M.E. (Mechanical) 2nd Semester Examination, 2014
Subject: Air-Conditioning Engineering (ME-1004)

Time: 3 hours   Full Marks: 70

Attempt any Five questions.
All questions carry equal marks.
Uses of Psychrometric chart, steam tables are permitted.

1. (a) Explain the following psychrometric processes with diagrams:

    (i) Sensible heating (ii) Sensible cooling and, (iii) Cooling and dehumidification.

   (b) 320 m^3 of air at 30°C dry bulb temperature and 28°C wet bulb temperature is heated to 42°C dry bulb temperature. Using the psychrometric chart estimate the amount of heat added, final relative humidity and wet bulb temperature. Take air pressure as 1.01325 bar.

2. (a) State the principles of air distribution in air conditioning. With sketch explain the different types of air distribution systems used in air conditioning.

   (b) Discuss about the different types of filters used in air-conditioning systems.

3. (a) How do you classify air-conditioning systems? With neat labeled sketches explain the following types of air-conditioning systems:

    (i) Summer air-conditioning systems (ii) Winter air-conditioning systems.

   (b) State some applications of air-conditioning.

4 (a) What are the different types of duct systems used in air-conditioning applications? Define aspect ratio. Derive an expression of the equivalent diameter of a circular duct for a rectangular duct when the velocity of air passing through the rectangular and circular ducts is same.

   (b) A duct of rectangular cross section 580 mm × 380 mm carries 120 m^3/min of air having density of 1.2 kg/m^3. Determine the equivalent diameter of a circular duct for the following cases:

    (i) When the quantity of air carried in both cases is same.

    (ii) When velocity of air in both the cases is same.

   If friction factor (f) = 0.011, find also the pressure loss per 130 m length of duct.

5. (a) Draw the inlet and outlet velocity triangles for moving blades of a centrifugal fan and find out an expression for the theoretical total head developed.

(b) The following data refer to a fan in which air enters the impeller with a small whirl component in the direction of impeller rotation, but the relative velocity meets the blade tangentially

Speed of the fan = 1200 r.p.m.

Quantity of air delivered = 125 m³/min.

Impeller diameter = 0.65 m.

Diameter at the blade inlet = 0.45 m.

Impeller width at the inlet and outlet = 155 mm and 110 mm.

The blade (backward curved) angles = 25° and 52° with the tangents at inlet and outlet.

Determine the theoretical total head produced by the impeller.

Neglect the effect of blade thickness and inter blade circulation.

6. Write short notes on any three of the following:

(a) Factors of selection of air-conditioning system.

(b) Estimation of load in an air-conditioning system.

(c) Central and unitary air conditioning systems.

(d) Air conditioning cycle.