SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | **Total number of pages: [3]**

B.Tech. || ME ||8th Sem

Refrigeration & Air conditioning

Subject Code:BTME-802

Paper ID:

Time allowed: 3 Hrs **Max Marks:60**

Important Instructions:

- **All questions are compulsory**
- **Assume, if any additional data is required but justify the same.**
- **Exchange of anything i.e. steam tables, calculator, pencil, scale etc. is not allowed.**
- **Use of refrigerant tables, steam tables and psychrometric chart is allowed.**

PART – A (10 × 2 marks)

Q. 1: Short answer questions. Write in brief.

a. What is difference between natural and mechanical refrigeration? Give an example of each.

b. Why some times cooler with evaporative fluid is used in aircraft refrigeration and air conditioning system?

c. Just show dry versus wet compression on T-s and P-h diagrams for vapour compression refrigeration cycle.

d. Why is heat removed from absorber in vapour absorption refrigeration system?

e. Designate/name the refrigerants CCl_3F and CF_3Br.

f. What is Joule-Thomson coefficient?

g. Define specific humidity and relative humidity of air water vapour mixture.

h. Just show the process on psychrometric chart for air treatment in desert cooler.

i. Which heat load is additional in grand total heat in comparison of room total heat?

j. Write two advantages of use of capillary tube.

PART – B (5 × 8 marks)

Q. 2: Using P-V and T-s diagrams and mentioning suitable assumptions, derive an expression of COP of reversed Carnot refrigeration cycle (single phase). Write it's limitations.

Or

A dense air refrigeration machine operates on reversed Brayton cycle is required for 8 tons cooling capacity. The cooler pressure is 5.2 bar and refrigerator pressure is 1.4 bar. The air is cooled to 50°C in the cooler and temperature at inlet to compressor is -25°C. For an ideal cycle, determine COP of the system, mass of air circulated per minute, theoretical piston displacement of the compressor and net power per TR of refrigeration.

CO 1

Q. 3: Describe simple vapour compression cycle with the help of p-v, T-s, p-h and schematic diagram. Describe the effect of subcooling, superheating, condenser pressure and evaporator pressure on performance of simple vapour compression system

Or

Describe two stage vapour compression refrigeration system with flash gas removal and flash gas intercooling using schematic and p-h diagram. Are flash gas intercooling and flash gas removal always beneficial?

CO3

Q. 4: Explain in detail the working of aqua ammonia vapour absorption refrigeration system using schematic diagram. Clearly describe the function of each and every component of the system.

Or

(i) Discuss about properties of any presently used refrigerant in domestic refrigerators.

(ii) Describe halide torch and electronic leak detector to detect leakage of refrigerant.

CO 2 & 3

Q. 5: **(a)** Explain working of automatic expansion valve using neat schematic diagram.

(b) Describe cascade system with help of neat sketch and p-h diagram.

Or

(a) Explain vortex tube refrigeration with help of sketch.

(b) What is difference between window and split air conditioner? How does decide that for any room or space cooling, which one should be preferred?

CO 3 & 4

Q. 6: **(a)** Briefly explain **(i)** Adiabatic wet bulb temperature **(ii)** Bypass factor

(b) The DBT and WBT of atmospheric air are 35°C and 23°C respectively when the barometer reads 75 mm of Hg. Determine (i) relative humidity, (ii) humidity ratio, (iii) dew point temperature, (iv) density and (v) enthalpy of atmospheric air.

Use the carrier equation as given below

$$p_v = (p_{vs})_{atwbt} - \frac{[p_t - (p_{vs})_{atwbt}](T_{dbt} - T_{wbt}) \times 1.8}{[2800 - 1.3(1.8T_{dbt} + 32)]}$$

Where pressure are in mm of Hg.

Or

An air-conditioning system is designed for Restaurant when the following data is available.

Total heat flow through the walls, roof and floor	21200 kJ/hr.
Solar heat gain through glass	6800 kJ/hr.
Equipment sensible heat gain	10,000 kJ/hr.
Equipment latent heat gain	2400 kJ/hr.
Total infiltrated air	400 m^3/hr.
Outdoor conditions	35 °C DBT and 26 °C WBT.
Inside design conditions	27 °C DBT and 55% R.H.
Minimum temperature of air supplied to room	17 °C DBT.
Total amount of fresh air supplied	1600 m^3/hr.
The seating chairs for dining	100.
Employees serving the meals	10.

Latent heat gain per person: 360 kJ/hr ; Sensible heat gain per person: 300 kJ/hr

If the fan is situated before the conditioner then find the followings.

(a) Amount of air delivered to the room in cu. m. per hour.

(b) Percentage of re-circulated air.

(c) Refrigeration load on the coil in tons of refrigeration.

Take motor power connected to the fan as 12 kW

(d) Also find the DPT of the cooling coil and its bypass factor.

CO 5 & 6