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Total No. of Pages: 03
Total No. of Questions: 09

B. Tech. (ME) (Sem.-7th)
REFRIGERATION AND AIR CONDITIONING
Subject Code: BTME-802
Paper ID: [A3063]

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. **Section –A, is Compulsory.**
2. **Attempt any four questions from Section-B.**
3. **Attempt any two questions from Section-C.**

Section –A

(10x2=20)

Q.1. Write briefly:

- (a) Define Energy performance ratio (EPR) and express its relationship with COP.
- (b) What are the components of vapour compression refrigeration cycle?
- (c) What is the function of absorber and rectifier?
- (d) Classify different types of refrigerants.
- (e) What are azeotropes? Give two examples.
- (f) What is the principle of steam jet refrigeration system?
- (g) What is the purpose of ‘Psychrometer’?
- (h) Differentiate between ventilation load and infiltration load.
- (i) Define the terms ‘by-pass factor’ used for heating or cooling coils.
- (j) What are different types of compressors used in refrigeration and air conditioning systems?

Section –B

(4X5=20)

- Q.2.** A refrigerator operating on standard vapour compression cycle has a COP of 6.5 and is driven by a 50 KW compressor. The enthalpies of saturated liquid and saturated vapour refrigerant at the operating condensing temperature of 35 °C are

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69.59 KJ/Kg & 201.4 KJ/Kg respectively. The saturated refrigerant vapour leaving evaporator has an enthalpy of 187.53 KJ/kg. Find the refrigerant temperature at compressor discharge. C_p for refrigerant vapour = $0.6155 \text{ KJ/kg } ^\circ\text{C}$

- Q.3.** What is the basic difference between a vapour absorption refrigeration system and a vapour compression system? Explain how, the function of the compressor in Vapour compression system is achieved in a vapour absorption system, and by which components? Draw a neat sketch of a practical vapour absorption system and describe its working in brief.
- Q.4.** Explain the working principle of thermo-electric refrigeration system. List out the merits and demerits of thermo-electric refrigeration system over other refrigeration systems. What are the major fields of its applications?
- Q.5.** 5 grams of water vapour per kg of atmospheric air is removed and temperature of air after removing the water vapour becomes 25°C DBT. Find the followings:
- (i) Relative humidity
 - (ii) Dew- point temperature.

Assume condition of atmosphere air is 35°C and 60% RH and pressure is 1.013 bar.

- Q.6.** In an air conditioning plant, an air handling unit supplies a total of $4000 \text{ m}^3/\text{min}$ of dry air which comprises by mass 20 per cent of fresh air at 39°C DBT and 26°C WBT and 80% re-circulated air at 24°C DBT and 50% RH. The air leaves the cooling coil at 12°C saturated. Calculate the
- (a) Total cooling load
 - (b) Room heat gain.

Section-C

(2X10=20)

- Q.7.** In a Bell Coleman refrigeration cycle, air is drawn from cold chamber at 1 bar and compressed to 6 bar in the compressor. The compression and expansion indices are 1.25 and 1.30 respectively. Obtain COP and Tonnage of the unit for an air flow rate of 0.5 kg/sec. Neglect the clearance volume and take temperatures at the beginning of compression and expansion to be 7°C and 37°C respectively. If the compression and expansions are isentropic, how the result will be modified.

Q.8. An office is to be air-conditioned for 50 staff when the outdoor conditions are 30°C DBT and 75% R.H. If the quantity of outdoor air supplied 0.4m³/min/person, find the followings:

- (a) Capacity of the cooling coil in tons of refrigeration.
- (b) Capacity of the heating coil in kW.
- (c) Amount of water removed by the eliminator per hour.

Assume that required comfort conditions are 20°C DBT and 60% R.H. Air is conditioned first by cooling and dehumidifying and then heating.

- (d) If the heating coil surface temperature is 25°C then find the bypass factor of the heating coil.

Q.9. Write short notes on the following

- (a) Various leak detection techniques CFC refrigerants?
- (b) Working of Central air conditioning system.

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