test evacuation, Gas charging Ammonia and R-22	Method of pressure testing, leak detection and evacuation and gas charging NH ₃ , R-12 properties, safety rules of NH ₃
16	Cold storage plant operation its care and safety	Cold storage plant operation, frozen food, commercial cabinets Its common trouble and remedies, thermal – types, properties
17	Ice plant, trouble shooting servicing testing	Ice-plant, their types, function and application, Principle of Ice plant, different types of Ice manufacturing
18-19	Repair and maintenance of Ice-candy Plant leak Test, evacuation and Gas charging	Ice-candy maintenance and trouble diagnosis and remedies Use of different controls – Agitator and fan motors (FAM) and secondary refrigerants.
20	Retrofitting Ice-Candy plant with alternate non CFC Refrigerant	Choice of economic alternative. If HFC 134a all steps needed to changing components to be carefully followed. Frozen food transport , safety aspects.
21	Pump down of cold storage system and ice plant system	Pump down procedure of cold storage and ice plant system
22	Servicing of electric control of ice –plant	Study of controls and electric wiring
23	Routine maintenance, overhauling, preventive maintenance of large. Cold storage and ice plants. Maintenance, log book and record keeping.	Planning for preventive maintenance and scheduling of Maintenance activities in large AC and Refrigeration plants.
24	Industrial visit	Industrial visit.

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

Advance Module in Cold Storage, Ice plant and Ice-candy plant

LIST OF TOOL'S & EQUIPMENT

Sr.No.	Names of the tools and equipments	Quantity
	Tool's Trainee Kit & Shop Out Fit	
1.	Flaring tool set, single type for tube 4.7mm to 16mm O.D.	5 sets
2.	Swaging tool, punch type, set of size for tube 4.7mm to 16mm O.D.	5 sets
3.	Swaging tool, screw type with adaptor set of size for tube 4.7mm to 16mm O.D.	5 sets
4.	Bending spring external type, for copper tube 3mm to 16mm DIA	5 sets
5.	Pipe cutter miniature for copper tube 3mm to 16mm DIA	5 Nos.
6.	Pinch of tool, for copper tube, 6mm to 18mm DIA	5 nos.
7.	Ratchet spanner of 6.4 sq.mm reversible	5 Nos.
8.	Capillary plague gauge	5 set
9.	Pinch of plier/crimping plier tool 6mm – 18mm DIA	5 Nos.
10.	Picreing plier 6-18mm & revercing vlave with access fitting	5 Nos. each
11.	Spanner double ended 4.7mm to 16mm	5 sets
12.	Ring spanner off set 4.7mm to 16mm	5 sets
13.	Wrench adjustable length 150mm	5 nos.
14.	Wrench adjustable length 200mm	5 nos.
15.	Wrench adjustable length 250mm	5 nos.
16.	Valve key handle – 4.7mm & 6.4mm sq.	5 sets
17.	Pressure guage diameter 63mm with recalibration set	5 nos.
18.	Compound gauge, diameter 63mm, with recalibration set screw, scale vacuum 76mm. Pressure 15 Kg/sq.cm	5 nos.
19.	Service man thermometer in metal case – 30 C to +30 C	5 nos.
20.	Scissor, gasket cutting stainless steel, length 25mm	5 nos.
21.	L-Allen key set size 1.5mm to 6.4mm	5 sets
22.	T-Allen key set size 5/32” to 1/8”	5 sets
23.	Screw driver, plastic handle, 6mm TIP length 100mm to 150mm	5 each
24.	Screw driver, plastic handle, 10mm TIP length 200mm to 250mm	5 each
25.	Philips screw driver – complete set in leather case	5 sets
26.	Screw driver, plastic handle 3mm TIP length 100mm to 150mm insulated	5 set
27.	Pliers combination insulated length 200mm	5 nos.
28.	Pliers long nose 200 mm	5 nos.
29.	Pliers flat nose 150mm	5 nos.
30.	Hammer ball pein 220 gms	5 nos.

31.	Hammer nylon 300 gms	5 nos.
32.	Tape measuring 2 m graduation in mm	5 nos.
33.	Chisel flat length 150mm	5 nos.
34.	Hack saw tubular metal frame adjustable	5 nos.
35.	Soldering iron exchangeable copper tip 65 watts	5 nos.
36.	Knife folded stainless steel – 150mm	5 nos.
37.	Line tester 500 v heavy duty	5 nos.
38.	Pipe cutter with built in reamer and space cutter, for copper tube 3mm to 32mm	5 nos.
39.	Spanner double ended 19mm to 31.8 mm	5 sets
40.	Ring spanner off set 19mm to 31.8mm	5 sets
41.	Box spanner size 6.4mm to 10mm	5 sets
42.	Pipe wrench size 50mm to 150mm	5 nos. each
43.	Torque wrench 300mm 12.7mm square drive right drive right and left hand	2 set
44.	Socket set, reversible ratchet, 12.7mm square drive with extension 4.7mm to 31.2mm	2 sets
45.	Socket set, reversible ratchet, ½ ” mm square drive with extension 3/16” to ¼” BSW & SR	2 sets
46.	Gas leak detector for halogen gas	2 nos.
47.	Sling phycrometer mounted on aluminium back, scale 50 C to +50 C	5 nos.
48.	Lapping plate 250mm x 200mm	5 nos.
49.	Punch hole for cutting gasket, 4.7mm to 16mm DIA	5 nos.
50.	Hammer ball pein 450 gms	5 nos.
51.	Engineers rule 300mm long	5 nos.
52.	Tape measuring 10m graduation in mm	2 nos.
53.	Oil can pressure type – 1 litre	2 nos.
54.	File flat medium double cut length 200mm	2 nos.
55.	Scriber 150mm length	5 nos.
56.	Divider spring joint length 150mm	5 nos.
57.	File, half rounq medium double cut, length 200mm	5 nos.
58.	Caliper spring joint in side length 150mm	5 nos.
59.	Caliper, odd leg, spring joint length 150mm	5 nos.
60.	Centre punch length 100mm	5 nos.
61.	Pipe being tool, lever type with degree indicator, for tube O.D 6.4mm to 16mm	2 nos.
62.	File, half round, fine double cut, length 150mm	5 nos.
63.	File, round, fine double cut, length 150mm	2 nos.
64.	Puller 3 legged, with flexible arm 120mm	5 nos.
65.	File flat, fine double cut, length 150mm	5 nos.
66.	File square, fine double cut, length 150mm	5 nos.
67.	Snipper sheet metal straight nose 200 mm	5 nos.
68.	Bench vice 75mm jaw	5 nos.
69.	Electrical drill portable drill with chuck and key, capacity 6.4mm	2 nos.

70.	Tong tester 0-10-30 amps 0-500 v (clamp on multimeter)	5 nos.
71.	Blow lamp capacity ½ liter	2 nos.
72.	Voltmeter, AC/DC portable precision grade teak wood case leather belt 0 to 500 volt	5 nos.
73.	Ammeter, AC/DC portable precision grade teak wood case leather belt 0 to 5 amp	5 nos.
74.	Blow lamp capacity 1 liter	2 nos.
75.	Ammeter, AC/DC portable precision grade teak wood case leather belt 0 to 30 amp	5 nos.
76.	Megger – 1000v	2 nos.
77.	Puller 3 legged with flexible arm 300mm	1 no.
78.	Hand blower portable complete 1/10 HP	2 nos.
79.	Spirit level precision metallic 200mm	2 nos.
80.	Wattmeter multi-range up to 1 KW	2 nos.
81.	Multimeter digital type	5 nos.
82.	Stop watch	1 set
83.	Tap set with matching drills 3 mm to 16mm	1 set
84.	Tap set with matching drills ¼” to 5/8”	1 set
85.	Tap & die set ¼” to 5/8” SAE size	1 set
86.	Refrigerant cylinder 2.5 Kg	4 nos.
87.	Tap and die set 3mm to 16mm size	1 set
88.	Vernier caliper length 250mm	1 no.
89.	Micrometer outside measurement 0 to 25mm	1 no.
90.	Bench vice 120mm jaw	1 no
91.	Heating kit with infra red bulb (200 w capacity)	
92.	Variac input 230v output 400v Amp. Portable complete with meter & controls	1 no.
93.	Multimeter analog type	2 nos.
94.	Work bench 1000mm x 600mm x 800mm High	4 nos.
95.	Almirahs 195cms x 90cm x 49 cm	2 nos.
96.	Technometer digital, multirange 0 rpm to 3000 rpm. Portable small size in leather case	2 nos.
97.	Micron vacuum gauge capable of reading upto 20 microns	4 nos.
98.	Transistor tester	5 nos.
99.	R.L.C bridge	5 nos.
100.	Sensor thermometer (digital)	5 nos.
101.	Fin straightener/fin comb.	5 nos.
102.	Filter gauge 0.05 mm – 1 mm	5 nos.
103.	134 A refrigerant in cylinders	2 nos.
104.	Wire gauge metric and whitworth	2 sets
105.	Refrigerant cylinder 30 Kg	2 nos.
106.	Dial thermometer remote control, armoured capillary dial 75mm – 50C to +50 C	2 nos.
107.	Anemometer (Vane type)	2 nos.
108.	Trichloroethylene bottle	2 nos.

134	Two stage rotary vacuum pump capacity approx. 60 – 10rmp capable of evacuating to 50 microns of Hg and fitted with gas ballast, anti such back valve and single phase motor	1 no
135	Air compressor, two stage for oil – less dry air, with rush proof tank assembly, heater and controls max. pr. 10 kgs/sq.m Capacity 45 ltr. Motor 1 hp.	1 no.
136	Descaling pumpset with stainless steel impeller and housing complete with motor 1 hp and accessories	1 no.
137	Reciprocating compressor with provision of capacity control etc. for demonstration. Capacity 9000Kcal/hr. semi hermetic open type.	1 no.
138	Portable air – LPC brazing kit with 2 kg. LPC cylinder, torches, houses, stand make A) with straight flame B) with eyelone/swirl jet flame	1 no.
139	Oxy-acetylene welding set complete with cylinders, regulators welding torches with difference nozzles	1 no
140	Dry N ₂ in cylinder with 2 stage regular or commercial N ₂ in cylinder with drier unit and 2 stage regular	1 no.
141	Ice candy unit complete with stainless steel tank, mould box, thermocool insulated sunmica body, agitator, compressor, motor ele. Temperature, pressure, refrigerant control gauges, motor, pipe fitting ele 3000 kcal/hr working trainer model/simulator	1 no.
142	Cold storage plan complete with all controls and accessories including cooling tower and water treatment plant capacity 15000 kcal/hr or working trainer model/simulator	1no.
143	Condensing unit with open typen compressor air cooled condensor controls ele capacity 3000kcal/hr	1no.
144	Condensing unit with open typen compressor evaporate condensor controls ele capacity 3000kcal/hr	1 no.

UPGRADATION OF ITI'S INTO
CENTRE OF EXCELLENCE (C.O.E)
NAME OF SECTOR – REFRIGERATION & AIR CONDITIONING

Advance Module in Cold storage, Ice plant and Ice candy plant
Other requirements

Sr.No.	Description	Quantity
1.	Instructor chair and table	1 no.
2.	Dual Desk	8 nos.
3.	Suitable work table with 4 vice	1no.
4.	Suitable work table	1 no.
5.	Stools	17 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.