CBCS SCHEME

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15AU34

Third Semester B.E. Degree Examination, Aug./Sept.2020
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 following :
(i) Elasticity (ii) Ductility (iii) Toughness (iv) Stiffness **(08 Marks)**

b. Derive the expression for total extension of tapered circular bar. **(08 Marks)**

OR

2 a. Explain generalized Hooke's law and define Bulk modulus and Elastic modulus. **(08 Marks)**

b. Determine total extension of bar and stress in each part.
E = 84 GPa, Cross-section = 300mm^2 [Refer Fig.Q2(b)].

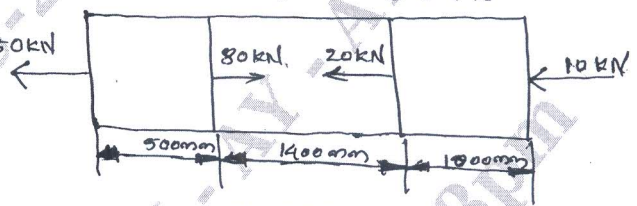

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. Derive expression for member subjected to direct stresses on two mutually perpendicular directions. **(08 Marks)**

b. A point in a strained material, the stress on two planes at right angles to each other are 80 N/mm^2(Tensile) and 40 N/mm^2(tensile). Each of the above stresses is accompanied by a shear stress of 60 N/mm^2. Determine Normal stress, Shear stress and resultant stress on an oblique plane inclined at an angle of 45° to the axis of minor tensile stress. Also find major principal stress, minor principal stress and their location, maximum shear stress and its location. **(08 Marks)**

OR

4 a. Derive equation for circumferential and longitudinal stress for thin cylinder. **(08 Marks)**

b. A pipe of 500 mm internal diameter and 75mm thick is filled with fluid at a pressure of 6 N/mm^2. Find maximum, minimum Hoop stresses across the cross-section of cylinder. Draw pressure and stress distribution. **(08 Marks)**

Module-3

5 a. Draw shear force diameter and bending moment diagram for cantilever beam as shown in Fig.Q5(a) locate contraflexure point.

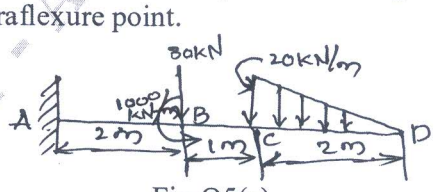

Fig.Q5(a) **(10 Marks)**

b. Explain types of beam and types of load. **(06 Marks)**

OR

6 a. Derive relationship between bending stress and radius of curvature. **(08 Marks)**

b. The cross section of beam as shown in Fig.Q6(b). If permissible stress is 150 N/mm^2. Find its moment of resistance compare it with equivalent section of same area for a square section.

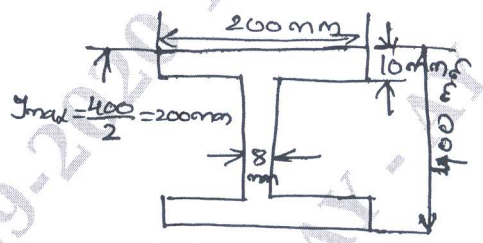

Fig.Q6(b) **(08 Marks)**

Module-4

7 a. Establish the relation between torque and stress in solid circular shaft. **(08 Marks)**

b. A solid shaft in subjected to maximum torque of 25 kNm. Find suitable diameter of solid shaft, if allowable shear stress and twist are limited to 80 N/mm^2 and 1° respectively for length of 20 times the diameter. **(08 Marks)**

OR

8 a. Derive the expression for Euler's crippling load when both the ends of column are hinged. **(08 Marks)**

b. A solid round bar of 60mm diameter and 2.5m is used as a strut find the safe compressive load for the strut if both ends are hinged and both end fixed. Take E = 2×10^5 N/mm^3, FOS = 3. **(08 Marks)**

Module-5

9 a. Explain Castigliano's theorem I and II of strain energy. **(08 Marks)**

b. Derive expression for strain energy due to bending. **(08 Marks)**

OR

10 a. Explain maximum principal stress theory and maximum shear stress theory of failure. **(08 Marks)**

b. A solid circular shaft in subjected to a bending movement of 40 kN-m and a torque of 10 kN-m. Design the diameter of the shaft according to (i) Maximum principal stress theory (ii) Maximum shear stress theory.
Take $\mu = 0.25$, Stress of elastic limit = 200 N/mm^2, FOS = 2. **(08 Marks)**

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