College of Engineering, Pune
Department of Mechanical Engineering
S.Y.B.Tech (Mech) ESE Examination -2013
Strength of Materials

[Time : 3 Hours] **[Max. Marks : 60]**

1) Solve all questions.
2) Use of electronic pocket calculator is allowed.
3) Assume suitable data, if necessary

1. (*a*) Write short notes on : [5]
   (*i*) Poisson's ratio
   (*ii*) Bulk modulus
   (*iii*) Modulus of rigidity
   (*iv*) Young's modulus

   (*b*) A member ABCD is loaded as shown in Fig.1. Determine total deformation of rod and displacement of C. Assume E=70 GPa. [5]

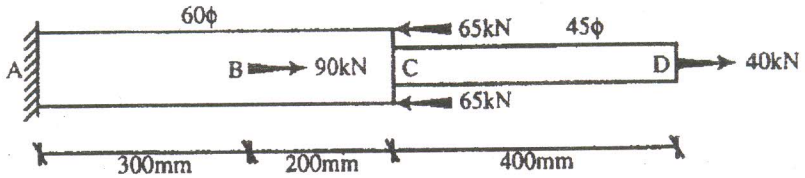

Fig.1

2. (*a*) The beam is supported and loaded as shown in Fig.2. Draw SFD & BMD indicating all important values. [5]

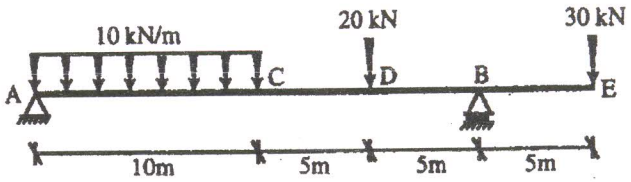

Fig.2

   (*b*) A symmetric I section is 150 wide and 200 deep. The flange thickness and web thickness is 10 mm. This section is used for cantilever beam having a span of 3 m and subjected to uniformly distributed load. Find the maximum u.d.l. that can be supported if E = 200 GPa and maximum allowable stress is 180 MPa. [5]

3. (*a*) Draw shear stress distribution on a T section with flange 150 × 15 deep and web 200×20 wide in mm. The section is symmetric @ vertical axis. The shear force applied is 110 kN. [5]

   (*b*) Design the diameter of solid circular shaft to transmit 50 kW power rotating at 150 rpm. Maximum torque is likely to exceed mean torque by 25%. Permissible shear stress = 60 MPa. Also calculate angle of twist for 2m length. Assume G=85 GPa. [5]

4. (*a*) Direct stresses of 105 N/mm^2 (tensile) and 45 N/mm^2 (compressive) are applied at a point in an elastic material on two mutually perpendicular planes. Determine the allowable shear stresses on these planes using Mohr's circle if the maximum principle stress in the material is limited to 160 N/mm^2. [5]

(*b*) At a point in a strained material, the state of stress is as shown in Fig.3. Determine the principle stresses, principle planes and maximum shear stress. [5]

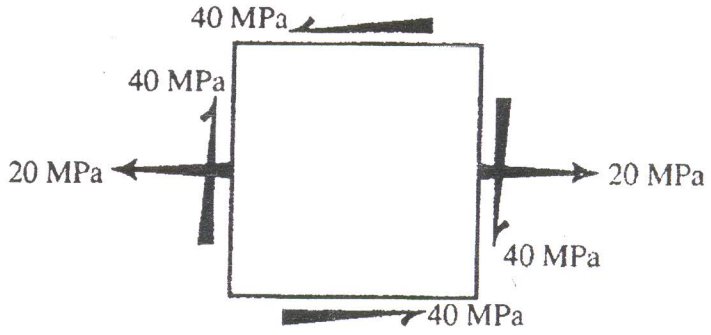

Fig.3

5. (*a*) Derive expression for critical load 'p' on the column having both ends hinge using Euler's method. [5]

(*b*) Compare the crippling loads given by Rankine's formula and Euler's formula for a tubular strut 3 m long having outer diameter 47.5 mm and 42.5 mm as inner diameter. Assume both ends pin-jointed. Take f_y = 315 MPa, a = 1/7500, E = 200 GPa. [5]

OR

5. (*a*) Explain with neat sketches the stable, unstable and neutral equilibrium related to column subjected to axial load and critical load. [5]

(*b*) A vertical steel bar having 16 mm diameter; 1.5 m long is provided with a collar at lower End as shown in Fig 4. Find the maximum weight that can be dropped through a height of 100 mm over the collar if maximum permissible tensile stress is 150 MPa. E=200 GPa. [5]

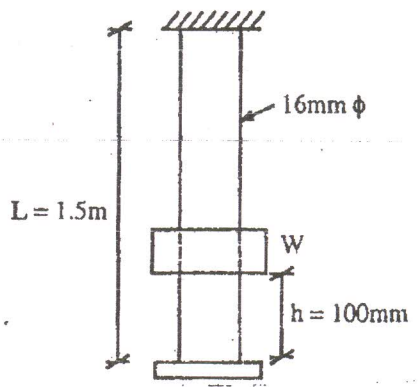

Fig.4

6. (*a*) Determine the deflection at point C, D and E in the beam shown in Fig.5. Take E = 200 kN/mm^2 and I = 60 x10^6 mm^4. [5]

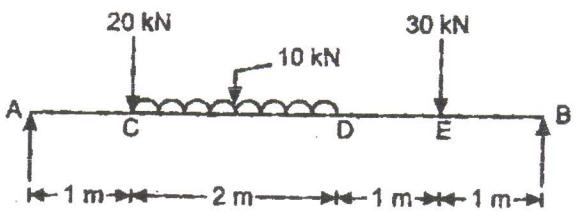

Fig.5

(*b*) For a simply supported beam acted upon by weight 'W' at the centre, find slope at the ends and deflection under the load W. [5]

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