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B. Tech. EXAMINATION, 2020

(Third Semester)

(B Scheme) (Re-appear Only)

(ME, AER)

ME203B

STRENGTH OF MATERIALS-I

Time : 2½ *Hours*] [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Four* questions in all. All questions carry equal marks.

1. (a) Draw stress-strain diagram for a typical mild steel depicting the various strength parameters such as proportional limit, yield strength etc. on the curve.

(b) Explain the following concepts :

(i) Elastic, inelastic and plastic deformations

(ii) Proof strength

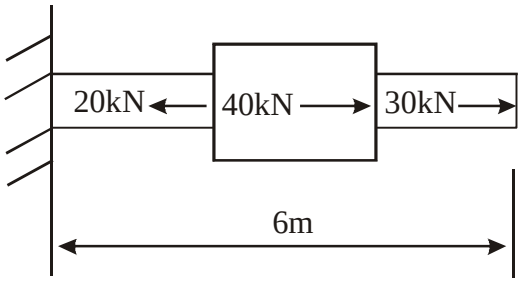
(iii) Rigid and deformable bodies.

2. A rod consists of three bars each of 2 m length made of the same material with Modulus of elasticity equal to 2×10^5 N/mm^2. The diameters of the bars are 20 mm, 40 mm and 30 mm respectively. The rod is fixed at one end and is loaded as shown in figure below :

(a) Calculate the stress in each bar.

(b) Calculate the total strain energy

(c) Determine the elongation of the rod.



3. (a) Considering a beam element of length Dx and showing the sign convention adopted for load, shear force and bending moment, derive relations among the shear force, bending moment and load.

(b) Derive expressions for shear force and bending mement diagrams and draw them for a uniformly loaded (load intensity q) simply supported beam of length L.

4. Determine the requisite expression for deflection and slope of a simply supported beam of span length L and uniformly loaded with load intensity q.

5. (a) Adopting a cylindrical coordinate system *r*-θ-*z*, depict with the help of a diagram a torque T acting on circular shaft of uniform cross section.

(b) Derive the torsion stress formula from the first principle clearly stating the assumptions made in arriving at the formula. Show that the shear stress so produced is $T_{\theta z}$.

6. For a column with fixed-fixed end conditions, (i) Derive the governing equation; (ii) Solve the governing equation to get the formula for the Euler critical stress as a function of slenderness ratio. Discuss the validity of Euler's formula from curve between Euler critical stress and slenderness ratio.

7. (a) Derive the bending stress formula clearly stating the assumptions employed therein.

(b) Consider a beam of I-section with dimensions of your convenience loaded with a bending moment M. Adopting a sign convention and a coordinate system, locate the position of the neutral axis and determine section moment of inertia.

8. A simply supported beam of length 20 metres has three concentrated load of 5 kN each symmetrically placed at equal interval. Calculate the deflection at the location of each load and the value and location of maximum deflection by adopting a method of your choice. Assume $E = 2 \times 10^5$ N/mm^2.