(b) What is outside and inside conditions? How the SHF is affected by these conditions? (5)

7. Write short notes on following :
   (a) Pressure sensors.
   (b) Temperature sensors.
   (c) Humidity sensors. (5×3=15)

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December 2023

B.Tech. (ME) V Semester

Refrigeration and Air Conditioning PCC-ME-504/21

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Steam table and PH & Psychometry Chart is allowed. Missing data, if any, may be assumed suitably.*

PART-A

1. (a) One ton in KW is equal to ..... (1.5)
   (b) Mention any two effects of global warming. (1.5)
   (c) Draw the Boot strap evaporative cycle diagram. (1.5)
   (d) Mention, why cascading refrigeration system needed. (1.5)
   (e) What are effects of superheating in VCRS? (1.5)
   (f) What is role of ammonia in simple VARS? (1.5)
   (g) What is value of RH at same DBT and WBT? (1.5)

(h) What is by-pass factor? (1.5)

(i) What is difference between the Infiltration and Ventilation? (1.5)

(j) What is a duct? (1.5)

PART-B

2. (a) Discuss the desirable properties of a ideal refrigerant. (10)

(b) Derive the COP for Bell-Coleman refrigerator. Assume the expansion and compression ratio are same. (5)

3. (a) Explain the Thermoelectric and Vortex tube refrigeration systems. (5)

(b) Explain the working of Lithium – Bromide VARS with neat sketch. Also mention its merits. (10)

4. A vapour compression refrigerating machine, with Freon-12 as refrigerant, has a capacity of 12 tonnes of refrigeration operating between –28°C and 26°C. The refrigerant is subcooled by 4°C before entering the expansion valve and vapour is superheated by 5°C before leaving the evaporator. The machine has a six cylinder single acting compressor with stroke equal to 1.25 times the bore. It has a clearance of 3% of the stroke volume. Determine: 1. Theoretical power required; 2. COP; 3. Volumetric efficiency; and 4. Bore and stroke of cylinder.

The speed of compressor is 1000 r.p.m.

Following properties of Freon-12 may be used.

Specific heat of liquid refrigerant –0.963 kJ/kgK and specific heat for superheated vapour = 0.615 kJ/kgK.

Saturation Temperature °C	Pressure bar	Sp. Volume of vapour, m^3/kg	Enthalpy, kJ/kg		Entropy, kJ/kgK	
			Liquid	Vapour	Liquid	Vapour
–28	1.093	0.1475	10.64	175.11	0.0444	0.7153
26	6.697	0.0262	60.67	198.11	0.2271	0.6865

(15)

5. A theatre of 1500 seating capacity is to be air conditioned for winter conditions when the following data is known :

Outdoor conditions = 12°C and 60% R.H.

Required comfort conditions = 20°C and 60% R.H.

Amount of free air supplied = 0.25 m^3/min/person.

The required condition is achieved by the heating, humidifying and then again heating. The air coming out of the humidifier has 80% R.H.; then find the followings:

(a) Heating capacity of the first heater in kW and condition of the air coming out of the heating coil. Also find the surface temperature of the coil if the bypass factor is 0.4.

(b) The capacity of the humidifier.

(c) Heating capacity of the second heater in kW and the bypass factor if the surface temperature of the coil is maintained at 24°C. (15)

6. (a) Discuss in brief about the various sources of heat which has to be taken into account in order to calculate the total cooling load for a building. (10)