

Total No. of Questions :12]

SEAT No. :

P2181

[5058]-20

[Total No. of Pages :5

T.E. (Mechanical)

REFRIGERATION & AIR CONDITIONING

(2008 Course) (Semester-II) (302051)

Time : 3 Hours]

[Max. Marks :100

Instructions to the candidates:

- 1) *Answer any three questions from each section.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Use of calculator is allowed.*
- 4) *Assume suitable data if necessary.*

SECTION-I

- Q1)** a) Explain reversed Carnot cycle and derive expression for COP of reversed Carnot cycle. **[8]**
- b) In a refrigerator working on Bell-Coleman cycle , air is drawn into the compressor from the cold chamber at a pressure of 0.95 bar & temperature of - 5°C. After compression to 5 bar it is cooled at constant pressure to temperature of 15°C. The compression and expansion follows $PV^{1.3} = C$. If air is expanded to 1 bar calculate COP & capacity if mass circulation of air is 1.5 kg/min. **[8]**

OR

- Q2)** a) What is Peltier effect? With neat diagram explain thermoelectric refrigeration system. **[8]**
- b) What are the limitations of Carnot cycle? Derive the practical VCC from Carnot cycle. **[8]**
- Q3)** a) A refrigeration Plant operates between the temperature limits of -15°C and 30°C. The machine circulates 4.5kg/min. There is no undercooling. Compressor discharge is at 75° C. Determine: COP, refrigerant quantity entering compressor, and ice produces at 0° C in kg/h from water at 25°C. **[10]**
- Assume: $C_{pg} = 2.82 \text{ kJ/kgK}$, $C_{pi} = 2.1 \text{ kJ/kgK}$, $C_{pl} = 4.18 \text{ kJ/kgK}$, & $H_{fs} = 336 \text{ kJ/kg}$.

P.T.O.

Use following properties:

Sat. temp, °C	h_f kJ/kg	h_g kJ/kg	s_f kJ/kgK	s_g kJ/kgK	V_f m ³ /kg	V_g m ³ /kg
-15	112.3	1426	0.457	5.549	0.00152	0.509
+30	323.1	1469	1.204	4.968	0.00158	0.111

b) Give the selection criteria of refrigerant absorbent pair in VARS. [6]

OR

Q4) a) Draw practical VCC on T-s and p-h diagram. Explain the various losses/gains in practical VCC. [8]

b) Explain double effect Li-Br vapour absorption system. What are its benefits over single effect system? [8]

Q5) a) Explain : ODP & GWP [6]

b) A two evaporator, single compressor and individual expansion valve arrangement is used in multistage vapour compression system using R134a. Sketch schematic arrangement and also cycle on p-h chart.

Determine overall COP, mass flow rate of refrigerant & cooling load on condenser. The exchanger details of system are as follows: [12]

i) Evaporator, E1 : - 30°C & 20TR capacity

ii) Evaporator, E2 : -5°C & 30TR capacity

iii) Condenser, C : 40°C & 10°C subcooling

OR

Q6) a) Write short note on “Alternative refrigerants”. [8]

b) Why Cascade system is required? Describe its working with neat diagram. Give its applications. [10]

SECTION-II

Q7) a) Moist air at 40°C & 80% RH passes through an air conditioning plant and attains the final condition 24°C & 60% RH. Assuming constant pressure of 100 kPa, determine capacity of cooling coil and rate of moisture removal in kg/h for mass flow rate of 2 kg/s. Show the process on psychrometric chart. [8]

b) Explain the heat balance of human body. What are the various factors affecting human comfort? [8]

OR

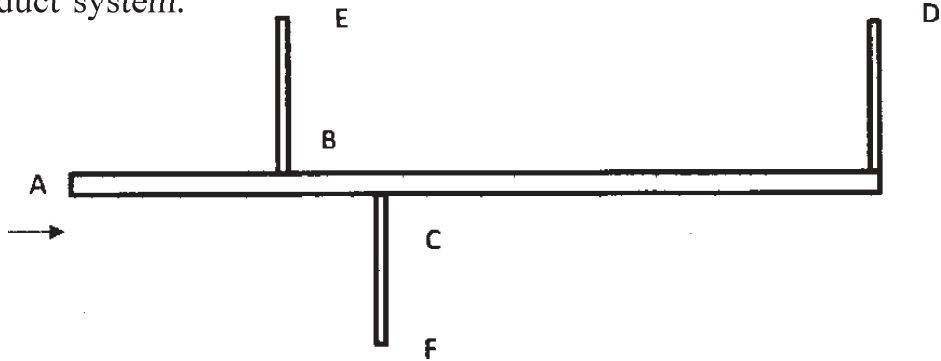
- Q8)** a) Explain : RSHF, GSHF and ESHF. [6]
 b) A psychrometer records 30°C & 25°C WBT. Calculate- vapour pressure, relative humidity, specific humidity, DPT & degree of saturation. Barometer reads 95 kPa. Calculate all properties when barometer reads 101.325 kPa [10]

- Q9)** a) Explain the various types of compressors used in refrigeration systems. Discuss the working of screw compressor. [8]
 b) What is variable air volume air conditioning system? What are the advantages of it over other types? [8]

OR

- Q10)** a) With neat schematic explain the central air conditioning system. [8]
 b) Explain the working of capillary tube. [8]

- Q11)** a) Explain the various types of food preservation techniques. [8]
 b) Use equal friction method to find duct dimensions for the following air duct system. [10]



Length of ducts are :

AB = 30 m, BC = 15m, CD = 60 + 15 m after elbow, CF = 22.5 m, BE = 30 m.

Air delivery :

At E = 60 cmm, At F = 180cmm, at D = 240 cmm

Assume free exit at each outlets (E,F,D).

OR

- Q12)** Write short note on : [18]

- CAMA storage
- Fan laws
- Static regain method of duct design.

