Roll No. | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 09

B.Tech. (CE) (Sem.–3rd)

SOLID MECHANICS

Subject Code : CE-207

Paper ID : [A0604]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A

1. Write briefly :

a) Find the ratio of second moment of area about the centroidal axis to the second moment of area about the base of a triangle with base = 300 mm and altitude = 600 mm.

b) A hollow circular shaft (outer diameter = 2 times the inner diameter) is subjected to a bending moment M and torque T. What is the ratio of maximum bending stress to maximum shear stress in the shaft?

c) How are the Young's Modulus of elasticity and modulus of rigidity related?

d) What is the limitation of Euler's Formula for calculating the crippling load on the columns?

e) A bar of steel is 1m long. For the first 0.4m it is 25mm in diameter, for next 0.3m it is 20mm in diameter and for remaining 0.3m it is 15mm in diameter. Find die change in length if it is subjected to a tensile load of 100 kN. The value of E = 0.210 MN/mm².

f) Define proof resilience.

g) What are flitched beams?

h) What is the nature of variation of bending moments due to UDL ?

i) List out the instances where moment area method is particularly convenient to use.

j) List the various theories of elastic failure.

SECTION - B

2) A Solid round bar 3 m long and 4 cm in diameter is used as a column with both ends hinged. Determine the percentage change in the Euler's crippling load of the column if the ends conditions are changed to both ends fixed. Take E = 200 GPa.

3) A cantilever beam of span 1.5 m carries a point load of 5 kN at its free end. The cross section of the beam is a uniform I section of 160 mm flange width, 240 mm overall depth and 20 mm thickness for flange and web each. Determine the max. bending stress in the beam. Draw the bending stress diagram.

4) A rectangular block of material is subjected to a tensile stress of 100 N/mm² on one plane and a tensile stress of 50 N/mm² on a plane at right angles, together with shear stress of 60 N/mm² on the same planes. Determine magnitude of the principal stresses, the magnitude of greatest shear stress and the direction of principal planes.

5) A cantilever beam AB (Fixed at A) is subjected to a concentrated load of 2 kN acting at free end. The Cross-section of beam is 200 × 500 mm and span is 1m. Determine the strain energy of the beam.

6) Derive torsion equation and state the assumptions made.

SECTION - C

7) Derive the expression (Bending Equation).

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

8) The stresses at a point in a component are 100 MPa (tensile) and 50 MPa (compressive). Determine analytically as well as graphically the magnitude of normal and shear stresses on a plane inclined at an angle of 25° with tensile stress. Also determine the direction of resultant stress and the magnitude of maximum intensity of shear stress.

9) A simply supported beam of length 8m rests on supports 6m apart the right hand end is overhanging by 2m. The beam carries a uniformly distributed load of 1500N/m over the entire length. Draw S.F. and B.M diagrams and find the point of contra flexure, if any.