Hall Ticket Number:

Code No.: 21005

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. II Year (Civil) I – Semester (Main) Examinations, December – 2015

Strength of Materials-I

Time: **3** hours Max. Marks: **70**

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

Part-A (10 X 2=20 Marks)

1. Explain the stress-strain behaviour of mild steel with neat sketch.
2. A solid circular steel bar, 20 mm diameter is subjected to an axial tensile load of 50 kN. What is the decrease in diameter of the bar? E = 200 GPa and $\nu = 0.25$
3. Define the terms; shear force, bending moment and point of contraflexure.
4. A simply supported beam of span 6 m carries a uniformly distributed load of 2.5 kN/m. Draw the SF and BM diagrams for the beam.
5. A rectangular beam 250 mm deep is simply supported over a span of 3.5 m. What is the concentrated load at mid span, the beam can carry if the bending stress is not to exceed 100 N/mm^2. Take I = 8 x 10^6 mm^4.
6. The maximum shear stress in a beam of circular section of diameter 120 m is 4.5 N/mm^2. Find the shear force to which the beam is subjected.
7. Prove that an eccentric load causes a direct stress as well as bending stress by taking rectangular column as an example.
8. Explain the concept and significance of the pole in Mohr's circle.
9. A cylindrical pipe of diameter 2 m and thickness 2 cm is subjected to an internal pressure of 1.8 N/mm^2. Find the longitudinal and circumferential stresses developed in pipe.
10. State the assumptions made in the analysis of thin and thick cylindrical shells.

Part-B (5 X 10=50 Marks)

(All bits carry equal marks)

11. a) A copper rod 12 mm φ and 40 mm long, fits into an aluminium tube of 20 mm φ and thickness 4 mm of equal length. If the assembly is held by a rigid plate at the end and is stress free at 20^{0}C. Take for copper E=120GPa and α =18x10^{-6}/°C, for aluminium E=70GPa, α = 23x 10^{-6}/°C. When the assembly is heated to 60°C, Find the stress in the copper rod and stress in the aluminium tube.

    b) Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 25 mm and of length 1.5m, if the longitudinal strain in a bar during a tensile test is four times the lateral strain. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 MPa. Take E = 1 x 10^5 N/mm^2.

12. a) Draw shear force and bending moment diagrams for the cantilever beam as shown in Fig.1.

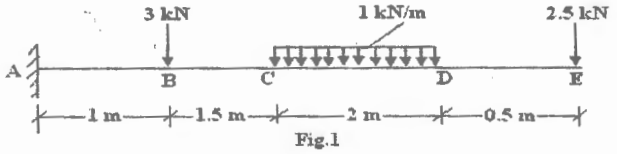

Fig.1

    b) Find the maximum bending moment and its position from A, for a beam loaded and supported as shown in **Fig.2** and draw SFD and BMD.

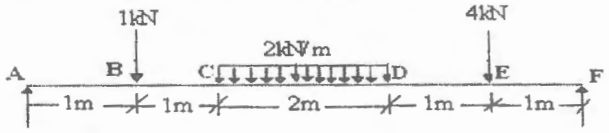

Fig.2

Contd…2

13. a) A T – beam having flange 150 mm x 20 mm and web 20 mm x 160 mm is simply supported over a span of 6 m. It carries a u d l of 5 kN/m, including the self-weight over its entire span, together with a load of 3.5 kN at mid span. Find the tensile and compressive stresses occurring in the beam section and draw the stresses across the section.

    b) A steel beam of I – section is 600 mm deep. Each flange is 250 mm wide and 25 mm thick. The web is 15 mm thick. The beam section is subjected to a shear force of 500 kN. Determine the shear stress distribution for the beam section at various points when the web is horizontal. Draw the shear stress distribution.

14. a) A short cast iron column is of hallow section of uniform thickness, the external diameter 250mm and internal diameter 150 mm. A vertical compressive load acts at an eccentricity of 50 mm from the axis of the column. If the maximum permissible stress is 90 N/mm^2 in compression, calculate the maximum allowable load.

    b) The stress system at a point is given by a normal stress of 120 N/mm^2 (compressive) along the x-axis, 80 N/mm^2 (tensile) along the y-axis and a shear stress of – 40 N/mm^2 on the x- planes. Find the principal stresses and the planes on which they act. Show the stresses and planes in a neat sketch.

15. a) A thin cylindrical pressure vessel has an internal diameter of 150 mm and a wall thickness of 5 mm. It is subjected to an internal pressure 7 N/mm^2. If the cylinder is 900 mm long and E = 200 GPa, find the Poisson's ratio for the material if the change in volume under this pressure is 15,000 mm^3.

    b) Find the thickness of metal necessary for a steel cylindrical shell of internal diameter 200 mm to withstand an internal pressure of 50 MPa. The maximum hoop stress in the section is not to exceed 150 MPa.

16. a) A 500 mm diameter reinforced concrete column has 8 bars of 20 mm diameter. The column is subjected to an axial load of 875 kN. Determine the stress developed in concrete and steel. Take $E_{steel} = 12\ E_{concrete}$.

    b) A doubly overhung beam, 9 m long, is supported at 1.5 m from either end. It carries a u d l of 30 kN/m for a length of 3 m from the right end and the left end. Draw SF and BM diagrams.

17. a) A wooden beam 100 mm wide and 150 mm deep is simply supported over a span of 4 m. If shear force at a section of the beam is 45 kN, find the shear stress at a distance of 25 mm above the neutral axis.

    b) A rectangular section of dimensions 200 mm x 100 mm, subjected to a load of 80 kN applied 40 mm and 20 mm off the centroid parallel to the 200 mm and 100 mm sides respectively. Find the stresses at four corners.

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