

**CERTIFICATE COURSE IN
REFRIGERATION & AIR CONDITIONING**

(6 MONTHS COURSE)



**STATE BOARD OF TECHNICAL EDUCATION & TRAINING
SANKETHIKA VIDYA BHAVAN, MASAB TANK, HYDERABAD.**

REFRIGERATION AND AIR CONDITIONING

SYLLABUS

SUB CODE	NAME OF THE SUECT	PERIODS/WEEK		TOTAL PERIOD S PER 6 MONTH S	SCHEME OF EXAMINATION			
		Theory	Practicals		Durati on Hours	Session al Marks	End Exa m Mar ks	Tota l Mar ks
RA-101	Fundamental s of Refrigeration	03	--	50	03	--	100	100
RA-102	Fundamental s of Air Conditioning	03	--	50	03	--	100	100
RA-103	Refrigeration Lab	--	06	75	03	40	60	100
RA-104	AIR CONDITION ING Lab	--	06	75	03	40	60	100
	TOTAL	06	12	250		--	--	400

SUBJECT TITLE : FUNDAMENTALS OF REFRIGERATION
SUBJECT CODE : RA 101
PERIODS/WEEK : 03
PERIODS/YEAR : 50

S.NO.	MAJOR TOPICS	NUMBER OF PERIODS
01	Introduction to Refrigeration	05
02	construction and working of Vapor compression cycle refrigeration cycle	05
03	Study of electrician hand tools in R&AC	10
04	Control unit in Refrigerator	10
05	Construction & Working of Refrigerator	10
06	Study of Refrigerator main Components	10
	TOTAL	50

UNIT-1 : Introduction to Refrigeration and Air conditioning trade in domestic, Industrial & Commercial fields. General safety in R& AC trade. Introduction to firefighting system. Study of Refrigeration and Air conditioning tools and equipment.
Fundamentals of Refrigeration: Definition and units of pressure, temperature, volume, power and density. Basic concepts and mode of heat transfer. History of Refrigeration. Methods of Refrigeration. Ton of Refrigeration and COP.

Unit-2 : Study the construction and working of Vapor compression cycle refrigeration cycle. - Allied trade knowledge in Fitting, Sheet metal and Welding. Study the different tools and equipment used in Fitting such as Chisel, hack saw, files, reamers, taps, Vernier calipers, and micrometer, portable and their use and safety. Identify the different tools used in sheet metal. Types of sheet metal joints and their use. Rivet and Riveting and their use and safety

Unit-3 : Study of electrician hand tools in R&AC .Study of Ammeter, Voltmeter, wattmeter, clamp meter and their uses. Concept on earthing Types and cable of insulated wire and their use and specifications. In R&AC

Unit-4 : Thermostatic temperature control and different electrical components in Frost free refrigerator such as timer, bimetal etc.- Refrigeration equipment: Study the different types of compressors such as reciprocating, rotary types, hermetically sealed compressors (reciprocating and rotary), hermetic scroll compressor, and semi hermetic reciprocating compressor. Study the different types of condensers such as Natural air cool condenser and forced air cool condenser.

Unit-5 : Study the air cooled condensers and water cooled. Evaporator, classification of evaporators and their use. Expansion Device types, - Construction, working. Refrigerants, their desirable properties, physical & thermodynamic properties, care & handling of

refrigerants, eco-friendly refrigerants. Difference in Gas Cans/ Cylinders, effect of Ozone layer, effect of global warming. Study of Leak testing, vacuumisation and Gas charging.

Unit-6 : Study the working of types of conventional and frost free refrigerators. Study the different types of relays, OLP, thermostat, heaters, fan, timer used in refrigerator. Study compressor, condenser, capillary tube, drier, and evaporator. - Refrigerant used in refrigerator Study the trouble shooting in refrigerator. Specifications of Refrigerator. Care and maintenance of Refrigerator.

SUBJECT TITLE : FUNDAMENTALS OF AIR CONDITIONING
SUBJECT CODE : RA 102
PERIODS/WEEK : 03
PERIODS/YEAR : 50

S.NO.	MAJOR TOPICS	NUMBER OF PERIODS
01	Introduction of Air Conditioning	05
02	Trouble shoot in Air Conditioners	05
03	Wiring Circuit of Window AC	10
04	Working of SPLIT AC	10
05	Thermal Insulation	10
06	A.C. in Motor Vehicles	10
	TOTAL	50

UNIT-1 : Introduction-Role of air-conditioning system in day to day life and industries, importance and definition of air conditioning. Human comfort-Effect of air temperature on human health, human body. Air Conditioning equipment. Study the construction and working of Window and Split A.C.

UNIT-2 : Study the different types of relays, OLP, Thermostat, fan, Capacitors, oscillating motors in window and split A.C. Study the trouble shooting in Air Conditioners. Care and maintenance of air Conditioner.

UNIT-3 : Wiring Circuit of Window AC . Installation method of Window AC. Trouble shooting and diagnosis of Window AC. - SPLIT A.C (Wall mounted) Construction and working principle, types, trouble shooting. Description of electrical components used in split A.C. Study the wiring circuit .

UNIT-4 : SPLIT A.C (floor & Ceiling mounted) Construction and working principle, types, trouble shooting. Description of electrical components used in split A.C. Study the wiring circuit.

UNIT-5 : Thermal Insulation: Categories of Insulation Materials. Selection of insulating material. Duct insulation and properties of insulating material

UNIT-6 : Automobile AC, Function of individual components. Refrigerants used & retrofitting of old car / Mobile AC's

SUJECT TITLE : REFRIGERATION LAB
SUBJECT CODE : RA- 103
PERIODS/WEEK : 06
PERIODS/YEAR : 75

S.NO.	MAJOR TOPICS	NUMBER OF PERIODS
01	Tools and materials used in R&AC field	10
02	Equipment used in R & AC	15
03	Assembly of tube joints	10
04	Fixing of Electrical Motors	10
05	Maintenance of Condenser	10
06	Maintenance of Control Unit	20
	TOTAL	75

Unit-1 : Introduction, orientation and familiarization with the equipment, tools and materials used in R&AC field. Demonstration of firefighting equipment and different gas cylinders. Safety precautions to be followed in Refrigeration and Air Conditioning. - Demonstration and usage of general and Refrigeration and Air Conditioning tools. Basic operations on copper tube such as cutting, bending, flaring, swaging, pinching, brazing etc.

Unit-2 : Identification of various components in Vapor compression refrigeration cycle. - Usage and working of tools and equipment in fitting. Filing of flat, square, round and curved profiles. Simple exercises on drilling, tapping, grinding and reaming operations. Use of sheet metal tools and equipment, marking sheet metal joints. Riveting exercise. Care and safety in Fitting and Sheet metal.

Unit-3 : Welding tools and equipment care and safety. Setting oxyacetylene plant. Brazing of tube joints (Cu to Cu, Cu to Steel, Cu to Brass) using (i) Air -LPG (ii) Oxygen- LPG (iii) oxygen -C₂ H₂ set up & use of the above gases with the right Torches, Brazing Filler Rods. Distinguishing good joints from bad joints Usage of Electrical hand tools. Measurement of current, voltage, power, resistance energy. Simple wiring practical related RAC field.

Unit-4 : Identification of different electrical motors. Formation of simple electrical circuits such as series circuit and parallel circuit. Fixing and connecting electrical switches, holders, fuses, plug sockets on T.W. board and testing. Safety precautions = Dismantling reciprocating compressor. Checking component parts-valve plate, piston,

piston pin seal etc. Servicing and testing compressor service valve. Shaft seal piston assembly and valve plate assembly etc.

Unit-5 : Flushing and cleaning of condenser with dry nitrogen, CTC, wire brush, water cleaning, coil shiner and air blower. Flushing and cleaning of evaporator and expansion devices. - Identification of refrigerant cylinders by Color coding standing pressure. Types of cylinders. Leak testing, Evacuation, Charging refrigerants in Refrigeration system.

Unit-6 :

Measuring Current, voltage and resistance. Check open circuit, short circuit and earth of hermetic Compressor. Identify starting , running, common terminal Check relay, OLP, thermostat, door switch, Refrigerator Bulb. Check the wiring circuit of refrigerator. Check the efficiency of hermetic compressor. Dismantle and Assemble hermetic Compressor

.Identify the trouble and rectification. De scaling refrigerator condenser. Flushing Condenser and Evaporator. Leak Testing, Evacuation, and Gas Charging in refrigerator. Wiring of Refrigerator.

SUJECT TITLE : **AIR CONDITIONING LAB**
SUBJECT CODE : **RA- 104**
PERIODS/WEEK : **06**
PERIODS/YEAR : **75**

S.NO.	MAJOR TOPICS	NUMBER OF PERIODS
01	Preparation of AC equipment	10
02	Rectification of Condenser	15
03	Check the wiring circuit of window AC	10
04	Testing on SPLIT AC	10
05	Fixing of insulation materials	10
06	Testing on AC Car system	20
	TOTAL	75

Unit-1 : Tube cutting, bending, flaring, swaging, brazing, welding. Measuring Current, voltage, resistance, temperature and pressure. Check open circuit, short circuit and earth of hermetic compressor. Identify starting, running, common terminal. Identification different components in Window AC and Split AC.

Unit-2 : Identify the trouble and rectification Decaling condenser coil, evaporator and filter. Check relay, OLP, thermostat, Capacitors Fan motors, and Oscillating motors. Check the efficiency of hermetic compressor. Dismantle and Assemble hermetic Compressor Flushing Condenser and Evaporator. Servicing of Window AC & Split AC

Unit-3 : Check the wiring circuit of window AC. Leak Testing, Evacuation, Gas Charging in Window AC .Servicing the Window A.C .Check the performance of Air conditioner. Installation of Window AC. Trouble shooting and diagnosis of Window AC. - SPLIT A.C (Wall Mounted) Identifying various components, electrical circuits, testing components, fault detection, install gauge manifold in the system, leak testing, evacuation, gas charging, Installation, trouble shooting.

Unit-4 : SPLIT A.C (Floor & Ceiling Mounted) Identifying various components, electrical circuits, testing components, fault detection, leak testing, evacuation, gas charging,

Unit-5 : - Identification of different insulating materials. Techniques of Glass wool filling method in conventional refrigerators. PUF, PUF mixing procedure.

Unit-6 : Test and diagnosis faults of Car A/C system. Pressure test/leak of the system. Strip the component parts. Cleaning Flushing leak testing, evacuating and charging & use of suitable chemicals (Trichloro Ethylene) for more contaminated coils.