

SUBJECT: REPAIR & MAINTENANCE OF REFRIGERATION SYSTEM (RMRS)**CLASS XII
SEMESTER - III****THEORY****FULL MARKS - 20****(MCQ Type Question)**

UNIT	Topic	No of periods assigned	Marks
1	General safety and trade related hazard	09	4
2	Introduction to Refrigeration	06	2
3	Refrigeration Systems	09	4
4	Components of VCRS	12	6
5	Refrigerator Servicing Tools	09	4

DETAIL SYLLABUS: THEORY

UNIT	Topics / Sub Topics	No of periods assigned
1	General safety and trade related hazard: 1.1 Personal protection in work place 1.2 Basic First Aid 1.3 Safety sign for danger, warning, caution and personal safety message 1.4 Types of fire and use of fire extinguisher 1.5 Electrical safety precautions 1.6 Hazards due to leakage of refrigerant and precautionary measures 1.7 Safety precaution to be taken during the use of hand tools for Refrigerator servicing 1.8 Use of PPE's during servicing of Air conditioner	09
2	Introduction to Refrigeration: 2.1 Definition of refrigeration 2.2 Definition of Refrigerating effect 2.3 Definition of COP 2.4 Definition of Ton of refrigeration 2.5 Major application areas of refrigeration	06
3	Refrigeration Systems: 3.1 Flow Diagram and function of each component of the following refrigeration system - Vapour Compression Refrigeration System (VCRS) - Vapour Absorption Refrigeration System (VARs)	09
4	Components of VCRS: 4.1 Types, working principle and construction of following components of Vapour Compression Refrigeration System (VCRS) - Compressor - Condenser - Expansion Devices - Evaporator	12
5	Refrigerator Servicing Tools: 5.1 Identification and uses of different tools and equipment required for servicing of	09

	refrigerator such as hammers, saw, screw drivers, wrenches, pliers, clamps, metal snips, files, torque wrench, flaring tool set, swaging tool, bending spring external type for copper tube, pipe cutter for copper tube, pinch of tool for copper tube, pipe cutter with built in reamer and space cutter for copper tube, pipe/tube bender lever type, puller 3 legged with flexible arm, multi meter, gas leak detector, compressor tester for hermetic compressor , evacuating and charging station, two stage rotary vacuum pump. etc.	
	Total	45

SUBJECT: REPAIR AND MAINTENANCE OF REFRIGERATION SYSTEM**CLASS XII
SEMESTER - IV****THEORY****FULL MARKS - 30****(SAQ AND LAQ Type Question)**

UNIT	Topic	No of periods assigned	Marks
1	Refrigerant	06	2(SAQ) & 5(LAQ)
2	Control Devices of Refrigerator	12	2(SAQ) & 5(LAQ)
3	Electrical concept relates to Refrigerator	09	1(SAQ)
4	Purpose of Dryer	06	1(SAQ) & 5(LAQ)
5	Troubleshooting Refrigerator	18	2(SAQ))
6	Industrial Application of Refrigeration system	12	2(SAQ) & 5(LAQ)

DETAIL SYLLABUS: THEORY

UNIT	Topics / Sub Topics	No of periods assigned
1	Refrigerant: 1.1 Classification of refrigerant 1.2 Desirable properties 1.3 Name and symbols of commonly used refrigerants 1.4 Eco friendly refrigerant (GWP, ODP etc.)	06
2	Control Devices of Refrigerator: 2.1 Identification, location and purpose of following control devices - Operating Controls: Thermostat - Fluid Flow Controls: Solenoid valve - Evaporator pressure regulating valve Safety controls: Pressure Switch (High Pressure & Low Pressure), Pressure relief valve, Oil-safety switch, Anti-freeze thermostat, Flow switch, Time delay relay (TDR), Electrical overloads protectors (Bimetal type) and Motor winding protection thermostat	12
3	Electrical concept relates to Refrigerator: 3.1 Concept of current, voltage, resistance, electrical power, electrical energy 3.2 Measurement of current, voltage, resistance, electrical power, electrical energy 3.3 Use of Multi meter, Watt meter and Energy Meter 3.4 Basic electrical circuit for refrigerator	09
4	Purpose of Dryer: 4.1 Causes of presences of moisture in refrigeration system 4.2 Uses of dryer 4.3 Types of dryers 4.4 Common Drying agents	06
5	Troubleshooting Refrigerator: 5.1 Common problems in direct cool refrigerator and possible causes such as: - No cooling due to leakage of gas/compressor not started. - Leakage of water	18

	▪ Poor cooling due to improper setting of controls/ compressor trips frequently/ moisture in the system. ▪ Remedy of the above problems. 5.2 Common problems in Frost Free Refrigerator and possible causes such as: ▪ No cooling due to Filter drier choked / Compressor no started ▪ Poor cooling due to partially choked capillary tube/malfunctioning of Bimetal thermo, Defrost heater and timer switch/ damaged Door gasket. ▪ Remedy of the above problem.	
6	Industrial Application of Refrigeration system: 6.1 Flow diagrams and working principles of: ▪ Cold storage systems. ▪ Milk processing plants. ▪ Ice-making plants. ▪ Ice cream plants. ▪ Water coolers.	12
	Total	63

Practical – 40marks

Project – 10marks

Practical

SL NO	CONTENT	DETAILS	Classes
1	Refrigerator Servicing tolls	1.1 Identification different tools and equipment required for servicing Refrigerator such as hammers, saw, screw drivers, wrenches, pliers, clamps, metal snips, files, torque wrench, flaring tool set, swaging tool, bending spring external type for copper tube, pipe cutter for copper tube, pinch of tool for copper tube, pipe cutter with built in reamer and space cutter for copper tube, pipe/tube bender lever type, puller, legged with flexible arm, multimeter, gas leak detector, compressor tester for hermetic compressor , evacuating and charging station, two stage rotary vacuum pump 1.2 Application of a Multimeter to take readings of voltage, current and resistance. 1.3 Reading of power and energy from watt meter and energy meter respectively	9
2	Domestic Refrigerator	2.1 Identification of various components of Domestic Refrigerator such as compressor, condenser, expansion	9

		device, evaporator, Current relay, PTC relay, OLP, Thermostat, Running Capacitor, Bimetal Thermal, Timer Switch, Heater, Thermal Fuse, Door Lamp, Door Switch etc. 2.1 Diagnosis of fault of the above components. 2.2 Servicing.	
3.	Compressor	3.1 Dismantling of Reciprocating Compressor (open type) and identification. 3.2 Overhauling, oiling and servicing of components like Cylinder, Piston, piston Ring, Crankshaft, Cylinder head valve plate assembly, Shaft seal, connecting rod etc. and assemble them. 3.3 Charging of compressor oil	18
4.	Condenser	4.1 Testing for leakage through condenser. 4.2 Repairing for leakage	12
5.	Expansion Device	5.1 Checking of capillary tube. 5.2 Detection of chocking in capillary tube by flushing. 5.3 Repair or replacement of the above part.	6
6.	Evaporator	6.1 Removal of oil from evaporator 6.2 Checking for leakage 6.3 Removal of oil from evaporator 6.4 Repair	6
7.	Copper tube	7.1 Cutting, bending and joining of copper tube 7.2 Flaring 7.3 Swaging 7.4 Silver Soldering.	9
8.	Gas charging in Refrigerator	8.1 Gas Charging 8.2 Vacuumising 8.3 Drying of the system	9
9.	Refrigerator cabinet	9.1 Servicing of refrigerator cabinet 9.2 Checking of door liner and body inside liner 9.3 Replacement of door liners and door gasket 9.4 Adjustment of door alignment	3
10.	Overload protector and starting relay	10.1 Checking of thermal overload protector, Motor starting relays and capacitors 10.2 Servicing of the above components.	9
11	Common problem on refrigerator	Diagnose common problem of refrigerator such as- 11.1 Common problems in direct cool refrigerator and possible causes such as- 11.2 No cooling due to leakage of gas/ compressor not started. 11.3 Leakage of water 11.4 Poor cooling due to improper setting of controls/ compressor trips frequently/ moisture in the system. 11.5 Remedy of the above problems 11.6 Common problems in Frost Free Refrigerator and possible	18

		causes such as No cooling due to Filter drier choked / Compressor no started. 11.7 Poor cooling due to partially choked capillary tube/malfunctioning of Bimetal thermo, Defrost heater and timer switch/ damaged Door gasket. 11.8 Remedy of the above problem.	
12	Project		36
Total Practical and Project			144

Project (Any Two)

Sl. No.	Content	Details	Hours
1.	Project I	Disassembly and assembly of different components of a domestic refrigerator.	18
2.	Project II	Preparation of report based on Industrial visit to a cold storage	18
3.	Project III	Preparation of report based on Industrial visit to an Ice Plant	18
4.	Project IV	Preparation of report based on Industrial visit to a Ice Cream Plant	18