GENERAL ENGINEERING SCIENCES

Paper—IV

(SECTION—II)

(Subjective)

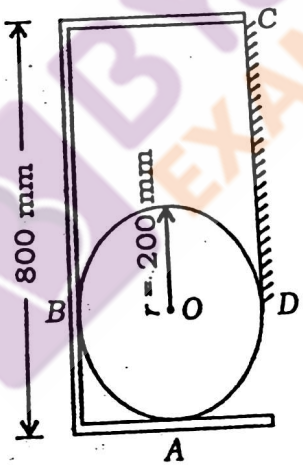
Time Allowed : 2 Hours] [*Maximum Marks* : 100

Note : (1) Attempt *any* **five** questions.
(2) The figures in the margin indicate full marks for the questions.
(3) All parts of a question must be answered together.

1. *(a)* Explain what you understand by section modulus. 10

   (b) Find the dimensions of the strongest rectangular beam that can be cut out of a log of wood 1·8 m diameter. 10

2. A 1000 N cylinder is supported in a frame *ABC* as shown in the figure below :



   The frame is hinged at *C*. Determine the reaction at *A*, *B*, *C* and *D*. 20

3. *(a)* State and prove Kirchhoff's law of radiation. 5

   (b) Air stream at 24 °C is flowing at 0·4 m/s across a 100 W bulb at 130 °C. If the bulb is approximated by 65 mm diameter sphere, calculate—

   (i) heat transfer rate;

   (ii) percentage of power lost due to convection. 7+8=15

4. (a) Describe the significance of break-even chart and the managerial uses of break-even analysis. 10

(b) Differentiate between risk and uncertainty. 5

(c) Define the following : 1×5=5

(i) Lead time

(ii) Safety stock

(iii) Value analysis

(iv) ABC analysis

(v) Profile volume ratio (PVR)

5. In a reaction turbine, the fixed blades and moving blades are of the same shape, but reversed in direction. The angles of receiving tips and discharging tips are 35° and 20°. Find the power developed per unit of blades for a steam consumption of 2·5 kg/s, when the blade speed is 50 m/s. If the heat drop per pair is 10·04 kJ/kg, find the efficiency of the pair. 20

6. (a) Establish the equivalence of the two statements of second law of thermodynamics. 10

(b) With the help of neat schematic diagram, discuss the modified Rankine cycle on *P-V*, *T-S* and *h-S* diagram. 10

7. (a) Compare among Otto, Diesel and dual cycles on the basis of—

(i) same compression ratio;

(ii) same maximum pressure and temperature. 5+5=10

(b) In an air standard Diesel cycle, the compression ratio is 16 and at the beginning of isentropic compression, the temperature is 15 °C and the pressure is 0·1 MPa. Heat is added until the temperature at the end of constant pressure process is 1480 °C. Calculate—

(i) the cutoff ratio;

(ii) the mean effective pressure. 5+5=10

9. Mention different sources of water available in India. What is purification of water? Discuss, in brief, the water purification plants available in India. 20

10. *(a)* Discuss the major pollutants produced by human activity. What are the environmental impacts of greenhouse gas pollutants? 10

(b) What do you understand by sustainable development? Discuss, in brief, the methods to enforce the concept of sustainable development. 10

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