Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC SEMESTER VII– EXAMINATION – SUMMER 2017

Subject Code: X71901 **Date: 27/04/2017**

Subject Name: Refrigeration and Air Conditioning

Time: 02.30PM to 05.00PM **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 Refrigerant and psychometric chart is permitted.**

Q.1 **(a)** Discuss in detail about the Desirable Properties of Refrigerant **07**

(b) Explain the working principle and Construction of practical H_2O-NH_3 vapour absorption refrigeration (Aqua Ammonia) system with neat sketch. **07**

Q.2 **(a)** In a Refrigeration plant working on Bell-Coleman cycle, Air is compressed to 5 bar from 1 bar. Its initial temperature is 10° C. After compression air is cooled up to 20° C in a cooler before expanding back to a pressure of 1 bar. Determine the theoretical COP of the plant and net refrigerating effect. Take C_p =1.005 kJ/kg K and C_v =0.718 kJ/kg K **07**

(b) Discuss the advantages and disadvantages of air refrigeration system used for air Crafts. **07**

OR

(b) Explain the working of boot-strap air refrigeration system with neat schematic. Also represent it on t-s diagram. **07**

Q.3 **(a)** Draw and Explain in Detail the actual vapour compression refrigeration system on p-h and t-s diagrams. **07**

(b) The following data refers to a 20 TR ice plant using NH_3 as Refrigerant: **07**

The temperature of water entering and leaving the condenser are 20° C and 27° C and temperature of brine in the evaporator is -15° C. Before entering the expansion valve, NH_3 is cooled to 20° C and NH_3 enters the compressor dry saturated.

Calculate for 1 TR, the power expended, amount of cooling water in condenser and COP of the Plant. Use the Properties given in the table below

T_{sat}, ° C	Enthalpy , kJ/kg		Entropy , kJ/kg K		Sp.Heat , kJ/kg K	
	h_f	h_g	S_f	S_g	C_{pl}	C_{pg}
-15	112.34	1426.54	0.4572	5.5490	4.396	2.303
25	298.90	1465.84	1.1242	5.0391	4.606	2.805

OR

Q.3 **(a)** Explain compound compression with flash chamber but without intercooler with system diagram and p-h diagram. **07**

(b) A single compressor using R12 as refrigerant has three evaporators of capacity 10 TR, 20 TR and 30 TR .All the evaporators operate at -10° C and the vapours leaving the evaporators are dry saturated. The condenser temperature is 40 ° C. The liquid refrigerant leaving the condenser is subcooled to 30° C. Assuming isentropic compression. Find: the mass of refrigerant flowing through each evaporator, the power required to drive the compressor and COP of the system. **07**

(Use p-h diagram of R-12)

Q.4	**(a)**	Explain following terms briefly: (i) Dew point temperature (ii) Wet bulb temperature (iii) Specific humidity (iv) Relative humidity (v) Degree of saturation (vi) Comfort Air-conditioning (vii) Effective temperature.	**07**
	(b)	The atmospheric air at 760 mm of Hg, dry bulb temperature 15° C and wet bulb temperature 11° C enters a heating coil whose temperature is 41° C. Assuming by-pass factor of heating coil as 0.5, determine dry bulb temperature , wet bulb temperature and relative humidity of the air leaving the coil. Also determine the sensible heat added to the air per kg of dry air. *(Use psychometric chart)*	**07**

OR

Q.4	**(a)**	What do you mean by duct? Classify the duct. Discuss in brief about Economic considerations in selection of duct.	**07**
	(b)	The amount of air supplied to an air conditioned hall is 300 m^3/min. The atmospheric conditions are 35° C DBT and 55 % RH. The required conditions are 20° C DBT and 60 % RH. Find out the sensible heat and latent heat removed from the air per minute. Also find sensible heat factor for the system. *(Use psychometric chart)*	**07**
Q.5	**(a)**	Short note on thermostatic expansion valve	**07**
	(b)	Draw and Explain the working of a steam-jet refrigeration system with neat sketch.	**07**

OR

Q.5	**(a)**	Explain the working of window room air conditioner with a schematic. How split air conditioner differs from it?	**07**
	(b)	Explain the procedure for calculating cooling load due to infiltration air.	**07**

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