C 6265

(Pages : 2)

Name..........................

Reg. No..........................

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2005

EC 2K 605—MECHANICAL ENGINEERING

(New Scheme)

Time : Three Hours — Maximum : 100 Marks

I. (a) Derive SFEE for nozzle and turbine.

(b) Define Entropy. Derive the equation for finding the change in entropy for an ideal gas.

(c) Classify the IC engines based on various methods.

(d) Compare Otto, Diesel and Dual cycles for the same compression ratio.

(e) Define Thermal conductivity. How does it vary with temperature for different metals ?

(f) Considering flow over a flat plate, define the velocity and thermal boundary layer thicknesses. Discuss.

(g) Distinguish between (i) Steady and unsteady flow ; and (ii) Rotational and irrotational flow.

(h) Describe Orifice meter for flow measurement.

($8 \times 5 = 40$ marks)

II. (a) (i) Which property is derived from First law and prove it. (8 marks)

(ii) During the compression stroke of an engine, the work done on the working fluid in the engine cylinder is 75 kJ/kg and the heat rejected to the surroundings is 40 kJ/kg. Find the change of internal energy.

(7 marks)

Or

(b) (i) Steam enters and leaves a turbine with enthalpy of 3220 kJ/kg and 2000 kJ/kg respectively. The heat losses to the surroundings are 45 kJ/kg. The mass flow rate is 90 kg/sec. Determine the work output from the turbine in kilowatts.

(8 marks)

(ii) Unit mass of air has an initial pressure and temperature of 140 kPa, and 25°C respectively. It is compressed to a pressure of 1.4 MPa and temperature of 200°C. Determine the change in entropy.

(7 marks)

III. (a) Explain the principle of operation of four-stroke petrol engine with relevant sketches. How does it differ from CI engine ?

Or

(b) Consider a steam power plant operating on the ideal Rankine cycle. The steam enters the turbine at 3 MPa and 350°C and is condensed in the condenser at a pressure of 10 kPa. Determine the thermal efficiency of this plant. If the steam is superheated to 600°C, instead of 350°C, find out the increase in efficiency.

(15 marks)

Turn over

IV. (a) A composite wall is built from an inside layer and an outside layer of 0.15 m thick brick (k = 0.6 W/m.K). Between them is a layer of insulation 0.04 m thick (k = 0.05 W/m.K). The temperature of the air inside the house is 20°C and outside is −10°C; the heat transfer coefficient on the inside is 10 W/m^2.K and on the outside is 30 W/m^2.K. Find the inside and outside surface temperatures of the wall and the heat flow through the wall.

Or

(b) Engine oil at 100°C flows over a 5.5 m long flat plate whose temperature is 25°C. Calculate the total drag force and the rate of heat transfer per unit width of the entire plate for a flow velocity of 2 m/s. Assume the following properties :

ρ = 864 kg/m^3, Pr = 1050, k = 0.14W/m.K, ν = 84 × 10^{-6} m^2/s.

(15 marks)

V. (a) From first principles obtain the expression for discharge of a liquid through a Venturimeter in terms of coefficient of discharge and constant of Venturimeter.

Or

(b) Derive the impulse momentum equation for fluid flow from omentum principle.

(15 marks)

[4 × 15 = 60 marks]