CBCS SCHEME

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15MR34

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define i) Plasticity ii) Ductility iii) Brittleness iv) Toughness. **(08 Marks)**

b. Derive the expression of a bar of uniform cross section due to self weight. **(08 Marks)**

OR

2 a. Derive relation between Young's modulus , Modulus of rigidity and Bulk modulus. **(08 Marks)**

b. A composite section comprises of a steel tube 10cm internal diameter and 12cm external diameter , fitted inside a brass tube of 14cm internal diameter and 16cm external diameter. The assembly is subjected to a compressive load of 500KN. Find the load carried by the tubes and the stresses induced in them. The length of tube is 150cm. Take E_S = 200GPa and E_B = 100 GPa. What is the change in length of tubes? **(08 Marks)**

Module-2

3 a. At a point in a strained material the principal tensile stresses across two perpendicular planes are 80N/mm^2 and 40N/mm^2. Determine the normal stress, shear stress and the resultant stress on a plane inclined at 20^0 with major principal plane. Determine also the angle of obliquity. What will be the intensity of stress which acting alone will produce the same maximum strain if Poisson's ratio = ¼. **(08 Marks)**

b. At a point in a strained material the stresses on two planes at right angles to each other are 80N/mm^2 and 40N/mm^2 and shear stress 60N/mm^2. Determine by Mohr's circle
i) Normal stress ii) Shear stress iii) Resultant stress on an oblique plane inclined at an angle of 45^0 to the axis of minor tensile stress. **(08 Marks)**

OR

4 a. Derive the expressions for circumferential and longitudinal stresses in thin cylinder. **(08 Marks)**

b. A thick cylinder of 500mm inner diameter is subjected to an internal pressure of 9 MPa. Taking allowable stress for the material of the cylinder as 40 MPa, determine the wall thickness of the cylinder. Also plot the stress distribution across the thickness of the cylinder. **(08 Marks)**

Module-3

5 a. Derive the relationship between Load , Shear force and Bending moment. **(04 Marks)**

b. Draw the shear force and bending moment diagram for the cantilever beam shown in fig. Q5(b). **(12 Marks)**

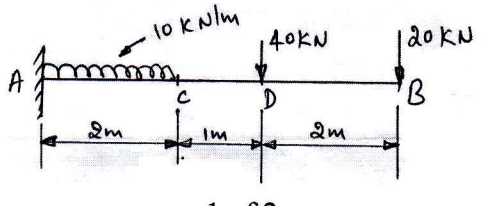

Fig.Q5(b)

OR

6 a. Draw SFD and BMD for a simply supported beam with a point load at mid – point. **(06 Marks)**

b. A simply supported beam AB of 6m span is loaded as shown in fig. Q6(b). Draw the SFD and BMD. **(10 Marks)**

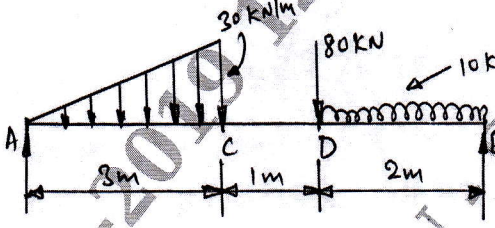

Fig.Q6(b)

Module-4

7 a. What are the assumptions made in simple bending? Derive relationship between bending stress and radius of curvature. **(08 Marks)**

b. A beam of an 'I' Section 200mm × 300mm has web thickness 10mm and flange thickness 10mm. It carries a shearing force of 10KN at a section. Sketch the shear stress distribution across the section. **(08 Marks)**

OR

8 a. Prove that in a rectangular cross section maximum shear stress is 1.5 times the average shear stress. **(08 Marks)**

b. Find deflection of a cantilever beam with a point load at the free end. **(08 Marks)**

Module-5

9 a. Find the maximum torque that can be applied to a shaft of 300 mm diameter. The permissible angle of twist is 1.5^0 in a length of 5m and the shear stress in not to exceed $42N/mm^2$. Modulus of rigidity = 84 GPa. **(08 Marks)**

b. A solid shaft rotating at 1000 rpm transmits 50KW. Maximum torque is 20% more than the mean torque. Material of the shaft has the allowable shear stress of 50MPa and modulus of rigidity 80GPa. Angle of twist in the shaft should not exceed 1^0 in one meter length. Determine the diameter of the shaft. **(08 Marks)**

OR

10 a. Derive the expression of Euler's crippling load for a column when one end of the column is fixed and other end is hinged or pinned. **(08 Marks)**

b. A 1.5m long column has a circular C/S of 50mm diameter. One end of the column is fixed and the other end is free. Taking the FOS as 3, calculate the safe load using

i) Rankine's formula $\sigma = 560$ MPa , $\alpha = 1/1600$.

ii) Euler's formula $E = 1.2 \times 10^5$ MPa. **(08 Marks)**

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