VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD
B.E. II Year (Mechanical) I-Semester (Main) Examinations, December - 2015

Mechanics of Materials

Time: 3 hours   Max. Marks: 70

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

Part-A (10 × 2 = 20 Marks)

1. Differentiate between Strength and Stiffness.

2. Define modular ratio and poisons ratio.

3. A simply supported beam carries a uniformly distributed load of w N per meter length over the whole span. Determine the shear force and B.M. at center.

4. Determine the section modulus for a rectangular beam of size B × D and solid circular section of radius R.

5. Define principal plane and principal stress.

6. Determine the slope and deflection of a simply supported beam of span L carrying a point load W at center.

7. Define flexural rigidity and torsional rigidity.

8. Stiffness of the spring is defined as _____ required to produce _____.

9. What is the core of the section of the column and draw the core of rectangular section?

10. Distinguish between thin and thick cylindrical shells.

Part-B (5 × 10 = 50 Marks)

11. a) A steel cube block of 50mm side is subjected to a force of 10kN (tension) 12.5 kN [5] (compression) and 7.5kN (tension) along x, y and z directions respectively. Determine the change in volume of the block. Take E = 200kN/mm^2 and 1/m = 0.3.

    b) A steel rod 3cm diameter and 5m long is connected to two grips and rod is maintained [5] at a temperature of 95° C. Determine the stress and pull exerted when the temperature falls to 30°C, if the ends do not yield. Take E = 2 ×10^5 MN/m^2 and α = 12 × 10^{-6}/°C.

12. a) A cast iron pipe of 60mm external diameter, 40mm internal diameter and of length 5m [5] is supported at its ends. Calculate maximum bending stress induced in the pipe if it carries a point load of 100N at center.

    b) A simply supported beam of length 10m, carries the uniformly distributed load and two [5] point loads as shown in figure. Draw the SFD and BMD for the beam.
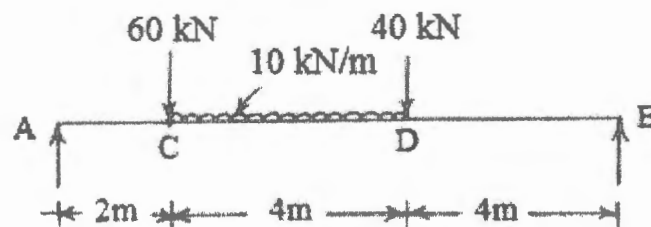
13. a) A beam of T-section is subjected to a shear force of 50kN. The dimensions of the beam [7]
     are 100mm × 100mm × 20mm. Calculate the shear stress at the neutral axis and at the
     junction of the web and the flange.

     b) Write the significance of Mohr's circle and its uses.   [3]

14. a) A cantilever beam rectangular cross section carries a UDL over whole span. The [5]
     deflection at the free end is 'Y'. If the distributed load and also depth of the beam is
     doubled. Determine the deflection at free end.

     b) A solid shaft of 200mm diameter has a same cross sectional area as a hollow shaft of [5]
     the same material with inside diameter of 150mm. Find the ratio of i) power transmitted
     by both the shafts at the same angular velocity. ii) Angles of twist in equal lengths of
     these shafts, when stressed to the same intensity.

15. a) A column of timber section 15cm × 20cm is 6m long both ends being fixed. If the [5]
     young's modulus for timber is $17.5kN/mm^2$. Determine i) crippling load and ii) safe
     load for the column if factor of safety is 3.

     b) Derive the expressions for circumferential and longitudinal stresses in thin cylinder [5]
     closed at both ends and subjected to an internal fluid pressure.

16. a) A bar of 25mm diameter is subjected to a pull of 40kN. The measured expression on [5]
     gauge length of 200mm is 0.085mm and the change in diameter is 0.003mm. Calculate
     the Poisson's ratio and the value of three moduli.

     b) Show that for a beam subjected to pure bending, neutral axis coincides with the centroid [5]
     of the cross section.

17. Answer any *two* of the following:

     a) For a rectangular section, show that the maximum shear stress is 3/2 times the [5]
        average Shear stress.

     b) Calculate the thickness of metal necessary for a thick cylinder of internal diameter [5]
        150mm to withstand and internal pressure of 50MPa. The maximum hoop stress in
        the section is not to exceed 150MPa.

     c) The maximum allowable shear stress and bending stress in solid shaft is 80MPa [5]
        and 120MPa respectively. Determine the diameter of the shaft if it is subjected to a
        torque of 4kN-m and bending moment of 3kN-m.

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