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VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD

B.E. (Civil Engg.: CBCS) III-Semester Supplementary Examinations, May/June-2018

Strength of Materials-I

Time: 3 hours Max. Marks: 70

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. Find an expression for the total elongation of a bar due to its own weight, when the bar is fixed at its upper end and hanging freely at the lower end.
2. Explain the basic principle involved in the analysis of composite section.
3. Derive the relationship between loading, shear force and bending moment.
4. A simply supported beam of length 4m carries a gradually varying load, 2kN/m at left end to 6kN/m at right end. Draw the shear force diagram.
5. State the assumptions made in deriving the equation for the bending of the beams.
6. A rectangular beam 400 mm deep is simply supported over a span of 5m. Compute the uniformly distributed load per metre the beam can carry, if the bending stress is not to exceed 120N/mm^2. Take I = 7×10^6 mm^4.
7. Explain briefly about (i) middle third rule for rectangular sections and (ii) middle quarter rule for circular sections.
8. A short column of diameter 300 mm carries and eccentric load of 60kN. Find the greatest eccentricity which the load can have without producing tension on the cross-section.
9. State and explain Lame's equations?
10. A thin cylinder of internal diameter 3m contains a fluid at an internal pressure of 5N/mm^2. Determine the thickness of the cylinder if the longitudinal stress is not to exceed 40N/mm^2.

Part-B (5 × 10 = 50 Marks)

(All bits carry equal marks)

11. a) A bar of steel is 50 mm×50 mm in section and is 150 mm long. It is subjected to a compressive load of 200 kN along the longitudinal axis and tensile loads of 500 kN and 400 kN on the lateral faces. Find the change in the dimensions of the bar and change in volume. Take E = 2×10^5 MPa and μ = 0.3.

    b) A steel rod of diameter 20 mm and length 400 mm is covered by a rigidly connected brass tube of inside diameter 20 mm and outside diameter 40 mm. Find the stresses in the two materials and deformation when the composite structure is subjected to 100 kN. E = 200 GPa for steel and 100GPa for brass.

12. a) Draw the shear force and bending moment diagram for the simply supported beam loaded as shown in the **Fig.1**.

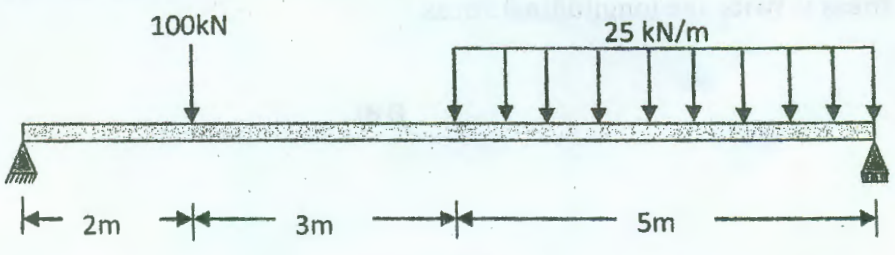

Fig. 1

    b) A cantilever of span 4 m, carries a uniformly distributed load of 10 kN/m over the entire length, in addition to point load of 30 kN at the free end. Draw the SF and BM diagrams indicating salient values.

Contd..2

13. a) A cantilever beam 250 mm wide and 350 mm deep is 4 m long. It is loaded with a uniformly distributed load of 2.5 kN/m over the entire length. A point load of 4 kN is placed at free end. Find the maximum bending stress.

    b) A beam of T section has flange 200mm×50 mm and web as 50mm×250 mm. The shear force acting on a section of a beam is 120 kN. Compute the maximum shear stress and draw shear stress distribution.

14. a) Draw a neat sketch of kernel of a hollow rectangular section of outer dimensions 400 mm×200 mm and inner dimensions are 200 mm×100 mm.

    b) The tensile stresses at a point across two mutually perpendicular planes are 120 MPa and 60 MPa. Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor stress.

15. a) A cylinder 1200 mm long and 300 mm internal diameter having thickness is 12 mm is filled with fluid at atmospheric pressure. If an additional 20000 mm^3 of fluid is pumped into cylinder, find the pressure exerted by the fluid on the cylinder and hoop stress. Take E = 200 GPa and $\mu = 0.3$.

    b) A closed cylindrical shell has an internal diameter of 400 mm and thickness of 15mm. It is 1.2 m long and is subjected to an internal pressure of 6 MPa. Determine the change in internal volume and thickness. Take E = 200 GPa and $\mu = 0.25$.

16. a) In a railway track, rails are placed and joined together such that they are stress free at 20°C. If no allowance is provided for expansion, find the maximum stress in the rails at peak summer temperature of 50°C for a rail length of 30 m. If expansion allowance of 7 mm per rail is provided, what will be the stress in the rails and what maximum temperature is possible to maintain the rails stress free. E for rails = 200 GPa and $\alpha = 12 \times 10^{-6}/°C$.

    b) An overhanging beam of length 10m rests on supports 7m apart. The beam is subjected to a uniformly distributed load of 25kN/m in addition to a point load of 75kN at the right end. Draw the shear force and bending moment diagrams.

17. Answer any ***two*** of the following:

    a) A timber beam 100 mm wide and 200 m deep is to be reinforced by two steel flitches each of 200mm depth and 25mm thickness attached symmetrically at the sides. Calculate moment of resistance, if allowable stress is not to exceed 6 N/mm^2.

    E for steel is 200 GPa and for timber is 10 GPa.

    b) A short column of rectangular section 100 mm×80 mm carries a load of 50 kN at a point 25 mm from the longer side and 45 mm from shorter side. Determine the maximum compressive and tensile stresses in section.

    c) Show that in thin cylindrical shell subjected to internal fluid pressure, the circumference stress is twice the longitudinal stress.

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