

**MEMBERS OF THE TRADE COMMITTEE FOR THE TRADE OF
REFRIGERATION AND AIR CONDITIONING MECHANIC**

CHAIRMAN :

Shri M.A. Risaldar
R.D.D., Ahemedabad

R.D.D Office,
Kubernagar, Ahemedabad

MEMBERS:

(S/Shri....)

- | | | |
|----|---|--|
| 1. | V.R. Bhavsar
Principal
(Rep. of R.D.A.T. Bomaby) | I.T.I. Nasik |
| 2. | Dr. M.B.Jain
Retired H.O.D.,
Mechanical,
L.D. College of Engineering | D-6, Parul Flat,
S.M.Road,
Ambavadi, Ahemedabad |
| 3. | A.Y. Shukla
Managing Director | Aerotherm Products,
414, Bhadr-raj Chamber
Navrangpura, Ahemedabad |
| 4. | S. Jayraman
Service Engineer | Voltas Limited
Pushpak Bldg.,
Khanpur, Ahemedabad |
| 5. | N.M.Patel
Managing Director | Kirti Sales Pvt Ltd
Kirti House , Nr. H.K. House,
Ashram Road, Ahemdabad |
| 6. | Sunil V.Shah
Director | Vam Airtex Pvt. Ltd.
4/5/15, Vasu Pujya Chamber
Ashram Road, Ahemedabad. |
| 7. | L.D.Sharma
Principal | I.T.I./A.V.T.S.
Kubernagar, Ahemedabad |
| 8. | E.I. Christie
Vice Principal | I.T.I/A.V.T.S/
Kubernagar,Ahemedabad |
| 9. | K.S. Suthar
Jr. Training Officer | A.V.T.S.
KUbernagar, Ahemedabad. |

GENERAL INFORMATION

1.	Name of the Trade	Refrigeration & Air Conditioning Mechani
2.	N.C.O. Code No.	845.70
3.	Entry Qualification	Pass in 10 th class examination under 10+2 system of education with Science and Mathematics or its equivalent
4.	Duration of Craftsman Training	2 years
5.	Duration of Apprenticeship Training	3 years including two years Basic Training
6.	Rebate to Ex-ITI Trainees	Full
7.	Ratio of Appretices to Workers	1:3

SYLLABUS FOR THE TRADE REFRIGERATION & AIR CONDITIONING MECHANIC

Under Craftsman Training Scheme

Duration of Training: 2 Years

Unit wise distribution of Practical Skills

General Engg. Training	Unit A
Servicing Domestic ref. Appliance	Unit B
Servicing Semi-commercial Ref. Appliance	Unit C
Servicing Cold-storage-small Capacity	
Unit D	
Servicing Air Conditioning Plant Small Capacity	Unit E
Repair & Maintenance Domestic & Semi Commercial	
Ref. Appliance	Unit f

WEEK WISE DISTRIBUTION OF PRACTICAL SKILLS

Unit	Prg.Skill Area	No.of Week	Week No. From to	Unit	Trg.Skill	No. of Week	Week No. From To
A 1	Introduction/ Orientation Basic Basic Fitting	1 5	1-2-6	C	Servicing Semi-commercial Ref. Appliances	3	53-55
A 2	Basic Sheet Metal Basic Welding	2 2	7-8 9-10	D-1	Servicing Commercial reciprocating compressor	5	56-60
A 3	Basic Electrical	6	11-16	D 2	Servicing commercial condenser, tower, water treatment plant	4	61-64
A 4	Basic Electronic	2	17-18	D 3	Servicing, evaporator chiller, Ref. control	2	65-66

**SYLLABUS FOR THE TRADE OF REFRIGERATION AND
AIR/CONDITION MECHANIC
UNDER CRAFTSMAN TRAINING SCHEME**

Period of Training : 2 Years.

A 5	Basic Automobile	2	19-20	D 4	Servicing & operation cold storage small cap.	6	67-72
	Revision Test	21-22			Revision Test		73-74
B 1	Identification Manipulation Ref. tools & components	3	23-25	E 1	Servicing Air handling humidity Control & heating	4	75-78
B2	Servicing domes Domestic – semi-Commercial & car A/c components	8	26-33	E 2	Servicing & operation Aircondition plant small capacity	4	79-82
B 3	Servicing Air Cooled condenser Cooling coil & controls	5	34-38	F 1	Repair & maintenance domestic refrigeration Appliance	1	83-83
B 4	Servicing refrigerated cabinet and storage	2	39-40	F 2	Repair & Maintenance semi-commercial Ref. appliances.	3	84-86
B 5	Checking and Testing Refrigeration System	7	41-46	F 3	Servicing Domestic Aircondition & Car A/c	4	87-90
B 6	Checking testing Window A/c & Split A/c Revision & Test	2	49-50 51-52		Industrial Training Revision & Test		91-102 103-104

**SYLLABUS FOR THE TRADE OF REFRIGERATION AND
AIR/CONDITION MECHANIC
UNDER CRAFTSMAN TRAINING SCHEME**

Period of Training: 2 Years.

Week No.	Practical	Theory	W/Shop Cal.	W/Shop Sci.	Engg. Drg.
1.	Induction training. Familiarization with the Institute. Type of practical Training to be followed. Workshop safety.	Importance of the trade in the industrial and commercial field. Theoretical subjects to be taught. Achievement to be made.	_____	_____	_____
2.	Use of simple marking and measuring tools. Marking out as per Blue print. Chipping Flat, grinding chisel. Hacksawing to alien.	Method of marking, Marking media. Simple marking and measuring tools & their use. Chisel Hacksaw frame & blade type specification & use.	Fraction-addition, subtraction , multiplication & division.	Unit & measurement, fundamental & derived unit.	Free hand sketching of straight line Rectangle, circle polygon etc
3.	Filing flat, square round & profile. Drilling clear and blind hole. Counter sinking counter boring grinding drill bit.	Files and drills Types, specification, Use, care and safety Drilling speed feed and coolants.	-do-	-do-	-do-
4.	Tapping clear and blind hole.	Taps and dies- Their	-do-	Matter, mass,	Free hand

	Treading b die. Fitting stud & removing broken stud. Hand reaming and fitting dowel pin.	specification, use and safety. Reamers type specification use and safety.		volume, density and specific gravity.	sketchin g of simple solid cube, rectangul ar block cylinder etc.
5.	Inspection & checking longitudinal, angular parallelism,square ness flatness and concentricity.	Important precision measuring, marking and checking tools- type specification, use and care and safety.	Decimal addition, subtraction , multiplicati on and division.	-do-	-do-
6.	Scraping flat surface sharpening of scapper Laping and polishing flat surface.	Limit, fit and tolerance. I.S.I. specification, Scraper-type, specification and plate type, specification and use.	-do-	-do-	- do-
7.	Use of sheet metal tools and equip. care and safety. Making sheet metal joints as used inducting riveting on sheet metal.	Sheet metal tools and equip. type, specification care and safety. Types of sheet metal joints and their use Rivet and riveting- their types and use.	Decimal addition , subtraction , multiplicati on and division.	Motion displaceme nt speed, velocity, acceleratio n.	Use of different types of line & symbol for drawing.
8.	Soldering and brazing on sheet metal joints	Soldering and brazing .Diffe rent types of solder,	Conversion of decimals to common fraction.	-do-	-do-

		composition and use of flux-their effect on metal Method of soldering and brazing.			
9.	Welding tools and equipment care and safety. Setting Oxy-actiyline pl;ant. Lighting and adjustment flame-simple joint M.S. Setting oxygen & acetylene pressure for welding of thin sheet & sheet cutting.	Welding tools and equipment-type specification and use. Safety method in welding. Method of gas welding gas used and flame adjustment.	-do-	Motion displacement speed, velocity, acceleration..	Free hand sketching nut bolt rivet and washers etc.
10.	Electric welding-current setting, striking and maintaining are. Simple electric joints on M.S.	Method of electric welding electrotype and application object of flux coating. Welding symbols and ISI code for gas and arc welding.	Reduction of common fraction to decimal.	Laws of motion force and momentum, measurement of force and momentum .	-do-
11.	Use of electrician hand tools. Safety precaution and first aid, Joints on single and std. conductors and soldering.	Electrician hand tools types specification use care and safety. Common terms used in the trade. Conductors	Percentage and its application .	-do-	Free hand sketching of screw and screw treads.

		and insulators. Selected letters symbol, and sign as per ISI rule for medium voltage.			
12.	Measuring of current voltage power and energy by voltmeter, ammeter, watt-meter & energymeter.	Electrical work power and energy, their calculation in simple electrical circuit. Type use and construction of common electrical measuring instruments.	-do-	-do-	-do-
13.	Formation of simple electrical circuit, series circuit and parallel circuit, measuring insulation resistance & earth resistances..	Simple electrical circuit, essential requirement of electrical circuit, series and parallel circuit. Different types of resistances. Earthing and fuses.	-do-	-do-	-do-
14.	Fixing and connecting electrical switches, holders, fuses, plug sockets on T.W. board and testing.	Types grades and sizes of insulated wire and cables their selection and use. List of material of wiring.	-do-	Weight, gravitation and centre of gravity.	Simple orthographic projection 1 st and 3 rd angle.

15.	Care maintenance and running of A.C single and poly phase motor, starters and transformer. Checking continuity earth, open etc. Use of megger Series lamp.	A.C. motor, starters and transformer. Their working principles, specification & use. Care & safety.	Mensuration –area of square, triangle, circle and ellipse.	Evaporation, boiling, condensation freezing. Effects of pressure on boiling and freezing point.	Drawing different types of clutches, coupling, bearing and lubrication system.
16.	-do-	-do-	-do-	-do-	-do-
17.	Introduction to electronics. Components- Resistor, Capacitor, Diode, Transistors, Zener, Transformer etc.	Electromovement, conduction & semiconductor resistor & its type, capacitor & its type, Zener & characteristics, Transistor as an amplifier, Transistor as a switch.	Ratio proportion & its application.	Work, power, energy, source of energy, Kinetic energy and potential energy.	Sketching if different views of simple solid & hollow bodies.
18.	Transistor as a switch & amplifier, voltage stabilization. Types of stabilization & application.	Transistor amplifier and configuration. Different methods of stabilization. Voltage & current stabilization. Wattage capacity.	-do-	-do-	-do-
19.	Starting & stopping of Engine, operations of	I.C. engine, types-main part working of each types.	Decimal		Par block Prism etc.

	various controls. In driver cabin, Adjustment of a belt tension removing & fitting of radiator, dynamo, belt etc. Removal & refitting battery with correct polarity.	Power calculation study of panel board. Identification of instruments of panel board. Their requirements in vehicle. Dynamo its basic functions, water pump, radiator their functions. Belt adjustments. Battery function & safety.			
20.	-do-	-do-	-do-	-do-	-do-

ACHIEVEMENT: Trainees will be able to:

1. Use and manipulate fitters hand tools and equipment.
2. Use and manipulate fitters hand tools and equipment. Simple fitting job.
3. Use and manipulate sheet metal tools and equipment.
4. Use and manipulate sheet metal tools and equipment. Simple sheet metal job.
5. Use and manipulate sheet welder tools and equipment.
6. Use and manipulate welder tools and equipment. Simple gas and welding.
7. Use and manipulate electricians hand tools.
8. Use and manipulate electricians measuring instruments.
9. Use and manipulate electricians measuring instruments. Connection and operation of AC motors and starter.
10. Use and manipulate electronic service circuit.
11. Use and manipulate electronic circuit.
12. Study of engine & driver cabin control.

21.	Revision	Revision	-do-	-do-	-do-
22.	Test	Test	-do-	-do-	-do-
23.	Use refrigeration service Tools-care and safety.	Refrigeration service tools type, specification and use, refrigeration components. Type specifications and use.	Metric system weight & measurement unit and conversion factors, problems.	Simple machine and mechanical advantage.	Use of drawing instruments. T-square, Drawing boards.
24	Cutting ,bending and joining of copper tubing Flaring, swaging, pinching and silver soldering.	Refrigeration principle system of refrigeration and application of refrigeration.	-do-	-do-	Use of different types of scales, inch and mm lettering, number and alphabets.
25.	Identification of refrigeration system Stripping Components Care & Safety.	Vapour compression system cycle of operation. Components and division – H.P. sides & L.P. sides of the system. Refrigeration capacity of the system.	-do-	Transmission of motion & power.	-do-
26.	Dismantling reciprocating compressor Checking Component parts-value plate.reeds, piston, piston pin seal etc.	Refrigeration compressor. Its function-mode of drive type of compression classification and application.	Algebraic symbol addition, subtraction multiplication & division.	-do-	-do-
27.	Dismantling car A/c reciprocating compressor Checking Coponent parts value plate-clutch-clutch bearing , reeds piston-piston pin seal etc.	Car A/c compressor its function mode of drive types of compressor classification and application.	-do-	-d0-	Drawing of simple figure and solid with dimensions & titles

28.	Servicing and testing compressor (open & Car A/c) service valve, Shift Seal piston assembly and valve plate assembly etc.	Reciprocating compressor/car A/c compressor-name construction and function of component parts.	Simple equations and transposition problems.	Stress and strain. Modulus of elasticity ultimate strength. Factor of safety.	-do-
29.	Cutting gasket of compressor. Assembly of compressor parts-testing pumping effect.	-do-	-do-	-do-	-do-
30.	Dismantling of hermetic compressor. Checking and servicing of components. Assembly of compressor and testing.	Hermetic compressor-its construction and application, advantage and disadvantage of open unit and hermetic unit.	-do-	-do-	-do-
31	Dismantling of Semi-Rotary compressor (Axial type.) Checking and servicing Components-parts-Assembly & Testing.	Semi Rotary Compressor types (Axial type), Construction and application. Name and function component parts .	Standard formulas Simple simultaneous equation with two unknown quantities .	Pressure, at atmospheric pressure , absolute pressure, gauge and vacuum.	-do-
32	Study of centrifugal & Screw type compressors. Identifications of its parts and working.	Centrifugal & screw type compressor, construction and application , name and function of components parts.	-do-	-do-	Projection of square, circle, polygon etc.
33.	Dismantling car A/c Rotary compressor (VANE type) checking and servicing components parts assembly and testing	Car A/c Rotary compressor (VANE type) types, construction and application. Name and	-do-	-do-	-do-

		function of component part.			
34.	Servicing air cooled condenser/Car A/c Condenser and liquid receiver, checking Leak-repaire and testing.	Condenser-Car A/c compressor its function. Type of classification. Construction and application.	-do-	Chemistry of common elements such as Carbon. Oxygen, Hydrogen and halogen.	Projection of solid and hollow object.
35	Servicing evaporator/Car A/c evaporator removal of oil from evaporator, checking leak repair and testing.	Evaporator its functions types classification and applications.	-do-	-do-	-do-
36	Checking automatic and thermostatic expansion valves and capillary tube. Servicing and testing.	Refrigeration control function and type, automatic thermostatic and capillary control construction operation and application.	Simple algebraic problem.	-do-	-do-
37	Checking thermostatic switch, high and low pressure switch and oil failure switch servicing and testing.	High pressure and low pressure and oil failure switch construction operation and application.	-do=	-do-	-do-
38	Checking solenoid valve pilot control valve and suction regulating valve servicing and testing.	Checking solenoid valve pilot control valve and suction regulating valve construction operation and testing.	-do-	Corrosive action due to electrolyte and chemical action.	-do-
39	Servicing refrigerated cabinet. Checking body inside liner and door liner repair defect.	Refrigerated cabinet type and classification construction and application.	Logarithm reading from table determination of characteristic	The chemistry of compound such as Carbon dioxide	View off various solid and hollow object and cut by

			and antilogarithm.	ammonia, Freon.	section plane.
40	Replacing thermal insulating material inside body and door liners and door gasket adjusting door alignment.	Thermal insulating material. Puf. There types , properties, use and safety. Odo-	-do-	-do-	-do-
41	Handling of gas cylinders repair leaky cylinder. Transfer of refrigerant. Identifications of various refrigerant in cylinder.	Safety in handing refrigerant and cylinder colour code of cylinder method of refrigerant transfer. Saturation temperature V/S pressure of refrigerant(Familiarisation with table).	Application of logarithm.	-do-	-do-
42	Oil charging to compressor. Installing compressor, cooling coil and condenser of refrigeration unit.	Oil used in refrigeration system. Their desirable properties Proper selection of refrigerant oil. Oil treatment before charging.	Geometry- properties line, angle, triangle and circle.	Properties and use of cast-iron wrought iron, plane Carbon, steel and alloy steel .	Isometric view to orthographic views.
43	Checking thermal O/L protector motor starting relays and capacitor-electric wiring of refrigeration system open and sealed unit.	Thermal O/L protector motor starting relay capacitor types, function construction and application and study of wiring diagram of refrigeration open and sealed unit.	-do-	-do-	-do-
44.	Testing leak in the system using dry air, carbon-di-oxide, nitrogen, Vaccumizing and drying the system	Vacuum pump, vacuum guage, and leak detectors, their type specification,	-do-	-do-	-do-

	using deep vacuum Pump. Familiarisation with vacuum gauge . Desirable vacuum in sealed and open system.	Range of desirable vacuum in open & sealed system.			
45	Charging gas in the system, study of gauge readings. Effect of over charging and under charge.	Application of indirect refrigerant Refrigerants- their desirable characteristics. Their properties and use, (f-12,f-22,f-11,NH3)	Graph-object and use of graph . Rules of plotting graph, Interpolation.	Effect of alloying elements on properties of metals.	Orthographic views to isometric views.
46.	Testing leakage in the refrigeration system. Using halde torch electronic leak detector Repaired leakage and testing.	Freon group refrigerants, atmosphere friendly refrigerant 134 A. Their properties and use. Care and safety in handling refrigerant.	-do-	-do-	-do-
47	Checking Compression type Refrigerator-nonfrost refrigerator and different type fault finding, servicing and testing.	Refrigerator-Nonfrost refrigerator different types. Their type, function and use. Trouble diagnosis and remedies.	-do-	Properties and use of copper, zinc, lead, tin, aluminium, etc.	-do-
48.	Visit absorption type refrigerator/air conditioning plant.	Absorption type Refrigerator-Air – Conditioning its principle and application.	-do-	-do-	-do-
49	Checking window type air conditioner-spilt type ductable non-ductable type air conditioner fault finding servicing & testing.	Window type airconditioner spilt type airconditioner their type, function and application. Trouble	The plotting of co-ordinates. Representation of simple equation.	-do-	Development of surface of simple object.

		diagnosis and remedies.			
50.	-do-	-do-	-do-	Properties and use of brass, bronze, solder, bearing metal etc.	-do-
51.	Revision	Revision	-do-	-do-	-do-
52.	Test	Test			

ACHIEVEMENT: Trainees will be able to :

1. Service open type of compressor, sealed system and semi-sealed system.
2. Service air cooled condenser cooling coil and control
3. Service air cooled condenser cooling coil and control : service refrigerated cabinet & storage.
4. Test leakage, evacuate, charge oil and charge gas to the system.
5. Service window air condition/Spilt air conditioner.
6. Service window air condition /Spilt air conditioner.
7. Service package plant 5 to 15 TR.
8. Service car air conditioner compressor.

53	Checking water cooler instantaneous and storage, type and bottle cooler-visible cooler deep freezer, fault finding servicing & testing.	Water cooler and bottle cooler-visible deep Freezer: Their type function of parts, working and use. Trouble diagnosis and remedies.	Trigonometry-trogonometric-function-standard and formulae.	Meaning of tenacity, elasticity, maleability, brittleness, hardness ductility.	Curve of interpenetration.
54.	-do-	-do-	-do-	-do-	-do-
55.	Checking ice candy plant and ice-cream storage. Fault finding servicing and testing.	Ice candy plant & ice-cream storage, their type, function and application	-do-	-do-	-do-

		trouble diagnosis and remedies.			
56.	Dismantling of commercial type reciprocating compressor, checking component parts.	Performance of reciprocating compressor value metric efficiency factor influencing volumetric efficiency.	-do-	-do-	-do-
57.	Checking and servicing valve plate and piston assembly, lapping valve plate etc, flitting and testing.	Commercial type reciprocating compressor-their type construction and application.	-do-	Heat and temperature. Measurement of temperature.	-do-
58.	Checking lubricating system, servicing oil pump etc, flitting & testing..	Compressor lubrication, type of lubrication splash and forced feed, compressor oil function and characteristic.	-do-	-do-	-do-
59.	Checking and servicing capacity control of the compressor. Bearing shaft seal flitting & testing.	Compressor capacity control – Different method and application Multistage compressor-their function, application.	Use of trigonometrical table applied problem	Different thermometric scales and their mutual conversion, absolute temperature carbon steel and alloy steel.	Drawing of rivet and riveted joints.
60.	Cutting gasket and	Centrifugal	-do-	Quantity	-do-

	assembly of compressor. Testing efficiency.	compressor, Construction and application refrigerant used.		of heat and its different units their mutual relation.	
61.	Servicing of water cooled condenser & evaporative condenser receiver checking leakage repairing & testing.	Condenser- its type and capacity. Water cooled condenser- evaporative condenser their type construction, function & application.	-do-	-do-	Drawing of different types of threads, nuts, bolts, locking devices, keys and cutters.
62.	Servicing of cooling tower water softening and iron removing plant its care and maintenance.	Cooling tower F.R.P tower its principle, type & application. Water treatment plant. Construction and application. Method of iron removing and water softening.	Calculation of area of triangle polygon ets.	-do-	-do-
63.	Servicing of water circulating pump, water regulating vlave, high pressure safety control etc. its care and maintenance.	Water circulating pump water regulating valve and control high pressure safety control etc. Their	-do-	-do-	-do-

		type construction and application.			
64.	Air cooler-Room cooler and desert cooler-water cycle, its care and maintenance.	Types of Air cooler-water cycle- its construction and installation its care & maintenance.	-do-	Specific heat, sensible heat, laten heat, total heat super heat.	-do-
65.	Servicing of commercial type evaporator liquid chiller its care and maintenance	Commercial evaporator liquid chilling evaporator air-cooling evaporator,- natural-and forced convection – Their type , construction application.	-do-	-do-	-do-
66.	Servicing of heat exchanger, commercial refrigerant control-expansion devise, solenoid valve etc. & electrical control, its care safety and maintenance.	Heat exchanger-commercial type refrigerant control, its function construction and application.	-do-	-do-	-do-
67.	Servicing cold store cooling system control and instrument .	Food preservation spoilage agents control of spoilage agents, preservation by	Volume and weight of simple solid bodies.	Vapour and gases. Saturated and super heated vapour. Critical pressure	Drawing of different types of threads. Nuts, bolts, locking,

		refrigeration. Cold storage-type construction capacity and specification.		and temperature etc.	devices keys and cutters. Riveted joints.
68	Installing commercial tube, Compressor .Use of vibration eliminator and shock absorber.	Method of installing. Compressor vibration eliminator and shock absorber their type and application.	-do-	-do-	Drawing of pulley and pulley drive, gear and gearing.
69	Electric wiring of the compressor and checking the wiring system of the plant.	Study of layout and electric wiring of the storage plant.	Volume and weight of regular cone sphere.	Gas law- perfect and real gases, Dalton law.	-do-
70	Pressure testing leak detection and evacuating the system.	Method of pressure testing leak detection and vacuumizing the system.	-do-	-do-	-do-
71.	Charging gas to the system and testing the efficiency.	Method of charging gas to the system and testing efficiency.	-do-	-do-	Drawing of engine compressor and pump parts such as piston, connecting, rod, crank shaft.
72.	Cold storage plant, operation. Its care and safety.	Cold storage plant operation. Its	Volume and weight of simple	-do-	-do-

		common trouble and remedies.	hollow bodies.		
73.	Revision	Revision.	-do-	-do-	-do-
74.	Test	Test

ACHIEVEMENT: The trainees will be able to :

1. Service semi-commercial refrigeration appliances.
2. Service commercial type reciprocating compressor.
3. Service commercial type condenser, cooling tower and water treatment plant.
4. Service commercial type evaporator and control .
5. Service and operate cold store (Small capacity)

75.	Care, maintenance and use of siling psychrometer, hygrometer, humid stat, remote bulb, thermometer, thermostat etc.	Study of air-dew points psychometric chart, humidity, measurement of humidity.	Transmission of power-applies problems.	Hygrometry properties of air, D.B., WB temperature relative and absolute humidity etc.	-do-
76.	Care and maintenance and use of anemometer, pilot tube and monometer etc.	Air distribution ducting size and construction, measurement of air flow.	-do-	-do-	
77.	Servicing of fan, blower, damper, air filters, humidifier and dehumidifier etc. its care and maintenance.	Fan, Blower damper, air filters, humidifiers and dehumidifiers etc, their construction and application.	-do-	-do-	-do-
78.	Servicing the heating system of the plant. Its care and safety.	Space heating-various method of heating. Function and application.	-do-	Transfer of heat, conduction, convection and radiation. Thermal conductivity	-do-

				etc.	
79.	Servicing and testing of air conditioning system and its control.	Air conditioning comfort condition, factors influencing comfort-comfort chart.	Estimating and costing applied problems.	-do-	
80.	Installing compressor, electric wiring and checking the wiring system of the plant.	Capacity and selection of air conditioning plant study of lay out and wiring diagram of the plant.	-do-	-do-	Drawing of details components from assemblies .
81.	Leak detecting, vacuumising, gas charging and testing the system.	Method of leak detection vacuumising, charging gas and testing the system.	-do-	General laws of thermodynamic 1 st and 2 nd law, mechanical equivalent of heat etc.	-do-
82.	Air conditioning plant operation. Care and safety.	Air conditioning plant operation-common trouble and remedies.	-do-	-do-	-do-
83.	Repair and maintenance of refrigerator, Nonfrost refrigerator and deep freezer.	Refrigerator, Non-frost refrigerator and deep freezer their maintenance trouble diagnosis and remedies.	-do-	-do-	-do-
84.	Repair and maintenance of bottle cooler-visible cooler and water cooler.	Bottle cooler – visible cooler and water cooler- their maintenance, trouble diagnosis and remedies.	-do-	-do-	Code of practice for general engineering drawing by I.S.I.
85.	-do-	-do-	-do-	-do-	-do-
86.	Repair and maintenance of ice-candy plant.	Ice-candy plant their maintenance,	Revision.	Revision	Revision.

		trouble diagnosis and remedies.			
87.	Repair and maintenance of window air conditioner.	Window air conditioner their maintenance trouble diagnosis and remedies.	-do-	-do-	-do-
88.	Repair and maintenance of split type air conditioner.	Split aircondition-er. Their maintenance, trouble diagnosis and remedies.	-do-	-do-	-do-
89.	Installation of car A/C compressor, condenser, evaporator, receiver, metering device etc. In the car, hose pipe connection, its leakage testing, vacuumize and gas charging in car A/c system. Testing and noting of all readings of pressure and temperature.	Car airconditioner wiring. Their maintenance, trouble diagnosis and remedies.	-do-	-do-	-do-
90.	-do-	-do-	-do-	-do-	-do-
91 to 102	Industrial Training : Cold store, ice and ice-cream plant, central air - conditioning plant (direct and indirect system) car air conditioner, dairy plant. Absorption type air conditioning plant. Repair and maintenance of refrigerator, window, split air conditioner, bottle cooler, visible cooler, air cooler and deep freezer etc.

103	Revision	Revision	Revision	Revision	Revision
104.	Test.	Test.	Test.	Test.	

ACHIEVEMENT : The trainees will be able to :

Service air handling, humidity control and heating apparatus.

Service and operate air conditioning plant (Small capacity)

Repair& Maintenance.

- (a) Refrigerator, nonfrost refrigerator and deep freezer.
- (b) Bottler cooler-visible cooler-Air cooler and water cooler.
- (c) Window air conditioner, Split air conditioner & car air conditioner.
- (d) Ice candy plant.

**Revised list of tool and equipments for the trade of
“Refrigeration & Air Conditioning Mechanic”
(for a batch of 16 trainees)**

**N.B. The nearest metric size or equivalent English size may be
Procured as available.**

A. TOOLS LIST

Sl. No	Description	Instructor	Trainees	Total
1.	Flaring tools set, single type for tube 4.7 to 16 mm O.D.	1 set	16 sets	17 sets
2.	Swaging tool, punch type, set of size , for tube 4.7 to 16 mm O.D.	1 set	16 sets	17 sets
3.	Bending spring external type, for copper tube O.D. 6.4. to 16mm.	1 set	16 sets	17 sets
4.	Pipe cutter miniature for copper tube 3 to 16 mm dia.	1 no.	16 nos.	17 nos.
5.	Pinch off tool . for copper tube 6 to 18 mm & pinch off pliers.	1 no. each	16 nos. each	17 nos. each
6.	Ratchet spanner 6.4 mm sq. reversible.	1 no.	16 nos.	17 nos.
7.	Valve key “T” handle – 4.7 and 6.4 mm sq.	1 set	16 sets	17 sets
8.	Pressure gauge , diameter 63 mm with recalibration set screw, scale 0 to 35 kg./sq.cm.	1 no.	16nos .	17 nos.
9.	Compound gauge, diameter 63 mm with recalibration set screw, scale vaccum 76 mm, pressure15 kg/sq. cm.	1no.	16 nos.	17 nos.
10.	Servicemen thermometer in metal case -30 to + 30 degree C.	1no.	16nos .	17 nos.
11.	Sling psychrometer mounter on aluminium back, scale -50 C to + 50 degree portable in leather case.	1no.	16nos .	17nos.

12.	Gas leak detector for halogen gas (Electronic)	1no.	16nos	17nos.
13.	Lapping plate 250 * 200mm.	0no.	16nos	17nos.
14.	Line tester 500 volt, heavy duty.	1no.	16nos	17nos.
15.	Tong tester 0-10 30amp ., 0-500volts portable , small size in leather case .	1no.	16 nos.	17nos.
16.	Punch hole for cutting gasket , 4.7 to 16 mm dia.	1 sets.	16set s.	17 sets
17.	Scissor, gasket cutting stainless steel, length 250 mm.	1no.	16 nos.	17 nos.
18.	L-Allen key set, size 1.5 to 6.4 mm.	1 set.	16set s.	17sets.
19.	T-Allen key set, size 5/32” & 1/8”	1 set.	16 sets.	17 sets.
20.	Screw driver , plastic handle, 6mm tip length 100,150	1 set	16 sets	17 sets.
21.	Screw driver, plastic handle, 10 mm tip, length 200, 250 mm.	1 set	16 sets	17 sets
22.	Pliers combination insulated, length 200 mm.	1 no.	16 nos.	17 nos.
23.	Pliers long nose, length 200 mm	1 no.	16 nos.	17 nos.
24.	Knife folded stainless steel – 6”.	1 no.	16 nos.	17 nos.
25.	Wrench adjustable length 200 mm	1 no.	16 nos.	17 nos.
26.	Wrench adjustable length 250 mm	1 set.	16 sets	17 sets
27.	Spanner, double ended 4.7 mm to 16 mm	1 set	16 sets	17 sets
28.	Ring spanner, off set 4.7 mm to 16 mm	1 set	16 sets	17 sets
29.	Philips screw driver-completer set in leather case.	1 no.	16 nos.	17 nos.
30.	Oil can pressure type- 1 litre can.	1 no.	16 nos.	17 nos.
31.	Soldering iron exchangeable	1 no.	16	17 nos.

	copper tip 65 watts.		nos.	
32.	Tape measuring 2 m graduation in mm	1 no.	16 nos.	17nos.
33.	Hammer plastic 300 gm.	1 no.	16 nos.	17 nos.
34.	Hammer ball pein 450 gm	1 no.	16 nos.	17 nos.
35.	Hack show tabular metal frame adjustable	1 no.	16 nos.	17 nos.
36	File flat medium, double cut, length 200 mm	1 no.	16 nos.	17 nos.
37.	File half round medium, double cut, length 200 mm	1 no.	16 nos.	17 nos.
38.	Engineers rule 300 mm long.	1 no.	16 nos.	17 nos.
39	Engineers square 200 mm long.	1 no.	16 nos.	17 nos.
40	Chisel flat, length 150 mm	1 no.	16 nos.	17 nos.
41.	Scriber 150 mm length.	1 no.	16 nos.	17 nos.
42.	Divider, spring joint length	1 no.	16 nos.	17 nos.
43.	Caliper spring joint, outside length 150 mm	1 no.	16 nos.	17 nos.
44.	Caliper spring joint, inside length 150 mm	1 no.	16 nos.	17 nos.
45	Caliper odd leg, spring joint, length 150 mm	1 no.	16 nos.	17 nos.
46.	Centre punch length 100 mm	1 no.	16 nos.	17 nos.
47.	Bench vise 75 mm jaw.	0 no.	16 nos.	17 nos.
48.	Flaring tool set, double type for tube 4.7 to 16 mm O.D.	1 set	- set	1 sets
49.	Swaging tool, screw type, with adapter set of size for the tube 4.7 to 16 mm O.D.	1 set	- set	1 sets.
50.	Pipe bending tool, lever type with degree indicator for tube O.D. 6.4 to 16 mm	1 set	- set	1 sets

51.	Pipe cutter with built in reamer and spare cutter for, copper tube 3 to 32 mm.	1 no.	- no.	1 no.
52.	Refrigerant cylinder capacity 2.5 kg.	4 nos.	- no.	4 nos.
53	Refrigerant cylinder capacity 30 kg.	2 nos.	-no.	2 nos.
54.	Vaccum pump , two stage, self contained with motor portable, final vac. 0.1 micron with gas ballistic valve, 0.1 splash reducing, non-return valve Cap-1/2 HP.	2 nos.	-no.	2 nos.
55.	Charging cylinder, stainless steel, portable cc & mm scale, compensation for vol. fluctuation with pr. Release valve, gauge etc.	2 nos.	- no.	2 nos.
56.	Charging manifold with valves and gauges.	2 nos.	- no.	2 nos.
57.	Dial thermometer, remote control, armoured capillary dial 75 mm – 50 deg. C to+ 50 deg. C.	2 nos.	- no.	2 nos.
58.	Comfort guide hygrometer 5 dg. C to 45 deg. C.	1 no	- no.	1 no.
59.	Dial thermometer, remote control, armoured capillary, dia. 2 1/2 ” – 40 degree F to = 120 degree F.	2 nos.	- no.	2 nos.
60	Temperature and humidity recorder.	1 no.	- no.	1 no.
61.	Electronic leak detector tangesterised with visible and audible indicator sensivity 15 g/year.	1 no.	- no.	1 no.
62.	Vaccum thermo couple gauge 1 to 3000 microns.	1 no.	- no.	1 no.
63.	Velocity meter with extension handle air lock.	1 no.	- no.	1 no.
64.	Stop watch	1 no.	- no.	1 no.
65.	Walt meter AC/DC portable	4 nos.	- no.	4 nos.

	precision grade teak-wood case, leather belt- 0 to 500 volt.			
66.	Ammeter AC/DC portable precision grade, teak wood case, leather belt- 0 to 5 Amp.	2 nos.	- no.	2 nos.
67.	Ammeter portable precision grade, teak wood case, leather belt- 0 to 10 Amp.	2 nos.	- no.	2 nos.
68.	Ammeter AC/DC portable precision grade, teak wood case, leather belt o to 30 Amp.	2 nos.	- no.	2 nos.
69	Megger – 100 volt.	1 no.	- no.	1 nos.
70	Variac input 230 volt output 400 volt 1 Amp. Portable, complete with meters and controls .	2 nos.	- no.	2 nos.
71	Wattmeter, multirange upto 1 kw.	2 nos.	- no.	2 nos.
72	Multimeter Digitel type.	1 no.	- no.	1 no.
73.	Multimeter Gigital type.	1 no.	- no.	1 no.
74.	Capacitance bridge, direct reading, 0-200 mfd. Portable, small size in leather case	1 no.	- no.	1 no.
75.	Teachmeter digital, multirange 0 to 3000 rpm. portable, small size, in leather case.	1 no.	- no.	1 no.
76.	Transistor taster.	1 no.	- no.	1 no.
77.	R.C.L. bridge.	1 no.	- no.	1 no.
78.	Filler gauge 0.05 mm–1mm.	1 no.	- no.	1 no.
79.	Wire gauge metric and with worth.	1 no.	- no.	1 no.
80.	Screw driver, plastic handle, 3 mm tip length 100 & 150 insulated.	1 no.	- no.	1 no.
81	Pliers flat nose length 150 mm	1 no.	- no.	1 no.
82	Pliers water pump, multi-fix length 250 mm.	1 no.	- no.	1 no.
83.	Pliers vice grip length 250	1 no.	- no.	1 no.

	mm			
84.	Pipe spanner size 250 mm.	2 nos.	- no.	2 nos.
85.	Pipe spanner size 300 mm.	2 nos.	- no.	2 nos.
86.	Wrench adjustable length 150 mm	1 no.	- no.	1 no.
87.	Spanner double ended 19 mm to 31.8 mm.	2 sets.	- set	2 sets.
88.	Instrument screw driver – complete set in leather case.	2 sets.	- set.	2 sets.
89.	Ring spanner, offset 19 mm to 31.8 mm.	2 sets	- set.	2 sets.
90	Flexible-Box spanner size 6.4 to 10 mm.	2 sets.	- set.	2 sets.
91.	Socket set, reversible ratchet, ½ square drive with extension 4.7 to 31.3 mm	1 set.	- set.	1 set.
92.	Socket set, reversible ratchet, ½ square drive with extension, 3/16” to 11/4” BSW & S.R.	1 set.	- set.	1 set.
93.	Torque wrench 300 mm, 12.7 mm square drive right and left hand.	1 set.	-set	1 set.
94.	Blow-lamp - capacity 1litre	2 nos.	-no.	2 nos.
95.	Puller 3 legged, with flexible arm 120 mm.	2nos.	-no.	2nos.
96.	Puller 2 legged, with flexible arm 300 mm.	2nos.	-no.	2nos.
97.	Platform scale, heavy duty 0 to 50 kg.	1 no.	-no.	1 no.
98.	Blow lamp capacity ½ Litre.	4 nos.	-no.	4 nos.
99.	Soldering Iron, exchangeable copper tip 25 watts.	1 no.	- no.	1 no.
100.	Hand blower portable complete 1/10 hp.	2 nos.	- no.	2 nos.
101.	Sprit level precision, metallic 200 mm.	1no.	-no.	1no.
102.	Plum weight 200 g.	1 no.	- no.	1 no.
103.	Tape, measuring 10 m graduation in mm.	1 no.	- no.	1 no.
104.	Electric drill portable with	1 no.	- no.	1 no.

	chuck & key capacity 6.4 mm				
105.	Hammer rubber 400 gms.	2 nos.	- no.	2 nos.	
106.	Snipper sheet metal straight nose 200 mm.	2 nos.	- no.	2 nos.	
107.	Hammer Ball pein – 200 gms.	4 nos.	- no.	4 nos.	
108.	File, half round fine double cut, length 10 mm.	4 nos.	- no.	4 nos.	
109	File round, fine, double cut, length 150 mm	4 nos.	- no.	4 nos.	
110	File flat, fine double cut, length 150 mm.	4 nos.	- no.	4 nos.	
111.	File square, fine double cut, length 150 mm.	4 nos.	- no.	4 nos.	
112.	Scribing block, universal, spindle 200 mm.	2 nos.	- no.	2 nos.	
113.	V-Block with stand, 600 *450 mm.	2 nos.	- no.	2 nos.	
114.	Surface plate with stand, 600 *450 mm.	1 set	- set	1 set	
115.	Micrometer, outside measurement, 0.25 mm.	1 no.	- no.	1 no.	
116.	Micrometer, outside measurement, 25- 50 mm.	1 no.	- no.	1 no,	
117.	Micrometer, inside measurement, 25-200 mm.	1 no.	- no.	1 no.	
118.	Vemier height gaige 250 mm.	1 no.	- no.	1 no.	
119.	Angle Plate, 120*100 mm 90 degree.	1 no.	- no.	1 no.	
120.	Vernier height gauge 250 mm.	1 no.	- no.	1 no.	
121.	Tap set with matching drills 3 mm to 16 mm size.	1 set	- set.	1 set.	
122.	Tap set with matching drills ¼” to 5/8” SAE size.	1 set	- set.	1 set.	
123.	Stock and die set set 3 mm to 16 mm size.	1 set	- set.	1 set.	
124.	Stock & die set ¼ to 5/8” SAE size.	1 set	- set	1 set	
125.	Bench vice 120 mm jaw.	2 nos.	- no.	2 nos.	
126.	Air compressor, two stage for oil – less dry air, with rust	1 no.	- no.	1 no.	

	proof tank assembly, heater and controls max. pr. 10 kg/cm ² cap. 45 litre, motor 1 HP.			
127.	Scraper, triangular blade removable 60 mm.	2 nos.	- no.	2 nos.
128	Descaling pump set completer with motor 1 HP and accessories.	1 no.	- no.	1 no,
129.	Spray outfit, V twin, with motor ½ HP deliver up to 4 cft air pressure up to 40 PSI spray gun and fitting.	1 no.	- no.	1 no.
130.	Hand shear machine 280 mm.	1 no.	- no.	1n0.
131.	Pillar drilling machine 200 to 2500 rpm. Capacity 20 mm.	1 no.	- no.	1 no.
132	Pedestal grinder, double ended wheel dia 200 mm 3000 rpm.	1 no.	- no.	1 no.
133.	Oxy Acetylene welding set complete with cylinders, regulators weldingtorches with different nozzles.	1 no.	- no.	1 no.
134.	Gas cylinder truck two wheel tyre.	1 no.	- no.	1 no.
135	Welding table 900 * 900*700 mm high.	1 no.	- no.	1 no.
136.	Work bench 1000* 600*800 mm high,	4 nos.	- no.	4 nos.
137.	Almirahs, 195 * 90 * 49 cm.	2 nos.	- no.	2 no.
138.	Lockers of eight compartments.	1 no.	- no.	1 no.
139.	Chalkboard portable.	1 no.	- no.	1 no.
140.	Instructor table and chair.	1 set	- set	1 set.

B. EQUIPMENTS LIST

Sr no.	Description	No.
1.	Refrigerator compression type, 165 litre, different make.	2 nos.
2.	Refrigerator compression type 300 litre double door, double compressor system.	1 no.
3.	Deep Freezer 165 litre, - 18 degree C, ¼ HP.	<u>1 no.</u>
4.	Window air conditioner capacity 300 k. cal/hr., different make.	2 Nos.
5.	Bottle cooler, 110 litres, 1/6 HP.	1 no.
6.	Water cooler instantaneous type.	1 No.
7.	Water cooler, storage type capacity.	1 No.
8.	Ice-candy unit complete with stainless steel tank, mould box, thermocole insulated sunmica body, Agitator, compressor, motor eltc. Temp., pressure, refrigerant control. Gauges, motor piping fitting etc. 3000 k. cal/hr.	1 No.
9.	Cold storage plant complete with all controls and accessories including cooling tower and water treatment plant capacity 15000 k. cal/hr.	1 No.
10.	Air conditioning plant, direct and indirect & water chiller, complete with all controls including humidity control etc. capacity 1500 k. cal./hr.	1 No.
11.	Condensing unit with hermetic compressor control etc. capacity 500 k. cal./hr.	1 No.
12.	Condensing unit, with open type compressor, air cooled condenser controls etc. capacity 750 k. cal./hr.	1 No.
13.	Condensing unit with open type compressor,	
	Evaporative condenser controls, etc. capacity 3000 k. cal./hr.	1 No.
14.	Reciprocating compressor with provision of capacity control etc. for demonstration.	1 No.
15.	Working model of absorption system of refrigeration, capacity, 500 k. cal./hr.	1 No.
16.	Visible cooler, 165 litre. It can accommodate 75 to 80 bottles- NO Frost- Temperature between 4 C to 8 C.	1 No.
17	Air cooler – 16” (Stainless steel body-Fan size 16”)	1 No.
18.	Desert cooler – 20”	1 No.

	(Wooden body – Fan size 20”)	
19.	Car A/c compressor – small capacity (Reciprocating, Vane type Rotary, Axial type compressor)	1 No. each
20.	Condenser, Evaporator, Receiver Metering device & Hose pipe etc. suitable for to fit in above car A/c system.	1 set.
21.	No frost refrigerator compression type – 165 litre.	1 No.

Note : 1. Item no. 54, 55,56 may be used to develop Gas charging station in the institute, other required spares may be provide by institute.

2. Item at serial 16-21 was not included in the existing list of revised syllabus (revised in 1982) which is now added as additional item.

C. SPARE PARTS/ACCESSORIES

SL. NO.	Description.
1.	Relays
2.	Capacitors
3.	O/L protectors
4.	Selector switch
5.	Thermostatic Switch
6.	Flare fitting
7.	Expansion valve –Thermostatic/automatic
8.	Solenoid valve
9.	High pressure/low pressure cut out
10.	Oil failure switch
11.	Liquid Indicator etc.

N.B. The quantities make and specification will depend on the actual equipment procured in the Institute. In addition to above spares for servicing/maintenance, the following units should be procured as recommended by the manufacture.

1. Condensing Unit
2. Cooling Tower
3. Water circulating pump
4. Water treatment plant
5. Air handling unit
6. Cooling unit for cold storage
7. Different system controls

Note: The list of the spare parts/accessories was included in the Existing list of revised syllabus and is now kept in the Revised list of tools and equipments as they are.

LIST OF REFERENCE BOOKS

1. Principal of refrigeration.
(By Roy J. Dossat. John Wiley and Sons Inc.)
2. Refrigeration and Air Conditioning.
(By Mayer, and Fittz-Megrow Hill Co,)
3. Air Conditioning & Refrigeration..
(BY Jenny and Lewess-International Text Book Co.)
4. Refrigeration and Air Conditioning.
(BY Rubber & Hutchson-John Wiley.
5. Hand Book for Refrigeration Enginerrrs.
(By Welrich & Bart)
6. Refrigeration Service Mnual.
(BY Manely HP, Fredrick J. Drake and Co.)
7. Refrigeration Service Air Conditioning & Cold Storage.
((By R.C. Grinther Chilton Book)
8. Refrigeration and Air Conditioning Guide.
(By Edmon P. Anderson-Audels- and Co.)
9. Trane Air Conditioning Manual –Trane Co.
- 10 Carrier Air Conditioning Manual – Carrier Co.

- 11 Guide and Data Book – American Society of Ref.& Air Con, Eng.
12 Hand Book of Fundamental-American Society of Ref. And Air Con.Eng.
13 Air Conditioning and Refrigeration.
(By Mr. P.N Anaathanarayanan, M/s Tata Magrawhill Publication)

**SYLLABUS FOR THE TRADE OF REFRIGERATION AND AIR
CONDITIONING MECHANIC
UNDER
APPRENTICESHIP TRAINING SCHEME**

Period of training : 3 Years

Note: The content of Basic Training is exactly the same as that of Craftsman Training in this trade. All freshers must undergo two years basic training before Shop Floor Training.

- Subjects :
1. Trade Practical.
 2. Trade Theory.
 3. Workshop Calculation and Science.
 4. Engineering Drawing
 5. Social Studies.

(1) **TRADE PRACTICAL (3RD YEAR)**

Installation of a complete part including erection, electric wiring, pipe lay out etc. putting the plant into operation, maintenance and testing of the plant. Trouble shooting on the erected plant.

Cold Storage

Insulation work of cold storage. Installation of the plant including lay out of pipe etc.

Care and maintenance of the plant.

Repair of compressor and auxiliary equipment at site.

R- Insulation work of Milk/Dairy Refrigeration. Installation of the milk/dairy plant. Including layout of the pipe etc. Care and maintenance of the milk/dairy refrigeration plant.

Air Conditioning.

Constructional features of air conditional space. Heat insulation, sealing of door, window etc. Installation of air conditioning plant for industrial and commercial purpose – factory, picture house, hotel, office etc. stripping overhauling and repairing of the plant. Window air conditioner, split air conditioner plant. Window air conditioner, split air conditioner plant-ductable and nonductable, overhauling and maintenance.

R- Constructional features of car/auto/transport airconditioned/refrigeration.
Installation of car/auto/transport airconditioning/refrigeration components-
electric wiring, hose pipe connection-putting the car/auto/transport
airconditioned/refrigeration into operation.
Maintenance and testing of the car/auto/transport airconditioned/refrigeration.
Trouble shooting etc.

Use of different types of instruments and controls in the refrigeration system.

Overhauling and maintenance of refrigerator, deep freezer, water cooler, bottle
cooler-visible cooler 7 Ice-candy.

TRADE THEORY 93rd Year)

**Vapour compression cycle-Pressure enthalpy diagram refrigeration effect,
mass flow rate of refrigeration, compressor displacement. Heat of
compression., HP per Ton, co-efficient of performance. Heat rejected per
Ton at condenser. Effect of vapourising and condensing temperature on
cycle efficiency. Effect of vapourising and condensing temperature on
cycle efficiency. Liquid sub-cooling and suction super heat. The effect of
suction super heat and pressure drop on co-efficient of performance.**

**R- Milk/dairy refrigeration plants constructional feature and
capacity. Cooling arrangements specifications of milk/milk
product-operation and maintenance of milk/dairy refrigeration
plant.**

**R- Car/auto/transport refrigeration/airconditioning components.
Feature-cooling arrangements & use of components and parts.**

Cooling Load Calculation

**Calculating transmission load solar heat, gain load and wall gain load
factor determining wall gain load, calculating air change load, calculating
product load-chilling rate factor, respiration heat. Container and packing
material calculating miscellaneous load safety factor etc.**

Cold Storage

Type of cold storage-Constructional feature of cold storage, heat insulation, opening doors etc. their position capacity and specification of a cold storage. Refrigerant used. Heat leakage, method of cooling, direct arrange of expansion, valve, cooling by brine circulation Air circulation. Operation and maintenance of cold store.

Effect of low various and high humidity.

Air Conditioning.

Composition of atmospheric air, psychrometric chart, comfort condition. Source of heat leakage in air conditioning space. Heat load, heat insulation, selectiuon of air conditioning plant and its specification, working of domestic and industrial air conditioning plant and its specification, working of domestic and industrial air conditioning plant and their distinctive feature. Name and function of various components parts.

Humidifier and dehumidifier-their description and use.

Air heating – various method of heating air, as used in iudustry.

Air washer-types construction, working maintenance, Types of desert coolers, their maintenance.

Ice-plants-Constructional feature and capacity. Cooling arrangements, specification of Ice,Ice-defect. Care and precaution to be observed in the manufacture of Ice. Operation and maintenance of the Ice plant.

At the completion of training the apprentice should be able to do :

1. Servicing of domestic and plotting of graph.

Mensuration problem applicable to trade.

Applied problems on algebra and trigonometry, Calculation of requirement of materials for cold storage, pipe layout, Insulation, brine layout etc.

Calculation of materials for Ice plant.

Fluid mechanics-Surface tension and viscosity of fluids, laws of fluids, laws of fluid flow. Flow of fluid and distribution in pipes and fitting, friction factors, losses in pipes and fittings, capillary flow compressibility of fluids.

Problems on work, energy, power, transmission of motion and power.

Applied heat-Problem on calorimetry and heat transfer and heat load, and problems on gas laws etc.

(4) **ENGINEERING DRAWING (3rd Year)**

Reading and sketching of mechanical drawing of refrigeration & air conditioning system.

Reading and sketching of electrical wiring diagram of refrigeration and air conditioning system.

Reading of layout drawing of air conditioning plant, including pipe work, ducting etc.

Reading of layout drawing of cold storage, including mechanical handling arrangements etc.

(5) **SOCIAL STUDIES.**

The syllabus has already been approved and is same for all trades.