Total No. of Questions : 10]

SEAT No. :

P3716

[Total No. of Pages : 3

[5461]-526

B.E. (Mechanical)

HEATING VENTILATION AND AIR-CONDITIONING

(2015 Pattern) (Elective - I)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***
2) ***All the three questions should be solved in one answer book and attach extra supplements if required.***
3) ***Draw diagrams wherever necessary.***
4) ***Use of scientific calculator is allowed.***
5) ***Assume suitable data wherever necessary.***

Q1) In HFC-134a 1 TR ejector refrigeration system, the motive vapour is saturated at 80°C has following data : **[10]**

a) Temperature of in the evaporator = –5°C

b) The pressure at which the condenser is operated l0 bar

c) Nozzle efficiency = 86%

d) Entrainment efficiency = 64%

e) Compression efficiency = 80%

f) Quality of refrigerant at the beginning of compression = 0.96

Determine the following :

i) Mass of motive fluid required per kg of secondary fluid

ii) The quantity of secondary fluid

iii) Refrigerating effect per kg

iv) COP of the system

OR

Q2) a) Explain parallel compression transcritical system. **[6]**

b) Discuss classification of cooling tower. **[4]**

P.T.O.

Q3) A two cylinder single acting reciprocating compressor with 5% clearance is used in a R 22 refrigeration cycle to take refrigeration capacity of 7.2 TR at 5°C (3.6 bar) refrigeration temp. & 40°C (9.6 bar) condensing temperature. The compressor index is 1.15. The speed of the piston is limited to 3 m/s. Take L/D = 0.8 specific volume as 0.0525 m^3/kg. **[10]**

Determine :

a) power

b) Volumetric efficiency

c) COP

d) Bore & stroke

e) RPM

Temp.	PT	h_f	h_g
5°C	3.6	40.69	189.65
40°C	9.6	74.59	203.2

OR

Q4) a) Draw various arrangements of suction line. **[4]**

b) Discuss the various methods of capacity controls of centrifugal compressor. **[6]**

Q5) a) Write a short note on "thermodynamics of human body" and explain comfort-discomfort diagrams with neat sketch. **[8]**

b) The following table shows the measurements made at 9 points in the occupied zone of an air conditioned building. Evaluate the design parameters of the air distribution system. Consider Supply air temperature as 17°C and exhaust temperature as 25°C. **[8]**

Measuring point	DBT (°C)	Air velocity (m/s)
1.	24.1	0.3
2.	23	0.25
3.	24	0.16
4.	22.3	0.21
5.	23.1	0.1
6.	22.5	0.09
7.	21.7	0.11
8.	24.1	0.19
9.	20.4	0.24

OR

Q6) a) Discuss types of air distribution devices. **[8]**

b) State factors affecting thermal comforts. **[8]**

Q7) a) A 25 cm thick wall is exposed to the periodic temperature and incident radiant variation on an hourly basis between 7 am and 6 pm is given in the table. Determine average heat gain of the room per unit area of the wall. The outdoor maximum and minimum temperatures are 40°C and 22°C respectively. The outside and inside design temperatures are 40 and 25°C respectively. What is the maximum heat gain and time of maximum heat gain from the wall? **[12]**

Density of material, $\rho = 2400$ kg/m^3

Thermal conductivity, k = 1.5 W/mK

Outside wall coefficient, $h_o = 23$ W/m^{2}K

Inside wall coefficient, $h_i = 7$ W/m^{2}K.

Time	7 am	8 am	9 am	10 am	11 am	12 noon	1 pm	2 pm	3 pm	4 pm	5 pm	6 pm
Wall Mass (kg/m^2)	Equivalent Temperature Difference (ΔT_E) °C											
500	3.9	3.3	3.3	3.3	3.3	3.3	3.9	4.4	5.5	6.7	9.4	11.1
600	6.1	5.5	5.0	4.4	4.4	4.4	5.0	5.5	5.5	5.5	6.1	6.7

b) Write a short note on : **[6]**

i) Sol-air temperature

ii) Air Spaces.

OR

Q8) a) Explain Energy Conservation Building Code. **[8]**

b) Explain the term "Decrement factor & time lag". **[10]**

Q9) a) Explain with schematic diagram Indirect Evaporative-Cooling Air Conditioning Systems. **[8]**

b) Draw and explain water-to-water heat pump circuit. **[8]**

OR

Q10) a) Write a short note on "Clean Room". **[8]**

b) Explain Hybrid Desiccant air-conditioning system. **[8]**