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(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 140302 | Roll No. | | | | | | | | | |

B.Tech.

(SEM. III) THEORY EXAMINATION, 2015-16

MECHANICS OF SOLIDS

[Time:3 hours] **[Total Marks:100]**

Section-A

1. Attempt **all** parts. All parts carry equal marks. Write answer of each part in short. (10x2=20)

   (a) Why stresses are called tensor?

   (b) What are the limitations of Euler's fomrula?

   (c) What is wire winding of thin cylinder?

   (d) What are the various stresses induced in closed coil helical spring?

   (e) Define Shear centre.

(f) Difference between thin and thick cylinder.

(g) Write the relation for axial deflectiion for open coil helical spring subjected to axial twist.

(h) Compare the strength of hollow and solid shaft.

(i) An unknown weight falls by 30 mm on to a collar rigidly attached to the lower end of a vertical bar 4m long and 1000 mm^2 in section. If the maximum instantaneous extension is found to be 3.66 mm. Find corresponding weight. $E=2* 10^5 N/mm^2$.

(j) Write relation for maximum deflection and slope for simply supported beam subjected to uniformly distributed load over the whole span.

Section-B

Attempt **any five** questions from this section. (10×5=50)

2. For a given loading conditions the state of stress in the wall of a cylinder is expressed as follows:

(i) 85 MN/m^2 tensile

(ii) 25 MN/ m^2 tensile at right angles to (i)

(iii) Shear stresses of 60 MN/m on the planes on which the stresses (i) and (ii) act; the sheer couple acting on planes carrying the 25 MN/ m^2 stress is clockwise in effect.

Claculate principal stresses and principal planes.

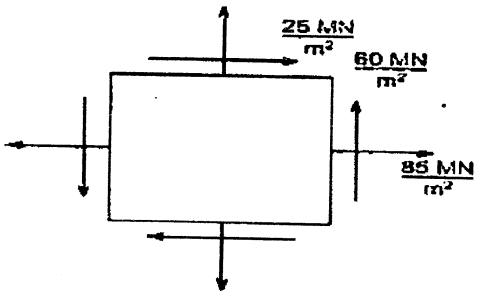

Figure: 1

3. State the generalized Hook's law and prove for an anisotropic elastic material the maximum number of elastic constants is 21 only. Also show that for isotropic materials it is 2.

4. Derive the deflection for cantilever beam loaded with uniformly distributed load.

5. Determine equivalent bending moment and equivalent torque for the shafts subjected to combined bending and torsion.

6. A close coiled helical spring is to carry a load of 5000 N with a deflection of 50 mm and a maximum shearing stress of 400 N/mm^2, if the number of active turns of active coils is 8.

   Estimate the following:

   (a) wire diameter

   (b) mean coil diameter

   (e) weight of the spring.

   Assume G=83000 N/mm^2;

   Specific weight $\rho = 7700\ kg/m^3$

7. A leaf spring is made of plates 50 mm wide and 8 mm thick. The spring has a span of 700mm. Determine the no. of plates required to carry a central load of 45 kN. The maximum allowable stress in the plates is 200 MPa. What is the maximum deflection under this load?

8. Derive the equations for circumferential stress and volumetric strain in a thin spherical shell under internal pressure.

9. Determine the Shear Centre for the Channel Section as shown in figure 2.

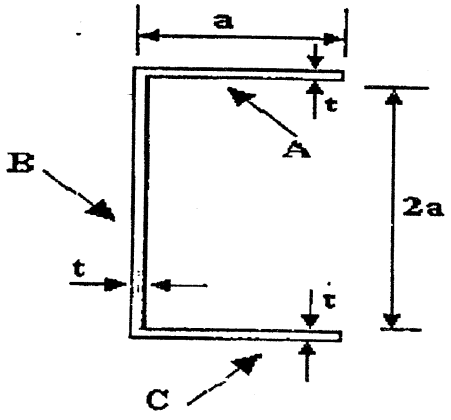

Figure: 2

Section-C

Attempt **any two** questions from this section. (2x15=30)

10. (a) A compound cylinder is composed of a tube of 250 mm internal diameter and 25 mm thick, shrunk on a tube of 200 mm internal diameter and 250 mm external diameter. The interface radial pressure at the junction is 8 N/mm^2. due to shrinking. Then the compound cylinder is subjected to an internal pressure of 60 N/mm^2. Find the variation in hoop stresses over the thickness of compound cylinder.

(b) Define product of inertia and principal moment of inertia.

11. (a) Derive the bending equation for a beam subjected to bending moment M in pure bending condition. Also state the assumptions.

(b) A close coil helical spring of round steel wire 10 mm in diameter and 10 complete turns with a mean diameter of 120 mm and subjected to an axial load of 200 N. Determine (i) deflection of the spring (ii) stiffness of the spring (iii) maximum shear stress and (iv) strain energy stored in spring.

12. Define the following terms:

(a) Draw the Stress – Strain diagram for mild steel under tensile load.

(b) Write down assumption in Euler's theory for column.

(c) Name different theories of failure and represent them graphically.

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