

UPGRADATION OF ITIs INTO CENTERS OF EXCELLENCE (CoE)
SECTOR / AREA : REFRIGERATION & AIR - CONDITIONING

BROAD BASED BASIC TRAINING

(FIRST YEAR)

BASIC MODULES	NAME OF THE MODULE	Trade(s) from where existing infrastructure/ equipment/ instructor could be utilized
RAC - BT-I	BASIC WORKSHOP PRACTICES	Sheetmetal work
RAC - BT-II	BASIC ELECTRICITY, ELECTRONICS AND ELECTRO-MECHANICS	Electronics Mech.
RAC - BT-III	BASIC REFRIGERATION I	Refrigeration & Air Conditioning
RAC - BT-IV	BASIC REFRIGERATION II	Refrigeration & Air Conditioning
RAC - BT-V	BASIC REFRIGERATION III	Refrigeration & Air Conditioning
RAC - BT-VI	BASIC REFRIGERATION IV	Refrigeration & Air Conditioning

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BROAD BASED BASIC TRAINING

(FIRST YEAR)

BASIC	NAME OF THE BASIC MODULE	DURATION IN WEEKS	PAGE NO
RAC - BBT-I	BASIC WORKSHOP PRACTICES	8 WEEKS	1-7
RAC - BBT-II	BASIC ELECTRICITY, ELECTRONICS AND ELECTRO-MECHANICS	8 WEEKS	8-12
RAC - BBT-III	BASIC REFRIGERATION I	8 WEEKS	13-18
RAC - BBT-IV	BASIC REFRIGERATION II	8 WEEKS	19-24
RAC - BBT-V	BASIC REFRIGERATION III	8 WEEKS	25-33
RAC - BBT-VI	BASIC REFRIGERATION IV	8 WEEKS	34-39

GENERIC MODULES

RAC - BBT-VII	ENGINEERING DRAWING	2 HRS. PER WEEK	40-41
RAC - BBT-VIII	WORKSHOP CALCULATION & SCIENCE	2 HRS. PER WEEK	42-43
RAC - BBT-IX	TOTAL QUALITY MANAGEMENT	2 HRS. PER WEEK	44-45
RAC G - 01	ENTERPRENEURSHIP AND COMMUNICATION SKILLS / SOCIAL STUDIES	1 HRS. PER WEEK	

MODULE I : BASIC WORKSHOP PRACTICES

Basic Fitting : 2 Weeks, Sheet Metal Work : 2 Weeks, Carpentry : 1 Week, Basic Welding : 1 Week, Basic Brazing : 2 Weeks,

Week No.	PRACTICAL	THEORY
1	<p>Basic Fitting : 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.</p>	<p>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.</p>
2	<p>Filing flat surfaces of mild steel / cast iron. Checking for flatness, straightness & square ness. Filing & Fitting of male & female joints within accuracy of \pm 0.2mm. Using a sprit level and dial test indicator. Measurements by precision instruments. Drilling, reaming & tapping as per given drawings. External thread cutting on pipes.</p>	<p>Introduction to files, their types and uses, care & maintenance, Bench & pipe vice, their constructional details & uses. Sprit levels & their uses, straight and angular measurements, Bevel Protractors. Introduction to precision measuring & least count. Micrometers, Verniers & Height gauges, 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.</p>
3 & 4	<p>Sheet Metal Work : Use of protective safety devices on shop floor. Identification of Tools & 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 90⁰ using wooden mallet. Practice on hard soldering method (Lead & Tin). Forming simple sheet metal articles like funnels, cylindrical vessels, boxes & buckets. Making holes on sheet metal by punching & riveting. Straight & oblique cutting, preparing A.C. ducts & components as per given drawings. Riveting practice, practice on removing dents on spherical & hemi spherical articles.</p>	<p>Introduction to sheet metal work & its applications, materials used for sheet metal work. Hand tools, measuring tools & gauges used in sheet metal work. Different sheet metal operations, their necessity & applications. Sheet metal joining processes, soldering brazing & welding. Sheet metal machinery, shears, forming & folding machines, bending & shearing machines seaming & nibbling machines. Development of surfaces for simple objects like boxes, cylinders, cones, prism & pyramids. Developing & forming A.C. ducts & components.</p>

Week No.	PRACTICAL	THEORY
5	<p>Carpentry: Jobs involving various carpentry applications, like marking, sawing, planning, chiseling & drilling. Making joints & simple frames used in A.C. work.</p>	<p>Timber, its classification & sources, seasoning of timber. Plywood & alternative materials. Carpentry tools, their uses, care & maintenance, simple carpentry operations & commonly used joints. Glues & adhesives, polishing & varnishing.</p>
6	<p>Basic Welding : Setting beading practices, striking & maintaining an arc setting up an oxy-acetylene flame. Laying short , straight line & weaved beads on M.S. plates, Fillet welds in open corner, Tee & Lap Joint, fusion runs with & without filler rods. Preparing different joints with gas welding.</p>	<p>Workshop & personal safety - Metal joining processes. Introduction to gas & arc welding, advantages & disadvantages. Different hand tools used in welding. Welding accessories like regulators, nozzles cylinders etc. Welding machines & welding transformers , Oxy-Acetylene gas welding plant. Welding processes & positions, welded joints, welding symbols, weld depositions, filler rods & electrodes, their types & selection, care & maintenance. Fluxes, types & application. Distortion in welding, welding defects, their causes & remedial measures.</p>
7-8	<p>Brazing : Soldering & brazing on sheet metal as per braze welding practice. Brazing of different size of copper, steel, aluminum pipes with different brazing material. Setting up of oxy - acetylene welding equipment, Study the double stage regulator. Lighting and adjustment of flame. Use of silver brazing by oxy-Ace process.</p>	<p>Soldering & brazing, Different types of solder, composition and use of flux- their effect on metal, method of soldering and brazing, Braze welding procedure. Difference between brazing & soldering, brazing & braze welding, brazing & welding, Brazing fluxes - their properties, types, constituents of fluxes. Gas welding hand tools - uses, oxy-acetylene welding - Principles and applications. Common gases used for welding. Types of Oxy-acetylene flames- their uses. Flame Temperature - chemistry and structure of oxy-acetylene flame, Oxygen cylinder, DA Cylinder description. Regulator Types- Construction, Care & maintenance of blowpipes and cutting torches. Filler rods used in Gas welding. Welding flux. Faults in gas welding - Causes- Corrections. Different types of brazing process.</p>

CENTRE OF EXCELLENCE (C.O.E.)
BROAD BASED BASIC TRAINING IN REFRIGERATION & AIR CONDITIONING
Basic Module RAC - BBT- I
(Basic workshop practices)
(First Year)

Tools, Equipments & machinery for RAC-BBT-I

Sr. No.	Names of the tools & Equipments	Quantity
1	2	3
1	Steel rule 300 mm	17 Nos.
2	Outside spring caliper 150 mm	17 Nos.
3	Inside spring caliper 150 mm	17 Nos.
4	Hermaphrodite caliper 150 mm	17 Nos.
5	Divider spring 150 mm	17 Nos.
6	Centre punch 100 mm	17 Nos.
7	Hammer B.P. 0.5 kg.	17 Nos.
8	Combination plier 150 mm	17 Nos.
9	Safety glasses	17 Nos.
10	File flat bastard 300mm	17 Nos.
11	File flat 2 nd cut 250 mm	17 Nos.
12	Engineers screw driver	17 Nos.
13	File flat smooth 200 mm	17 Nos.
14	Cold chisel flat 25 x 200 mm	17 Nos.
15	Granite Surface plate 1000mm x 630mm grade 1	4 Nos.
16	Metal stand table for surface plate 900 x 900 x 1200mm	4 Nos.
17	Screw Driver Set (multiheads)	1 set
18	Scribing block universal 300mm	2 Nos.
19	"V" Block universal 300 mm	2 Nos.
20	Try square 150mm	2 Nos.
21	Outside spring caliper 200 mm	2 Nos.
22	Divider spring 200 mm	2 Nos.

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

49	Needle file set	1 No.
50	File square 2 nd cut 250 mm	4 Nos.
51	Reamer 6mm to 13mm by 1 mm	1 set
52	Hacksaw adjustable 250-300 mm with blades	8 Nos.
53	Magnifying glass 75mm	2 Nos.
54	Micrometer outside 0-25mm	4 Nos.
55	Micrometer outside 25-70 mm	4 Nos.
56	Micrometer outside 50-75mm	2 Nos.
57	Micrometer depth gauge 0-150mm	8 Nos.
58	Direct reading Vernier caliper 0 to 300	4 Nos.
59	Vernier height gauge 250mm	1 No.
60	Vernier bevel protractor with least count of 5 minutes	1 No.
61	Dial Gauge	4 Nos.
62	Lever Type dial gauge	4 Nos.
63	Dial gauge stand	4 Nos.
64	Screw pitch gauge for metric pitches (0.5 to 7mm)	2 sets
65	Radius gauge metric set (1-6mm)	1 set
66	Feeler gauge	1 No.
67	Sensitive Drilling machine pillar 12mm capacity with accessories	2 Nos.
68	Drilling machine pillar 20mm capacity with accessories	1 No.
69	Planner 18" wooden	2 Nos.
70	Handsaw 24"	6 Nos.
71	Pedestal grinder	1 No.
72	Hand Drilling Machine Power (10mm)	1 Nos.
73	Planner Wooden 9"	4 Nos.
74	Steel Jack planner 9"	1 No.

75	Centre punch 100 mm	17 Nos.
76	Ordinary Wooden Mallet 50mm	17 Nos.
77	Cross Peen Hammer 0.25 kg with handle	17 Nos.
78	Protractor with blade 150mm	17 Nos.
79	Steel tape 2 meters	17 Nos.
80	Scriber 150mm x 3mm (Engineers)	17 Nos.
81	Hammer peaning with handle	4 Nos.
82	Hammer creasing with handle	4 Nos.
83	Hammer Planishing with handle	4 Nos.
84	Hammer Block with handle	2 Nos.
85	D.E.Spanner G.P. (6mm to 32 mm) (set of 12 spanner)	2 Set
86	Handvice 50mm	16 Nos.
87	Steel wire Brush 50mm x 150mm	16 Nos.
88	Gloves for welding (Leather and Asbestos)	16 Nos.
89	Leather Apron	16 Nos.
90	Tongs, Close mouth and pick up (1 each)	4 pairs
91	Portable Electric drill (single phase)	2 Nos.
92	Round File 2 nd cut 250mm	4 Nos.
93	Triangular file smooth 250mm	4 Nos.
94	Punch Round 3mm, 4mm & 6mm Dia	4 Nos.
95	Punch Round 4mm Dia	4 Nos.
96	File Flat 250mm smooth	2 Nos.
97	File half round 300mm smooth	2 Nos.
98	Hand Groover 3mm, 4mm, 5mm	4 Nos.
99	Grip Wrench 200mm	2 Nos.
100	Ladle 150mm Dia	2 Nos.

101	Blow Lamp 1 litre	2 Nos.
102	Hand Drill 0 to 6mm, 8mm, 10mm, & 12mm	2 Nos.each
103	Soldering Copper Hatchet type 250 gms	8 Nos.
104	Welding plant Oxy-Acetylene complete (high pressure) with regulator	2 Nos
105	Liquefied Petroleum Gas (LPG) Cylinder, Regulator and Torch with Burner	2 Nos.
106	D.E.Grinder Pedestal motorized 200 mm	1 No.
107	LPG 2.5 kg Cylinder for swirl jet torch	4 Nos.
108	Welding Transformer (200 to 400 amps)	2 Nos.
109	Slip roll former 1.6mm x 1000mm	1 No.
110	Gas welding table 1220mm x 760mm	2 Nos.
111	Anvil 50kgs with stand	1 No.
112	Swirl Jet Torch	4 Nos.
113	Bench Vice 120mm, 150mm	2 each
114	Snip (Straight) 300mm	8 Nos.
115	Snip (Straight) 150 mm	8 Nos.
116	Shear (Straight) 450 mm	4 Nos.
117	Shear (Straight) 600 mm	4 Nos.
118	Stakes Half moon	2 Nos.
119	Stake Hatchet	2 Nos.
120	Stake funnel	2 Nos.
121	Stake Anvil	2 Nos.
122	Nylon Hammer (40mm Dia) with Handle	8 Nos.
123	Snip(Bend) 300mm	4 Nos.
113	Bench Vice 120mm, 150mm	2 each
114	Snip (Straight) 300mm	8 Nos.
115	Snip (Straight) 150 mm	8 Nos.
116	Shear (Straight) 450 mm	4 Nos.
117	Shear (Straight) 600 mm	4 Nos.
118	Stakes Half moon	2 Nos.
119	Stake Hatchet	2 Nos.
120	Stake funnel	2 Nos.
121	Stake Anvil	2 Nos.
122	Nylon Hammer (40mm Dia) with Handle	8 Nos.
123	Snip(Bend) 300mm	4 Nos.

Basic Module RAC - BBT- I
(Basic workshop practices)
(First Year)
Other requirements

Sr. No.	Description	Quantity
(A) Lab & Class Room area		
1	Class room	30 sq.mtr.
2	Workshop	100 sq.mtr.
(B) Lab & Class Room Furniture		
	Instructor chair & table	1 No.
	Dual Desk	8 Nos.
3	Workshop	
	Suitable work table with 4 vice	4 Nos.
	Stools	17 Nos.
	Discussion table	1 No.
4	Tool cabinet	2 Nos.
5	Trainee's lockers	2 Nos.
6	First Aid Box	1 No.
7	Book Shelf (glass panel)	1 No.
8	Storage rack	1 No.

(C) Audio Visual Equipment

1	OHP	1 No.
2	LCD Projector	1 No.
3	Lap Top Computer	1 No.
4	Magnetic white Board	1 No.
5	White Board	1 No.
6	Flip Chart	1 No.

**Basic Electricity 4 weeks
weeks**

Basic Electronics 3 weeks

Electro-Mechanics 1

Week No.	PRACTICAL	THEORY
BASIC ELECTRICITY		
1	<p>Demonstration of use of Safety equipments and artificial respiration. Use of hand tools. Joining Practice with single and multi-stand conductors. Joining practice of bare conductors, Demonstration & 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.</p>	<p>Static & current Electricity, Safety - in electrical shops & installations. Description, specification, general care & maintenance of common electrical hand tools. Wires & cables - conductors, Insulators & semiconductors, their shapes, sizes with respect to low, medium & high voltage. Different fluxes for different purposes on metals, Crimping equipment - Single & Multistranded conductors joining and soldering.</p>

2	<p>Making a simple circuit with a lamp and battery. Study and use of Multimeters measurement of current, voltage, resistance in DC/AC circuits. Demonstration & verification of ohm's law - Series circuits - Parallel circuits. Demonstration & Practice on connecting & 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 & parallel circuits, Power & 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 & its importance. Preventive maintenance, routine & periodical tests</p>
3-4	<p>Simple wiring practice with distribution boards, Junction Boxes, Main Switches two way and intermediate Switches. Identification of different parts of DC generators- testing and measuring the field and Armature resistances. Identification of different parts of AC Motors - Testing and measurement on Induction motors - and generators. Identification and testing of transformers. Grouping & testing of cells for a specified voltage & current - Preparation of battery charging, Drawing simple panel board wiring diagrams.</p>	<p>Induction principles - Electro-magnetism-Faraday's Laws. Single phase & Poly phase system 3 phase star-delta connections, Impedance & power factor -Principles & Applications of DC Motors , Series, Shunt & compound motor - AC Motors. Transformers their types and applications. Chemical effect of electric current - Rechargeable batteries - Care & maintenance of cells. AC Motor starting with DOL Starter and Star - Delta Starter. Panel boards & their designing.</p>

Week No.	PRACTICAL	THEORY
BASIC ELECRTONICS		
5	<p>Identification and testing of different types of electronic components, components semiconductor devices - Symbols - Symbols. Testing of capacitors, specifications - Diodes, Transistors, Uni-junction diodes, PNP/NPN Transistors - Uni -Rectifier & ICs. Half wave, full wave & Bridge junction Transistor, Field effect Transistor, Silicon Controlled Rectifier with filters, DC Power supply. Transistor & Silicon Controlled Rectifier ICs etc. Soldering & desoldering practice - Demonstration on Rectifiers - Identification of ICs</p>	<p>Fundamentals of electron theory - passive components semiconductor devices - Symbols - Symbols. Testing of capacitors, specifications - Diodes, Transistors, Uni-junction diodes, PNP/NPN Transistors - Uni -Rectifier & ICs. Half wave, full wave & Bridge junction Transistor, Field effect Transistor, Silicon Controlled Rectifier with filters, DC Power supply. Transistor & Silicon Controlled Rectifier ICs etc. Soldering & desoldering practice - Demonstration on Rectifiers - Identification of ICs</p>
6-7	<p>Full wave & bridge rectifier circuits, voltage regulators, construction of low voltage power supply, construction of transistor, amplifier circuits, Multivibrator circuits, CR circuits for wave shaping, wiring of SCR, UJT for motor control.</p>	<p>Rectification and Rectifiers, zener diode as voltage regulator, Transistor parameters-CB,CC,CE configuration, amplification, photo diodes, transistors, multivibrations CR & LR circuits, SCRs, UJTs & ICs.</p>
BASIC ELECTRO-MECHANICS		
8	<p>Testing solid state thermostats, PTCR, remote controls. Operating & testing contactors, relay, pressure controls, timer, solenoid, heater, pressure controls, Identification of keys & display of microprocessor trainer kit</p>	<p>Thermistor, RTDs, Electronic thermostat, principle of remote control & controllers. Use & specifications of contactors, starter & crankcase heater etc., Introduction to Microprocessors</p>

BROAD BASED BASIC TRAINING IN REFRIGERATION & AIR CONDITIONING

Basic Module RAC - BBT- II

Basic Electrical, Electronics & Electromechanics

(First Year)

Tools, Equipments & machinery for RAC-BBT-II

Sr. No.	Names of the tools & Equipments	Quantity
1	2	3
1	Combination Pliers 200mm insulated	17 Nos.
2	Screw Driver 100mm 200mm	17 Nos.
3	Neon Tester 500V pencil bit type	17 Nos.
4	Electrician Knife	17 Nos.
5	Hammer ball peen 0.25kg	17 Nos.
6	File round 150mm	17 Nos.
7	Pliers side cutting 200mm	4 Nos.
8	Pliers round nose 200mm	4 Nos.
9	Pliers fat nose 150mm	4 Nos.
10	Pliers long nose 200mm	4 Nos.
11	Firmer chisel 25mm	4 Nos.
12	Hammer ball pein 1.0kg	1 No.
13	Wall jumper octagonal 37mm x 450mm	1 No.

14	Center punch 100mm	1 No.
15	Steel measuring tape 20mts	1 No.
16	Allen keys	1 Set
17	Spanner double ended set of 6	2 Sets
18	Adjustable spanner	1 No.
19	Steel rule 300mm	4 Nos.
20	Electric soldering iron 35W	4 Nos.
21	Electric soldering iron 125W	2 Nos.
22	Rubber gloves 5000V	2 Pairs
23	Multimeter 0-5, 100, 200, 500 mill amperes 0-100-1000, 10000 ohms 0-150, 300, 600V AC/DC	2 Nos.
24	Bar magnet	1 No.
25	Horse shoe magnet	1 No.
26	Electric Drill Machine 6mm capacity universal type 250V	1 No.
27	D.C.Shunt motor 1 H.P. 250V (Laboratory type)	2 Nos.
28	Universal motor 750W AC/DC 250V	2 Nos.
29	Squirrel cage induction motor 1 H.P., 230V with DOL starter	1 Nos.
30	Transformer single phase 500 ma./250/12V	4 Nos.

31	L.F. oscilloscope with Attenuation probes	1 No.
32	Star Delta starter (contact type 8 points)	1 No.
33	Tong Tester	1 No.
34	Megger	1 No.
35	DC Power Supply 0V-110V/5A	1 No.
36	Auto - transformer - varies 230v	1 No.
37	Tweezers	16 Nos.
38	Crimping tools	1 Set
39	Digital type clamp meter	2 Nos.

Basic Module RAC - BBT- II
Basic Electrical, Electronics & Electromechanics
(First Year)
Other requirements

Sr.No.	Description	Quantity
	(A) Lab & Class Room area	
1	Class room	30 sq.mtr.
2	Workshop	60 sq.mtr.

	(B) Lab & Class Room Furniture	
	Class room	
	Instructor chair & table	1 No.
	Dual Desk	8 Nos.
3	Workshop	
	Suitable work table with 4 vice	1 No.
	Suitable work table	3 Nos.
	Stools	17 Nos.
	Discussion table	1 No.
4	Tool cabinet	2 Nos.
5	Trainee's lockers	2 Nos.
6	First Aid Box	1 No.
7	Book Shelf (glass panel)	1 No.
8	Storage rack	1 No.
	(C) Audio Visual Equipment	
1	OHP	1 No.
2	LCD Projector	1 No.
3	Lap Top Computer	1 No.

4	Magnetic white Board	1 No.
5	White Board	1 No.
6	Flip Chart	1 No.

MODULE - III BASIC REFRIGERATION I

Week No.	PRACTICAL	THEORY
1-2	Introduction to operations on copper tubing like bending, flaring, swedging, pinching etc. & tools used. Study & sketch refrigerator parts, storing arrangement, Fitting refrigerator doors & hinges, Tube brazing. Safety in handling tools & equipment.	History of refrigeration, its principle & need. Introduction to refrigeration equipment, constructional details of a refrigerator. Heat and temperature. Types of heat and its measurement. Thermometers & thermometric conversions. Atmosphere, air & its constituents. Properties of gases & gas laws. Measurement of pressure. Pressure gauges. Humidity, relative humidity & dew point temperature.
3-4	Refrigerator cleaning, inspection, testing of components in refrigeration system. Tracing the electrical components and testing relay, OLP, Thermostat, light assembly, door switch etc. To remove & refix refrigerator doors. To cut & fix door gaskets. Refrigerator installation, care & maintenance.	Functions of refrigeration system components i.e condensers, evaporators and capillary tube. Compressor, its types & working principle. Reciprocating compressors. Comparative study of sealed & open type compressors, Internal construction of a sealed compressor, its part & their functions. Introduction to soldering & brazing, their applications. Brazing Vs welding. Advantages & disadvantages. Brazing Processes. Defects & remedial measures.

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

CENTRE OF EXCELLENCE (C.O.E.)

BROAD BASED BASIC TRAINING IN REFRIGERATION & AIR CONDITIONING

Basic Module RAC - BBT- III

Basic Refrigeration I

(First Year)

Tools, Equipments & machinery for RAC-BBT-III

Sr. No.	Names of the tools & Equipments	Quantity
1	2	3
1	Flaring tool set, single type for tube 4.7mm to 16mm O.D.	4 sets
2	Electrical drill portable drill with chuck & key, capacity 6.4mm.	2 Nos.
3	Swaging tool, punch type, set of size for tube 4.7mm to 16mm O.D.	4 sets
4	Swaging tool, screw type, with adaptor set of size for tube 4.7mm to 16mm O.D.	1 set
5	Gas cylinder truck two wheel type.	1 No.
6	Bending spring external type, for copper	4 sets

	tube 3mm to 16mm DIA.	
7	Line tester 500 v. heavy duty.	4 Nos.
8	Pipe cutter miniature for copper tube 3mm to 16mm DIA.	4 Nos.
9	Tong tester 0-10-30 amps. 0 - 500 v.(clamp on multimeter.	4 Nos.
10	Pipe cutter with built in reamer & space cutter, for copper tube 3mm to 32mm .	1 No.
11	Knife folded stainless steel - 150mm.	4 Nos.
12	pinch of tool, for copper tube, 6mm to 18mm DIA.	4 Nos.
13	Voltmeter, AC/DC portable precision gread teak wood case leather belt 0 to 5 amp.	2 each
14	Ratchet spanner of 6.4sq.mm reversible	4 Nos.
15	Ammeter, AC/DC portable, precision gread teak wood case leather belt 0 to 5 amp.	2 Nos.
16	Capillary plague gauge.	2 Nos.
17	Megger - 1000 v.	1 No.
18	Pinch of plier / crimping plier tool 6mm - 18mm. DIA.	2 Nos.
19	Wattmeter multirange upto 1 kw.	1 No.
20	Piercing plier 6-18mm & reversing valve with access fitting.	2 Nos. Each
21	Multimeter analog type .	1 Nos.
22	Spanner double ended 4.7mm to 16mm.	5 sets
23	Multimeter digital type .	1 No.
24	Spanner double ended 19mm to 31.8mm.	1 set
25	Stop watch.	1 No.
26	Ring spanner off set 4.7mm to 16mm.	5 sets
27	Filler gauge 0.05mm - 1mm.	1 Set
28	Ring spanner off set 19mm to 31.8mm.	1 set
29	Wire gauge metric & whitworth.	1 Set

30	Box spanner size 6.4mm to 10mm.	2 sets
31	Refrigerant cylinder 2.5 kg.	2 Nos.
32	Wrench adjustable length 150mm.	1 No.
33	I) Evacuating & refrigerant charging station, compression.	1 No.
	a) Rotary two stage vacuum pump & motor (with gas ballast & anti suck back) manifold with gauges & valves & capable of pulling vacuum upto 50 microns of Hg & with provision of connecting to a microns level vacuum gauge.	
	b) Graduated charging cylinder with provision for temperature correction & all necessary isolating valves.	
	II) Evacuating & charging station as above but fitted with weighing scale (upto 2 kg. In lieu of (b) above & with accuracy of +/-1g for charging hydrocarbons.	1 No.
34	Wrench adjustable length 200mm.	2 Nos.
35	Two stage rotary vacuum pump capacity approx. 60 - 100 rpm, capable of evacuating to 50 microns of Hg & fitted with gas ballast, anti suck back valve & single phase motor.	1 No.
36	Wrench adjustable length 250mm.	2 Nos.
37	Scraper triangular blade removable 60mm.	2 Nos.
38	Pipe wrench size 50 & 150 mm.	01 No. each
39	Pressure testing tank with lighting arrangement, pressure gauge (0 to 35kg/sq.cm.) double stage.	1 No.
40	Torque wrench 300mm, 12.7mm square drive right & left hand.	1 set

41	Heating kit with infra red bulb. (200 watt capacity.)	1 No.
42	Valve key -t handle - 4.7mm & 6.4mm.sq.	4 sets
43	Refrigerator, compression type 165 litres	1 No.
44	Socket set, reversible ratchet, 12.7mm square drive with extension4.7mm to 31.2mm.	2 sets
45	Refrigerator, compression type 300 litres double door, double compressor system.	1 No.
46	Socket set, reversible ratchet, 1/2" square drive with extension3/16" to 1/4" BSW & SR.	1 set
47	Work bench 1000mm x 600mm x 800mm. High.	2 Nos.
48	Pressure gauge diameter 63mm with recalibration set	4 Nos.
49	Portable air- LPG brazing kit with 2 kg. LPG cylinder, torches, houses, stand make. A) with straight flame. B) with eyelone/ swirl jet flame.	1 No.
50	Compound gauge, diameter 63mm. with recalibration set screw, scale vacuum 76mm. Pressure 15 kg/sq.cm.	4 Nos.
51	Pliers flat nose 150mm.	1 No.
52	Service man thermometer in metal case - 30 ⁰ C to +30 ⁰ C	4 Nos.
53	Tap set with matching drills 3mm to 16mm.	1 Set
54	Gas leak detector for halogen gas.	2 Nos.
55	Micron vacuum gauge capable of reading upto 20 microns.	1 No.

56	L-Allen key set size 1.5mm to 6.4mm.	4 Sets
57	Sensor thermometer (digital).	2 Nos.
58	T-Allen key set size 5/32" to 1/8".	4 Sets
59	Fin straightener/fin comb.	4 Nos.
60	Screw driver, plastic handle, 6mm TIP length 100mm to 150mm.	4 each
61	HC refrigerant in cylinders / disposable containers.	2 Nos.
62	Screw driver, plastic handle, 10mm TIP length 200mm to 250mm.	4 each
63	134 A refrigerant in cylinders.	2 Nos.
64	Philips screw driver - complete set in leather case.	2 sets
65	Recovery unit one each for cfc & 134A refrigerants with recovering cylinders	1 Nos.
66	Screw driver, plastic handle, 3mm TIP length 100mm to 150mm. Insulated.	1 set
67	Refrigerator 170 lit. using 134a refrigerant	1 No.
68	Pliers combination insulated length 200mm.	2 Nos.
69	Pliers long nose 200mm.	2 Nos.
70	Fire extinguisher power type.	2 Nos.
71	Hammer ball peen 220 gms.	4 Nos.
72	Dry N ₂ in cylinder with 2 stage regulator or commercial N ₂ in cylinder with drier unit and 2 stage regulator.	1 No.
73	Hammer nylon 300 gms.	4 Nos.
74	Trichloroethylene bottle.	1 No.
75	Engineers rule 300mm long.	1 No
76	Two way manifold with gauges.	1 No.
77	Tape measuring 2m graduation in mm.	1 No.
78	Four way manifold with gauges.	1 No.
79	Chisel flat length 150mm.	4 Nos.
80	Filter driers for cfc - 12 & hfc - 134A for	8 Nos.

	repairs - retrofits.	
81	Hack saw tubular metal frame adjustable.	4 Nos.
82	Sealed ex - proof components for use in hs appliances : thermostat, sealed olp's. solid state PTC's, door switches, lamp holders	4 Nos. each
83	Centre punch length 100mm.	4 Nos.
84	Safety gloves, eye protection glasses.	4 Nos.
85	Oil can pressure type - 1 litre.	2 Nos.
86	Schrader valve core removal tool.	1 No.
87	File, flat medium, double cut, length 200mm.	4 Nos.
88	Acid test kit.	1 No.
89	File round , fine double cut, length 150mm.	4 Nos.
90	Pop rivet gun.	1 No.
91	File flat , fine double cut, length 150mm.	4 Nos.
92	Brazing alloy rods for 1/4"to7/8" tubes- Cu tocu, cu to steel, cu to brass & appropriate fluxes	1Set
93	File square , fine double cut, length 150mm.	4 Nos.
94	l) Hermetic compressors 1/8hp to 1/2hp) for use in repair work of appliances for CFCs&HFCs 1) Hermetic compressor for 134a	2/3 No. 1/2 No.
95	Engineers square 200mm long.	2 Nos.
96	Ball valves service valves, hand shut of valves of 1/4"to 7/8"	2 Nos. Each
97	Soldering iron exchangeable copper tip 65 watts.	5 Nos.
98	Quick couplers , process tube adaptors for 1/4",3/8"	2 pairs each
99	Pipe bending tool, lever type with	2 Sets

	degree indicator, for tube O.D. 6.4mm to 16mm.	
100	Compressors testers for small hermetic compressors	1 No.
101	Hand blower portable complete 1/10 HP.	1 No.
102	Evaporator of direct cooled refrigerator with capillary heat exchanger	1 No.
103	Tap & die set 3mm to 16mm size	1 Set
104	Evaporator of frost free refrigerator	1 No.
105	Tap set with matching drills 1/4" to 5/8".	1 Set
106	Bellow type type thermostats, H.P.stat, L.P.stat, humid stat, solenoid valves	1 No. each
107	Tape & die set 1/4" to 5/8" SAE size	1 Set
108	Electrical accessories: current & potential relays, start & run capacitors, PTCs, overload protectors, relays, contactors	1 No. each
109	Digital type clampmeter	1 No.

Basic Module RAC - BBT- III

Basic Refrigeration I

(First Year)

Other requirements

Sr.No.	Description	Quantity
	(A) Lab & Class Room area	
1	Class room	30sq.mtr.
2	Workshop	60sq.mtr.
	(B) Lab & Class Room Furniture	
	Class room	
	Instructor chair & table	1No.

	Dual Desk	8Nos.
3	Workshop	
	Suitable work table with 4 vice	1No.
	Suitable work table	1No.
	Stools	17Nos.
	Discussion table	1No.
4	Tool cabinet	2Nos.
5	Trainee's lockers	2Nos.
6	First Aid Box	1No.
7	Book Shelf (glass panel)	1No.
8	Storage rack	2Nos.
	(C) Audio Visual Equipment	
1	OHP	1 No.
2	LCD Projector	1No.
3	Lap Top Computer	1No.
4	Magnetic white Board	1No.
5	White Board	1No.
6	Flip Chart	1No.

MODULE IV : BASIC REFRIGERATION II

WEEK NO.	PRACTICAL	THEORY
1	Stripping the components of Frost Free Refrigerator, tracing electrical circuits & defrost heater, Inspection & testing.	Study of Frost Free Refrigerators, Refrigeration system of Frost Free Refrigerators, components & their functions, electrical components, wiring, automatic defrost & air duct system. Comparative study of refrigerators available in the market.

2	Retrofitting of CFC filled refrigerator with Non CFC refrigerant i.e.134a & HC 600. Use of sealed components.	Scope and methodology of retrofitting CFC appliances with HFC & HCS refrigerants, study of refrigerator components using HC refrigerants. Comparative study of performance of refrigerators using different refrigerants.
3	Dismantling & Assembly of an Air conditioner, study of different components, their functions & specifications. Calculating Relative Humidity by using sling psychometric.	Introduction to Air conditioning , its past, present & future. Air conditioning Fundamentals. Constructional details and functioning of room air conditioner. Air circulation system. Psychometric & psychometric charts, construction & use of sling psychrometer.
4 & 5	Study & testing of thermostatic relay, capacitors, OLP, blower motor. Inspecting & testing condenser & evaporator coil. Checking of electrical wiring by CSR method. PSC circuits in Room A.C.	Study of mechanical & electrical components of Window A. C. & Split A.C., Role of each part. Split A.C., its constructional details, comparison with window air conditioner advantages & Disadvantages. Air cooled condensers : Constructional details & selection.
6	Dry Servicing & brought down servicing of Air conditioners. Brazing & water immersion testing of evaporator & condenser coils.	Air cleaning :Filters, their types and specifications. Air flow measurements Use of velocity meters. Performance Testing criterion.
7	Evacuating & gas charging of an Air conditioner. Performance Testing for Air Velocity, grill & condenser temperature & smooth running of fan motor.	Principles of pipe sizing & study of services valves for charging at site. Principle of working of infra red remote control, study of electronic circuits.
8	Testing all weather air conditioners. Trouble shooting electrical & mechanical faults.	Fault diagonisis in window & split A.C. units with the help of problem trees.

CENTRE OF EXCELLENCE (C.O.E.)

BROAD BASED BASIC TRAINING IN REFRIGERATION & AIR CONDITIONING

Basic Module RAC - BBT- IV**Basic Refrigeration II****(First Year)****Tools, Equipments & machinery for RAC-BBT-IV**

Sr. No.	Names of the tools & Equipments	Quantity
1	2	3
1	Flaring tool set, single type for tube 4.7mm to 16mm O.D.	4 sets
2	Puller 3 legged, with flexible arm 300mm.	1 No.
3	Swaging tool, punch type, set of size for tube 4.7mm to 16mm O.D.	4 sets
4	Hand blower portable complete 1/10 HP.	1 No.
5	Swaging tool, screw type, with adaptor set of size for tube 4.7mm to 16mm O.D.	1 set
6	Bench vice 75mm jaw.	2 Nos.
7	Bending spring external type, for copper tube 3mm to 16mm DIA.	4 sets
8	Electrical drill portable drill with chuck & key, capacity 6.4mm.	2 Nos.
9	Pipe cutter miniature for copper tube 3mm to 16mm DIA.	4 Nos.
10	Pedestal grinder, double ended wheel dia 200mm. 3000rpm.	1 No.
11	Pipe cutter with built in reamer & space cutter, for copper tube 3mm to 32mm .	1 No.
12	Oxy-Acetylene welding set complete with cylinders regulators welding torches with difference nozzles	1 No.
13	pinch of tool, for copper tube, 6mm to 18mm DIA.	4 Nos.

14	Gas cylinder truck two wheel type.	2 Nos.
15	Ratchet spanner of 6.4sq.mm reversible	4 Nos.
16	Line tester 500 v. heavy duty.	4 Nos.
17	Capillary plague gauge.	2 Nos.
18	Tong tester 0-10-30 amps. 0 - 500 v.(clamp on multimeter.	4 Nos.
19	Pinch of plier / crimping plier tool 6mm - 18mm. DIA.	2 Nos.
20	Knife folded stainless steel - 150mm.	4 Nos.
21	Piercing plier 6-18mm & reversing valve with access fitting.	2 Nos. Each
22	Voltmeter, AC/DC portable precision gread teak wood case leather belt 0 to 500 V.	2 Nos.
23	Spanner double ended 4.7mm to 16mm.	5 sets
24	Ammeter, AC/DC portable, precision gread teak wood case leather belt 0 to 5 amp.	2 Nos.
25	Spanner double ended 19mm to 31.8mm.	1 set
26	Ammeter, AC/DC portable, precision gread teak wood case leather belt 0 to 30 V	2 Nos.
27	Ring spanner off set 4.7mm to 16mm.	5 sets
28	Megger - 1000 v.	1 No.
29	Ring spanner off set 19mm to 31.8mm.	1 set
30	Wattmeter multirange upto 5 kw.	1 No.
31	Box spanner size 6.4mm to 10mm.	2 sets
32	Multimeter analog type .	1 No.
33	Wrench adjustable length 150mm.	1 No.
34	Multimeter digital type .	1 No.
35	Wrench adjustable length 200mm.	2 Nos.
36	Technometer digital, multirange 0 rpm to 3000 rpm. Portable small size in leather case.	1 No.
37	Wrench adjustable length 200mm.	2 Nos.
38	Filler gauge 0.05mm - 1mm.	1 Set
39	Pipe wrench size 50 & 150 mm.	01 No. each
40	Wire gauge metric & whitworth.	1 Set

41	Torque wrench 300mm, 12.7mm square drive right & left hand.	1 set
42	Refrigerant cylinder 2.5 kg.	2 Nos.
43	Valve key -t handle - 4.7mm & 6.4mm.sq.	4 sets
44	Refrigerant cylinder 5 kg.	2 Nos.
45	Socket set, reversible ratchet, 12.7mm square drive with extension 4.7mm to 31.2mm.	2 sets
46	I) Evacuating & refrigerant charging station, compression.	1 No.
	a) Rotary two stage vacuum pump & motor (with gas ballast & anti suck back) manifold with gauges & valves & capable of pulling vacuum upto 50 microns of Hg & with provision of connecting to a microns level vacuum gauge.	1 No.
	b) Graduated charging cylinder with provision for temperature correction & all necessary isolating valves.	1 No.
	II) Evacuating & charging station as above but fitted with weighing scale (upto 2 kg. In lieu of (b) above & with accuracy of +/-1g for charging hydrocarbons.	1 No.
47	Socket set, reversible ratchet, 1/2" square drive with extension 3/16" to 1/4" BSW & SR.	1 set
48	Dial thermometer remote control, armoured capillary dial 75mm. -50°C to +50°C.	2 Nos.
49	Pressure gauge diameter 63mm with recalibration set	4 Nos.
50	Compound gauge, diameter 63mm. with recalibration set screw, scale vacuum 76mm. Pressure 15 kg/sq.cm.	4 Nos.
51	Anemometer (Vane type)	1 No.
52	Service man thermometer in metal case -	4 Nos.

	30° C to +30° C	
53	Sling psychrometer mounted on aluminium back, scale - 50 C to +50 C.	2 Nos.
54	Gas leak detector for halogen gas.	2 Nos.
55	Window air conditioner capacity 1.5 ton with remote control	2 Nos.
56	L-Allen key set size 1.5mm to 6.4mm.	4 Sets
57	Pilot tube & inclined tube manometer	1 No.
58	T-Allen key set size 5/32" to 1/8".	4 Sets
59	Ball valves service valves, hand shut of valves of 1/4"to 7/8"	2 Nos. Each
60	Screw driver, plastic handle, 6mm TIP length 100mm to 150mm.	17 each
61	Quick couplers , process tube adaptors for 1/4",3/8"	2 pairs each
62	Screw driver, plastic handle, 10mm TIP length 200mm to 250mm.	5 each
63	Hermetic compressors 1.5 (AC)	1 No.
64	Philips screw driver - complete set in leather case.	2 sets
65	Micron vacuum gauge capable of reading upto 20 microns.	2 Nos.
66	Screw driver, plastic handle, 3mm TIP length 100mm to 150mm. Insulated.	1 set
67	Sensor thermometer (digital).	2 Nos.
68	Pliers combination insulated length 200mm.	2 Nos.
69	Fin straightener/fin comb.	4 Nos.
70	Pliers long nose 200mm.	2 Nos.
71	Reverse cycle AC/Heat pump 3000kcal/hr. or 4500kcal/hr.	1 No.
72	Pliers flat nose 150mm.	1 No.
73	Split type AC 4500kcal/hr. with indoor unit & outdoor units & electronics remote control.	2 Nos.
74	Hammer ball peen 450 gms.	4 Nos.

75	Portable air- LPG brazing kit with 2 kg. LPG cylinder, torches, houses, stand make. A) with straight flame. B) with eyelone/ swirl jet flame.	1 No.
76	Hammer nylon 300 gms.	4 Nos.
77	Dry N ₂ in cylinder with 2 stage regulator or commercial N ₂ in cylinder with drier unit and 2 stage regulator.	1 No.
78	Engineers rule 300mm long.	1 No.
79	Trichloroethylene bottle.	1 No.
80	Tape measuring 2m graduation in mm.	1 No.
81	Two way manifold with gauges.	1 No.
82	Chisel flat length 150mm.	4 Nos.
83	Four way manifold with gauges.	1 No.
84	Hack saw tubular metal frame adjustable.	4 Nos.
85	Scriber 150mm length	4 Nos.
86	Safety gloves, eye protection glasses.	4 Nos.
87	Centre punch length 100mm.	4 Nos.
88	Safety shoes (optional).	NIL
89	Oil can pressure type - 1 litre.	2 Nos.
90	Pipe threading dies protection glasses.	1 No.
91	File, flat medium, double cut, length 200mm.	4 Nos.
92	Acid test kit.	1 No.
93	File flat , fine double cut, length 150mm.	4 Nos.
94	Brazing alloy rods for 1/4"to7/8" tubes- Cu tocu, cu to steel, cu to brass & appropriate fluxes	1Set
95	Engineers square 200mm long.	2 Nos.
96	Pipe bending tool, lever type with degree indicator, for tube O.D. 6.4mm to 16mm.	2 Sets
97	Soldering iron exchangeable copper tip 65 watts.	5 Nos.
98	Puller 3 legged, with flexible arm 120mm.	1 No.
99	frost free Refrigerator 260 liters use in H.C.	2 Nos.

	Refrigerant	
100	Cut section of semi-harmatic screw compressor	1 No.
101	Digital type clamp meter	2 Nos.
102	Recovery machine one each for CFC & 134a refrigent with recovery cylinder	1 No.

Basic Module RAC - BBT- IV
Basic Refrigeration II
(First Year)
Other requirements

Sr.	No.	Description	Quantity
1		Workshop	60 sq.mtr.
2		workshop furniture	
		Instructor chair & table	1 No.
		Suitable work table with 4 vice	1 No.
		Suitable work table	1 No.
		Stools	17Nos.
		Discussion table	1No.
4		Tool cabinet	2 Nos.
5		Trainee's lockers	2 Nos.
6		First Aid Box	1 No.
7		Book Shelf (glass panel)	1 No.
8		Storage rack	2 Nos.

MODULE - V BASIC REFRIGERATION III

Computer Awareness 2 Weeks Commercial Refrigeration 6 Weeks

PRACTICAL	THEORY
Computer Awareness	
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 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, Control Panel, 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,	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 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>change the settings in IE, customize Internet Explorer for default applications, change the 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>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 workout 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 & C to get the full salary. Add the Column D into a new cell as TOTAL amount.</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>
<p>Copy the sheet into sheet 2. Sort the sheet as per names. Sort the sheet2 as per Total salary.</p>	
<p>Insert two rows in sheet. Merge these rows. Enter heading as Salary Bill. Use border and shading for the entire used column. Print the sheet using set print area with margins, and use scale factor for reduction and enlargement. Use portrait and Landscape.</p>	
<p>Water cooler construction (Instantaneous and)</p>	<p>Water storage, distribution and drainage</p>

storage) refrigeration circuit, electrical circuit, working and control, soldering of copper tubes with stainless steel, Trouble shooting of commonly faced problem like condenser Fan Failure, corrosion etc.	b) Refrigeration system using R-22 and components in lieu of R-12,
	Retrofitting with HFC-134a & HCs
	c) Electrical and control system
	d) Insulation and Energy conservation
Checking- and servicing visi cooler, deep freezer, Preventive maintenance and Trouble Shooting Retrofitting with Hydrocarbons and HFC 134a	Chest type bottle coolers, Deep Freezers and visi coolers Description, Construction and function substituting R-12 with R-134a or Hydrocarbon (Montreal protocol)
Checking and servicing deep freezer, Preventive maintenance and Trouble Shooting. Retrofitting with Hydrocarbons and HFC 134a	Deep Freezers description, Construction and function, Low temperature thermostat, different type of deep freezer construction. Substituting R-12 with R-134a or Hydrocarbon (Montreal protocol)
Ice Candy Plant, refrigeration circuit, electrical circuit, working and control, Preventive maintenance and Trouble Shooting (Better to visit establishment for maintenance part)	Ice Candy Plant, Refrigerant used, Brine agitator, Expansion Device; used, Electrical Motor Controls etc.
Cold storage Plant, types of condenser cooling coil used, expansion devices, refrigerant used and electrical circuit study. Drawing out layout of a typical chilling plant. Maintenance & trouble shooting.	Cold storage plant construction, refrigeration system with condenser & coil type used, RCD device used, super heat concept, electrical devices used. Chilling plants constructional details, System of refrigeration.

CENTRE OF EXCELLENCE (C.O.E.)

BROAD BASED BASIC TRAINING IN REFRIGERATION & AIR CONDITIONING

Basic Module RAC - BBT- V**Basic Refrigeration III****(First Year)****Tools, Equipments & machinery for RAC-BBT-V**

Sr. No.	Names of the tools & Equipments	Quantity
1	2	3
1	Flaring tool set, single type for tube 4.7mm to 16mm O.D.	4 sets
2	Swaging tool, punch type, set of size for tube 4.7mm to 16mm O.D.	4 sets
3	Gas cylinder truck two wheel type.	2 Nos.
4	Swaging tool, screw type, with adaptor set of size for tube 4.7mm to 16mm O.D.	1 set
5	Line tester 500 v. heavy duty.	4 Nos.
6	Bending spring external type, for copper tube 3mm to 16mm DIA.	4 sets
7	Tong tester 0-10-30 amps. 0 - 500 v.(clamp on multimeter.	4 Nos.
8	Pipe cutter miniature for copper tube 3mm to 16mm DIA.	4 Nos.
9	Knife folded stainless steel - 150mm.	4 Nos.
10	Pipe cutter with built in reamer & space cutter, for copper tube 3mm to 32mm .	1 No.
11	Voltmeter, AC/DC portable precision gread teak wood case leather belt 0 to 500 V.	2 Nos.
12	pinch of tool, for copper tube, 6mm to 18mm DIA.	4 Nos.
13	Ammeter, AC/DC portable, precision gread teak wood case leather belt 0 to 5 amp.	2 Nos.
14	Ratchet spanner of 6.4sq.mm reversible	4 Nos.
15	Ammeter, AC/DC portable, precision gread teak wood case leather belt 0 to 30 V	2 Nos.

16	Capillary plague gauge.	2 Nos.
17	Megger - 1000 v.	1 No.
18	Pinch of plier / crimping pliers tool 6mm - 18mm. DIA.	2 Nos.
19	Variance input 230 v. output 400 v. Amp. Portable complete with metet & controls.	1 No.
20	Piercing plier 6-18mm & reversing valve with access fitting.	2 Nos. Each
21	Wattmeter multirange upto 1 kw.	1 No.
22	Spanner double ended 4.7mm to 16mm.	5 sets
23	Wattmeter multirange upto 5 kw.	1 No.
24	Spanner double ended 19mm to 31.8mm.	1 set
25	Multimeter analog type .	1 No.
26	Ring spanner off set 4.7mm to 16mm.	5 sets
27	Multimeter digital type .	1 No.
28	Ring spanner off set 19mm to 31.8mm.	1 set
29	Technometer digital, multirange 0 rpm to 3000 rpm. Portable small size in leather case.	1 No.
30	Box spanner size 6.4mm to 10mm.	2 sets
31	Transistor tester.	1 No.
32	Wrench adjustable length 150mm.	1 No.
33	R.L.C. bridge.	1 No.
34	Wrench adjustable length 200mm.	2 Nos.
35	Stop watch.	1 No.
36	Wrench adjustable length 250mm.	2 Nos.
37	Filler gauge 0.05mm - 1mm.	1 Set
38	Pipe wrench size 50 & 150 mm.	01 No. each
39	Wire gauge metric & whitworth.	1 Set
40	Torque wrench 300mm, 12.7mm square drive right & left hand.	1 set
41	Refrigerant cylinder 2.5 kg.	2 Nos.
42	Valve key -T handle - 4.7mm & 6.4mm.sq.	4 sets
43	Refrigerant cylinder 5 kg.	2 Nos.
44	Socket set, reversible ratchet, 12.7mm square drive with extension4.7mm to 31.2mm.	2 sets
45	l) Evacuating & refrigerant charging station, compression.	1 No.

	a) Rotary two stage vacuum pump & motor (with gas ballast & anti suck back) manifold with gauges & valves & capable of pulling vacuum upto 50 microns of Hg & with provision of connecting to a microns level vacuum gauge.	
	b) Graduated charging cylinder with provision for temperature correction & all necessary isolating valves.	
	II) Evacuating & charging station as above but fitted with weighing scale (upto 2 kg. In licu of (b) above & with accuracy of +/-1g for charging hydrocarbons.	1 No.
46	Socket set, reversible ratchet, 1/2" square drive with extension 3/16" to 1/4" BSW & SR.	1 set
47	Dial thermometer remote control, armoured capillary dial 75mm. -50 ⁰ C to +50 ⁰ C.	2 Nos.
48	Pressure gauge diameter 63mm with recalibration set	4 Nos.
49	Two stage rotary vacuum pump capacity approx. 60 - 100 rpm, capable of evacuating to 50 microns of Hg & fitted with gas ballast, anti suck back valve & single phase motor.	1 No.
50	Compound gauge, diameter 63mm. with recalibration set screw, scale vacuum 76mm. Pressure 15 kg/sq.cm.	4 Nos.
51	Anemometer (Vane type)	1 No.
52	Service man thermometer in metal case - 30 ⁰ C to +30 ⁰ C	4 Nos.
53	Air compressor, two stage for oil - less dry air, with rush proof tank assembly, heater & controls max. pr. 10kg/sq.cm. Capacity 45 litre, motor 1 hp.	1 No.
54	Scraper triangular blade removable 60mm.	2 Nos.
55	Gas leak detector for halogen gas.	2 Nos.
56	Lapping plate 250mm x 200mm.	2 Nos.
57	Spray outfit, 'V' twin motor 1/2 hp. Delivery upto 120 litre free air pressure upto 3kg/sq.cm. With spray gun & fitting.	1 No.
58	Punch hole for cutting gasket, 4.7mm to 16mmDIA.	4 Nos.
59	Deep frizer 165 litres - 18 ⁰ C., 1/4 hp.	1 No.
60	Scissor, gasket cutting stainless steel, length 25mm.	4 Nos.
61	L-Allen key set size 1.5mm to 6.4mm.	4 Sets

62	Bottle cooler 110 litres 1/6 hp.	1 No.
63	T-Allen key set size 5/32" to 1/8".	4 Sets
64	Water cooler instantaneous type .	1 No.
65	Screw driver, plastic handle, 6mm TIP length 100mm to 150mm.	17 each
66	Water cooler storage type .	1 No.
67	Screw driver, plastic handle, 10mm TIP length 200mm to 250mm.	5 each
68	Ice candy unit complete with stainless steel tank, mould box, thermocol insulated sunmica body, agitator, compressor, motor ele. Temperature, pressure, refrigerant control gauges, motor, pipe fitting ele 3000kcal/hr. working trainer model/ simulator.	1 No.
69	Philips screw driver - complete set in leather case.	2 sets
70	Cold storage plant complete with all controls & accessories including cooling tower & water treatment plant capacity 15000 kcal/hr. or working trainer model/ simulator.	1 No.
71	Screw driver, plastic handle, 3mm TIP length 100mm to 150mm. Insulated.	1 set
72	Pliers combination insulated length 200mm.	2 Nos.
73	Pliers long nose 200mm.	2 Nos.
74	Pliers flat nose 150mm.	1 No.
75	Hammer ball peen 450 gms.	4 Nos.
76	Welding table 900mm x 900mm x 700mm high.	1 No.
77	Hammer ball peen 220 gms.	4 Nos.
78	Electrical drill portable drill with chuck & key, capacity 6.4mm.	2 Nos.
79	Hammer nylon 300 gms.	4 Nos.
80	Pillar drilling machine 200 rpm to 2500rpm capacity 200mm.	1 No.
81	Engineers rule 300mm long.	1 No.
82	Micrometer outside measurement 0 to 25mm.	2 Nos.
83	Tape measuring 10m graduation in mm.	1 No.
84	Vernier height gauge 250mm.	1 No.
85	Tape measuring 2m graduation in mm.	1 No.

86	Vernier Caliper gauge 250mm.	1 No.
87	Chisel flat length 150mm.	4 Nos.
88	Micron vacuum gauge capable of reading upto 20 microns.	2 Nos.
89	Hack saw tubular metal frame adjustable.	4 Nos.
90	Sensor thermometer (digital).	2 Nos.
91	Scriber 150mm length	4 Nos.
92	Fin straightener/fin comb.	4 Nos.
93	Divider spring joint length 150mm.	4 Nos.
94	Hc refrigerant in cylinders / disposable containers.	2 Nos.
95	Caliper spring joint out side length 150mm.	4 Nos.
96	134 A refrigerant in cylinders.	2 Nos.
97	Caliper spring joint in side length 150mm.	4 Nos.
98	Recovery unit one each for cfc & 134A refrigerants with recovering cylinders	1 No.
99	Caliper, odd leg, spring joint length 150mm.	4 Nos.
100	Fire extinguisher power type.	2 Nos.
101	Centre punch length 100mm.	4 Nos.
102	Portable air- LPG brazing kit with 2 kg. LPG cylinder, torches, hoses, stand make. A) with straight flame. B) with eyelone/ swirl jet flame.	1 No.
103	Oil can pressure type - 1 litre.	2 Nos.
104	Dry N ₂ in cylinder with 2 stage regulator or commercial N ₂ in cylinder with drier unit and 2 stage regulator.	1 No.
105	File, flat medium, double cut, length 200mm.	4 Nos.
106	Trichloroethylene bottle.	1 No.
107	File half round medium, double cut length 200mm.	4 Nos.
108	Two way manifold with gauges.	1 No.
109	File half round medium, double cut length 200mm.	4 Nos.
110	Four way manifold with gauges.	1 No.
111	File round , fine double cut, length 150mm.	4 Nos.
112	Filter driers for cfc - 12 & HFC - 134A for repairs - retrofits.	8 Nos.
113	File flat , fine double cut, length 150mm.	4 Nos.
114	Sealed ex - proof components for use in hs appliances : thermostate, sealed o/p's. solid state PTC's, door	4 Nos. each

	switches, lamp holders	
115	File square , fine double cut, length 150mm.	4 Nos.
116	Small capacity shell & tube condenser.	1 No.
117	Engineers square 200mm long.	2 Nos.
118	Fan coil unit with water valves (2 & 3way).	1 No.
119	Marking block, unversed spindle 200mm.	2 Nos.
120	Shell & tube, DX chillers (small).	1 No.
121	V - block with clamp 75mm.	2 Nos.
122	Circulating water pump (small).	1 No.
123	Surface plate with stand 600mm x 450mm.	1 Set
124	Safety gloves, eye protection glasses.	4 Nos.
125	Angle plate, 120 ^o C 100mm 90 ^o C.	1 No.
126	Safety shoes (optional).	NIL
127	Soldering iron exchangeable copper tip 65 watts.	5 Nos.
128	Pipe threading dies protection glasses.	1 No.
129	Pipe bending tool, lever type with degree indicator, for tube O.D. 6.4mm to 16mm.	2 Sets
130	Schrader valve core removal tool.	1 No.
131	Puller 3 legged, with flexible arm 120mm.	1 No.
132	Acid test kit.	1 No.
133	Puller 2 legged, with flexible arm 300mm.	1 No.
134	Refractometer (optional).	1 No.
135	Hand blower portable complete 1/10 HP.	1 No.
136	Hand formers & 20 g capacity lock former.	1 No.
137	Spirit level precision metallic 200mm.	1 No.
138	Pop rivet gun.	1 No.
139	Plumb weight 200g.	1 No.
140	Brazing alloy rods for 1/4"to7/8" tubes- Cu tocu, cu to steel, cu to brass & appropriate fluxes	1Set
141	Snipper sheet metal straight nose 200mm.	1 No.
142	Pilot tube & inclined tube manometer	1 No.
143	Tap set with matching drills 3mm to 16mm.	1 Set
144	l) Hermatic compressors 1/8hp to 1/2hp) for use in repair work of appliances for CFCs&HFCs 1) Hermatic	1 No.

	compressor for 134a	
145	Tap set with matching drills 1/4" to 5/8".	1 Set
146	Ball valves service valves, hand shut of valves of 1/4" to 7/8"	2 Nos. Each
147	Tape & die set 1/4" to 5/8" SAE size	1 Set
148	Quick couplers, process tube adaptors for 1/4", 3/8"	2 pairs each
149	Tap & die set 3mm to 16mm size	1 Set
150	Compressors testers for small hermetic compressors	1 No.
151	Hermetic compressors 1.5 (AC)	1 No.
152	Visi cooler	1 No.
153	Evaporator of direct cooled refrigerator with capillary heat exchanger	1 No.
154	Digital type clamp meter	2 Nos.
155	Desktop Personnel Computers Intel Pentium-IV-CPU, 17" Monitor, Key Board, FDD, HD 80 GB, Window XP Professional Operating System	8 Nos.
156	UPS 600 VA	8 Nos.
157	Suitable Computer Tables	As per required
158	Shoe Rack	As per required
159	Computer Chairs	17 Nos.
160	Vacuum cleaner	1 No.

Basic Module RAC - BBT- V
Basic Refrigeration III
(First Year)
Other requirements

Sr. No.	Description	Quantity
1	Workshop	60 sq.mtr.
2	workshop furniture	
	Instructor chair & table	1 No.
	Suitable work table with 4 vice	1 No.
	Suitable work table	1 No.
	Stools	17 Nos.
	Discussion table	1 No.
4	Tool cabinet	2 Nos.
5	Trainee's lockers	2 Nos.
6	First Aid Box	1 No.
7	Book Shelf (glass panel)	1 No.
8	Storage rack	2 Nos.

MODULE VI : BASIC REFRIGERATION IV

WEEK NO.	PRACTICAL	THEORY
1	Dismantling a pump unit from foundation. Checking the parts, servicing re-installing & testing the unit for performance & power consumption. Identifying & sketching parts of pumps & valves & note their functions. Preparing a problem tree for fault diagnosis.	Pumps, types & applications. Centrifugal pumps, their constructional details & applications. Working of a centrifugal pump. Calculations of heads, frictional losses, selection of pump. Valve, their types & applications. Sluice valve, butterfly valve, non return valves, constructional details & principle of working. Fault diagnosis.
2	Sketching & dimensioning the parts of a typical package unit and study its constructional & operational details. Operating a package unit for its working and performance. Study the installation details & duct system of a package unit. Rewire a package unit. Mechanical, electrical & operational fault finding.	Package Air conditioners, their need, types & applications Ductable & non ductable units. Constructional details of a package unit. Electrical wiring & refrigerant system controls & electrical controls. Installation & operational details. Fault diagnosis with help of a problem tree. Comparative study of package units available in the market.
3	Isolating, servicing & re-installing a car A.C. unit. To test, service & adjust different controls and switches. To check & test the total system for performance.	Automobile air conditioning, its history, need & applications. Difference between a room A.C. and automobile A.C. Study the details of a typical automotive air conditioning system parts and their functions. Installation & operation of a Car A.C. Trouble shooting with the help of a problem tree.
4	Study of typical central A.C. system using vapour absorption system. Study of typical ice-manufacturing plant. Typical maintenance problems & trouble shooting. (Practicals should be site oriented)	Vapour Absorption Refrigeration system. Typical refrigeration cycle. Ammonia & Lithium Bromide absorption system. Typical Electrolux refrigeration system & its applications. Advantages & disadvantages of vapour absorption refrigeration system. Different applications. Air Refrigeration, steam jet refrigeration & non-conventional refrigeration

		systems.
5, 6, 7, 8	<p>Studying and drawing the layout & piping arrangement of the given Central A.C. Plant.</p> <p>Studying & drawing the chilling water & condensate water circuits.</p> <p>Studying different controls.</p> <p>Maintenance of pumps, compressors & controls.</p> <p>Studying & drawing the panel board connections & wiring.</p> <p>Testing, pumping down & re-testing the plant.</p> <p>Evacuating & gas charging the system.</p> <p>Designing Central A.C. systems for different applications.</p>	<p>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.</p> <p>Cooling Towers, their types, constructional details & operation. Cooling Tower installation & maintenance, make up water arrangements.</p> <p>Types of compressors used, loading and unloading arrangements. Ducting & its installation. Different switches & controls.</p> <p>Trouble shooting. Heat load calculations for different site conditions & applications.</p>

CENTRE OF EXCELLENCE (C.O.E.)

BROAD BASED BASIC TRAINING IN REFRIGERATION & AIR CONDITIONING

Basic Module RAC - BBT- VI**Basic Refrigeration IV****(First Year)****Tools, Equipments & machinery for RAC-BBT-IV**

Sr. No.	Names of the tools & Equipments	Quantity
1	2	3
1	Flaring tool set, single type for tube 4.7mm to 16mm O.D.	4 sets
2	Electrical drill portable drill with chuck & key, capacity 6.4mm.	2 Nos.
3	Swaging tool, punch type, set of size for tube 4.7mm to 16mm O.D.	4 sets
4	Swaging tool, screw type, with adaptor set of size for tube 4.7mm to 16mm O.D.	1 set
5	Bending spring external type, for copper tube 3mm to 16mm DIA.	4 sets
6	Line tester 500 v. heavy duty.	4 Nos.
7	Pipe cutter miniature for copper tube 3mm to 16mm DIA.	4 Nos.
8	Tong tester 0-10-30 amps. 0 - 500 v.(clamp on multimeter.	4 Nos.
9	Pipe cutter with built in reamer & space cutter, for copper tube 3mm to 32mm .	1 No.
10	pinch of tool, for copper tube, 6mm to 18mm DIA.	4 Nos.
11	Voltmeter, AC/DC portable precision gread teak wood case leather belt 0 to 5 amp.	2 Nos.
12	Ratchet spanner of 6.4sq.mm reversible	4 Nos.
13	Ammeter, AC/DC portable, precision gread teak wood case leather belt 0 to 5 amp.	2 Nos.
14	Capillary plague gauge.	2 Nos.
15	Megger - 1000 v.	1 No.
16	Pinch of plier / crimping plier tool 6mm - 18mm. DIA.	2 Nos.
17	Piercing plier 6-18mm & reversing valve with access fitting.	2 Nos. Each

18	Multimeter analog type .	1 Nos.
19	Spanner double ended 4.7mm to 16mm.	5 sets
20	Multimeter digital type .	1 No.
21	Spanner double ended 19mm to 31.8mm.	1 set
22	Stop watch.	1 No.
23	Ring spanner off set 4.7mm to 16mm.	5 sets
24	Filler gauge 0.05mm - 1mm.	1 Set
25	Ring spanner off set 19mm to 31.8mm.	1 set
26	Box spanner size 6.4mm to 10mm.	2 sets
27	Wrench adjustable length 150mm.	1 No.
28	I) Evacuating & refrigerant charging station, compression.	1 No.
	a) Rotary two stage vacuum pump & motor (with gas ballast & anti suck back) manifold with gauges & valves & capable of pulling vacuum upto 50 microns of Hg & with provision of connecting to a microns level vacuum gauge.	
	b) Graduated charging cylinder with provision for temperature correction & all necessary isolating valves.	
	II) Evacuating & charging station as above but fitted with weighing scale (upto 2 kg. In lieu of (b) above & with accuracy of +/-1g for charging hydrocarbons.	1 No.
29	Wrench adjustable length 200mm.	2 Nos.
30	Two stage rotary vacuum pump capacity approx. 60 - 100 rpm, capable of evacuating to 50 microns of Hg & fitted with gas ballast, anti suck back valve & single phase motor.	1 No.
31	Wrench adjustable length 250mm.	2 Nos.
32	Pipe wrench size 50 & 150 mm.	01 No. each
33	Pressure testing tank with lighting arrangement, pressure gauge (0 to 35kg/sq.cm.) double stage.	1 No.
34	Torque wrench 300mm, 12.7mm square drive right & left hand.	1 set
35	Valve key -t handle - 4.7mm & 6.4mm.sq.	4 sets
36	Socket set, reversible ratchet, 12.7mm square drive with extension4.7mm to 31.2mm.	2 sets
37	Socket set, reversible ratchet, 1/2" square drive with extension3/16" to 1/4" BSW & SR.	1 set
38	Work bench 1000mm x 600mm x 800mm. High.	2 Nos.

39	Pressure gauge diameter 63mm with recalibration set	4 Nos.
40	Portable air- LPG brazing kit with 2 kg. LPG cylinder, torches, houses, stand make. A) with straight flame. B) with eyelone/ swirl jet flame.	1 No.
41	Compound gauge, diameter 63mm. with recalibration set screw, scale vacuum 76mm. Pressure 15 kg/sq.cm.	4 Nos.
42	Pliers flat nose 150mm.	1 No.
43	Service man thermometer in metal case - 30 ⁰ C to +30 ⁰ C	4 Nos.
44	Gas leak detector for halogen gas.	2 Nos.
45	Micron vacuum gauge capable of reading upto 20 microns.	2 Nos.
46	L-Allen key set size 1.5mm to 6.4mm.	4 Sets
47	Sensor thermometer (digital).	2 Nos.
48	T-Allen key set size 5/32" to 1/8".	4 Sets
49	Fin straightener/fin comb.	4 Nos.
50	Screw driver, plastic handle, 6mm TIP length 100mm to 150mm.	4 each
51	134 A refrigerant in cylinders.	2 Nos.
52	Philips screw driver - complete set in leather case.	2 sets
53	Recovery unit one each for cfc & 134A refrigerants with recovering cylinders	2 Nos.
54	Pliers combination insulated length 200mm.	2 Nos.
55	Pliers long nose 200mm.	2 Nos.
56	Fire extinguisher power type.	2 Nos.
57	Hammer ball peen 220 gms.	4 Nos.
58	Dry N ₂ in cylinder with 2 stage regulator or commercial N ₂ in cylinder with drier unit and 2 stage regulator.	1 No.
59	Trichloroethylene bottle.	1 No.
60	Engineers rule 300mm long.	1 No
61	Two way manifold with gauges.	1 No.
62	Tape measuring 2m graduation in mm.	1 No.
63	Four way manifold with gauges.	1 No.
64	Hack saw tubular metal frame adjustable.	4 Nos.
65	Centre punch length 100mm.	4 Nos.
66	Safety gloves, eye protection glasses.	4 Nos.
67	Oil can pressure type - 1 litre.	2 Nos.

68	File, flat medium, double cut, length 200mm.	4 Nos.
69	Brazing alloy rods for 1/4"to7/8" tubes- Cu tocu, cu to steel, cu to brass & appropriate fluxes	1Set
70	Soldering iron exchangeable copper tip 65 watts.	5 Nos.
71	Quick couplers , process tube adaptors for 1/4",3/8"	2 pairs each
72	Pipe bending tool, lever type with degree indicator, for tube O.D. 6.4mm to 16mm.	2 Sets
73	Hand blower portable complete 1/10 HP.	1 No.
74	Bellow type thermostats, H.P.stat, L.P.stat, humidi stat, solenoid valves	1 No. each
75	Descaling pumpset with stainless steel impeller & housing complete with motor 1 hp & accessories.	1 No.
76	Sling psycrometer mounted on aluminium back, scale - 50 C to +50 C.	2 Nos.
77	Micron vacuum gauge capable of reading upto 20 microns.	2 Nos.
78	Components for car AC systems.	1 each
	A) Wobble plate compressor with mounting	
	B) Serpentine evaporator.	
	C) Parallel flow condenser.	
	D) Hoses, tubes, receiver, expansion valve.	
	E) electrical components & wiring harness.	
79	Puller 3 legged, with flexible arm 120mm.	1 No.
80	Technometer digital, multirange 0 rpm to 3000 rpm. Portable small size in leather case.	1 No.
81	Dial thermometer remote control, armoured capillary dial 75mm. -50 ⁰ C to +50 ⁰ C.	2 Nos.
82	Two stage rotary vaccum pump capacity approx. 60 - 100 rpm, capable of evacuating to 50 microns of Hg & fitted with gas ballast, anti suck back valve & single phase motor.	1 No.
83	Anemometer (Vane type)	1 No.
84	Air compressor, two stage for oil - less dry air, with rush proof tank assembly, heater & controls max. pr. 10kg/sq.cm. Capacity 45 ltr, motor 1 hp.	1 No.

85	Air conditioning, direct & indirect water chiller. Complete with all controls including humidity control ele capacity 15000kcal/hr. or working trainer model/ simulator. Alternatively, a packaged air - conditioner of similar capacity.	1 No.
86	Reciprocating compressor with provision of capacity control etc. for demonstration. Capacity 9000kcal/hr. semi hermetic open type.	1 No.
87	Recovery unit one each for cfc & 134A refrigerants with recovering cylinders	1 No.
88	Condensing unit with open type compressor air-cooled condenser, controls cap. 3000 k.cal/ hr.	1 No.
89	Condensing unit with open type compressor, evaporative condenser, with electric control cap. 3000 k.cal/hr.	1 No.
90	Working model of absorption system of Refrigeration cap. 3000 k.cal/hr.	1 No.
91	Air-velocity meter (Digital type)	1 No.
92	Testing machine for calibration & testing fo electrical starter, relay, contractor, solenoid valve. LP, HP, Oil pressure cut out.	1 No.
93	Package A/C 7.5 ton cap. Water cool type	1 No.
94	Package A/C 3 ton Air cooled type	1 No.
95	Small capacity shell & Tube type condenser	1 No.
96	Fan coil unit with water valve (2 & 3 way)	1 No.
97	Shell & tube type Dx chiller (Small)	1 No.
98	Thermostatic Exp. Valve	1 No.
99	Solenoid valve	1 No.
100	HP, LP, Oil pressure cut out switch	1 each
101	Cut section of Dx chiller	1 No.
102	Cut section of Shell & tube type condenser	1 No.
103	Cut section of Hermatic Scroll comp	1 No.
104	Cut section of Hermatic Reciprocating compressor	1 No.
105	Table model of vapur absorption system	1 No.
106	Screw compressor (open type)	1 No.

Basic Module RAC - BT- VI
Basic Refrigeration IV
(First Year)
Other requirements

Sr. No.	Description	Quantity
1	Workshop	60 sq.mtr.
2	workshop furniture	
	Instructor chair & table	1No.
	Suitable work table with 4 vice	1No.
	Suitable work table	1No.
	Stools	17 Nos.
	Discussion table	1No.
4	Tool cabinet	2Nos.
5	Trainee's lockers	2Nos.
6	First Aid Box	1No.
7	Book Shelf (glass panel)	1No.
8	Storage rack	2Nos.

MODULE - VIII	WORKSHOP CALCULATION & SCIENCE	- 2 hours / week - 48 weeks
Familiarization with the Institute		
Units & Measurements - Systems of units, Fundamentals and derived units		
Conversion of units and applied problems. FPS, CGS, MKS and SI units		
Fraction & decimals - Addition, Subtraction, multiplication and division		
Fraction & decimals - Addition, Subtraction, multiplication and division		
Mass weight, volume and Density and their units.		
Problems on density and volume of Steel, Aluminum and copper.		
Simplification of Fraction and Decimals		
Simplification of Fraction and Decimals		
Definition -Force, Pressure, and their units		
Definition- Stress, Strain and Modulus of Elasticity		
Square & Square roots		
Plotting and reading of simple graph.		
Heat, Temperature and conversion of scales Fahrenheit, Centigrade, and Kelvin. -		
Thermometer, Thermocouple and Pyrometer and its application		
Transmission of heat and co-efficient of Thermal expansion of solid and related problems.		
Ratio and proportion		
Ratio proportion - Direct - Indirect and mixed proportions		
Simple machines - Mechanical advantage, velocity ratio and efficiency		
Simple problems on simple machines		
Menstruation - area of circle, triangle and polygons		
Menstruation - Surface area, Volume of cube and Sphere		
Menstruation - Surface area and volume of Cone and prism		
Menstruation - Surface area and volume of Cylinder and Hollow cylinder		
Use of Logarithm and anti logarithm tables		
Multiplication and Division - use logarithms		
Simplification of Fraction and decimals - use logarithms		
Friction, kinds of friction - Advantage & disadvantage		
Percentage problems - Metal removal by machining		
Percentage problems - Metal added by welding		
Estimation and cost of finished products.		
Classification of Ferrous and Non -Ferrous Metals and Alloys.		
Physical and mechanical properties of metal		
Simple algebraic addition and subtraction		
Simple algebraic multiplication and division		

MODULE : IX TOTAL QUALITY MANAGEMENT 2 HOURS / WEEK 48 WEEKS

1	Introduction to T.Q.M., concept & its importance.
2	Organisation & T.Q.M., customer & T.Q.M.
3	Concept of globalisation and challenges arising from it.
4	Quality, its meaning and importance, quality chain.
5	Enforcement of T.Q.M., problems & solutions.
6	T.Q.M. and Employees, needs & ways for their total involvement.
7	5- S meaning & applications.
8	Implementation of 5 -S in an organisation.
9	Kaizan : Its concept, importance & necessity.
10	Implementation of kaizan in organisation.
11	Kaizan & 5 - S : case studies.
12	Production & productivity
13	Meaning & importance of productivity, productivity & quality.
14	Total productive Management, introduction to quality control.
15	Implementation of seven techniques of quality control.
16	Housekeeping, importance, underlying principles and implementation.
17	Multiskilling, its concept & importance.

18

Utilisation of human resource & human abilitie.

**Basic Module RAC - BT- VII, VIII, IX
 GENERIC MODULE
 (First Year)
 Other requirements**

Sr. No.	Quantity	
1		sq.mtr.
2		sq.mtr.
		No.
		Nos.
		No.
		Nos.
		Nos.
3		Nos.
4		No.
1		No.
2		No.
3		No.
4		1No.
5		1No.
6		1No.
1		17Nos.

2		17Nos.
3		17Nos.