CBCS SCHEME

USN

18AE/AS33

Third Semester B.E. Degree Examination, Jan./Feb. 2023
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define Stress and derive the stresses on inclined plane for uniaxial loading condition. **(08 Marks)**

b. Draw stress-strain curve for the given materials mentioning salient features:
i) Steel ii) Aluminium iii) Glass iv) Rubber **(04 Marks)**

c. A point in a strained material is subjected to a tensile stress of 120 N/mm^2 and compressive stress of 80 N/mm^2 acting at right angles to each other. Find the normal stress, tangential stress and its obliquity on a plane inclined at an angle 30° with the axis of compressive stress. Also find the maximum shear stress. **(08 Marks)**

OR

2 a. Define the following :
i) Volumetric strain ii) Shear strain iii) Shear stress iv) Poisson's ratio
v) Young's modulus vi) Principal stress **(06 Marks)**

b. Derive the elongation in uniform section bar. **(06 Marks)**

c. Determine the magnitude of the load "P" necessary to produce zero net change in the length of the straight bar shown in Fig.Q2(c). A = 400 mm^2.

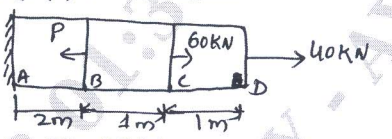

Fig.Q2(c) **(08 Marks)**

Module-2

3 a. Discuss types of beams and derive for relation between loads, shear forces and bending moment. **(10 Marks)**

b. Find the reactions at the fixed and draw the SFD and BMD for the cantilever shown in Fig.Q3(b).

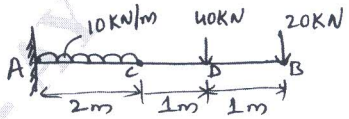

Fig.Q3(b) **(10 Marks)**

OR

4 a. Derive the bending equation in beam. **(10 Marks)**

b. The cross-section of a beam is shown in Fig.Q4(b), if permissible stress is 150 N/mm^2, find its moment of resistance. Compare it with equivalent section of the same area for a square section. **(10 Marks)**

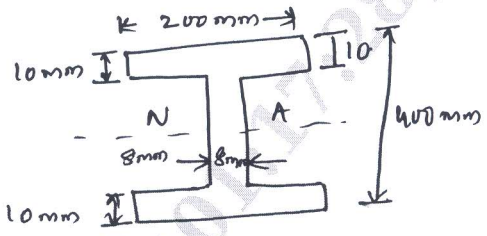

Fig.Q4(b)

Module-3

5 a. Show that intensity of load, $\omega = -EI\frac{d^4y}{dx^4}$ in beam. **(10 Marks)**

b. Show that deflection in simply supported beam with a point load at centre

$$Y_c = \frac{\omega \ell^3}{48EI}$$ **(10 Marks)**

OR

6 a. Show that $\tau = \frac{G\theta}{\ell} \cdot R$ in case of shaft. **(10 Marks)**

b. A solid circular shaft is required to transmit 100 kW at 180 rpm. The permissible shear stress in the shaft is 60 N/mm^2. Find suitable diameter of the shaft, if the angle of twist is not to exceed 1° in length of 3 meter. The value of modulus of rigidity is 0.8×10^5 N/mm^2. **(10 Marks)**

Module-4

7 a. State and prove Castigliano's second theorem. **(10 Marks)**

b. Write a note on complementary energy and virtual work. **(10 Marks)**

OR

8 a. Derive for the strain energy due to axial force on the bar. **(10 Marks)**

b. A simply supported beam of span l carries a point load P at mid span. Determine the strain energy stored by the beam. Also find the deflection at mid-span. **(10 Marks)**

Module-5

9 a. Define fracture and explain Type I fracture. **(10 Marks)**

b. Discuss Type II and Type III fractures. **(10 Marks)**

OR

10 a. Define creep with example mentioning the demerits. **(10 Marks)**

b. Explain the stages of creep with neat stage diagram. **(10 Marks)**

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