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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (CBCS: Mech. Engg.) III-Semester Main Examinations, December-2017

Mechanics of Materials

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. Define longitudinal strain and Poisson's ratio.
2. Define ductility and malleability.
3. Define point of contra flexure.
4. Define section modulus. Compute section modulus for rectangular section of size b × d.
5. Define principal stress and principal plane.
6. Draw shear stress distribution across depth of a diamond section.
7. Calculate deflection of a cantilever beam span '3m' subjected to load 50kN at free end.
8. Write the torsion equation and explain the terms in it.
9. Define Core (Kern) of a section, what is the core size of a rectangular column section of size 200mm x 300mm?
10. Define slenderness ratio and effective length of a column.

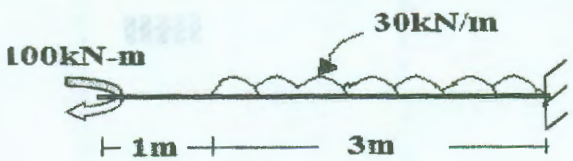
Part-B (5 × 10 = 50 Marks)

11. a) Explain types of stresses and strains [4]

    b) A steel bar 300mm long and 30mm × 30mm cross section, is subjected to a tensile force of 150kN in the direction of its length. Determine the change in volume. Take 'E' = 200GPa and 1/m = 0.3 [6]

12. a) Define Neutral axis. Sketch the bending stress distribution across the cross section of a rectangular beam section 230 × 400 m subjected to 80 kNm moment. [5]

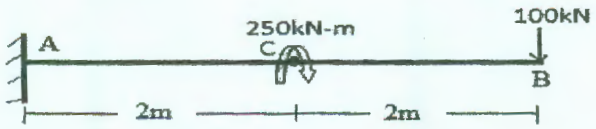
    b) Draw SFD and BMD for the cantilever beam loaded as shown in Figure below: [5]



13. a) Derive expression for normal stress for a bar subjected to uniaxial stress. [4]

    b) Sketch the shear stress distribution for a rectangular cross section 250mm × 400mm subjected to a shear force of 60 kN. Calculate maximum and average shear stress. [6]

14. a) Determine the slope and deflection at the free end of a cantilever beam loaded as shown in Figure. [5]



    b) Determine the diameter of a solid shaft which will transmit 200kW at 200 rpm. The maximum shear stress should not exceed 25MPa and twist should not be more than 1° in a shaft of length 2m. Take modulus of rigidity 1×10^5 N/mm^2. [5]

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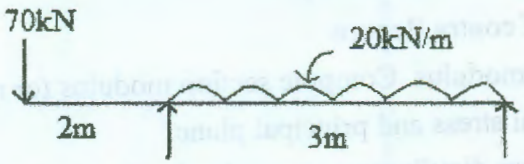
15. a) Derive the expression for circumferential stress and longitudinal stress for a thin spherical shell subjected to an internal pressure. [5]

    b) A hollow rectangular column is having external and internal dimensions as 2.8m × 2.0 m and 1.4m × 1.4m respectively. Calculate the safe load that can be placed at an eccentricity of 50 cm on a plane bisecting the longer side, if the maximum compressive stress is not to exceed 4MPa. [5]

16. a) Draw stress-strain diagram for mild steel and explain the various salient points on it. [4]

    b) Draw SFD and BMD for the beam loaded as shown in Figure [6]



17. Answer any *two* of the following:

    a) At a point in a strained material, the principal stresses acting on two mutually perpendicular planes are 90 MPa and 60 MPa, both compressive. Determine the resultant stress acting on a plane inclined at 60^0 measured clockwise to the plane on which the larger normal stress is acting. [5]

    b) A close coiled helical spring is to carry a load of 120N. The mean coil diameter has to be 10 times that of the wire diameter. If the maximum shear stress is not to exceed 60 N/mm^2, calculate (a) the diameter of the wire and (b) diameter of the coil. [5]

    c) A hollow circular cast iron column is 5m long with both ends fixed. Determine the maximum diameter of the column if it is to carry a safe load of 250 kN with a factor of safety of 4. Take internal diameter as 0.6 times the external diameter. Take σ_c = 550MPa and E = 200GPa [5]

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