Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII • EXAMINATION – SUMMER 2014

Subject Code: 181901 **Date: 05-06-2014**

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)** A dense air refrigeration machine operating on Bell-Coleman cycle works between 3.4 bar and 17 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

(b) A Two stage ammonia refrigeration system operates between overall pressure limits of 15 bar and 2 bar resply. The liquid is sub-cooled to 30°C. The temperature of de-superheated vapour leaving the water intercooler is also 30°C. The flash chamber separates the dry vapour at 5 bar pressure. The liquid refrigerant then expands to 2 bar, the evaporator pressure. The load on the evaporator is 50 kW. Calculate **07**

1. Mass flow rate in different lines
2. Power required
3. COP

Q.2 **(a)** A single compressor using R-12 as refrigerant has three evaporators of capacity 30TR, 20TR and10TR.The temperature in the three evaporators is to be maintained at -10 ^{o}C , 5$^o C$ and 10$^o C$ respectively. The condenser pressure is 9.609 bar. The liquid refrigerant leaving the condenser is sub-cooled to 30°C. The vapour leaving the evaporators is dry and saturated. Assuming isentropic compression, calculate (a) the mass of refrigerant flowing through each evaporator; (b) the power required to drive the compressor; and (c) C.O.P. of the system. **07**

(b) What are desirable characteristics of ideal refrigerant? Explain how refrigerants are designated. **07**

OR

(b) What are desirable characteristics of absorbent and absorbent refrigerant combination in vapour absorption refrigeration cycle? **07**

Q.3 **(a)** Draw neat and labeled sketches only of following: **07**

1. Flooded evaporator
2. Dry expansion evaporator
3. Thermostatic expansion valve

(b) With neat sketch explain working of steam jet refrigeration system and list its advantages and disadvantages. **07**

OR

Q.3 **(a)** With neat sketch explain working of an Ice Plant. **07**

(b) A two cylinder reciprocating compressor with 5% clearance is used in a refrigeration cycle to take load of 7.5 tons at 5^oC refrigeration temperature and 40^oC condensing temperature. The compression index is 1.35. The speed of piston is limited to 3m/s. take L/D =0.8 if refrigerant used is R-12 determine **07**

1. Power consumption of compressor and COP of cycle
2. Volumetric efficiency of cycle
3. Bore , stroke and RPM of compressor

Q.4 **(a)** Define following terms: Dalton's law of partial pressure, degree of saturation, relative humidity, dew point temperature, By pass-factor. **07**

(b) State and explain various heat loads to be considered for cooling load calculations of a typical building. **07**

OR

Q.4 **(a)** What is effective temperature? What factors affect effective temperature and explain its significance in design of air-conditioning systems. **07**

(b) A summer air –conditioning system for a small office building is to be designed. The design is to be based on the following information: **07**

Outside design condition	35^oC T_{db} ,28^oC T_{wb}
Inside design condition	26^oC T_{db}, 50% RH
Room sensible heat gain	45 kW
Room latent heat gain	9 kW
Ventilation air	0.95 m^3/s

A four row direct expansion refrigerant 134a coil with bypass factor of 0.2 is to be used. Analyze the problem on a psychrometric chart and determine the following:

a) The room apparatus dew point(ADP)
b) The temperature of the air leaving the coil
c) The total quality of air required(m^3/s)
d) The temperature of mixed air entering the coil
e) The coil apparatus dew point temperature.

Q.5 **(a)** What are different methods used for design of the ducts and explain advantages of each over other. **07**

(b) With neat sketch explain construction and working of any one type of humidifier. **07**

OR

Q.5 **(a)** A fan gives a static pressure of 290 Pa with a velocity of 800 m/min at its outlet while delivering a quantity of 120 m^3/ min of air. The inlet static pressure and velocity are 200 Pa and 500m/min resply. Calculate (1) Total head developed (2) Power required if fan mechanical efficiency = 75%. **07**

(b) With line diagram explain Central Air-conditioning system of any multi storey building **07**

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