Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII • EXAMINATION – SUMMER • 2015

Subject Code: 181901 **Date: 15/05/2015**

Subject Name: Refrigeration and air-conditioning

Time:10.30AM-01.00PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain in brief simple air–refrigeration system. Show processes on T→s diagram and derive equation of COP in terms of temperatures. **07**

(b) The speed of an air craft flying at an altitude of 8000m, where the ambient air is at 0.341 bar pressure and 263K temperature is 900km/h. The compression ratio of the air compressor is 5. The cabin pressure is 1.01325 bar and the temperature is 27^0C. For 1kg/s flow of air ,determine following **07**

i) Power requirement for pressurization excluding ram work

ii) Refrigerating effect

iii) power required for refrigeration excluding ram work

Q.2 **(a)** Discuss effect on COP of simple vapour compression refrigeration if refrigerant is sub-cooled using vapour refrigerant. **07**

(b) A refrigeration machine is required to produce ice at 0^0C from water at 20^0C. The machine has a condenser temperature of 25^0C while evaporator temperature is -5^0C. 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

OR

(b Explain with neat sketch and p→h diagram, two evaporators with individual compressor with flash chamber. Derive equation for its COP. **07**

Q.3 **(a)** Draw thermodynamic model of vapour absorption system and Derive equation of COP of ideal vapour absorption system. **07**

(b) State advantage and disadvantage of steam get refrigeration system. Where this system is widely used ? **07**

OR

Q.3 **(a)** Explain working of thermostatic expansion valve and compare it with capillary tube. **07**

(b) Discuss thermodynamic and physical properties of ideal refrigerant. **07**

Q.4 **(a)** Define following : **07**

1) Specific humidity 2) saturation ratio 3) sensible heat factor 4) humidifying efficiency

(b) Dry bulb temperature and wet bulb temperature recorded by sling psychrometer are 35^0C and 25^0C respectively. Calculate following : **07**

1) Relative humidity 2) vapour density and 3)enthalpy of moist air. Take, Saturation pressure of water at 25^0C is 0.0317 bar

Saturation pressure of water at 35^0C is 0.0563 bar.

OR

Q.4 **(a)** Which factors are to be considered in 'Load Estimation Sheet' for comfort application. **07**

(b) What is effective temperature. Discuss various factors which govern it. **07**

Q.5 **(a)** A duct of rectangular cros-section 600mm * 400mm carries $90m^3$/min of air having density of 1.2 kg/m^3. Determine the equivalent diameter of the circular duct : **07**

i) When the quantity of air carries in both the cases is same; and

ii) When velocity of air in both the cases is same .

Take friction factor = 0.011. Also calculate pressure loss per 100m length of duct.

(b) Explain desert air cooler show its process on psychroetric chart and write equation of its efficiency. **07**

OR

Q.5 **(a)** Explain with neat sketch 'Year round air-conditioner'. **07**

(b) Explain following terms with respect to fan **07**

i) Total fan pressure

ii) Dynamic pressure

iii) Specific speed

iv) Static fan efficiency

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