Code: 17D11105

M.Tech II Semester Supplementary Examinations January/February 2019

DESIGN OF AIR-CONDITIONING SYSTEMS

(Refrigeration & Air Conditioning)

(For students admitted in 2017 only)

Time: 3 hours Max. Marks: 60

Answer all the questions

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1 (a) Explain briefly, what are the considerations for selection and location of outlets.

(b) A length of a main circular duct has three branch ducts taking equal air volumes at equal intervals. Each interval duct has a friction loss of 1.3 mm of water and a static pressure of 5 mm of water is necessary at each branch to cope with its friction loss. If the initial velocity in the main duct of 1.2 m diameter is 600 m/min, calculate the velocity and diameters of the second and third lengths, where by the static pressure regain factor is 0.6. Draw simple sketch of the duct system and identify total, static and velocity pressures at the appropriate points of change.

OR

2 (a) Describe the different methods of air conditioning duct design. Why are dampers required in some systems?

(b) A galvanized steel duct of 0.4 m diameter and 20 m long carries air at 20^{o} C and 1.013 bar. If the flow rate of air through the duct is 60 m^{3}/min, determine the pressure loss due to friction in: (i) N/m^{2}. (ii) In mm of water.

3 (a) Explain in brief solar heat gain (sensible) through outside walls and roofs.

(b) The following data relates to the office air conditioning plant having maximum seating capacity of 25 occupants:
Outside design conditions = 34^{o}C DBT, 28^{o}C WBT; Inside design conditions = 24^{o}C DBT, 50% RH; Solar heat gain = 9120 W; Latent heat gain per occupant = 105 W; Sensible heat gain per occupant = 90 W; Lightening load = 2300 W; Sensible heat load from other sources = 11630 W; Infiltration load = 14 m^{3}/min.
Assume 40% fresh air and 60% of re-circulated air passing through the evaporator coil and the by-pass factor of 0.15, find the dew point temperature of the coil and capacity of the plant.

OR

4 (a) An air-conditioned room is maintained at 27^{o}C DBT and 50% RH when ambient conditions are 40^{o}C DBT and 27^{o}C WBT. The room sensible heat gain is 14 kW. The air enters the conditioned hall at 7^{o}C DBT and saturated. Determine: (i) volume of moist air supplied to the space in m^{3}/min. (ii) Latent heat gain in the room in kW. (iii) Cooling load of the air-washer in kW if 30% of the air supplied to the room is fresh air and remaining 70% is recirculated.

(b) What are the different factors which must be considered evaluating cooling load? What are the different means by which this load can be reduced?

5 (a) Difference between central, district and unitary air conditioning systems.

(b) An air conditioning plant is required to supply 60 m^{3} of air per minute at a DBT of 21^{o}C and 55% RH. The outside air is at DBT of 28^{o}C and 60% RH. Determine the mass of water drained and capacity of the cooling coil. Assume the air conditioning plant first to dehumidify and then to cool the air.

OR

6 (a) Draw a diagram of constant volume variable temperature air-conditioning system and explain its working.

(b) A room has a sensible heat gain of 24 kW & a latent heat gain of 5.2 kW and it has to be maintained at 26^{o}C DBT & 50% RH. 180 m^{3}/min of air is delivered to the room. Determine the state of supply air.

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7 (a) What is the importance of relative humidity for the selection of insulation?

(b) Calculate the overall heat transfer coefficient (based on ID) for steel pipe covered with fiberglass insulation.

The following data is given:

ID of pipe = 2 cm

Thickness of pipe = 0.2 cm

Thickness of insulation = 2 cm

K(insulation) = 0.05 W.m-^{o}C

h_i = 10 W/m^2-^{o}C

h_0 = 5 W/m^2-^{o}C.

OR

8 (a) Explain the heat transfer phenomenon through insulation.

(b) Find out the heat transfer area of a steam condenser, considering 10,000 kg of steam per hour at 0.2 bar absolute pressure. Steam entering into the condenser is dry and saturated and the condenser is saturated water. The rise in temperature of the cooling water is 20^{o}C and temperature difference causing the heat flow at the outlet is 10^{o}C. The overall heat transfer coefficient is 4 kJ/m^2-K-sec.

9 (a) Explain the various industrial applications of air-conditioning systems.

(b) What are the basic requirements of air-conditioning system used for houses?

OR

10 (a) Discuss heat and mass transfer through dried material.

(b) Draw neat diagram of LNG liquefaction process.

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