Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–VII • EXAMINATION – WINTER 2013

Subject Code: X71901 **Date: 03-12-2013**

Subject Name: Refrigeration and 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 R12 chart and psychrometric chart is permitted.**

Q.1 **(a)** Draw a neat named schematic of practical H_2O-NH_3 vapour absorption refrigeration system. Explain its working. **07**

(b) Draw a neat named schematic of a steam-jet refrigeration system. Explain its working. **07**

Q.2 **(a)** A single compressor using R-12 as a refrigerant has three evaporators of capacity 30 TR, 20 TR and 10 TR. The temperature in the three evaporators is to be maintained at -10°C, 5°C and 10°C respectively. The system is provided with individual expansion valves and back pressure valves. The condenser temperature is 40°C.The liquid refrigerant leaving the condenser is sub cooled to 30°C.The vapours leaving the evaporators are dry and saturated. Assuming isentropic compression, find(a) the mass of refrigerant flowing through each evaporator(b)the power required to drive the compressor(c)COP of the system. **07**

(b) Discuss the effect of the following on performance of vapour compression refrigeration system with the help of p-h and t-s diagrams. **07**
(i) Increase in condenser temperature assuming same evaporator temperature.
(ii) Sub cooling in the condenser.

OR

(b) Draw actual vapour compression refrigeration system on p-h and t-s diagrams. Enumerate various losses. **07**

Q.3 **(a)** A Bell-coleman refrigerator operates between pressure limits 1 bar and 8 bar. Air is drawn from the cold chamber at 9°C,compressed and then it is cooled to 29°C before entering the expansion cylinder. Expansion and compression follow the law $pv^{1.35}$ =constant. Calculate the theoretical COP of the system. For air take γ=1.4,c_p=1.003 kJ/kgK **07**

(b) State advantages and disadvantages of air refrigeration system used for air crafts. **07**

OR

Q.3 **(a)** Explain in brief working with a schematic of (i)scroll compressor and (ii) screw compressor. **07**

(b) Draw schematic of a thermostatic expansion valve. Explain its working. **07**

Q.4 **(a)** Discuss the desirable thermodynamic properties of a good refrigerant. **07**

(b) Classify air conditioning systems. Describe with schematic the operation of AHU during different seasons of the year. **07**

OR

Q.4 **(a)** An a/c system is designed under following conditions: **07**
Outdoor conditions:30° C dbt ,RH=75%

Required indoor conditions:22° C dbt ,RH=70%
Amount of free air circulated:3.33 m^3/s
Coil dew point temperature:14° C.
Required condition is achieved first by cooling and dehumidification and then by heating. Estimate (i) capacity of cooling coil in TR and bypass factor,(ii)capacity of heating coil and its surface temperature if bypass factor is equal to 0.2, and(iii)amount of water vapour removal rate.

(b) Explain: dew point temperature ,specific humidity, relative humidity, wet bulb temperature, degree of saturation **07**

Q.5 **(a)** A rectangular duct section 500 mm × 400 mm size carries 70 m^3/min of air having density of 1.15 kg/m^3.Determine the equivalent diameter of a circular duct, if the quantity of air carried in both the cases is same. **07**
If f=0.01 for sheet metal, find the pressure loss per 100 m length of duct

(b) (i)Describe with a schematic 'can ice plant'. **04**
(ii)Write short note on 'car air conditioning' **03**

OR

Q.5 **(a)** Explain velocity reduction method of duct design. State its advantages and disadvantages. **07**

(b) (i) Discuss about various internal and external sources of heat load. **04**
(ii) Discuss the factors on which solar heat gain through glass depends. **03**

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