C 14824 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2010

EC 2K 605—MECHANICAL ENGINEERING

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Distinguish between closed and open systems by giving practical examples.

(b) Explain entropy and prove that entropy is a property of steam.

(c) Define air-standard efficiency and derive the efficiency of carnot cycle.

(d) Explain the principle and operation of 2-stroke engine.

(e) Explain the tree basic modes in which heat is transferred.

(f) Explain the Fourier's law of heat conduction.

(g) Explain continuity, momentum and energy equations.

(h) Explain capillary flow and viscous flow.

(8 × 5 = 40 marks)

II. (a) Piston and cylinder machine contains a fluid system which passes through a complete cycle of four processes. During a cycle, the sum of all heat transfers is –170 KJ. The system completes 100 cycles per min. Complete the following table showing the method for each item, and compute the net rate of work output in kW.

Process	*Q(kJ/min)*	*W(kJ/min)*	*AE(kJ/min)*
a-b	0	2,170	–
b-c	21,000	0	–
c-d	–2,100	–	– 36,600
d-a	–	–	–

Or

(b) (i) Define thermodynamic work. When a work is said to be done by a system? What are positive and negative work interactions.

(ii) Air initially at 300 KPa pressure and 0.02 m^3 volume expands according to the law PV = constant until the pressure reduces to 150 KPa. Subsequently it is compressed at constant pressure to its original volume of 0.02 m^3. Sketch the process on P-V diagram and calculate the work interaction per unit mass of air.

III. (a) (i) What do you mean by air Standard cycles ? What are the assumptions for air Standard cycles ?

(ii) Derive an equation for the air Standard efficiency of an engine working on the Otto cycle in terms of its compression ratio and ratio of specific heats of air.

Or

Turn over

(b) (i) With the help of T-s and p-v diagrams explain simple Rankine cycle.

(ii) A steam power plant is supplied with dry saturated steam at a pressure of 15 bar and exhausts into a condenser at 0.1 bar. Cucullate the Rankine efficiency by using steam tables.

IV. (a) (i) What is the geometrical factor of radiation ? Explain.

(ii) Estimate the heat loss by radiation from a high pressure steam pipe at a temperature of 127° C situated in a large room whose walls are at 27°C. Assume emissivity of pipe surface to be 0.8.

Or

(b) A spherical ball of 10 cm diameter maintained at a constant temperature of 1100 K is suspended in air. Assuming the ball to closely approximate a blackbody. Determine (i) the total blackbody emissive power ; (ii) the total amount of radiation emitted by the ball in 10 minutes ; and (iii) the spectral blackbody emissive power at a wavelength of 3 μm.

V. (a) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem from first principle and state the assumptions made for such a derivation.

Or

(b) Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if the rate of flow through pipe is 40 lit/s.

[4 × 15 = 60 marks]