Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2161908 **Date:17/05/2016**

Subject Name: Refrigeration and Air Conditioning

Time: 10:30 AM to 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 Refrigeration Air-Conditioning charts and Steam tables is permitted.**

Q.1 **(a)** Explain the effect of evaporator pressure, condenser pressure and liquid sub-cooling on performance of vapour compressor refrigeration system using P-H diagram. **07**

(b) A dense air refrigeration machine operating on Bell-Coleman cycle works between 3.4 bar and 7 bar. The temperature of air after the cooler is 15°C and after refrigeration is 6°C, for a refrigeration capacity of 6 tons calculate **07**

1. Temperature after compression and expansion
2. Air circulation required in cycle per minute
3. Work of compression and expansion
4. Theoretical COP
5. Rate of water circulation required in the cooler in Kg/min if rate of temperature rise is limited to 30°C.

For air take Cp=1.005 kJ/kg K, γ = 1.4. for water Cp = 4.18 kJ/kg K.

Q.2 **(a)** Define refrigeration, State the Name of different types of system used for cooling of aircraft cabin, Also Explain with schematic diagram Bootstrap air Refrigeration system. **07**

(b) A R22 vapour compression refrigeration system operates between -10^{0}C and 45^{0}C. The refrigerant is subcooled by 5^{0}C before entering the expansion valve and vapour is superheated by 5^{0}C before entering the compressor. By using Pressure-enthalpy chart, Calculate (i) Refrigeration effect per kg.(ii) Mass flow rate of refrigerant for 5 TR capacity and(iii) COP of the system. **07**

OR

(b) A refrigeration machine is required to produce ice at 0°C from water at 20°C. The machine has a condenser temperature of 25°C while evaporator temperature is -5^{0}C. The relative efficiency of the machine is 50% and 6 kg of Freon-12 is circulated through the system per minute. The refrigerant enters in the compressor with dryness fraction of 0.6. Calculate the amount of ice produced in 24 hrs. Take latent heat of ice 335 kJ/kg. **07**

Temperature (^{0}C)	Liquid heat (KJ/kg)	Latent heat (KJ/kg)	Entropy of liquid (KJ/kg-K)
25	59.7	138	0.2232
-5	31.4	154	0.1251

Q.3 **(a)** Explain with neat sketch working of ammonia-hydrogen refrigerator also explain significance of Hydrogen used in system. **07**

(b) Explain construction, working, advantages and disadvantages of Thermostatic Expansion valve with neat sketch. **07**

OR

Q.3	**(a)**	Explain Thermodynamic, Chemical and Physical properties of an Ideal Refrigerant.	**07**
	(b)	State and explain various heat loads to be considered for cooling load calculation of typical building.	**07**
Q.4	**(a)**	Define following term related to psychrometry (i) wet bulb temperature (ii) psychrometry (iii) Relative humidity (iv) By pass factor (v) dew point temperature (vi) apparatus dew point temperature (vii) sensible heat factor	**07**
	(b)	Explain various methods used for design of the duct.	**07**

OR

Q.4	**(a)**	Explain with neat sketch the Cascade refrigeration system.	**07**
	(b)	A circular duct of 40 cm is selected to carry air in an air conditioned space at a velocity of 440 m/min to keep the noise level at desired level. If this duct is replaced by a rectangular duct of aspect ratio of 1.5, find out the size of rectangular duct for equal friction method when (a) the velocity of air in two ducts is same, (b) the discharge rate of air in two ducts is same.	**07**
Q.5	**(a)**	Classify air conditioning systems. Explain Central air conditioning system with a neat sketch.	**07**
	(b)	Explain in brief the following: (i) Ice Making plant. (ii) Effective Temperature.	**07**

OR

Q.5	**(a)**	Classify Fan used in air-conditioning system. Explain selection of the an using fan characteristic curve.	**07**
	(b)	Explain working of Li-Br vapour absorption refrigeration system with neat sketch.	**07**

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