SE Sem III (R 2019) "Mechanical" Nov-Dec 2022

23/11/2022

Paper / Subject Code: 51622 / Strength of Materials

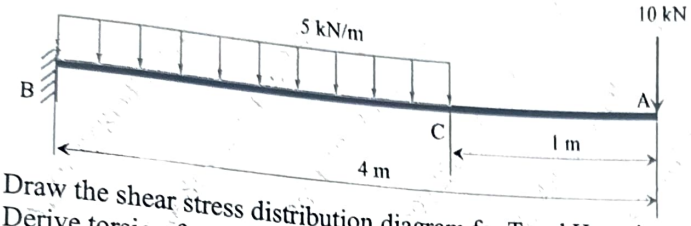
(3 Hours) **[Total Marks : 80**

NB: 1. Question no. 1 is compulsory
2. Attempt any three questions from Q2 to Q6
3. Figures to the right indicates maximum marks

Q1 Attempt any **four** of the following (20M)

(a) For a given material the modulus of rigidity is 80E3 N/mm^2. The poisons ratio is 0.35. Calculate the bulk modulus.

(b) For the beam loaded as shown in figure below draw Shear force diagram.

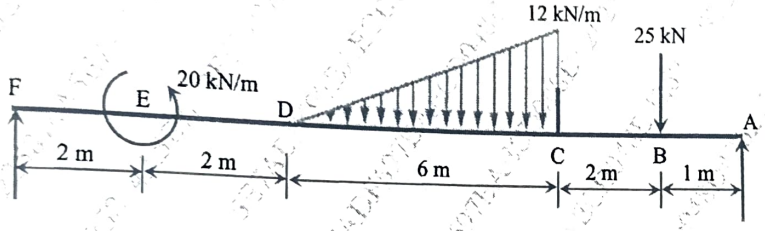


(c) Draw the shear stress distribution diagram for T and H section.

(d) Derive torsion formula.

(e) State limitations of Eulers column theory.

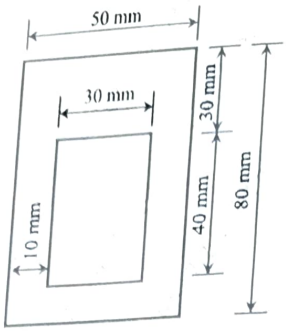
Q2 (a) For the beam loaded as shown in figure below draw shear force and bending moment diagram. (10M)



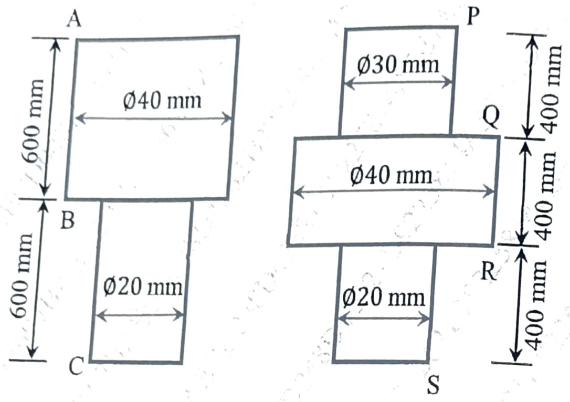
(b) A solid shaft is required to transmit 300 kW at 100 RPM. The maximum torque is 20% greater than the mean torque. Find the diameter of the shaft if the shear stress is not to exceed 80 N/mm^2. If the above shaft is to be replaced by hollow shaft with 3:5 diameter ratio and no change in maximum shear stress and torque, calculate the inner and outer diameters of hollow shaft. (10M)

Q3 (a) A beam of hollow rectangular section shown below is acted upon by highest sagging bending moment of 30 kN-m. Draw the bending stress distribution diagram. (10M)

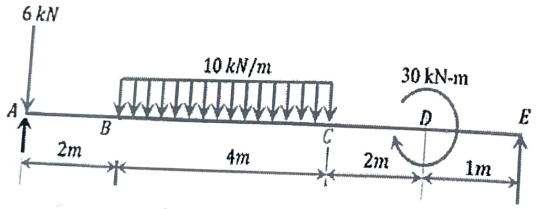
(iv) A diabetic flame temperature [08]



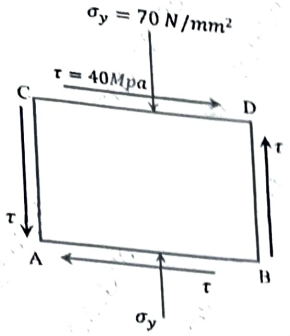
(b) Both machine components AC and PS are acted upon by a tensile load of 50 kN. Find the ratio of their strain energies. Take E = 2E5 N/mm^2. (10M)



Q4 (a) For the beam with supports at A and E, loaded as shown in figure find the slope at point A and deflection at point C. Assume EI = Constant. (10M)

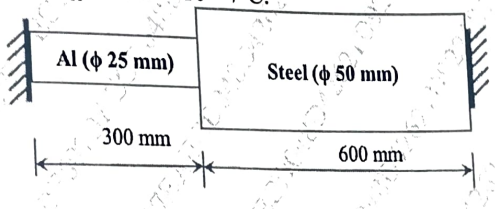


(b) At a point in a material is acted upon by compressive stress of 70 MPa intensity in Y direction accompanied by shear stress of 40 MPa as shown in figure. Determine the principal stresses. Also determine values of normal and tangential stresses at a plane 20 degrees to the plane DB. (10M)



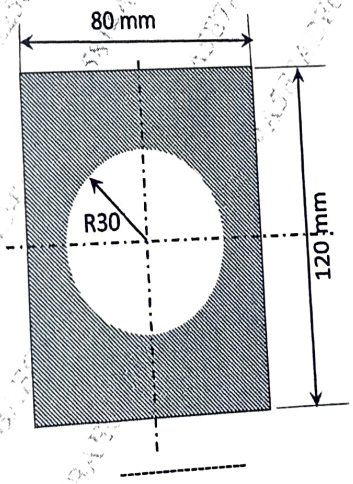
Q5 (a) A cylindrical shell is of 3 m length, 1 m diameter and 10 mm thickness. The shell is subjected to an internal pressure of 1.5 MPa. Find circumferential, longitudinal and shear stresses. Also find change in diameter, length and volume. Take E = 200 GPa and 1/m = 0.3 (10M)

(b) A composite bar made up of aluminium and steel is held between supports. The bars are stress free at 40°C. What will be the stresses in the bars if the temperature is dropped down to 20°C if (i) the supports are non-yielding and (ii) the supports can come closer by 0.1 mm. Take E_S= 210 GPa, E_A= 74 GPa, α_S= 11.7 x 10 $^{-6}$/°C α_A = 23.4 x 10 $^{-6}$/°C. (10M)



Q6 (a) Find the Euler's crippling load for the hollow circular cylindrical column of 50 mm OD and 5 mm thickness. Both ends of the column are hinged and length of the column is 2.5 m. Also determine the Rankine's crippling load for the same column. Take E=2E5 MPa, σ_c = 350 MPa and 1/α = 1600 (10M)

(b) For the beam of cross section as shown in figure, draw the shear stress distribution diagram, if acted upon by shear stress of 50 kN (10M)



(iv) Adiabatic flame temperature [0