

## MAIN FEATURES OF THE CURRICULUM

**Title of the course:** Certificate Course in 'REFRIGERATION AND AIR-CONDITIONING'

**Duration:** SIX MONTHS

**Pattern of the course:** Modular System

**Intake:**

**Type of course:** Full Time

**Entry qualification:** Minimum V standard & 14 years of age

**Mode of admission:**

Study and Evaluation Scheme for

**SIX-MONTHS  
CERTIFICATE COURSE IN  
REFRIGERATION AND AIR-CONDITIONING**  
(To be Effective from.....)

<b>Curriculum</b>					Courses/ Subject	Theory Marks	Practical Marks
Periods per week							
Lecture		Lab.		Total			
3		15		18	1. SHOP FLOOR SKILLS PRACTICES- REFRIGIRATION	10	35
3		15		18	2. SHOP FLOOR SKILLS PRACTICES- AIR-CONDITIONING	10	35
					3. PROJECT		10
					TOTAL	20	80
					GRAND TOTAL	(20+80)	100
					36		
					36		

**NOTE:**

1. Each period will be of 50 minutes duration.
2. Each session will be of 24 weeks
3. Effective teaching will be at least 20 weeks.
4. Remaining periods will be utilized for revision etc.
5. Each student shall under take a project in any of the areas depending on her interest and facilities available in the establishment. The duration of the project shall be one Week.

## SYLLABUS FOR THE 'REFRIGERATION & AIR CONDITIONING'

<b>SHOP FLOOR TRAINING - PRACTICAL</b>	
<b>S.No.</b>	<b>REFRIGERATION</b>
1	Identification of refrigeration cycle and components for high, medium and low temperature application machine, Identification of tubes and pipes, joints & pipe layout, safety, fire fighting equipments.
2	Refrigeration cycle layout of machines, its lubrication system, lubricant. Refrigerant gas cylinder and their use, color code and safety.
3	Practice in connecting domestic refrigerator electric motor with main supply, measurement of current in the circuit. Use of megger for insulation testing
4	Testing new evaporator coils for leak, choke & repairing and cleaning of fins. Manufacturing of evaporator & condenser coils.
5	Testing condenser coils for leak, choke & repairing. De-scaling of water cooled condenser. Servicing of air cooled condenser & straightening of fins
6	Handling of gas cylinders, repair of leaky cylinder, reclaiming of refrigerant from dead refrigeration system. To charge the refrigeration oil & remove oil with help of syphon or vacuum method.
7	Wiring of hermetic compressor motor with relays, controls, cabinet light & their fault & remedies.
8	Use of recovery machine to recover CFC/ HCFC/ HFCs. Necessity to change the components, clean & flush with dry N <sub>2</sub> . Retrofitting of CFC filled commercial as well as domestic appliances with hydrocarbon, HFCs using sealed components.
9	Safety handling of N <sub>2</sub> cylinder with two stage regulator. Replacement of components, brazing sealed system, leak testing with dry N <sub>2</sub> pressure test. Evacuation of refrigeration system.
10	Trouble shooting- commonly faced problems in direct cooled refrigeration system. Mechanical & electrical & their remedies. Retrofitting.
11	Trouble shooting- commonly faced problems in frost free refrigeration system. Mechanical & electrical & their remedies. Retrofitting.
12	Over-hauling of ice cuber, testing electrical circuit, leak tests, evacuation and gas charging, water circulating system. Retrofitting of existing system.
13	Overhauling of water & bottle cooler, testing electrical circuit, leak tests, evacuation and gas charging, water circulating system. Retrofitting of existing system.
14	Over-hauling of deep freezer, testing electrical circuit, leak tests, evacuation and gas charging. Retrofitting.
15	Over-hauling of visi cooler, testing electrical circuit, leak tests, evacuation and gas charging. Retrofitting.
16	Use of Sling psychrometer, study and use of psychometric charts. Measurement of dry bulb and wet bulb temperature, relative humidity stripping, inspections & cleaning of outer wrapper, grills, blower motor. Condenser fan positions, evaporators, condenser and sweep mechanism, rotary switch and thermostat.

AIR CONDITIONING	
17	Servicing and maintenance of window A.C., testing the mechanical and electrical system for fault rectification. Installation of window A.C.
18	Servicing and repairing of air cooler /desert coolers stripping of air cooler/ desert coolers, inspection, cleaning & reassembly of components.
19	Servicing and maintenance of split A.C., safety aspects, leak testing, evacuation, gas charging & testing the performance. Installation of split A.C.
20	Dismantling and assembly of wobble plate compressor used in automobile A.C. assembling on mounting brackets, engine adjustment, temperature controls, identification and functioning of key components like thermostat, electrical operating valves, fused connectors, clutch, alternator, batteries.
21	Small capacity refrigerator- Selection of compressor, condenser, drier/ filter, size & length calculation of capillary, evaporator selection.
22	Commercial water cooler & bottle cooler- Selection of compressor, condenser, drier/ filter, size & length calculation of capillary, freezer selection.
23	Visi cooler, ice cuber- Selection of compressor, condenser, drier/ filter, size & length calculation of capillary, evaporator selection.
24	Window & split A.C.- Selection of compressor, condenser, drier/ filter, size & length calculation of capillary , evaporator selection.
25	Project work, review and test.

**THEORY:**

IMPORTANT INSTRUCTIONS	
S. No.	REFRIGERATION
1	Application of high temperature, medium temperature and low temperature machines, food preservation, its spoilage. Human comfort, Air Conditioning by Refrigeration
2	Freezing methods, lubrication methods & types of lubricants, refrigerants & their properties.
3	Study of alternating current, direct current, resistance, electrical insulation, series & parallel circuits.
4	Evaporator, its function, type-dry & flooded types, construction & application. Effects of temperature, effect of pressure inside the evaporator on working side of the system.
5	Condenser, its function, types, construction & application. Effects of temperature, effect of pressure inside the condenser on working side of the system.
6	Refrigerants, their desirable properties, physical & thermodynamic properties, care & handling refrigerants, eco friendly refrigerants. Difference in Gas Cans/ Cylinders, effect of Ozone layer, effect of global warming.
7	Types of motor used in refrigeration system & their controls- operation, function, application & maintenance. Type of relays, O.L.P., capacitor. Testing methods of relay O.L.P., capacitor, thermostat, etc.
8	Need of elimination of refrigerant through recover & recycling. Brazed joints, proper leak testing before charging refrigerant, importance of evacuation, removal of moisture & non-condensable gasses from the system, need of 2 stage rotary vacuum pump.
9	Non condensable gases removed from refrigeration system, need of 2 stage rotary vacuum pumps to reach the desired level. Study of different insulating materials.
10	Theory behind the causes of problems & analytical approach to trouble shooting, need for right instruments & tools. Electrical component testing.
11	Theory behind the causes of problems & analytical approach to trouble shooting, need for right instruments & tools. Electrical component testing.
12	Fault and remedies of ice cuber, construction, working and application of ice cuber, study of electrical components, brief description of ice cuber.
13	Fault and remedies of water & bottle cooler, construction, working and application of water & bottle cooler , study of electrical components.
14	Fault and remedies of deep freezer, construction, working and application of deep freezer, study of electrical components. Brief description of deep freezer.
15	Fault and remedies of visi cooler, construction, working and application of visi cooler, study of electrical components. Brief description of visi cooler, study of electrical components.

AIR CONDITIONING	
16	Fundamental of A.C., comfort condition, psychometric properties and process of air cleaning and air filtration, effect of dust on health, selection of air filters. Odour removal, Human comfort zone.
17	Methods of servicing, care and safety handling of window A.C., installation & testing performance.
18	Study of air cooler/ desert coolers- construction, working and application.
19	Care & maintenance of split A.C. procedure of leak testing, vacuuming, gas charging and installation. Safety aspects.
20	Study of wobble plate compressor used in automobile A.C., understanding of working, lubrication systems, shaft seal in compressor, flow and direction control in evaporator, performance varies with compressor/ engine speed, temperature control for R-12 and R-134a system.
21	Heat load calculation of refrigerator i.e. wall gain, product, air change, other misc. load, etc.
22	Heat load calculation of water cooler & bottle cooler i.e. wall gain, product, air change, other misc. load, etc.
23	Cooling load calculation of visi cooler, ice cuber i.e. wall gain, product, air change, other misc. load etc.
24	Cooling load calculation of window & split A.C. i.e. wall gain, heat gain from sun, heat gain from human being, air change, other misc. load, etc.

## GENERAL EQUIPMENTS & INSTALLATION

Sr. No.	Name of the General installations
1.	Refrigerator (frosting) (CFC & NON CFC refrigerant)
2.	Refrigerator Non-frosting
3.	Refrigerator (Side-by-side/frost free)
4.	Deep freezer (Open type compressor )
5.	Bottle cooler (chest type)
6.	Water coolers
7.	Window type room airconditioner
8.	Window type room air conditioner (with remote control)
9.	Package type air conditioners
10.	Heating & cooling type room airconditioner
11.	Visi cooler
13.	Juice dispenser
14.	Air cooler
15.	Refrigerant charging station (CFC & NON CFC refrigerant)
16.	Spray outfit (spray painting unit)
17.	Refrigerant recovery unit
18.	Air compressor –(with dry air system)
19.	Nitrogen cylinder with pressure regulator
20.	Oxy-acetylene welding set
21.	Air-LPG brazing kit
22.	Automobile airconditioning unit
23.	Compressor test Rig. Unit
24.	<b>List of Tools:-</b> Screw driver, Line tester, File, Hammer, Drilling Machine, Pliers, Crimping Tool, Solder Iron, ampere meter, volt meter, Megger, Multi meter, Dry bulb & wet bulb thermometer, Tube cutter, Hacksaw, Pipe Wrench, Torque Wrench, Screw Wrench, Vice, Snip, DE

	Spanner Set, Ring Spanner Set, Swaging tool, Oxy Acetylene gas, cylinder/Oxy LPG gas cylinder, Blow torch, Recovery Machine, Gas Manifold, Compound Gauges, Pressure Gauge, Empty Cylinder for Refrigerant, Nitrogen Cylinder with two stage regulator, Halide Torch, Flaring tool set, Compressor Condenser, Evaporator, Expansion device/capillary
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