

INSTITUTE OF ADVANCED STUDIES IN
EDUCATION (DEEMED UNIVERSITY)
GANDHI VIDYA MANDIR
SARDARSHAHR

*Detailed Syllabus
of*

**CERTIFICATE IN
REFRIGERATION & AIR CONDITION REPAIR
(CRACR)**

COURSE TITLE : CRACR
DURATION : 02 YEARS (YEARLY SYSTEM)
TOTAL DEGREE MARKS : 800

FIRST YEAR

COURSE TITLE	PAPER CODE	MARKS		
		THEORY	INTERNAL	TOTAL
TRADE THEORY	CRACR-110	70	30	100
WORKSHOP CALU.& SECINCE	CRACR -120	70	30	100
ENGINEERING DRAWING	CRACR -130	70	30	100
PRACTICAL	CRACR -140	70	30	100

SECOND YEAR

COURSE TITLE	PAPER CODE	MARKS		
		THEORY	INTERNAL	TOTAL
TRADE THEORY	CRACR -210	70	30	100
WORKSHOP CALU.& SECINCE	CRACR -220	70	30	100
ENGINEERING DRAWING	CRACR -230	70	30	100
PRACTICAL	CRACR -240	70	30	100

FIRST YEAR

TRADE THEORY	Code CRACR -110
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THEORY

(1)

Importance of the trade industrial and commercial field. Theoretical subjects to be taught. Terminal Performance Objectives.

(2)

Method of marking , Marking media. Simple markingmeasuring tools &teir use. Chisel hacksaw frame, blade type specification,& their use.

(3)

Files and dills Types. Specifications, Uses, care and safety aspects, Drilling speed, feed & coolants.

(4)

Specification, use and safety of taps &dies Reamers types. Elents of screw threads, thread forms.

(5)

Important precision measuring, marking and checking tools type and their specification, use, care and safety.

(6)

Limit, fit, and tolerance I. S. I. Specification. Scraper-type, specification and use-lap materian and plate type, specification & use.

(7)

Sheet metal tools and equipnent type specification, care and safety. Types of sheet metal joints and their news. River & riveting -their types and use .Calculation of Blank sizes from component drawing.

(8)

Introduction to basic principles of commonly used welding processesr welding, oxyfuel gas welding /cutting. Brazing & soldering.

(9)

Welding tools and equipment- type specification and use. Safety method in welding. Method of gas welding, gas used and flames adjust ment . differences between soldering and Brazing in terms of temperaturef, filler materials, joint strengthf and applications Use of Oxyacceptlene, Oxy LPG and air LPG for brazing /soldering.

(10)

Method of electric welding electrode -type and application- object of flux coating. Welding symbols and I.S.I.code for gas and are welding.

(11)

Electrician hand tools type, specification,use care and safety. Common terms used in the trade. Conductrors and insulators. Selected letters symbols and sign as per I..S. I. Rules for medium voltage.

(12)

Electrical work , power and energy their calculation in simple electrical circuit. Type use & construction of common electrical meafuring insprunents.

(13)

Simple electrical circuit, essential requirement of electrical circuit, series and parallel circuit .Different types of resistances. Earing and fuses.

(14)

Types grades and sizes of insulated wire and cables-their selection use.List of material for wiring.

(15)

A.C. motore starters and transformer. Their working principal specification & use.Care&safety.

Run/StartCapaitors and PTCs. Motor protection devices. Temperature rise of winding.

(16)

A.C. motor, starters and transformer. Their working principles specification and use . Care safety.

(17)

Introducation to Electronics. Principles and Application Basic principles of Diodes, Semiconductor, Amplifiers, Transistors, SCR's.

(18)

Rectification zener diode as voltage regulator transistors parameters CB,CE,CC, configuration, amplification.

(19)

Photo diodes-photo transistor, multi -vibrator, CR&LR circuit . SCRs, UJTs, lcs .

(20)

Thermistors, RTDs, Electronics Thermostats . Principles of Remote Controls and Controllers .

(21)

Use and function of Contactors/Starters, Crankcase Heaers, Pressure Controls, Solenoids, Timers both Electromechanical and Solid State.

(22)

Fundamentals of Refrigeration and Understanding a typical Refrigeration System, its Componemts, working, etc.

(23)

Temperature-Pressure Relationship. The refrigeration cycle. Sensible and Latent Heats. Superheating and sub-cooling.

(24)

Understanding Cu tubes in Refrigeration :soft Annealed, Hard drawn etc. &their applications . Purity&cleanliness of Cu tubes used in Refrigeration . Flared, compressed & brazed joints, standard flared & other fittings available – brass and copper .

(25)

Theory of Brazing. Safe handling of cylinders. Care to be taken whilst preparing joints for Brazing. Flame Chemistry &temperature. Use of right torches, tips & flame. Use of appropriate Brazing filler rods and fluxes.

(26)

Working princitles of Hermetic, Semi-Hermetic& open type compressors of the Reciprocal, Rotary, Scroll&Rotary Wobble plate compressors used in Auto AC Understanding the working of the Lubricatiom system, Shaft seals in open Compressors and Capacity control of Multicylimder Compressors .

(27)

Basic Evaporation process on the P-H chart . Types of Evaporators like

- dry Expansion Type
- Shell&Tube, DX type

- Flooded type
- Role of Accumulator
- Importance of Superheat
- Diftribution of Circuits .

(28)

Role and operation of comdemasers, Condenser capacity, types of Condensers like static condensers, Forced Draught, Coin type, Shell & tube type, Desuperheating condensing & Subcooling in condensers .

(29)

Metering Devices

1 Role

2 Types of Metering devices, fixed and modulating orifice controls

3 Capillaries

4 Fixed Orifices

5 Float valves-Low side, High side

- 6 Constant pressure Exp-valves
- 7 Thermostatic Expansion Valves
- 8 Electronic Expansion Valves

(30)

Liquid Distributors & their role . Refrigeration cycle accessories & their role-

- Filter drivers
- Sight glass

Suction Line Accumulator, Crankcase heaters, Hot gas mufflers, Oil separators, Receivers, Heat Exchangers

(31)

System Controls :

Basic Controls. Operated by Temperature (Thermostats), Humidity (Humidistats), Pressure (Pressure stats), Time (Time Switch).

(32)

Operating Controls :- Refrigerant solenoid valves . Four way Reversing Valves. Back pressure valves. Check valves.

Safety Controls :- Electric over load protectors. Pressure Relief Valves. Oil Pressure Safety Switch.

(33)

Refrigerant. Historical developments till today . Physical & chemical properties and Environmental hazards of CFCs & HCFCs . Montreal protocol & India's CFC/HCFC phase out schedules. Ozone Rules 2000 . Substitute refrigerants in lieu of CFCs, their properties & comparison With CFCs . HFCs and HCs wrt component changes . flammability etc .

(34)

Need for elimination of refrigerant emissions through : Recovery/ Recycling; Good Brazed joints ; Proper leak testing before charging refrigerant. Importance of Cleanliness and Hygiene in a refrigeration system. Importance of evacuation of Moisture and Non condensable. Gases from a refrigeration system and the need Rotary 2 define vacuum levels

(35)

Changes in components & practices whilst retrofitting CFC appliances with HC and HFC refrigerants.

(A) HCs- Flammability issues to be addressed using safety components .

(B) HFCs- Changes in compressors, lubricants, need for filter driers of XH7/XH9 . & greater risk of moisture absorption & system failures .

- 1 **UNITS:-**
 Introduction--Defination--classification of units--interrrelationship between Metric and British System of units
- 2 **SIMPLIFICATION :-**
 Introduction--fractions--decimal fractions--lowest common multiple, LCM.
- 3 **SQUARE ROOT :-**
 Square and square root--symbol of root--method of finding out the square root of a number-- factorization method--division method.
- 4 **RATIO AND PROPORTION :-**
 Introduction--ratio--proportion-
- 5 **PERCENTANCE :-**
 Introduction--percentance method
- 6 **ALGEBRA :-**
 Introduction-careful consideration of subject items--addition and subtraction--multiplication and division--algebraic formulac-factorization--equations
- 7 **MENSURATION :-**
 Introduction-rectangle--square--parallelogram--rhombus--trapezium--trianglesh--circle
- 8 **TRIGONOMETRY :-**
 definition--formula--measurement of angles—
- 9 **ELECTRICITY :-**
 Introduction--uses of electricity--molecule--atom--atomic structure--electric current-AC.
 -DC.--ampare--EMF.--resistance--conductor--insulator--circuit
- 10 **ELECTRICAL POWER AND ENERGY :-**
 electric power--electric energy--
- 11 **EFFECT OF ELECTRIC CURRENT :-**
 Introduction---resistance --specific resistance--heating effect of electric current
- 12 **ELECTRICAL MACHINES :-**
 Introduction---DC.generator--DC. moterratio of transformer

ENGINEERING DRAWING

Code CRACR-130

- 1 INTRODUCTION, DRAWING INSTRUMENTS AND MATERIALS :-
Introduction—Drawing—drawing board—set-square—instrument box—pencil—rubber—drawing sheet--
- 2 CONVENTIONS FOR LINES, MATERIALS AND BREAKS :-
Introduction—convention for lines—grouping of lines—conventional breaks
- 3 FREE HAND LETTERING AND SKETCHING :-
Introduction—lettering—type of lettering—free hand sketching--
- 4 GEOMETRICAL DRAWING :-
Introduction—points—line—curved line—angle—circle—square—rectangle
- 5 HAND TOOLS :-
Hammers—files—pipe wrench—plier—spanner—hackaws—drilling machines—screw driver—tester—chisel—try-square—vice—etc.
- 6 ELECTRICAL CIRCUITS AND DISTRIBUTION :-
Introduction—electrical circuits
- 7 RECTIFIERS AND INSULATORS :-
Introduction—full wave rect.—brize wave rectifier—pin type insu.—suspension type insulater--
- 8 ELECTRICAL WINDING :-
Introduction—AC winding—DC-winding--
- 9 ELECTRICAL EARTHING :-
Introduction—plate earthing—pipe earthing--
- 10 ELECTRICAL AND ELECTRONICS SYMBOLS :-
positive—nagitive—DC—AC—fuse—bell—fan—lamp etc.--

PRACTICAL

Code CRACR-140

- 1 Importance of Trade and safety precautions
- 2 Basic fitting
- 3 Sheet metal
- 4 Basic welding
- 5 Basic electricity
- 6 Basic automobile
- 7 Refigeration Tools
- 8 Refigeration system
- 9 Compressor
- 10 Condenser
- 11 Refigerant
- 12 Refigerant control and safety Devices

SECOND YEAR

TRADE THEORY	Code CRACR -210
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- 1 Study construction of the Refrigerator & components Like door, gaskets, PUF Insulation, chiller tray, crisper etc, Electrical components & Wiring drawings, Ref sealed system, Roll bond evaporators, Suction Heat exchanger, open and concealed clean back condensers.
- 2 Study construction of Frost Free (2 or 3 door) Refrigerator parts particularly, the forced draft cooling. Air Duct circuit, the temperature control in Freezer & Refrigerator, the Evaporator, the automatic defrost system, the hot gas lines to prevent condensation on cabinet. The Electrical system.
- 3 Theory behind the causes of the problem & the analytical approach to trouble shooting need for right instruments & tools to trouble shoot.
- 4 Study of construction & functioning of WRAC. Role of each component. Principle of working. Evaporative cooling of condenser.
- 5 Study of Split A/Cs/Room Unit & Condensing unit. Principle of pipe sizing & study of service valves for charging at site. Principles of working of Infra red remote control & understanding Electrical/
- 6 Electronic circuitry. Condensate removal from room units & need for traps.
- 7 Importance of maintaining filter cleanliness. The problems in installation with Evaporator at higher/Lower levels & Versa. Also use of right instruments & tools to trouble shoot.
- 8 Study of refrigerant systems in auto A/C and Air flow & Direction control in evaporator. How performance varies with compressor/ Engine speed. Difference in R-12 & R-134 a system Temp. control in the cab. Electrical/Electronic Wiring diagram.
- 9 Theory behind the problems listed under trouble shooting and analytical approach to trouble shooting
- 10 Description, Construction, Function of different types of blower and fans, motors etc. Used for Evaporators and condensers.
- 11 Role of start & Run capacitors, Relays and PTCs.
- 12 Explanation of
 - (A) Water storing, Distribution & Drainage.
 - (B) Refrigeration system using R-22 & components in lieu of R-12.
 - (C) Electrical & control system
 - (D) Insulation.
 - (E) Retrofitting with HFC 134 a or HCFCs.
- 13 Chest type bottle coolers, Deep Freezers and Vending coolers, Description, Construction & Function. Substituting R-12 with R-134 a or Hydrocarbon
- 14 Ice Candy Plant & Ice Cream storage. Their types, Construction & Applications. Retrofitting
- 15 Performance of reciprocating compressor metric efficiency, Factor influencing volumetric efficiency.
- 16 Commercial type reciprocating compressor-Their type Construction and application.
- 17 Compressor lubrication. Types of lubrication. Splash and forced feed. Compressor oil function and characteristic.
- 18 Compressor capacity control. Different method and application.
- 19 Multistage compressor-Their function, Construction and application.
- 20 Centrifugal compressor. Construction and Application. Refrigerants used. Alternatives to R-11, like R-123, to R-12, like R-134. Screw compressor chillers. Types construction.
- 21 Condenser-its type and capacity. Water cooled condenser-Their type, Construction and Application.
- 22 Evaporative condenser- their function, Construction and application.
- 23 Cooling power – its Principle, type, capacity, construction & Application. Advantage & Disadvantage of different types of cooling towers. Selection of site, Efficiency. Wet bulb temp. and C.T. approach.
- 24 Water conditioning. Scale and deposit control, Corrosion and its control. Slime and Algae-water conditioning systems.
- 25 Principles of working of a pump. Causes of commonly faced problems like poor pumping, Air leaks, high power consumption.
- 26 Introduction to standard fittings, Valves etc. Used in chilled water, condenser water & drain lines.
- 27 Plate & tube forced air DX evaporators. Types of Defrost system & Condensate disposal.
- 28 Water / Brine chillers. Types of Brine used as secondary refrigerants.
- 29 Suc – liquid Heat Exchangers, Their function, construction, application & advantage.
- 30 Study of control & electrical wiring diagrams used in cold storage/commercial refrigeration.
- 31 Food preservation spoilage agents – control of spoilage agents, preservation by refrigeration.
- 32 Cold storage – type construction capacity and specification.
- 33 Method of installing compressor vibration eliminator and shock absorber their type and application
- 34 Study of layout and electric wiring of the storage plant.
- 35 Method of pressure testing, leak detection and evacuating the systems.

- 36 Method of charging gas to the system and testing efficiency .
 37 Cold storage plant operation . Its common trouble and remedies .
 38 Fundamentals of Central Air conditioning – Comfort Air conditioning conditions. Psychometrics. Dry point temperature. Introduction to psychometric charts.

WORKSHOP CALCULATION & SCIENCE	Code CRACR-220
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- 1 **ALGEBRA :-**
 Introduction--careful consideration of subject items--addition and subtraction--multiplication and division--algebraic formulac-factorization--equations
- 2 **MENSURATION :-**
 Introduction-rectangle--square--parallelogram—
 rhombus--trapezium--trianglesh--circle
- 3 **TRIGONOMETRY :-**
 definition--formula--measurement of angles—
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Introduction—plate earthing—pipe earthing--
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PRACTICAL**Code CRACR-240**

- 1 Air-Conditioning
- 2 Automobile Air-Conditioning
- 3 Air Distribution and cooling load
- 4 Cold storage
- 5 water and its treatmant
- 6 Commmercial compressor
- 7 Thermal insulation
- 8 oil lubrication
- 9 today refrigerator