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Total Number of Pages: 02

Course: B.Tech/IDD
Sub_Code: RME3C001

3rd Semester Back Examination: 2024-25
SUBJECT: Mechanics of Solid
BRANCH(S): MMEAM, CIVIL, CE, AUTO, AERO, MECH, ME
Time: 3 Hours
Max Marks: 100
Q.Code: R571

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions:

(2 x 10)

- Define Resilience.
- What are different types of loadings?
- What are principal planes?
- Differentiate between thin cylinder & thick cylinder.
- Write the equation for simple bending theory.
- What do you mean by point of contraflexure?
- Enlist the methods for finding out the slope and deflection at a section.
- Write down the assumptions in Euler's column theory.
- Define torsional rigidity.
- Define springs. What are the different types of springs?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)

(6 x 8)

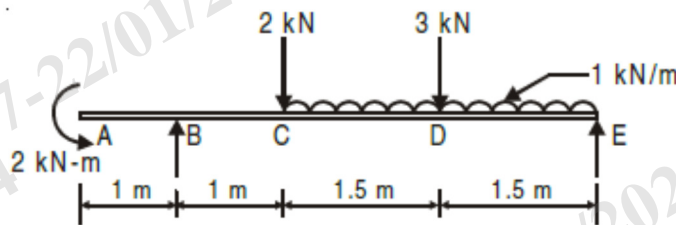
- Draw stress - strain curve for a mild steel rod subjected to tension and explain about the salient points on it.
- A bar of 25 mm diameter is subjected to a pull of 50 kN. The measured extension on gauge length of 200 mm is 0.005 mm and the change in diameter is 0.025 mm. Calculate the value of Poisson's ratio and the three moduli.
- A rectangular block of material is subjected to a tensile stress of 110 N/mm² on one plane and a tensile of 47 N/mm² on a plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm². Determine the principal stresses, principal planes, and the maximum shear stresses.
- Distinguish between circumferential stress and longitudinal stress in a cylindrical shell, when subjected to an internal pressure.
- Draw the S.F. & B.M. diagrams for simply supported beam of length 'L' carrying a point load 'W' at its middle point.
- A cantilever beam of 1.4 m length carries a uniformly distributed load of 1.5 kN/m over its entire length. Draw S.F. and B.M. diagrams for the cantilever.

- g) A rectangular beam 60 mm wide and 150 mm deep is simply supported over a span of 6m. If the beam is subjected to central point load of 12 kN, find the maximum bending stress induced in the beam section.
- h) A beam of length 5 m is simply supported at its ends and carries two point loads of 47 kN and 30 kN at a distance of 1.1 m and 3.2 m respectively from the left support. Find the deflection under each load. Take, $I = 85 \times 10^6 \text{ mm}^4$ and $E = 2 \times 10^5 \text{ N/mm}^2$.
- i) Derive the Euler's buckling load for a column with one end fixed and other end hinged.
- j) Compare and contrast between torsion, bending and torque.
- k) A closely coiled helical spring made out of a 10 mm diameter steel bar has 12 complete coils, each of mean diameter of 100 mm. Calculate the stress induced in the section of rod, If It is subjected to an axial pull of 200 N and Modulus of rigidity is $0.84 \times 10^5 \text{ N/mm}^2$.
- l) What is the importance of impact tests? Describe the Izod test.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3 A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15.5 mm diameter to which it is rigidly joined at each end. If, at a temperature of 10°C there is no longitudinal stress, Analyze the stresses in the rod and the tube when the temperature is raised to 200°C . Take $E_s = 2.1 \times 10^5 \text{ N/mm}^2$, $E_c = 1 \times 10^5 \text{ N/mm}^2$, $\alpha_s = 11 \times 10^{-6} \text{ per } ^\circ\text{C}$ and $\alpha_c = 18 \times 10^{-6} \text{ per } ^\circ\text{C}$. (16)
- Q4 An elemental cube is subjected to tensile stresses of 30 N/mm^2 and 10 N/mm^2 acting on two mutually perpendicular planes and a shear stress of 10 N/mm^2 on these planes. Draw the mohr's circle for the stresses and determine the magnitudes and direction of principal stresses and also the greatest shear stress. (16)
- Q5 Draw the shear force and bending moment diagram for the beam as shown below. (16)



- Q6 a) Derive the torsion equation for a circular shaft of diameter 'd' subjected to torque 'T'. (8+8)
- b) Find the torque that can be transmitted by a thin tube 40 mm mean diameter and wall thickness 2 mm. The permissible shear stress is 40 MPa.