[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2063)

924

B.Tech 2nd Semester Examination

Basic Mechanical Engineering

ME-1003

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/ continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each of the section A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION - A

1. (a) Derive steady flow energy equation (SFEE)? Also give applications of steady of steady flow energy equation? **(12)**

   (b) Define the following terms:

   (i) System

   (ii) Reversible Process

   (iii) Quasi-static Process

   (iv) Thermodynamic Work. **(8)**

OR

2. (a) In a steam power station, steam flows steadily through a 0.2m diameter pipeline from the boiler to the turbine. At the boiler end, the steam conditions are found to be: p=4MPa, t= 400 C, h=3213.6 kJ/kg, and

v=0.073 m^3/kg. At the turbine end, the conditions are found to be: p = 3.5 MPa, t=392°C, h=3202.6 kJ/kg, and v=0.084 m^3/kg. There is a heat loss of 8.5kJ/kg from the pipeline. Calculate the steam flow rate. **(12)**

(b) Define a thermodynamic system. Differentiate between open system, closed system ana isolated system. **(8)**

SECTION - B

3. (a) Which is more effective way to increase the efficiency of a Carnot engine: to increase T_1, keeping T_2 constant; or to decrease T_2, keeping T_1 constant? **(12)**

(b) State Kelvin Planck and Clausius statements of the second law and prove their equivalence. **(8)**

OR

4. (a) A domestic food freezer maintains a temperature of –15°C. The ambient air temperature is 30°C, if heat leaks into the freezer at the continuous rate of 1.75kJ/s. What is the least power necessary to pump this heat out continuously. **(6)**

(b) What is the difference between refrigerator and heat pump? **(4)**

(c) State and explain the Carnot cycle with a suitable P-V and T-S diagrams. Also explain the limitations of the Carnot cycle. **(10)**

SECTION - C

5. (a) A copper rod of 600 mm cross-sectional area is carrying loads as shown in Figure 1. Determine the elongation of the bar. Take E for the steel as 200 GPa. **(10)**

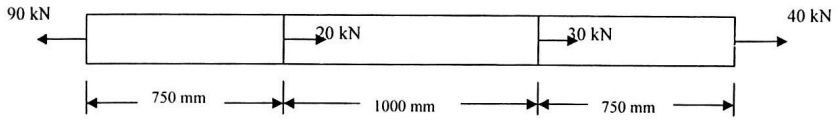

Fig. 1

(b) Define stress, strain and elasticity. State clearly the Hooke's law. **(5)**

(c) Define all the three elastic constants and find a relationship between them. **(5)**

OR

6. A horizontal beam 8m long is supported at both ends and carries point loads of 5 kN, 6 kN and 4 kN acting vertically downwards at distances 2m, 3 m and 6m respectively from the left hand end of the beam. Find

(i) the reactions at the supports.

(ii) Draw Shear Force and Bending Moment Diagrams.

(iii) Find Shear Force and Bending Moment at the middle of the beam. **(20)**

SECTION - D

7. (a) Prove with usual notations the bending equation

$$\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$$ **(10)**

(b) A rectangular beam 100 mm wide and 200 mm deep is simply supported over a span of 3.5 m and carries uniformly distributed load of 1500 N/m. Find:

(i) The bending stress developed at a section distant 1 m from the right hand support.

(ii) Position and magnitude of the maximum stress developed in the beam. **(10)**

OR

8. (a) In a hollow circular shaft, the external diameter is 100 mm and the internal diameter is 60 mm. The allowable shear stress in the shaft material is 50 N/mm^2. Determine the angle of twist in a length of twenty times the external of the shaft. Take $G = 8\times10^4$ N/mm^2. **(10)**

(b) A section of a solid circular shaft is subjected to a bending moment of 500 kNm and torque of 250 kNm. If the diameter of the shaft is 100 mm, find—

(a) Major principal stress

(b) Minor principal stress

(c) Maximum shear stress

(d) Principal planes **(10)**

SECTION - E

9. (a) Define state, process & cycle?

(b) Define the term intensive and extensive property with examples?

(c) Explain zeroth law of thermodynamics.

(d) Define hardness & brittleness.

(e) Define point of contra flexure.

(f) Define S.F. and B.M diagram.

(g) What do you understand by thermodynamic equilibrium,

(h) Define eccentric load.

(i) What is an ideal gas.

(j) State the equation of torsion giving meaning of each term used. **(10×2=20)**