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Total Number of Pages : 02

B.Tech
RME3C001

3rd Semester Regular Examination 2019-20
MECHANICS OF SOLID
BRANCH : AERO, AUTO, CIVIL, ENV, MECH
Max Marks : 100
Time : 3 Hours
Q.CODE : HR838

Answer Question No.1 (Part-1) 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 Only Short Answer Type Questions (Answer All-10) (2 x 10)

- a) State principle of Superposition.
- b) Define Resilience.
- c) How do you determine shear force at any section in a beam?
- d) Give the expression for strain energy due to axial force.
- e) What is the use of Mohr's circle?
- f) Write any two assumptions in the theory of simple bending.
- g) Determine the diameter of shaft, which will transmit 150 kW at 250 rpm, the maximum shearing stress is limited to 100 N/mm².
- h) Write down the assumptions in Euler's column theory.
- i) Write assumptions made in theory of pure torsion.
- j) The mean coil diameter of a helical spring and diameter of the coil are 100 mm and 10 mm respectively. Find the spring index if it carries an axial load of 20 N.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

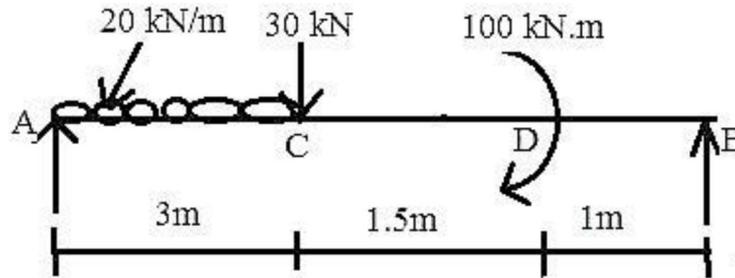
- a) Distinguish between plane stress and plane strain problems.
- b) Derive the relationship between modulus of elasticity and modulus of rigidity.
- c) Obtain a relation for change in length of a bar hanging freely under its own weight.
- d) Draw the Mohr's circle for a state of pure shear and indicate the principal stresses.
- e) Summarize and sketch the types of supports used for a beam indicating the reactions in each case.
- f) Derive equation for pure bending with usual notations.
- g) Derive an expression for deflection of a simply supported beam carrying an eccentric point load.
- h) Derive an expression for strain energy stored in a body due to torsion.
- i) Distinguish between flexural rigidity and torsional rigidity.
- j) Derive the Euler's buckling load for a column with one end fixed and other hinged.
- k) Define springs. Classify the different types of springs.
- l) A closely coiled helical spring made out of a 10mm diameter steel bar has 15 complete coils, each of mean diameter of 100mm. Calculate the stress induced in the section of rod, if it is subjected to an axial pull of 220N. Modulus of rigidity is 0.85×10^5 N/mm².

Part-III

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

Q3 Three bars made of copper, zinc and aluminium are of equal length and have cross-section 500, 700 and 1000 mm², respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 250 kN, estimate the proportional of the load carried on each rod and the induced stresses. Take the value of E for copper = 1.3×10^5 N/mm², for zinc = 1×10^5 N/mm² and for aluminium = 0.8×10^5 N/mm². (16)

Q4 Draw the shear force and bending moment diagram for the beam as shown below. (16)



Q5 A beam AB of span 12 m is simply supported at its ends is subjected to a point load of 40kN at C at a distance of 4 m from left end. Using moment area method, Compute the deflection at the point C, slope at the points A, B and C. Take $I = 5 \times 10^8$ mm⁴ and $E = 210$ GPa. (16)

Q6 A steel shaft ABCD having a total length of 2800mm is contributed by three different sections as follows. The portion AB is hollow having outside and inside diameters 100mm and 60mm respectively. BC and CD are solid having diameters 70mm and 60mm respectively. If the angle of twist is same for each section, determine the length of each portion and the total angle of twist. Maximum permissible shear stress is 80 MPa and shear modulus 0.85×10^5 MPa. (16)