Reg. No. _____

Karunya University

(Karunya Institute of Technology and Sciences)

(Declared as Deemed to be University under Sec.3 of the UGC Act, 1956)

Model Question Paper

Subject Title:MECHANICS OF SOLIDS **Time : 3 hours**

Subject Code:12CE264 **MaximumMarks: 100**

Answer ALL questions

PART – A (10 x 1 = 10 MARKS)

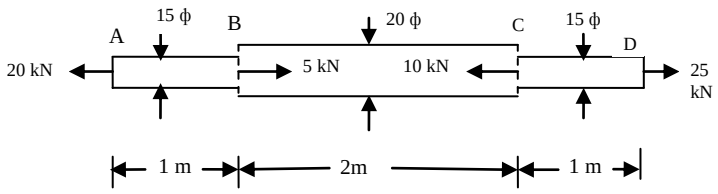
1. The total change in length of a bar of different sections is equal to_____.
2. In a thin shell, what is the ratio of longitudinal stress to the circumferential stress?
3. If a cantilever beam is subjected to a point load at its free end, the shear force under the point load is _____.
4. The bending moment at the centre of a simply supported beam carrying a uniformly distributed load is, _____.
5. Define neutral axis.
6. When the closely coiled spring is subjected to an axial load, it is said to be under_____.
7. 7. When a body is subjected to the mutually perpendicular stress σ_x and σ_y, the centre of the Mohr's circle from Y-axis is taken as, _____.
8. The magnitude of direct stress across a principal plane is called_____.
9. What is the slope at the supports of a simply supported beam carrying a point load at its centre?
10. A column of length *l* is hinged at its both ends. Its equivalent length is _____.

PART – B (5 x 3 = 15 MARKS)

11. A steel rod 1 m long and 20 mm x 20 mm in cross-section is subjected to a tensile force of 40 kN. Determine the elongation of the rod if modulus of elasticity for the rod material is 200 GPa.
12. Write the relationship between shear force and bending moment.
13. A hollow shaft of external and internal diameter of 80 mm and 50 mm is required to transmit torque from one end to the other. What is the safe torque it can transmit if the allowable shear stress is 45 MPa?
14. Define principal planes and principal stresses and explain their uses.
15. Write the expressions for the crippling load of column for the following conditions:
    i. Both ends hinged
    ii. Both ends fixed
    iii. One end fixed and the other free.

PART – C (5 x 15 = 75 MARKS)

16. A steel bar ABCD 4m long is subjected to forces as shown in Figure. Determine the elongation of the bar. Take E = 200 GPa for steel.

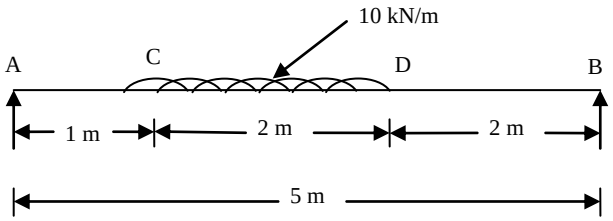


(OR)

17. Answer all the following:
    a. A spherical shell of 2mm diameter is made up of 10 mm thick plates. Calculate the change in diameter and volume of the shell, when it is subjected to an internal pressure of 1.6 MPa. Take E = 200 GPa and poisson's ratio = 0.3. (8)

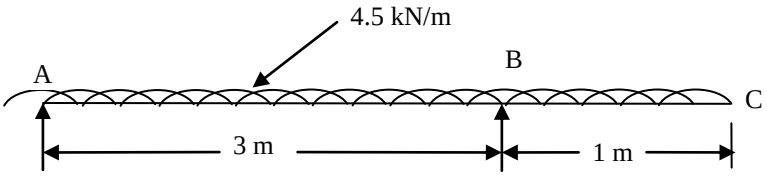
    b. A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the three moduli. (7)

18. A simply supported beam of span 5m is loaded with a uniformly distributed load of 10 kN/m over a length 2m as shown in Figure. Draw the shear force and bending moment diagrams for the beam indicating the value of maximum bending moment.



(OR)

19. An overhanging beam ABC is loaded as shown in Figure. Draw the shear force and bending moment diagrams and find the point of contraflexure, if any.



1.

20. a)A rectangular beam 300 mm deep is simply supported over a span of 4m. What uniformly distributed load the beam may carry, if the bending stress is not to exceed 120 MPa? Take I = 225 x 10^6 mm^4. (8)
    b) Derive the bending equation with a neat sketch. (7)

(OR)

20. a)A hollow shaft is to transmit 200 kW at 80 rpm. If the shear stress is not to exceed 60 N/mm^2 and internal diameter is 0.6 of the external diameter, find the diameters of the shaft. (8)

b) A closely coiled helical spring of mild steel wire 5 mm in diameter having 12 complete coils of 50 mm mean diameter is subjected to an axial load of 100 N. Find the deflection of the spring and the maximum shear stress in the material. Modulus of rigidity C = 80 x 10^3 N/mm^2. (7)

21. The stresses at point of a machine component are 150 N/mm^2 and 50 N/mm^2,both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55 degrees with the axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component.

(OR)

22. The stresses at a point in a component are 100 N/mm^2 (tensile) and 50 N/mm^2 (compressive). Find the magnitude of normal and shear stresses on a plane inclined at an angle of 25 degrees with tensile stress. Also determine the direction of the resultant stress and magnitude of the maximum intensity of shear stress. Use Mohr's circle method.

23. A simply supported beam AB of span 5 m is carrying a point load of 30 kN at a distance 3.75 m from the left end A. Calculate the slopes at A and B and deflection under the load. Take EI = 26 x10^{12} N/mm^2.

(OR)

24. Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at its both ends. Take E = 205 x 10^3 N/mm^2. Also determine crippling load by Rankine's formula using constants as 335 N/mm^2 and 1/7500.