

D 27078

(Pages 2)

Name.....

Reg. No.....

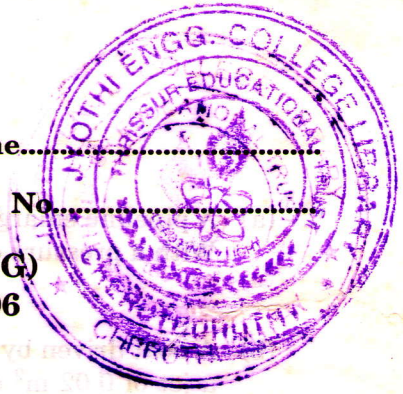
**FIFTH SEMESTER B.TECH. (ENGINEERING)  
DEGREE EXAMINATION, DECEMBER 2006**

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 heat 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.

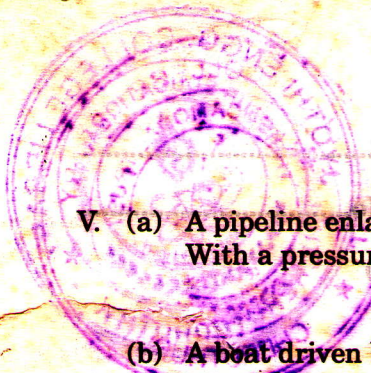
- IV. (a) A furnace wall is made of refractory bricks of 350 mm thick. The inner and outer surfaces of the wall have temperature of 900°C and 100°C. Find the heat loss per sqm. per hour. Assume  $k = 4.5 \text{ W/mK}$  for refractory bricks.

*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  $68.65 \text{ kN/m}^2$  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  $0.02 \text{ m}^2$  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)

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 fluid in a capillary tube, highlighting the similarities and differences.

(8 × 5 = 40 marks)

- II. (a) A reversed heat engine operated between a source at  $600^\circ\text{C}$  and a sink at  $20^\circ\text{C}$ . Determine the rate of heat rejection per kW net output of the engine.

Or

- (b) A household refrigerator maintains the refrigerated space at  $4^\circ\text{C}$  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 0.8 times the heat rejected. The difference in temperature between the source and the sink is  $200^\circ\text{K}$ . 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  $310^\circ\text{K}$  and  $590^\circ\text{K}$  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  $900^\circ\text{C}$  and  $100^\circ\text{C}$ . Find the heat loss per sqm. per hour. Assume  $k = 1.5 \text{ W/mK}$  for refractory bricks.

Or

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

Turn over