

GUJARAT UNIVERSITY

B.E. Sem. VII (Mech.) (Old/New) Examination

Refrigeration Engineering (EP-I)

Thursday, 3rd January, 2008]

[Time : 3 Hours

Max. Marks : 100

- Instructions :** (1) Attempt all questions.
 (2) Answer to the two sections must be written in separate answer books.
 (3) Assume suitable data if required.
 (4) Figures to the right indicate full marks.

SECTION I

-- (16)

1(a) Describe with a sketch regenerative air refrigeration system. Draw the T-s diagram and state the equation of mean of air, power and COP of this system.

(b) Discuss the main components of vapour compression refrigeration system. State the advantages and disadvantages of vapour compression refrigeration system over air refrigeration system.

-- (16)

OR
 1(a) Discuss the physical and thermodynamic properties of the following refrigerants and how leaks are detected. R 717, R 134(a), R 502, R 13

(b) Which refrigerants are required to be replaced and why?

(c) Give the chemical formula and chemical names of following refrigerants R 12, R 22, R 114, R 744

(d) Explain the mechanism of ozone layer depletion and discuss the terms ODP & GWP

on page - (2) [P.T.O.]

Q. 2(a) State the limitations of vapour compression refrigeration system for production of low temperature. What are the advantages of cascading?

(b) A cascade refrigeration system using R22 and R13 is required to produce 70 kW refrigeration at -70°C . Heat is rejected in cascade condenser of R13 at -20°C to R22 at -20°C . The condensation in the water cooled condenser at 40°C . Assume simple saturated cycles for both the circuits. Determine,
 (i) Pressure ratio and mass flow rate of each cascade
 (ii) COP and piston displacement of each system.
 (iii) COP of the cascade refrigeration system.

OR (16)

Q. 2(a) Describe briefly the construction and working of hermetically sealed compressor for VCR system.

(b) What is twin screw compressor? With a neat sketch explain its principles of operation.
 (c) What are the factors which affect the volumetric efficiency of a reciprocating refrigeration compressor? (18)

Q. 3. Write short notes (Any Three)

1. Condensers used in cold storage plants.
2. Automatic Expansion Valve
3. Gauge manifold and Service Valves
4. Flooded type evaporator.
5. Importance of shaft seals in open type refrigerant compressor.

on page no. (3)

Section: II

--- (16)

- Q. 4(a) State the applications and limitations if any of the Steam Jet Refrigeration System.
- (b) As COP is very low, under what circumstances the steam jet refrigeration system is preferred over other system.
- (c) Describe briefly the principle of production of hot and cold air from a vortex Tube.

OR

--- (16)

- Q. 4(a) Explain principle and working of Linde System for air liquifaction with the help of sketches.
- (b) Discuss the suitability of solid CO_2 as a cooling medium.
- (c) Why the yield of liquid air is more in case of Claude System than that of a Linde System? Explain.

- 5(a) Explain the method of obtaining clean and clear ice from an Ice Plant. (16)
- (b) Differentiate primary and secondary refrigerant in relation to Ice plant.
- (c) Explain principle and working of ~~sol~~ solenoid valve, also differentiate its function from Thermostatic Expansion Valve.

OR

[P.T.O]

on Page no. (4)

Q.5 (a) State the functions of the following components in an vapour ~~compression~~ absorption refrigeration system.

- (i) Absorber (ii) Rectifier (iii) Generator
(iv) Heat exchanger (v) Analyser
- (b) State the advantages of a vapour ~~compression~~ ^{absorption} refrigeration system over steam jet refrigeration system.
- (c) Draw a neat diagram of "Electrolux Refrigerator" and mention the function of each fluid used.

Q-6 Write short note (Any Three) - - - (18)

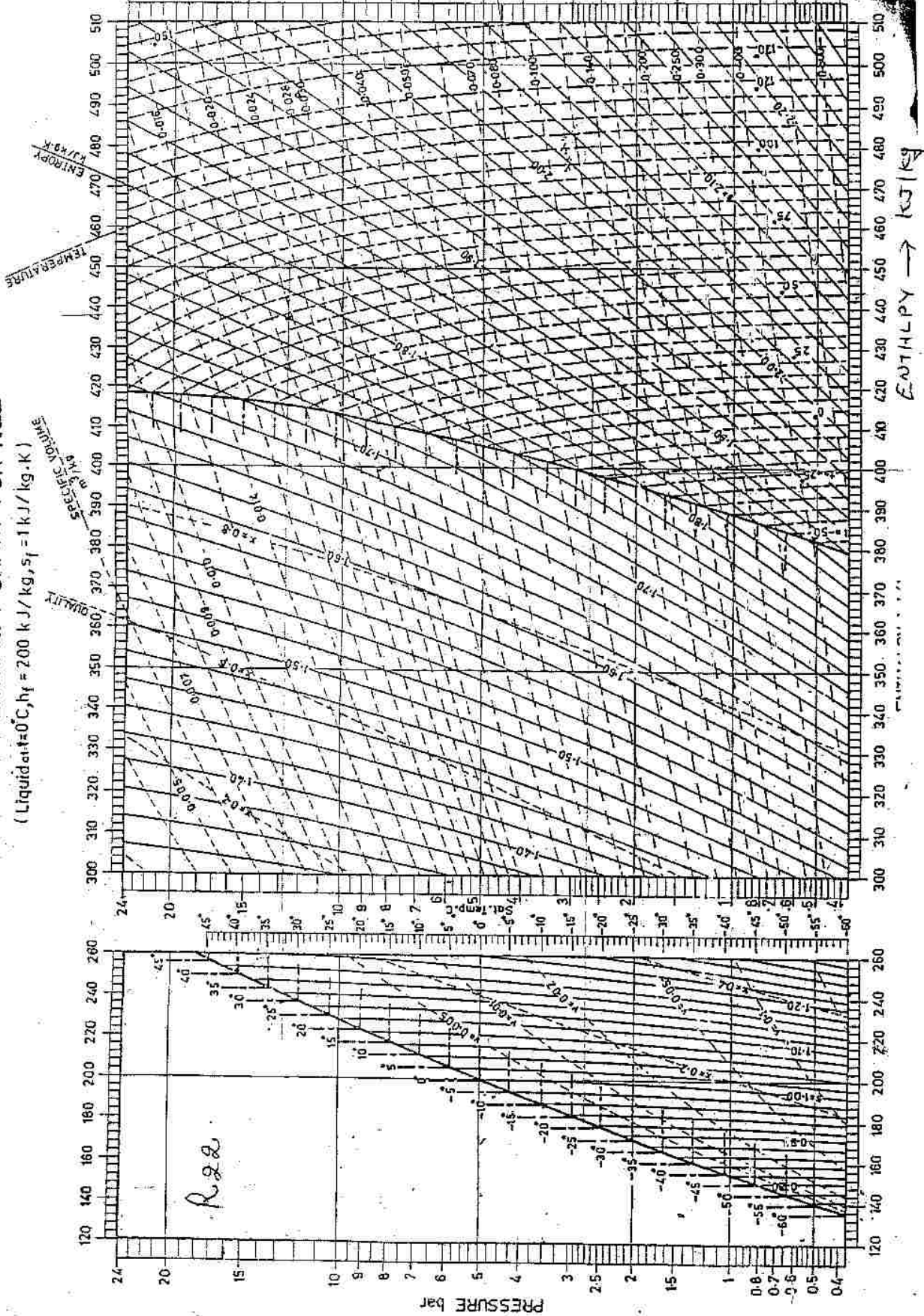
1. Water in cooler
 2. Leak detection methods in R & AC system.
 3. Defrosting methods of Refrigeration system
 4. ~~Thermo~~ Thermo electric Refrigeration.
 5. Relay and overload protector used in Refrigeration system.
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Page 2 of 2 Section I

CHART C-6 PRESSURE-ENTHALPY CHART FOR R22

(Liquid at $t=0^{\circ}\text{C}$, $h_f = 200 \text{ kJ/kg}$, $s_f = 1 \text{ kJ/kg}\cdot\text{K}$)

DD3-Y



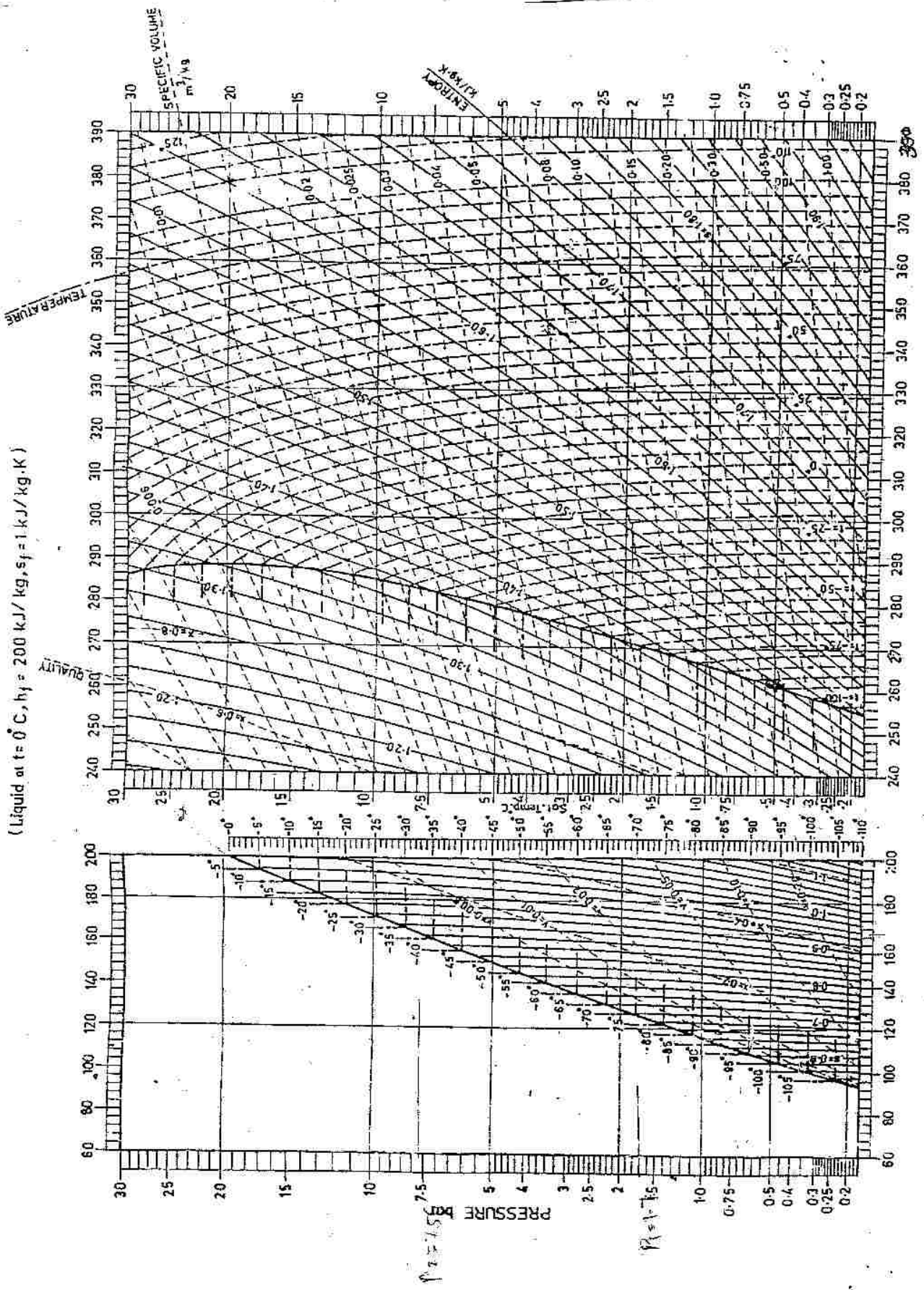
ENTHALPY → kJ/kg

PRESSURE bar

R22

PRESSURE-ENTHALPY CHART FOR R13

(Liquid at $t = 0^\circ\text{C}$, $h_f = 200 \text{ kJ/kg}$, $s_f = 1 \text{ kJ/kg}\cdot\text{K}$)



57000