D 42159 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2007

EC 04 502 – MECHANICAL ENGINEERING

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Explain Carnot cycle.

(b) Explain concept of entropy.

(c) State and explain Zeroth law of thermodynamics.

(d) What is Mollier diagram?

(e) Explain Fourier law of conduction.

(f) Describe the concept of black body.

(g) Explain viscous flow.

(h) Explain Capillary flow.

(8 × 5 = 40 marks)

II. (a) Two thermometers, one centigrade and other Fahrenheit, are immersed in a fluid. After the thermometers reach equilibrium with the fluid, it is noted that both the thermometers, indicate the same numerical value. Find the identical numerical value shown by the thermometer. What would be the corresponding temperature of the fluid expressed in degree Kelvin and Degree Rankin?

Or

(b) In a certain heat exchanger, 50 kg of water is heated per minute from 50° C to 110° C by hot gases which enter the heat exchanger at 250° C. If the flow rate of gases is 100 kg/minute estimate the net change in entropy.

C_p (water) = 4.186 kj / kg K ;

C_p (Gas) = 1 kj / kg K.

III. (a) An engine working on Diesel cycle has a compression ratio of 15 and fuel supply is cut off at 8% of stroke. If the engine has a relative efficiency of 50%, determine the fuel consumption per kW-hr. Assume the fuel has a calorific value of 42000 kJ/kg.

Or

(b) The upper and lower temperature limits for an Otto cycle are 1500 K and 300 K respectively. What compression ratio is required to develop maximum work? Estimate the maximum theoretical power developed by an engine working on this cycle when the air flow rated is 0.35 kg/minute.

Turn over

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

Or

(b) A long pipe 5 cm in diameter passes through a room and is exposed to air at atmospheric temperature of 27° C. The pipe surface temperature is 100° C. Assuming emissivity of the pipe surface 0.6, calculate the heat loss per meter length of pipe.

V. (a) State and prove Bernovilli's equation. Explain *one* of its applications.

Or

(b) Water at the rate of 40 litres/sec. is flowing through a 150 mm diameter fire hose, at the end of which a 50 mm diameter nozzle is fixed. Calculate the force exerted by the nozzle if the pressure at the inlet of the nozzle is 200 kPa.

[4 × 15 = 60 marks]