Exam. Code: 0943
Sub. Code: 7064

1079

B. Engg. (Mechanical Engg.)

7th Semester

MEC-701: Refrigeration & Air Conditioning

Time allowed: 3 Hours Max. Marks: 50

NOTE: *Attempt **five** questions in all, including Q. No. 1 which is compulsory and selecting atleast two questions from each Part. Use of refrigeration table is allowed.*

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Q1.

a) Carnot refrigerator gives low COP when evaporator temp is _____and condenser temperature is _____.
b) Compare open cycle and closed cycle Refrigeration system
c) The highest temperature in vapour Compression cycle occurs at_____
d) Compare two fluid VAR systems with three fluid VAR systems.
e) What is drier?
f) Define the term: Absolute humidity
g) Draw the following processes on psychometric chart
(i) Winter air-conditioning process (ii) summer air-conditioning process
h) Discuss the purpose of air washer.
i) Write a short note on hermetically sealed reciprocating compressors.
j) Draw the sketch of Automatic expansion valve.

PART-A

Q2. (i) What are main factors affecting the performance of simple vapour compression refrigeration system?.Explain with relevant P-H and T-S diagrams. (5)

(ii)The capacity of a refrigerator is 200 TR when working between - 6°C and 25°C. Determine the mass of ice produced per day from water at 25°C. Also find the power required to drive the unit. Assume that the cycle operates on reversed Carnot cycle and latent heat of ice is 335 kJ/kg. (5)

Q3. A regenerative type air-cooled system is designed to take a load of 20 tons when the plane is moving at Mach number 1.4. The temperature and pressure conditions of atmosphere are 20°C and 0.8 bar. The pressure of the air is increased from 0.8 bar to 1.2 bar due to ramming action. The pressure of the air leaving the main compressor is 4.5 bar. 60% of the total heat of the air leaving the main compressor is removed in the heat exchanger and then it is passed through the cooling turbine. The temperature of the rammed air which is used for cooling purposes in heat exchanger is reduced at 40°C by mixing the air coming out of the cooling turbine.
Assuming isentropic efficiencies of compressor and turbine are 90% and 80% respectively.
Find the followings :
(a) Ratio of the by-passed air to ram air used for cooling purposes.
(b) kW power required for cooling and pressurization of the cabin.
(c) CO.P. of the system.
The temperature of air leaving the cabin should not exceed 25° C and pressure required in the cabin is 1.03 bar.Assume ramming is isentropic and mass of cooled air passing through the heat exchanger is equal to the mass of cooling air. (10)

Q3 (i) Five ton Freon-12 Refrigeration plant has saturated suction temperature of -5°C. The condensation takes place at 30°C and there is no under cooling of Refrigeration liquid. Assuming isentropic compression find (i) COP (ii) Mass flow rate of

P.T.O.

refrigerant (iii) Power required to derive the compression in kW takes the following properties of Freon-12 and $C_{pv} = 0.615$ KJ/Kg K.

P(bar)	T(^{0}C)	h_f (KJ/kg)	h_g (KJ/kg)	S_g (KJ/kgK)
8	30	130	265	1.55
3	-5	-	250	1.57

(5)

(ii) Explain with the help of neat sketch the working of Lithium Bromide vapour absorption refrigeration system. (5)

PART-B

Q5 A conference room for seating 100 persons is to be maintained at 22°C dry bulb temperature and 60% relative humidity. The outdoor conditions are 40°C dry bulb temperature and 27°C wet bulb temperature. The various loads in the auditorium are as follows:

Sensible and latent heat loads per person, 80 W and 50 W respectively ;lights and fans, 15000 W;sensible heat gain through glass, walls, ceiling etc., 15000 W. The air infiltration is 20 m^3/min and fresh air supply is 100 m^3/min.Two-third of recirculated room air and one-third of fresh air are mixed before entering the cooling coil. The by-pass factor of the coil is 0.1.Determine apparatus dew point, the grand total heat load and effective room sensible heat factor. (10)

Q6 The design data for an air-conditioning plant of a restaurant is given below :

Outdoor design conditions	= 35°C DBT and 24°C WBT
Indoor design conditions	= 27°C DBT and 55% RH
Seating capacity of the restaurant	= 50
Latent heat gain per person	= 44 W
Latent heat gain from meals per person	= 6 W
Sensible heat gain per person	= 58 W
Sensible heat gain from meals per person	= 3.5 W
Number of service employees	= 5
Latent heat gain per employee	= 75 W
Sensible heat gain per employee	= 58 W
Sensible heat gain from outside	= 8.14 kW
Sensible heat gain from inside equipment	= 2.9 kW
Latent heat gain from inside equipment	= 0.7 kW
Rate of infiltrated air	= 400 m^3/h
Rate of fresh air supply	= 1600 m^3/h
Minimum temperature of air supplied to room	= 17°C DBT

The fan is situated before the conditioner and has a motor of 11 kW. Calculate:
(a) Volume of air passing through the room in m^3/h ;
(b) Percentage of recirculated air ;
(c) Apparatus dew point temperature and by-pass factor ; and
(d)Cooling capacity in tonnes of refrigeration. (10)

Q7 Explain in brief which refrigerant/s would you choose for each of the following applications and why?
(a) A cold storage of 100 TR capacity using reciprocating compressor,
(b) A 800 TR air conditioning plant using centrifugal compressor/s,
(c) A small capacity frozen food cabinet to maintain -30°C temperature. (10)

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