Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–VII • EXAMINATION – SUMMER 2013

Subject Code: X 71901 Date: 10-05-2013

Subject Name: Refrigeration & Air conditioning

Time: 10.30 am - 01.00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of student's own tables and charts are allowed.**

Q.1 **(a)** State the advantages and disadvantages of Bell-Coleman air refrigeration cycle and justify the use of air refrigeration for aircraft cooling. **07**

(b) A 5 tons vapour compression refrigeration plant uses R-12 as refrigerant. Saturated suction temperature is -5 ^{0}C and condensation temperature is 32 ^{0}C. There is no subcooling of liquid refrigerant. Assuming isentropic compression find COP, mass flow rate of refrigerant and power required to run the compressor in kW. **07**

For R-12 at 32 ^{0}C, h_f = 130.5 kJ/kg, h_g =264.5 kJ/kg and s_g=1.542 kJ/kg-K. At -5 ^{0}C, h_f =95.4 kJ/kg, h_g =249.3 kJ/kg and s_g=1.557 kJ/kg-K

Q.2 **(a)** Why flash intercooler is used in multi stage compression system? Write a short note on single compressor with multiple evaporators, multiple expansion valves and a back pressure valve. **07**

(b) A NH_3 multi load system with single compressor works at condenser pressure 10 bar. It uses three evaporators of capacities 35 kW at 4 bar, 52 kW at 2 bar and 70 kW at 1 bar with back pressure valve and individual expansion valve. The liquid leaving the condenser is saturated liquid and compression is isentropic. Assume that vapour leaving the each evaporator is dry and saturated.Determine mass flow rate in each evaporator and COP of the system. **07**

OR

(b) Air refrigerator of 10 tons capacity works on Bell-Coleman cycle. The inlet condition of air to compressor is 1 bar, 16 ^{0}C and it is compressed up to 5.2 bar. Air is cooled at constant pressure up to 40 ^{0}C before it enters the into expansion cylinder. Index of compression and expansion are 1.4. Find COP and quantity of air circulated per minute. **07**

Q.3 **(a)** Describe practical ammonia–water vapour absorption system **07**

(b) Discuss why CFC refrigerants are to be phased-out? Explain alternatives to CFCs. **07**

OR

Q.3 **(a)** Describe Steam jet refrigeration system and discuss various processes with T-S diagram. **07**

(b) Discuss any two methods of capacity control for vapor compression refrigeration system. **07**

Q.4 **(a)** What are the factors that affect human comfort and discuss their effect? **07**

(b) Room air at 20 ^{0}C DBT and 60 % RH is mixed with outdoor air at 40 ^{0}C DBT and 40 % RH in the ratio of 5:1.The mixture is passed through cooling coil whose temperature is maintained at 8 ^{0}C and bypass factor is 0.2. Find temperature of air entering the coil and leaving the coil. **07**

OR

Q.4 **(a)** Explain the load due to outside air and solar heat gain through glass **07**

Q.4	**(b)**	An air conditioning system is to be designed for a hall. Outside design condition : 35^0C DBT, 28^0C WBT Inside design condition : 26^0C DBT,50 % RH RSH = 46.5 kW, RLH= 9.3 kW, ventilation air = 60 m^3/min B.F.= 0.2 Determine room ADP, coil ADP and total quantity of air.	**07**
Q.5	**(a)**	Write a short note on all water system and its applications.	**07**
	(b)	A rectangular duct section 600 mm x 500 mm size caries 60 m^3 / min of air having density of 1.15 kg/m^3. Determine the equivalent diameter of circular duct, if quantity of air carried in both the cases is same. If f=0.01 for duct material find the pressure loss per 100 m length of duct.	**07**
		OR	
Q.5	**(a)**	Compare forward and backward curved centrifugal fan	**07**
	(b)	Write short note on air conditioning of public building	**07**

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