Total No. of Questions : 10] [Total No. of Printed Pages : 4

Roll No. .....

AU/IP/IM/ME–302(N)

B. E. (Third Semester) EXAMINATION, Dec., 2010

(New Scheme)

(Common for AU/IP/IM/ME Engg. Branch)

STRENGTH AND MECHANICS OF MATERIALS

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt *five* questions selecting *one* question from each Unit. All questions carry equal marks. Assume suitable missing/misprint data, if any.

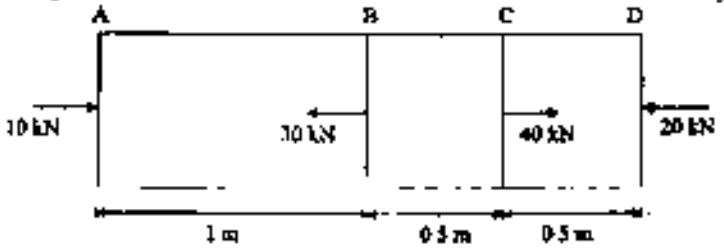
Unit–I

1. (a) Define the following mechanical properties of engineering material : 8

(i) Ductility (ii) Hardness

(iii) Toughness (iv) Malleability

(b) A rod having diameter 35 mm is subjected to an axial force as shown in the figure. Calculate the change in length if $E = 2 \times 10^5$ MPa. 12



P. T. O.

Or

2. (a) Explain the behaviour of a ductile material under tension with the help of stress-strain diagram. 10

(b) A 2 m long bar is 30 mm wide and 15 mm thick which is subjected to axial pull of 35 kN in the direction of length. Calculate the changes in its dimension and volume if $\mu = 0{\cdot}2$ and $E = 2{\cdot}1 \times 10^5$ MPa. 10

Unit – II

3. (a) Prove that shear stress in a body acted upon by two equal perpendicular stresses is zero. 10

(b) A piece of material is subjected to two perpendicular tensile stresses of 100 MPa and 60 MPa. Determine the plane on which the resultant stress has maximum obliquity with the normal. Also find the resultant stress on this plane. 10

Or

4. (a) What do you mean by pressure vessels ? What types of stresses act on them ? 8

(b) A 800 mm long shaft with a diameter of 80 mm carries a flywheel weighing 4 kN at its midway. The shaft transmits 24 kW at a speed of 240 r. p. m. Determine the principal stresses and the maximum shear stress at the ends of a vertical and horizontal diameter in a plane near the flywheel. 12

Unit – III

5. (a) State the assumptions made in the analysis of torsion of shaft. 5

(b) A solid shaft transmits 200 kW of power at 80 r. p. m. Determine the diameter of the shaft if the shear stress

is not to exceed 75 MPa. If this shaft is replaced by a hollow shaft whose internal diameter is 0·6 of the external diameter while the length, material and the maximum shear stress are the same, find the % saving in weight. 15

Or

6. (a) What is a close coiled helical spring ? Deduce an expression for its deflection under the action of an axial load. 10

(b) In an open coiled helical spring, the stresses due to twisting and bending are 120 MPa and 90 MPa respectively, when the spring is loaded axially. The spring consists of 8 coils and the mean diameter of the coils is 10 times diameter of the wire. Determine the maximum permissible load and the diameter of the wire for a maximum deflection of 30 mm. G = 80 GPa and E = 208 GPa. 10

Unit—IV

7. (a) Prove the relation :

$$\frac{\sigma}{y} = \frac{M}{I} = \frac{E}{R}$$

for simple bending. 10

(b) A simply supported beam of span 2 m carries a uniformly distributed load of 140 kN per m over the whole span. The cross-section of the beam is a T-section with flange width 120 mm, web and flange thickness 20 mm and overall depth 160 mm. Determine the maximum shear-stress in the beam and shear stress distribution for the section. 10

P. T. O.

Or

8. A 280 mm × 120 mm I beam is to be used as a cantilever 3·6 m long. Find the uniformly distributed load which can be carried by the beam if the permissible stress is 125 MPa. $I = 75 \times 10^6$ mm^4.

If the cantilever is strengthened by 10 mm thick steel plates welded at the top and bottom flanges to withstand a 40% increased load. Find the width of the plate and length over which plates should extend, the maximum stress being the same. 20

Unit—V

9. (a) What are the main theories of failures for a material ? Explain their relative use. 10

(b) What is a strut ? How does it differ from a column ? 5

(c) Define slenderness ratio of a column. What is its importance ? 5

Or

10. (a) What is Euler's curve ? What is its importance ? 6

(b) A 1·5 m long straight steel bar which is 20 mm × 5 mm mm in section is compressed longitudinally until it buckles. Applying Euler's formula for pinned ends, determine the maximum deflection before the steel attains the yield point stress of 320 MPa, E = 210 GPa. 14