Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**

P2HTCC02

2nd Semester Regular Examination 2016-17

REFRIGERATION ENGINEERING

SPECIALISATION: HEAT POWER & THERMAL ENGINEERING, HEAT POWER ENGINEERING, THERMAL ENGINEERING

Time: 3 Hours

Max Marks: 100

Q.CODE:Z505

Answer Question No.1 which is compulsory and any four from the rest.

The figures in the right hand margin indicate marks.

1 Answer the following questions:

a) Write the advantage of heating the refrigerant to superheated stage at suction. 2

b) When the volumetric efficiency of the compressor becomes highest? 2

c) In a two stage vapour compression system, if the operating condition of condenser at 1.35 MN/m^2, 35^0C and evaporator at 0.0718 MN/m^2, -40^0C; calculate the intermediate pressure. 2

d) Calculate the overall efficiency of the ejector if the efficiencies of nozzle, entrainment and diffuser are 0.85, 0.65 and 0.85 respectively. 2

e) Define Rault's law of solubility. 2

f) Define degree of saturation of moist air. 2

g) Define by-pass factor of a cooling coil. 2

h) What is the difference between flooded type and dry type evaporator? 2

i) Define clearance factor of a compressor. 2

j) Write the chemical formula of R_{11}. 2

2 a) An ammonia refrigerator produces 20 tons of ice per day from and at 0^0C. The condensation and evaporation takes at 20^0C and -20^0C respectively. The temperature of the vapour at the end of isentropic compression is 50^0C and there is no under cooling of the liquid. The actual COP is 70% of the theoretical COP. Determine: (i) the rate of NH_3circulation, (ii) the size of single acting compressor when running at 240 RPM assuming length to bore ratio unity and volumetric efficiency of 80%. (Assume fusion of ice, h_{fg}=335 KJ/Kg., specific heat of superheated vapour = 2.8 KJ/Kg^0k, specific volume of dry vapour at -20^0C, v_{sup} = 0.264 m^3/kg). Table for NH_3: (10)

Temperature (^0C)	Sp. Enthalpy (KJ/Kg)		Sp. Entropy(KJ/Kg^0K)	
	h_f	h_g	s_f	s_g
20	274.98	1461.58	1.0341	5.0919
-20	89.72	1419.05	0.3682	5.6204

b) Write advantages and disadvantages for wet compression and dry compression refrigeration (10)

system. Write the effect of evaporator pressure on refrigeration system.

3 a) With neat sketch explain in detail the manufacture of solid carbon dioxide. (10)

b) A mixture of dry air and water vapour at a temperature of 22^0C under a total pressure of 736 mm of Hg. The dew point temperature is 17^0C. Find relative humidity, specific humidity, specific enthalpy of water vapour, enthalpy of air per kg of dry air, specific volume of air per kg of dry air. (10)

4 a) 40 cmm of a mixture of recirculated room air and outdoor air enters a cooling coil at 31^0C DBT and 18^0 WBT. The effective surface temperature of the coil is 4.5^0C. The surface area of the coil provides 12.5 KW of refrigeration with given entering air state. Determine the dry and wet bulb temperatures of the air leaving the coil and the coil by-pass factor. (10)

b) Discuss in detail the thermodynamic properties required for a refrigerant. (10)

5 a) Applying conservation principle analyze different components of a vapour-absorption refrigeration system. (10)

b) A R-12 reciprocating compressor with 4 percent is to be designed for 7.5 TR capacity at 5^0C evaporating and 35^0C condensing temperatures. The compression index may be taken as 1.15. The number of cylinders may be selected as two and the mean piston speed as 3 m/sec. The stroke to bore ratio for fluorocarbons may be taken as 0.8. Pressure drops at suction and discharge valves may be assumed as 0.2 and 0.4 bar respectively. Determine: (a) power consumption and COP of the cycle, (b) volumetric efficiency of the compressor, (c) bore, stroke and RPM of the compressor. Table for R-12: (10)

Temperature (^{0}C)	Sp. Enthalpy (KJ/kg)		Sp. Volume (m^3/kg)		Pressure (bar)
	h_f	h_g	v_f	v_g	
5	40.7	189.7	0.72	0.0475	3.62
35	69.5	201.5	0.79	0.0206	8.47

6 a) With neat sketch explain different types of evaporators. (10)

b) An R-12 thermostatic expansion valve not equipped with an external equalizer has a superheat setting of 7^0C while supplying the refrigerant to the evaporator at 0^0C. The power fluid is same as the refrigerant. (a) Determine the difference in pressures on opposite sides of the diaphragm required to operate the valve. (b) If the temperature at the evaporator inlet is -5^0C and the pressure drop through the coil is 0.2 bar, what is the degree of superheat of the suction gas leaving the evaporator? (10)

7 a) With neat sketch explain the working principle of different types of condensers. (10)

b) Explain the working principle of magnetic refrigeration system. (10)