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B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Third Semester

Civil Engineering

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

(Regulation 2008/2010)

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

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between strength and stiffness.
2. What is the value of normal stress on the plane of maximum shear stress in an element of a strained body when it is in two dimensional state of stress?
3. What are the advantages of method of sections over method of joints in the analysis of pin jointed trusses?
4. Name the various stresses induced in a thin cylinder with ends closed when it is subjected to some internal fluid pressure.
5. Draw the bending moment diagram for a simply supported beam when it is subjected to a central clockwise moment.
6. Define: Neutral axis.
7. State Mohr's theorem for slope and deflection.
8. How will you prove that the shear stress changes abruptly at the junction of the flange and web of an I-section?
9. If a circular shaft transmits 20 kW of power at 200 rpm, what is the torque generated?
10. Why are hollow circular shafts economical and efficient than solid circular shafts?

11. (a) A steel rod of diameter 30 mm and length 500 mm is placed inside a aluminium tube of internal diameter 35 mm and external diameter 45 mm which is 1 mm longer than the steel rod. A load of 320 kN is placed on the assembly through the rigid collar. Find the stress induced in steel rod and aluminium tube. Take the modulus of elasticity of steel as 200 GPa and that of aluminium as 80 GPa.

Or

(b) An element in a strained body is subjected to tensile stresses of 100 MPa and 80 MPa on two mutually perpendicular planes and an anticlockwise shear stress of 50 MPa on the plane having the normal stress of 100 MPa. Find :

(i) the major and minor principal stresses and its corresponding principal planes. (10)

(ii) the maximum shear stress and its corresponding planes. (6)

12. (a) Analyze the simply supported truss shown in Fig. Q. 12(a) by method of joints.

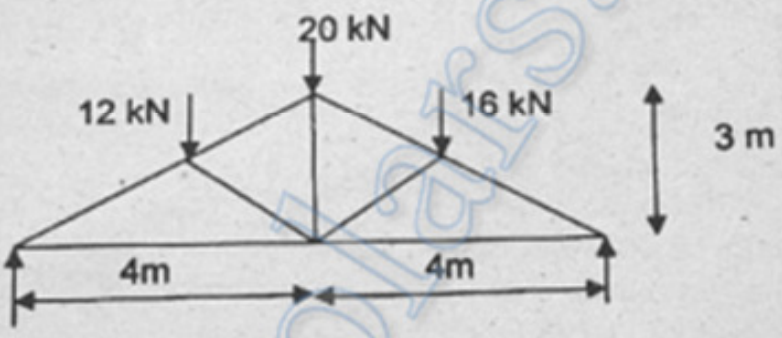

Fig. Q 12(a)

Or

(b) A thin cylindrical shell, 2.5 m long has 220 mm diameter and 10 mm thickness. It is filled completely with a fluid at atmospheric pressure. If an additional 25000 mm^3 fluid is pumped in, find the pressure developed and hoop stress developed. Find also the changes in diameter and length. Take modulus of elasticity of the wall material as 200 GPa and Poisson's ratio as 0.3.

13. (a) A horizontal beam AB of length 8 m is simply supported at A and B. It carries a uniformly distributed load of 4 kN/m over the left half span and a clockwise moment of 10 kNm at 6 m from A. Draw the shearing force and bending moment diagrams and determine the position and magnitude of maximum bending moment.

Or

same bending moment. The cross-section of the beams are a square, rectangle with depth twice the width and a circle. Find the ratios of weights of the circular and the rectangular beams with respect to the square beam.

14. (a) A beam AB of span 8 m is simply supported at its ends A and B. It carries a point load of 16 kN at a distance of 3 m from the end A and a uniformly distributed load of 6 kN/m over the right half span length. Determine (i) the maximum deflection in the beam and (ii) slope at the ends. Take $EI = 10000$ kN-m^2.

Or

(b) A symmetrical I section of a beam has horizontal flanges of size 150 mm × 15 mm at top and bottom and web of size 250 mm × 12 mm. Calculate the shear stress at important points and draw shear stress distribution diagram across the section when the beam section is subjected to a vertical shear force of 120 kN.

15. (a) A hollow cylindrical shaft has to transmit a power of 200 kW at 80 rpm The maximum torque may be 1.5 times the mean torque. If the shear stress is not to exceed 70 MPa, find the diameters of the shaft by taking the internal diameter as 0.65 times the external diameter. Take modulus of rigidity as 80 GPa.

Or

(b) A semi – elliptic leaf spring of span 850 mm and central rise of 100 mm comprises 6 mild steel strips of 10 mm thickness and 45 mm width. Determine its proof load and the maximum permissible load, if the allowable stress is 230 N/mm^2 and modulus of elasticity is 210 GPa. Determine also the load required to cause a deflection of 20 mm.

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