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Ex/BESUS/ME-501A/09

B.Arch. Part-III 5th Semester Examination, 2009

Mechanical Services
(ME-501A)

Time : 2 hours

Full Marks : 35

Use separate answerscript for each half.

Answer FOUR questions, taking TWO from each half.

The questions are of equal value.

FIRST HALF

1. a) What is the difference between classical thermodynamics and statistical thermodynamics?
b) When a system is said to be in a state of thermodynamic equilibrium? Explain.
c) What is the Zeroth Law of thermodynamics? Why is it said to be the basis of concept of temperature as well as the basis of all temperature measurement?
2. a) Starting from first principles derive the expression of thermal efficiency for Otto Cycle.
b) The compression ratio of an engine working on Otto Cycle is 8. The pressure and temperature at the beginning of compression are 100 kPa and 15°C. The heat transfer to the air per cycle is 1800 kJ/kg. Determine (a) the thermal efficiency and (ii) the mean effective pressure.
Take $\gamma=1.4$ and $C_p=1.005$ kJ/kg-K for air to be the working fluid.
3. Write notes on :
 - a) Vapour compression refrigeration system.
 - b) Required properties of ideal refrigerant,

OR

Three important refrigerants.

SECOND HALF

4. a) Define Humidity ratio and Dew-point temperature. How humidity ratio can be expressed in terms of relative humidity?
b) Why Psychrometric chart is so useful in air-conditioning applications?
c) 250 kg/hr of saturated air at 2°C is mixed with 50 kg/hr of air at 35°C and 80% relative humidity. Determine the final state of air in terms of DBT and relative humidity. Show the corresponding process on a Psychrometric chart.

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5.
 - a) With a schematic diagram of air washer, explain how a cooling and dehumidification process can be achieved using the same device.
 - b) What are the different factors that affect the thermal comfort?
 - c) Show a typical comfort chart and identify summer and winter comfort zones.

6.
 - a) Define Room Sensible Heat Factor and Bypass Factor.
 - b) How can we calculate Mean Radiant Temperature for the conditioned space?
 - c) An air-conditioned space is to be maintained at 27°C DBT and 50% RH. The outdoor air is at 40°C DBT and 25°C WBT. The space has a sensible heat gain of 14 kW. Air is supplied to the space at 7°C saturated. Calculate mass of moist air supplied to the space in kg/hr and latent heat gain of space in kW.

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