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B.TECH
(SEM III) THEORY EXAMINATION 2022-23
MECHANICS OF SOLIDS

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

(a) Define stress and its type
(b) Explain Hook's Law in brief.
(c) What is pure bending of beam?
(d) Differentiate between different types of stresses
(e) Write the assumptions involved in the Euler's column theory
(f) Explain in brief about laminated springs
(g) Differentiate between thin walled and thick walled pressure vessels
(h) Write the expression for hoop stress &volumetric strain in thin cylindrical vessels
(i) Explain shear center and its importance
(j) Define neutral axis

SECTION B

2. Attempt any *three* of the following: 10x3=30

(a) Obtain the expression for maximum shearing stress and maximum shearing planesfor an element subjected to compound stresses..
(b) A steel bar 10 cm wide and 8 mm thick is subjected to bending moment. The radius of neutral surface is 100 cm. Determine maximum and minimum bending stress in the beam.
(c) A T-section 150 mm×120 mm×20 mm is used as a strut of 4 m long with hinged at its both ends. Calculate the crippling load, if Young's modulus for the material be 200
(d) Derive the differential equation of deflection curve.
(e) Two wooden planks 150 mm × 50 mm each are connected to form a T- section of a beam. If a moment of 6.4 kN-m is applied around the horizontal neutral axis, inducing tension below the neutral axis, find the bending stresses at both the extreme fibres of the cross- section

SECTION C

3. Attempt any *one* part of the following: 10x1=10

(a) In an elastic material, the direct stresses of 120 MN/m^2 and 90 MN/m^2 are applied at a certain point on planes at right angles to each other in tension and compressive respectively. Estimate the shear stress to which material could be subjected, if the maximum principal stress is 150 MN/m^2.
(b) Three bars of equal length and having, cross-sectional areas in ratio l:2:4, are all subjected to equal load. Compare their strain energy

4. Attempt any *one* part of the following: 10x1=10

(a) A wooden beam of rectangular cross section is subjected to a bending moment of 5KNm. If the depth of the section is to be twice the breadth and stress in wood is not to exceed60N/cm^2. Find the dimension of the cross section of the beam.

(b) A torque of 1 KN-m is applied to a 40 mm diameter rod of 3 m length. Determine the maximum shearing stress induced and the twist produced. Take G = 80GPa

5. Attempt any *one* part of the following: 10x1=10

(a) An I section joist 400 mm × 200 mm × 20 mm and 6 m long is used as a strut with both ends fixed. What is Euler's crippling load for the column? Take Young's modulus for the joist as 200 GPa

(b) Derive the relation for Euler's buckling load for both ends fixed condition

6. Attempt any *one* part of the following: 10x1=10

(a) A cylindrical thin drum 850 mm in diameter and 4.5 m long is made of 15 mm thick plates. If the drum is subjected to an internal pressure of 2.5 MPa, determine its changes in diameter and length. Take E as 250 GPa and Poisson's ratio as 0.25.

(b) A thick metallic cylindrical shell of 150 mm internal diameter is required to withstand an internal pressure of 8 N/mm^2. Find the necessary thickness of the shell, if the permissible tensile stress in the section is 20 N/mm^2

7. Attempt any *one* part of the following: 10x1=10

(a) A rectangular beam 60 mm wide and 150 mm deep is simply supported over a span of 4 metres. If the beam is subjected to a uniformly distributed load of 4.5 kN/m, find the maximum bending stress induced in the beam

(b) A steel tube 40 mm outside diameter and 30 mm inside diameter is simply supported over a 6 m span and carries a central load of 200 N. Three such tubes and firmly joined together, to act as a single beam, in such a way that their centres make an equilateral triangle of side 40 mm. Find the central load, the new beam can carry, if the maximum bending stress is the same in both the cases