C 47564 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2008

Electronics and Communication Engineering

EC 2K 605—MECHANICAL ENGINEERING

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

1. (a) Explain the concept of Zeroth law of thermodynamics.

   (b) 1.5 kg. of liquid having a constant specific heat of 2.5 kJ/kg. °C. is stirred in a well-insulated chamber causing the temperature to rise by 15°C. Find :

   (i) Change in internal energy ; and

   (ii) Work done for the process.

   (c) Derive the air standard efficiency for Otto cycle.

   (d) Explain the principles of 4-stroke engine.

   (e) Explain the radiation mode of heat transfer.

   (f) Explain the law of radiation.

   (g) Define Bernoullis equations and mention its application.

   (h) Explain any *one* velocity measuring devices.

   (8 × 5 = 40 marks)

2. (a) 1 kg. of nitrogen (molecular weight 28) is compressed reversibly and isothermally from 1.01 bar, 20°C. to 4.2 bar. Calculate the work done and the heat flow during the process. Assume nitrogen to be a perfect gas.

   Or

   (b) Air at 1.02 bar, 22° C., initially occupying a cylinder volume of 0.015 $m.^3$, is compressed reversibly and adiabatically by a piston to a pressure of 6.8 bar.

   Calculate :

   (i) The final temperature.

   (ii) The final volume.

   (iii) The work done on the mass of air in the cylinder.

3. (a) An engine 200 mm. bore and 300 mm. stroke works on Otto cycle. The clearance volume is 0.0016 $m.^3$ The initial pressure and temperature are 1 bar and 60° C. If the maximum pressure is limited to 24 bar, find

   (i) The air-standard efficiency of the cycle.

   (ii) The mean effective pressure for the cycle.

   Assume ideal conditions.

   Or

(b) The pressure on the compression curve of a diesel engine are at $\frac{1}{8}$ th stroke 1.4. Bar and at $\frac{7}{8}$ th stroke 14 bar. Estimate the compression ratio. Calculate the air-standard efficiency of the engine if the cut-off occurs at $1\frac{1}{5}$ of the stroke.

4. (a) A 240 mm. steam main, 210 meters long is covered with 50 mm. of high temperature insulation (K = 0.092 W/mK) and 40 mm. of low temperature insulation (K = 0.062 W/mK). The inner and outer surface temperatures as measured are 390° C. and 40° C. respectively. Calculate :

(i) The total heat loss per hour.

(ii) The total heat loss per $m.^2$ of outer surface.

(iii) The heat loss per $m.^2$ of pipe surface.

(iv) The temperature between two layers of insulation.

Neglect heat conduction through pipe material.

Or

(b) The inner surface of a plane brick wall is at 50° C. and the outer surface is at 25° C. Calculate the rate of heat transfer per $m.^2$ of surface area of the wall, which is 220 mm. thick. The thermal conductivity of the brick is 0.51 W/mK.

(c) Explain the concept of black body.

5. (a) Derive Eulers equation of motion along a stream line.

(b) The diameters of a pipe at sections 1 and 2 are 200 mm. and 300 mm. respectively. If the velocity of water flowing through the pipe at section 1 is 4 m/s, find :

(i) Discharge through the pipe ; and

(ii) Velocity of water at section 2.

Or

(c) Explain with sketch, how a venturimeter is used to measure the flow of a liquid in a pipe.

(d) Water is flowing through a pipe having diameters 600 mm. and 400 mm. at the bottom and upper end respectively. The intensity of pressure at the bottom end is 350 $kN/m.^2$ and the pressure at the upper end is 100 $kN/m.^2$ Determine the difference in datum head if the rate of flow through the pipe is 60 lts/s.

(4 × 15 = 60 marks)