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Question Paper Code : 21244

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Third Semester

Civil Engineering

CE 2201/CE 34/CE 1202 A/080100010/10111 CE 304 – MECHANICS OF SOLIDS

(Regulations 2008/2010)

(Common to 10111 CE 304 – Mechanics of solids for B.E. (Part-Time) First Semester – Civil Engineering – Regulations 2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Hooke's law.

2. Write the relationship between (a) Young's Modulus (E) and Rigidity Modulus (G) (b) Young's Modulus (E) and Bulk Modulus (K).

3. What is perfect and imperfect frame?

4. Calculate the volumetric strain in a thin cylinder : Given

   Pressure : 7.59 N/mm^2 Internal diameter : 180 mm

   Poisson's ratio : 0.33 Thickness : 10mm, $E = 200 \times 10^3$ N/mm^2.

5. What are the supports used to construct beam? Indicate its reaction components.

6. Draw the shear force diagram for the beam shown in Fig. 6

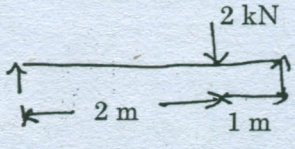

Fig.6

7. Write the moment area theorem No : 1 (first theorem).

8. Sketch the shear stress variation for a beam of cross section 'equal I'. Indicate the position of maximum shear stress.

9. Write the expression to calculate the power transmitted in a circular shaft; subjected to torsion.

10. The mean coil diameter of a helical spring and diameter of the coil are 8 cm and 8 mm respectively. Find the spring index if it carries an axial load of 10 N.

PART B — (5 × 16 = 80 marks)

11. (a) A bar of 20 mm diameter is subjected to a pull of 50 kN. The measured extension over a gauge length of 200 m is 0.10 mm and the change in diameter is 0.0035 mm. Calculate the Poisson's ratio and the value of modulus of elasticity and bulk modulus.

Or

(b) (i) Explain with a neat sketch the stress strain curve for a mild steel bar subjected to tension. (8)

(ii) At a point in a strained material the normal stresses on two planes at right angles are 8 kN/cm^2 and 6 kN/cm^2 both tensile. Find the intensity of stress on a plane inclined at 60° to the axis of maximum stress. (8)

12. (a) For the truss shown in Fig. 12(a) find the forces in members *AB*, *AE* and *BC* by method of sections.

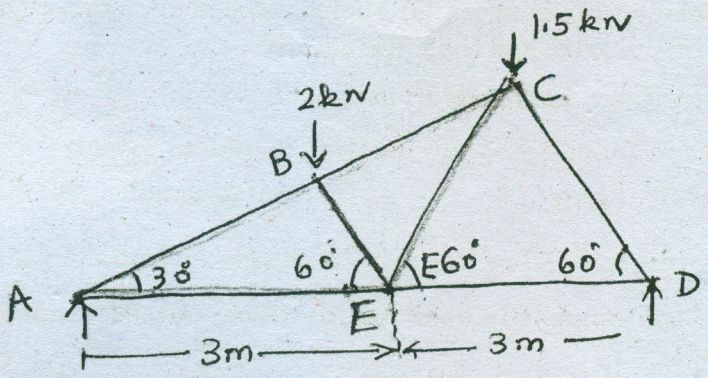

Fig. 12(a)

Or

(b) A copper tube of 5 cm diameter, 1 metre long and 1.25 mm thick has closed ends and is filled with water under pressure. Neglecting any distortion of the end plates, determine the alteration of pressure when an additional volume of 3 C.C of water is pumped into the tube $G = 1.03 \times 10^7 N/cm^2$, $\mu = 0.3$, K for water $= 2.1 \times 10^5 N/cm^2$.

13. (a) For the beam shown in Fig. 13(a) draw SFD and BMD indicating salient points.

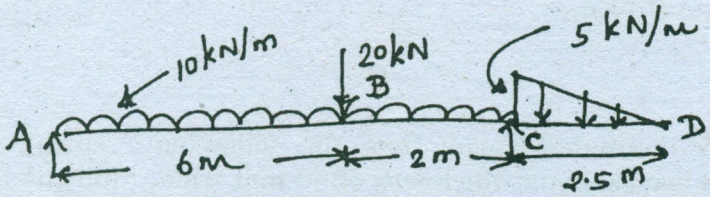

Fig. 13(a)

Or

(b) A 'T'– section of a beam has the following dimensions

Flange width : 100 mm, Overall depth : 80 mm

Thickness of web : 10 mm, thickness of flange : 10 mm

Determine the maximum bending stress in the beam, when a B.M. of 200 N.M. is applied. Also sketch the bending stress variation.

14. (a) For the beam shown in Fig. 14(a), find the slope at A and deflection at C by conjugate beam method $E = 200$ GPa.

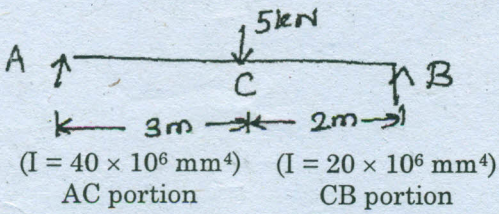

Fig. 14(a)

Or

(b) An I section beam is shown in Fig. 14(b). It carries a shear force of 500 kN at a section. If the moment of inertia of the section is 1164×10^6 mm^4, calculate the maximum and also web junction shear stress.

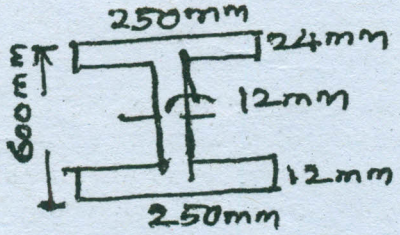

Fig. 14(b)

15. (a) A circular solid shaft transmits 115 kN power at 300 rpm. If the permissible shear stress is 75 N/mm^2 and allowable twist is 1.5° in a length of 3 meters, determine the diameter of the shaft $G = 82 \times 10^9 N/m^2$.

Or

(b) (i) A laminated spring has the following : spring 750 mm long, 8 leaves, equal thickness of 50 mm wide. Find the thickness of the leaves if the stress in the material is to be limited to 250 MPa; when the spring is loaded to 9 kN at the centre. To what radius should the leaves be initially bent for the spring to be flat when under this load and what is the central deflection $E = 2 \times 10^5 N/mm^2$. (8)

(ii) An open coil helical spring made of 5 mm diameter, wire has 16 coils, 100 mm inner diameter with helix angle of 16°. Calculate the deflection, maximum direct and shear stress induced due to an axial load of 300 N

$E = 200$ GPa, $G = 90$ GPa. (8)