B.E.(with Credits)-Regular-Semester 2012 - Mechanical Engineering Sem VIII ME802 - Refrigeration and Air Conditioning

#### P. Pages: 3

## Time : Three Hours

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### GUG/W/16/7110

Max. Marks: 80

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	Notes	s: 1. 2. 3. 4. 5. 6. 7.	All questions carry marks as indicated Q. 1 OR Q. 2, Q.3 OR Q.4, Q.5 OR Q.6, Q.7, OR Q.8, Q.9, OR Q.10. Answer <b>five</b> questions. Due credit will be given to neatness and adequate dimensions. Assume suitable data wherever necessary. Diagrams should be given wherever necessary. Illustrate your answers wherever necessary with the help of neat sketches. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted			
1.	a)	<ul> <li>Comment in brief about the following for VCR system.</li> <li>i) Wet Compression is not desirable.</li> <li>ii) Throttling device is used in place of expander.</li> <li>iii) Refrigerant after throttling should contain more liquid refrigerant.</li> </ul>				
	b)	The foll Refriger Condens Evapora Compre Clearand Condens Suction Capacity If s using tal i) C.C ii) Vo iii) The iv) Bo	by by the system of the cylinder if stroke is 1.5 times the bore.	10		
			OR			
2.	a)	Discuss in brief working of three fluid refrigerator working of vapour absorption principle.				
	b)	In a 15TR $NH_3$ refrigeration plant, compression is carried out in two with water and flash intercooler and water subcooler condenser pressure, evaporator pressure and inter coolers pressure are 12 bar, 3 bar and 6 bar respectively. If the limiting temperature for intercooling and subcooling is 20°C determine the following.				

- i) COP of the plant.
- ii) Power required for LP and HP compr.
- iii) The swept volume for each compressor if the volumetric efficiency of each compressor is 80%.

Assume the compression to be isentropic in both the compressors.

- **3.** a) Discuss in short working of a thermostatic expansion valve.
  - b) A single compressor system using R-12 as refrigerant has three evaporators of capacity 18 tonnes, 27 tonnes and 9 tonnes of refrigeration. The temperatures in the three evaporators are to be maintained at -5°C, 0°C & 7°C respectively. The system is provided with individual expansion valves and back pressure valves. The condenser pressure is 9.61 bar. The liquid refrigerant leaving the condenser is sub cooled to 30°C. The vapours leaving the evaporators are dry and saturated. Assuming isentropic compression, determine:
    - i) Mass of refrigerant flowing through each evaporator.
    - ii) Power required to drive the compressor.
    - iii) Co-efficient of performance of the system.

#### OR

Discuss the applications of cryogenics in short. 4 4. a) b) Describe the work of Claude air liquefaction system. What are its advantages over Linde-8 Hampson system. Explain the principle of thermoelectric cooling. Also list its advantages. 4 c) 5. Write short notes any three. 16 Hermetically sealed compressor. i) Aqua - NH<sub>3</sub> refrigeration system. ii) iii) Charging a refrigeration system. iv) Alternate refrigerant. GWP and ODP. v) OR Define the following psychrometric terms:-3 6. a) Relative humidity. i) ii) Dew point temperature. iii) Vapour density. Derive the expression for specific humidity of moist air. b) 4 In a Laboratory test a psychrometer recorded 36°C DBT and 30°C WBT Atm. Pressure is 9 c) 1 bar. Calculate. Vapour pressure **Relative humidity** i) ii) Degree of saturation Specific humidity iv) iii) Dew point temperature Enthalpy of moist air. v) vi) 7. The following data refers to summer air-conditioning of a building. 16 Outside design conditions : 43° DBT, 27°C WBT Inside design conditions : 25° DBT, 50% RH Room Sensible heat gain : 84,000 kJ/hr Room Latent heat gain : 21,000 kJ/hr

By pass factor of the cooling coil : 0.2

2

4

The return air from the room is mixed with the outside air before entry to cooling coil in the ratio of 4:1 by mass. Determine.

- Apparatus dew point of the coil. i)
- Entry and exit conditions of air for cooling coil. ii)
- iii) Fresh air mass flow rate.

8.

9.

iv) Refrigeration load on the cooling coil.

#### OR

8.		The following data is available for designing an air-conditioning system for a restaurant.				
		Inside design conditions	: 27°DBT, 55%RH			
		Outdoor design conditions	: 35°DBT, 26°WBT			
		Minimum temperature of air supplied to room	<ul> <li>: 17°C DBT</li> <li>: 1600 m<sup>3</sup>/hr.</li> <li>: 400m<sup>3</sup>/hr.</li> <li>: 50</li> <li>: 5</li> <li>: 58W</li> <li>: 44W</li> <li>: 76W</li> <li>: 0.17KW</li> <li>: 0.3KW</li> </ul>			
		Total amount of fresh air supplied				
		Total infiltration air				
		Seating chairs for dining				
		Employees serving the meals				
		Sensible heat gain/person				
		Latent heat gain/sitting person				
		Latent heat gain/employee				
		Sensible heat gain from meals				
		Latent heat gain from meals				
		Heat gain through wall, roof and floor	: 6.2KW			
		Solar heat gain through glass	: 2KW			
		Equipment sensible heat gain	: 2.9KW			
		Equipment latent heat gain	: 0.7KW			
		Motor power of the fan : 7.5KW If the fan is installed before the conditioner, determine:				
		i) Amount of air delivered to the room in m	<sup>3</sup> /hr.			
		ii) % of recirculated air				
		iii) Refrigeration load on coil in TR				
		iv) ADP of coil and bypass factor.				
9.	a)	Write in short about types of air outlets used in air conditioning systems.				
	b)	List the methods of duct design. Describe any one method in detail.				
	c)	What are the various types of controls provided in air conditioning systems. Write in shor about:-				
		i) Thermostats. ii)	Humidistats.			
		01	R			
10.		Write short notes <b>any three</b> .		16		

- Effective temperature with reference to Human Comfort. i)
- ii) Window air conditioner.
- iii) Air washers.
- iv) Applications of air conditioning.

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