Subject Code: KME072

PAPER ID-410431

Roll No: | | | | | | | | | | | | | |

B.TECH,
(SEM VII) THEORY EXAMINATION 2021-22
HVAC SYSTEMS

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
2. Use of Refrigeration table, steam table and .

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a. What are future refrigerants?
b. What do you understand by Greenhouse effect?
c. Explain the importance of Alignment circle. In psychrometric chart.
d. Explain ADP.
e. What is performance index of a heat pump? How is it related to COP of a refrigerator?
f. Differentiate between natural ventilation and mechanical ventilation.
g. Explain evaporative cooling.
h. What is sol air temperature?
i. Explain the role of duct in air-conditioning systems.
j. Suggest materials used in fabrication of ducts.

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. A refrigerator working on an ideal vapor compression cycle uses refrigerant R-12. The minimum and maximum pressures of the cycle are 0.15 MPa and 0.9 MPa respectively. If the mass flow rate of the refrigerant is 0.045 kg/s, determine:
   (i) The rate of heat removal from the refrigerated space
   (ii) Power input to the compressor
   (iii) The rate of heat rejection to the environment
   (iv) COP of the system

b. The moist air at 10°C and 50% relative humidity enters a steam heating coil at the rate of 50 kg/s and the temperature at the exit is noted to be 30°C Determine:
   (i) Sensible heat transfer
   (ii) Mass flow rate of steam if it enters saturated at 100°C and the condensate leaves at 65°C.

c. Differentiate among all water, all air and air water air-conditioning systems.

d. With neat sketch, explain how Centralized air-conditioning systems differ from Unitary air-conditioning system.

e. Classify the ducts on the basis of its application, pressure inside it and the velocity of air in the duct.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain the effects of superheating, subcooling and reduction in condenser pressure on the COP of the vapor compression refrigeration system.

(b) Explain classification of refrigerants in detail.

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) 400 m^3/min of air at 20°C DBT coming out from air-conditioned hall is mixed with 150 m^3/min of fresh air at 35°C DBT and 45% RH adiabatically. Determine: (i) enthalpy (ii) specific humidity (iii) specific volume and (iv) DPT of the mixture.

(b) Define human comfort. Explain the factors affecting human comfort.

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Classify heat pumps. Also explain any one type of it.

(b) Explain different components of Central Air-conditioning system.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain the procedure to estimate the cooling load with the help of suitable example.

(b) A seminar hall for seating 250 persons is to be maintained at 22°C DBT and 50% R.H. The outside air conditions are 40°C DBT and 27°C WBT. 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., 12000 W;
The air infiltration is 30 m^3/min;
Determine room sensible heat factor.

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Compare the characteristic of backward and Forward Curved blade vanes with the help of suitable sketches.

(b) The main air supply duct of an air conditioning system is 800 mm × 600 mm in cross-section and carries 300 m^3/min of standard air. It branches into two ducts of cross section 600 mm × 500 mm and 600 mm × 400 mm. If the mean velocity in the larger branch is 480 m/min, find:
1. Mean velocity in the main duct and the smaller branch, and
2. Mean velocity pressure in each duct.