Question Paper

Exam Date & Time: 16-Nov-2018 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
III SEMESTER B S ENGINEERING THEORY EXAMINATION-NOVEMBER 2018
STRENGTH OF MATERIALS [CE 232A]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

Missing data, if any, may be suitably assumed

1) Define (4)

A) i) Young's modulus ii) Bulk modulus iii) Factor of safety iv) Poisson's ratio

B) A 25 mm diameter brass rod is 750 mm long and subjected to an axial tension of 56 kN. The contraction in diameter and extension in length are found to be 0.0089 mm and 0.95 mm respectively. Determine Poisson's ratio, modulus of elasticity and change in volume of the bar. (8)

C) Derive an equation for deformation in tapering circular bar subjected to axial load P. (8)

2) Derive the relationship between Young's modulus, and Shear modulus of a materials. (8)

A)

B) Two copper and a steel rod together support a rigid uniform bar of weight P as shown in figure 2b. Determine safe maximum value of P if the stress in steel and copper is not to exceed 120MPa and 60MPa respectively. Assume $E_S = 2\ E_C$. (12)

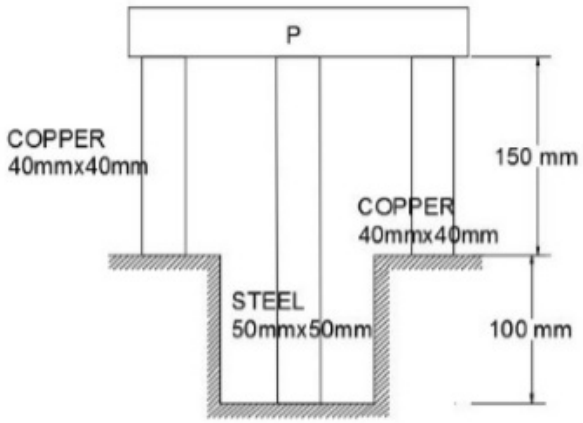

Figure 2b

3) Prove with usual notations, Torsion equation i.e., $\frac{T}{J} = \frac{G\theta}{L} = \frac{f_s}{r}$ (10)

A)

B) A hollow circular shaft has to transmit 225KW of power at 200RPM. (10)

Determine the external and internal diameter of shaft if the max shear stress is not to exceed 50Mpa and twist is not to exceed 1^O in a length of 3000 mm, the maximum torque shall be taken as 50% higher than mean torque, adopt diameter ratio = 1.25, take G= $8x10^4$ N/mm^2.

4) A) Draw the SFD and BMD for the beam shown in figure 4a. Indicate the maximum bending moment and its location. Also indicate point of contra flexure if any. (10)

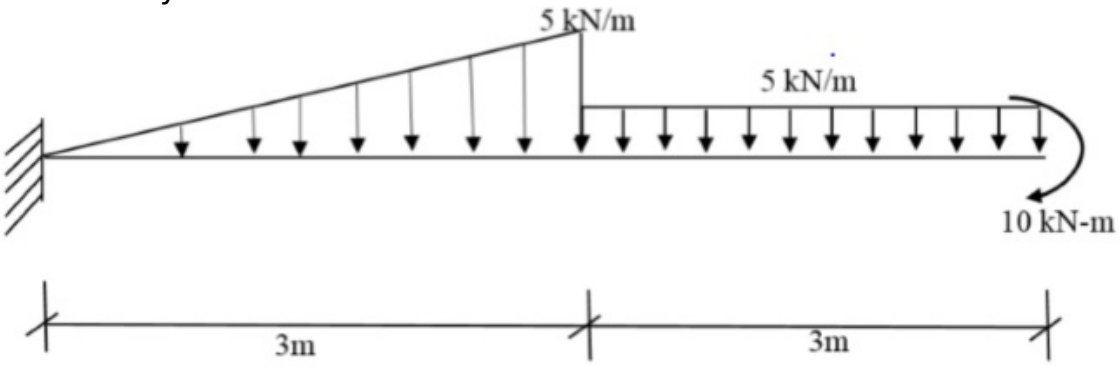

Figure 4a

B) For the beam shown in figure 4b. Draw the shear force and bending moment diagram and mark salient points. (10)

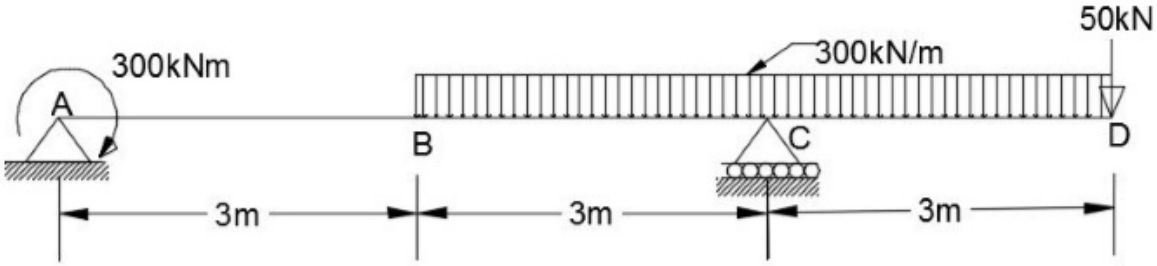

Figure 4b

5) A) The two dimensional stress system acting on an element in a body consist of tensile stresses of magnitude 100 MPa and 60 MPa on mutually perpendicular planes together with shear stress of magnitude 50 MPa. Find principal stress their planes, maximum shear stress and planes represent your answer in neat sketches. (12)

B) At a point in an elastic material direct stresses 126 N/mm^2 (tensile) and 94 N/mm^2 (compressive) are applied on planes at right angles to each other. If the maximum principal stress is limited to 145 N/mm^2 (tensile). Determine the shear stress that may be allowed at the point in the same plane. (8)

6) A) A cantilever beam of span L carries UDL of intensity w over the entire span. Determine
i) Maximum slope ii) Maximum deflection. (8)

B) A 6m long beam ABCD consists of overhanging AB= 2m and BD = 4m. It carries concentrated loads at free end A of magnitude 30 kN and at C the centre of BD 60 kN. Determine the maximum deflection where it (12)

occurs.

7) A) A cantilever beam 300mmx400mm in section weighing 7.5 kN/m is subjected to a load of 5 kN as shown in figure 7a. Determine the maximum stress developed at a section 2 m from free end. Sketch the stress distribution. (10)

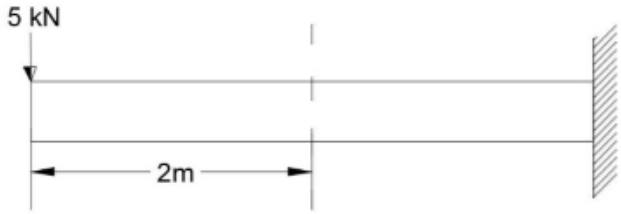

Figure 7a

B) Define neutral axis, section modulus and state assumptions made in simple bending theory. (10)

8) A) State assumptions made in Euler's theory of long column and explain the limitation of Euler's formula. (8)

B) Figure 8b shows the section of a steel column of 3m length and whose ends are hinged. Calculate the safe load that the column can carry if FOS=3. Assume fc= 350N/mm^2, a=1/7500. (12)

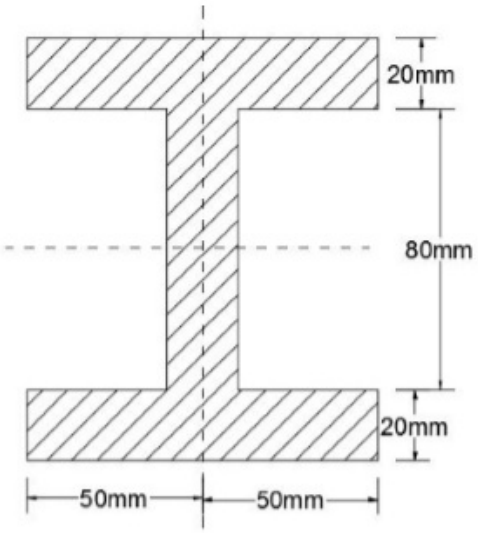

Figure 8b

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