SV - 79

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Seat No.	

S.E. (Mechanical) (Semester - IV) Examination, May - 2018

ANALYSIS OF MECHANICAL ELEMENTS

Sub. Code: 63361

Day and Date : Monday, 07 - 05 - 2018 **Total Marks : 100**

Time :10.00 a.m. to 1.00 p.m.

Instructions :

1) **All questions are compulsory.**
2) **Assume suitable data wherever necessary and state it clearly.**
3) **Figures to the right indicate full marks.**
4) **Draw neat and labeled sketches wherever necessary.**
5) **Use of non programmable calculator is allowed.**

Q1) a) Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 50 cm apart as shown in Fig. 1. Diameters and lengths of each rod are 2 cm and 4 m respectively. A cross a bar fixed to the rods at the lower ends carries a load of 5000 N such that the cross bar remains horizontal even after loading. Find the stress in each rod and the position of the load on the bar. Take E for steel = 2×10^5 N/mm^2 and E for copper 1×10^5 N/mm^2. **[12]**

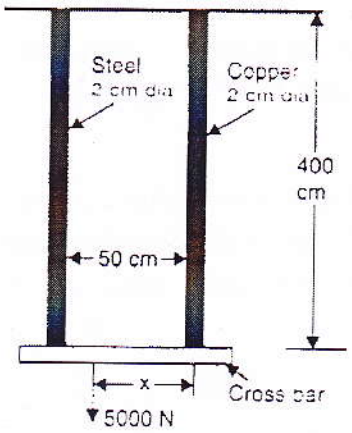

Fig. 1

P.T.O.

b) Explain the stress strain curve for ductile and brittle material with the help of neat sketch. **[6]**

OR

b) Find the angle of twist per meter length of hollow shaft of 100 mm external and 60 mm internal diameter. If the shear stress is not to exceed 35 N/mm^2. Take modulus of rigidity as 85×10^3 N/mm^2. **[6]**

Q2) Draw SFD and BMD for loading condition shown in fig 2. Locate point of inflection if any. **[16]**

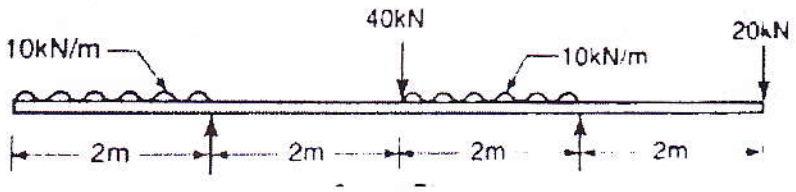

Fig. 2

Q3) The tension flange of a cast iron I section beam is 240 mm wide and 50 mm deep, the compression flange is 100 mm wide and 20 mm deep whereas web is 300 mm × 30 mm as shown in fig. 3. Find the load per meter run which can be carried over a 4m span by a simply supported beam, if the maximum permissible stresses are 90 N/mm^2 in compression and 24 N/mm^2 in tension. **[16]**

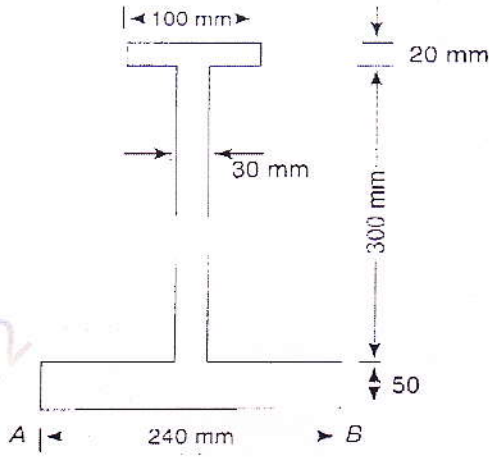

Fig. 3

Q4) a) Derive the expression for the principal stresses and the maximum shear stress for a member subjected to like direct stresses in mutually prependicular directions. Show the locations of Principal Planes and Planes of Maximum shear stress. **[9]**

b) The stresses on the two perpendicular planes through a point are 120 MPa (tensile), 80 MPa (Compressive), 60 MPa (Shear). Determine the normal and shear stress components on a plane at 60° to that of the 120 MPa stress and also the resultant and its inclination with normal components on the plane. **[9]**

OR

b) The cross section of a beam is T section 120mm × 200mm × 12mm Fig. 4 with 120mm side horizontal. Sketch the shear stress distribution and hence find the maximum shear stress if it has to resist a shear force of 200 kN. **[9]**

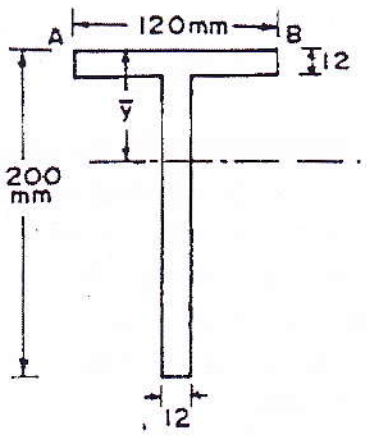

Fig.4

Q5) a) Derive the expression for slope and deflection of a cantilever subjected to uniformly distributed load (UDL) over whole length using double integration method. **[8]**

b) A cantilever beam of span 4 m carries a point load of 20 kN at a distance of 3 m from the fixed end. Determine, by moment area method the slope and deflection at the free end of the cantilever Assume $EI = 9\times10^{12}$ N mm^2. **[8]**

OR

b) State the importance of theories of failure and explain the maximum strain energy theory. **[8]**

Q6) a) Explain the concept of Equivalent Length and slenderness ratio of the column. Discuss the limitation of the Euler's Formula. **[8]**

b) A tension bar 5 m long (Fig. 5) is made up of two parts, 3m of its length has a cross sectional area of 10 cm^2 while the remaining 2 m has an cross sectional area of 20 cm^2. An axial load of 80 kN is gradually applied. Find the total strain energy produced in the bar of the same length and having the same volume when under the same load. Take $E = 2 \times 10^5$ N/mm^2. **[8]**

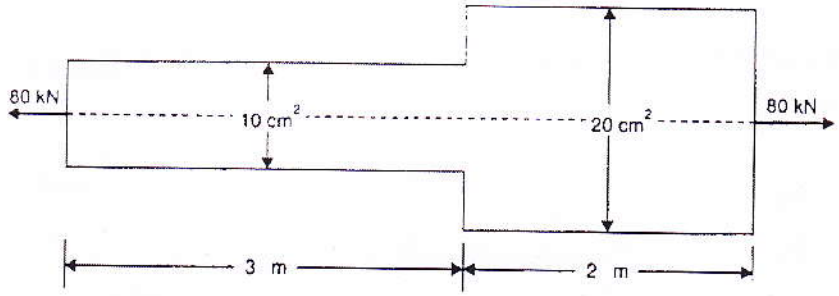

Fig. 5

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