

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 10 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<sup>3</sup>/kg. [10]

Determine :

- power
- Volumetric efficiency
- COP
- Bore & stroke
- 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,  $\rho = 2400 \text{ kg/m}^3$

Thermal conductivity,  $k = 1.5 \text{ W/mK}$

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

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

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 <sup>2</sup> )	Equivalent Temperature Difference ( $\Delta T_E$ ) °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]

\*\*\*