

TME-303

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ODD SEMESTER EXAMINATION, 2019-20

B. Tech: MECHANICAL/MECHATRONICS/CIVIL/AUTO. ENGG.

Solid Mechanics

Time: 2:00 hrs.

M.M: 50

Total no. of printed pages: 2

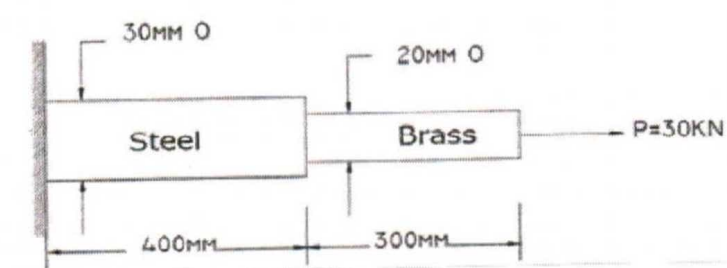
Note : (i) Attempt ALL questions.

(ii) In case of numerical problems assume data whenever not provided.

Q1. Answer any four of the following

4x05=20 Marks

- Derive an expression for strain at a point
- State the generalized Hook's law and prove for an anisotropic elastic material the maximum number of elastic constants is 21 only. Also show that for isotropic materials it is 2.
- What is shear force and bending moment? Also explain the concept of sagging and hogging.
- Derive an expression of equilibrium in X,Y,Z direction, by considering the equilibrium of an infinitesimal rectangular element of size dx, dy, dz in the Cartesian co-ordinate system.
- What is Macaulay's methods of beam deflection analysis? What are its advantages over the direct integration methods .
- The Composite bar shown in figure is subjected to a tensile force of 30 KN. The extension observed is 0.372mm. Find the Young Modulus of brass, If Young Modulus of steel is 2×10^5 N/mm²



Q2. Answer any four of the following

04x05=20Marks

- Draw and explain stress and strain diagrams for ductile and brittle materials.
- Explain Cauchy's stress theorem.
- Derive an expression of deflection for cantilever of length 'l' carrying UDL of 'w' per unit run for a distance 'a' from a fixed end
- What do you understand by the term "Theories of failure"? Explain any two theories of failure.

P.T.O

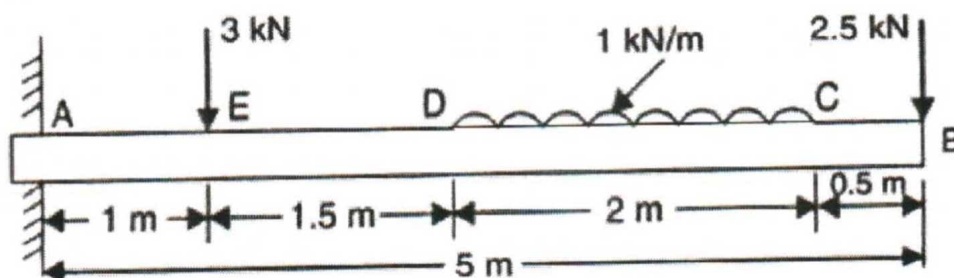
- e) A bolt 20mm in diameter is subject to a direct tensile force of 15kN and a shearing force of 10kN. Determine the following stresses on a plane inclined at 60° to the bolt axis

(i) Normal stress (ii) Shear stress (iii) Resultant stress (iv) shear stress

Q3. Answer any two of the following

02x10=20Marks

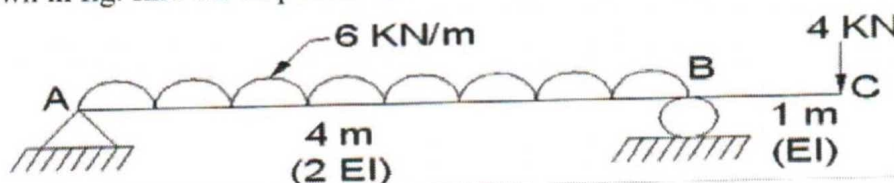
- a) Write the assumption of pure torsion and also Drive the torsional equation for a solid shaft.
b) Draws shear force and bending diagram for the beam shown in figure.



Q4. Answer any two of the following

02x10=20Marks

- a) Derive the equation of deflection curve.
b) State and derive the Reciprocity theorem.
c) For the beam shown in fig. find the slope and deflection at 'C'. also find the maximum deflection.



Q5. Answer any four of the following

04x05=20Marks

- a) Explain Castigliano's theorem also proof the statement for the same.
b) Write a short note on Maxwell's Reciprocal theorem for elastic system.
c) Derive an expression of strain energy due to bending.
d) A ship's propeller shaft has external and internal diameters of 25 cm and 15 cm. What power can be transmitted at 110 rev/minute with a maximum shearing stress of 75 MN/m^2 , and what will then be the twist in degrees of a 10 m length of the shaft? $G = 80 \text{ GN/m}^2$
e) Derive the simple bending of a beam formulawith usual notation. Give the assumption in theory of pure bending

$$\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$$