D 27078 (Pages 2) Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2006

EC 04 502—MECHANICAL ENGINEERING

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Define thermodynamics and discuss different approaches to the study of thermodynamics.

(b) What is an ideal or perfect gas ?

(c) What processes constitute the carnot cycle ?

(d) Explain briefly the Diesel cycle with the help of PV and TS diagrams.

(e) Indicate the three modes of heat transfer.

(f) What is called a perfect black body ?

(g) Define the term total head as applied to a fluid mass in motion. What does it comprise of ?

(h) Compare flow of blood through veins with flow of a viscous liquid in a capillary tube, highlighting the similarities and differences.

(8 × 5 = 40 marks)

II. (a) A reversed heat engine operated between a source at 600°C and a sink at 20°C. Determine the leat rate of heat rejection per kW net output of the engine.

Or

(b) A household refrigerator maintains the refrigerated space at 4°C by removing heat from it at the rate of 5 kW. The power required to run the refrigerator is 1.5 kW. Determine the CoP of the refrigerator.

III. (a) A carnot engine operates between two reservoirs at temperatures T_1 and T_2 the work output of the engine is 0.6 times the heat rejected. The difference in temperature between the source and the sink is 200°K. Calculate the thermal efficiency, source temperature and the sink temperature.

Or

(b) In an otto cycle, the temperature at the beginning and end of the isentropic compression are 316°K and 596°K respectively. Determine the compression ratio and air standard efficiency.

IV. (a) A furnace wall is made of refractory bricks of 350 mm thick. The inner and outer surfaces of the wall have temperature of 900°C and 100°C. Find the heat loss per sqm. per. hour. Assume k = 4.5 W/mK for refractory bricks.

Or

(b) Derive an expression for heat transfer between two fluids through a cylindrical wall.

Turn over

V. (a) A pipeline enlarges from a diameter of 10 cm. at A to 20 cm at B which is 2 m higher than A. With a pressure of 68.65 kN/m^2 at A, water flows at the rate of 15.0 l/s. Find the pressure B.

Or

(b) A boat driven by jet propulsion, discharges water at a speed of 20 m/s relative to the ship in a jet of 0.02 m^2 cross-sectional area. If the boat velocity is 20 km/hr, find the resistance to motion, power of the jet and efficiency. Take the inlet opening to race the flow.

(4 × 15 = 60 marks)