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Question Paper Code : 40792

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Third Semester
Aeronautical Engineering
CE 6452 – SOLID MECHANICS
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions and missing data may be appropriately assumed.

PART – A (10×2=20 Marks)

1. What do you mean by relative elongation of the bar ?
2. Give a mathematical expression for the Poisson's ratio.
3. Sketch the shear stress distribution across a rectangular beam section.
4. Give two examples for the beam of uniform strength.
5. Define Maxwell's reciprocal theorem.
6. Mention the limitations of moment-area method.
7. How many times a fixed-fixed long column is stronger than hinged-hinged long column ? Show the calculations.
8. What do you understand by proof-load, in case of open-coiled helical spring ?
9. Schematically sketch an element subjected to pure shear.
10. In some bi-axial state of stress, the maximum and minimum principal stresses are 100 and 50 MPa, respectively. What is the maximum shear stress developed in it ?

PART – B (5×13=65 Marks)

11. a) i) Give the three mathematical expressions, each containing the two moduli of elasticity and Poisson's ratio of the material. (3×2)

ii) Figure 1 shows the stepped column with loadings. Find the respective stresses at different sections of the column. (7)

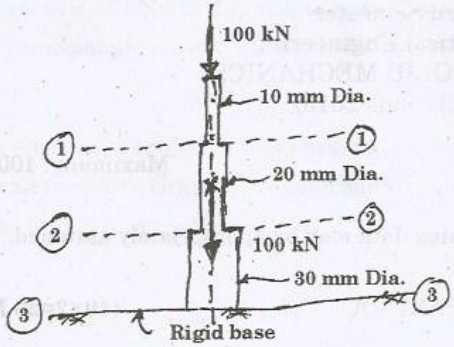

Figure 1

(OR)

b) Analyze the plane-truss shown in Fig. 2, by method of sections and tabulate the member forces. (3+7+3)

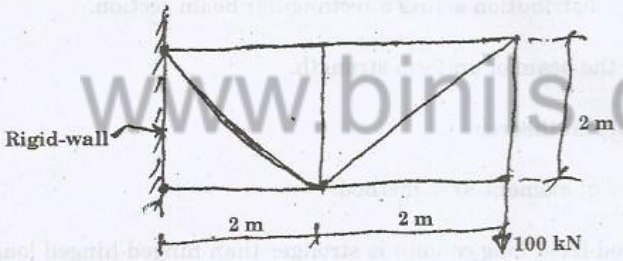

Figure 2

12. a) Analyze the beam shown in Fig. 3 and draw the BMD indicating the salient values in it. (3+6+4)

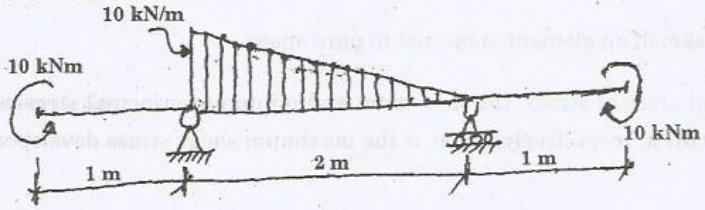

Figure 3

(OR)

b) Sketch the shear stress distribution in the beam shown in Fig. 3, at a section taken at the mid of two supports. Take the beam dimensions as 150 mm wide and 300 mm deep. **(3+6+4)**

13. a) A homogeneous and prismatic simply supported beam of span 6 m carrying three clockwise moment couples of magnitudes 5, 10 and 15 kNm equally spaced each other. Determine the slopes at the two supports, by double-integration method. **(6+7)**

(OR)

b) i) State the principle of superposition and also its essential applications in finding a slope and deflection in the beams. **(3+4)**

ii) Using conjugate beam method determine the deflection at the free-end of a homogeneous and prismatic cantilever beam of span 6 m carrying a central concentrated load of 10 kN. **(6)**

14. a) i) Write the mathematical expression for simple torsion equation explaining the various terms in it. **(6)**

ii) A 4 m long steel-tube of square section as outer dimension and wall thicknesses of 400 mm and 5 mm respectively. If its ends are firmly fixed in position and direction, find its buckling load. Take the Young's modulus of steel-tube as 210 GPa. **(7)**

(OR)

b) i) For the stepped-shaft shown in Fig. 4, find the net-twist in it. Take the modulus of rigidity as 80 GPa. **(8)**

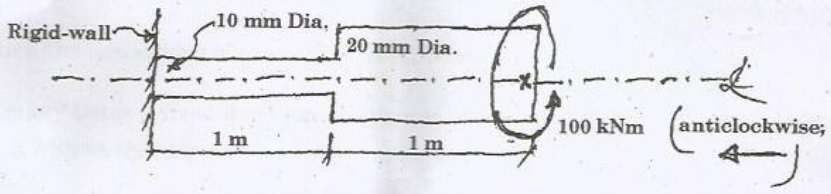

Figure 4

ii) Mention the various uses of helical and leaf-springs. **(5)**

15. a) With usual notations, for a bi-axial state of stress system, derive mathematical expressions for the principal stresses and maximum shear stress. **(7+6)**

(OR)

b) Analyze the cylindrical pressure vessel subjected to an internal fluid pressure, for its Hoop and longitudinal stresses. **(6+7)**

PART – C (1×15=15 Marks)

16. a) A propeller-shaft of 240 mm external diameter and 180 mm internal diameter has to transmit 1100 kW at 100 rpm. It is additionally subjected to a bending moment of 10 kNm and an end-thrust of 200 kN. Determine : i) principal stresses ii) principal planes and iii) maximum shear stress. (8+4+3)

(OR)

b) An element is subjected to a pure-state of shear stress of magnitude 100 MPa on all the faces. Graphically determine the : i) principal stresses ii) their planes and iii) maximum shear stress. (8+4+3)

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