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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg.) II Year I-Semester Old Examinations, May/June-2018

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. State and explain Hooke's law.
2. Explain what happens if Poisson's ratio of a material is zero.
3. Define bending moment and shear force.
4. Draw the bending stress diagram of a rectangular section at support section of cantilever beam, which is subjected to a point load at the free end. Indicate tension and compression zones.
5. A rectangular beam of 200 mm×350 mm subjected to a shear force 30 kN. Find average shear stress and maximum shear stress.
6. An element is subjected to 20 N/mm^2 (compression) and 30 N/mm^2 (compression) in perpendicular directions. Determine maximum and minimum principal stresses.
7. What are the limitations of double integration method?
8. Give the boundary conditions used to determine slope and deflection in a cantilever beam of length 'L' subjected to a point load at free end.
9. Define middle third rule and explain its importance.
10. Classify the columns based on their failure.

Part-B (5 × 10 = 50 Marks)

11. a) Briefly explain thermal stress and thermal strain. [3]

    b) A short steel tube of external diameter 75 mm and internal diameter 50 mm is surrounded by a brass tube of same length and having external diameter 100 mm and internal diameter 75mm. The tubes are rigidly fixed and an axial load of 20 kN is placed on the tubes, Find the load carried by each and also shortening of each tube, if it is 250 mm long. Take $E_s = 2\times10^5$ N/mm^2 and $E_b = 1\times10^5$ N/mm^2. [7]

12. a) Define Modulus of section, Moment of resistance and Flexural rigidity. [3]

    b) A simply supported beam of length 4 m carries an U.D.L of 3kN/m over central 2 m length and two point loads 2 kN and 3 kN at a distances 0.5 m and 3.5 m from the left support. Draw Shear force and Bending moment diagrams. [7]

13. a) A rectangular element in a strained material is subjected to tensile stresses of 120 N/mm^2 and 60 N/mm^2 on two mutually perpendicular planes together with a shear stress of 70 N/mm^2. Fine the principal stresses, principal planes and maximum shear stress in the block. [4]

    b) A beam of I section top and bottom flanges 200 mm×20 mm and web 20mm×360 mm. Calculate the maximum intensity of shear stress across the section and sketch the shear stress distribution across the section of the beam, if it carries a shearing force of 300 kN at a section. [6]

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14. a) Find the torque which a shaft of 100 mm diameter can transmit safely, if the shear stress is not exceeding 120 N/mm^2. [3]

    b) A simply supported beam of span 4 m and circular cross section is having a diameter of 200 mm is loaded with UDL 10kN/m over a 2 m length from left support. Determine maximum deflection of the beam. Take $E=2\times10^5 N/mm^2$. [7]

15. a) Briefly explain the difference in analysis of thin and thick cylinders. [4]

    b) A hollow cylindrical cast iron column of 150mm external diameter and 15mm thickness, 3 m long and is hinged at one end and fixed at the other. Find (a) the Euler's crippling load (b) for what length, the critical load by Euler's formula will be equal, if both ends of the column are hinged. [6]

16. a) Draw stress stain curve for mild steel. Indicate and explain the salient points. [5]

    b) A simply supported beam of length 10 m carries two UDL each of magnitude 2kN/m over a length of 3 m from both supports. Draw S.F. and B.M. diagrams. [5]

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

    a) Briefly explain graphical method of finding principal stresses, when a rectangular element subjected to normal stresses and shear stress. [5]

    b) What are the different assumptions made in torsion of circular shafts? [5]

    c) What do you mean the term limit of eccentricity? Find out the limit of eccentricity for i) a solid circular section for diameter 'D' and (ii) for a rectangular section (b×d). [5]