CBCS SCHEME

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15AE34

Third Semester B.E. Degree Examination, July/August 2022
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. Derive equilibrium equation for 3D stress element. **(08 Marks)**
b. Define plane stress and plane strain. **(04 Marks)**
c. Explain analysis of state of stress at a point. **(04 Marks)**

OR

2 a. Explain in detail Material selection for structural performance. **(08 Marks)**
b. Write a note on constitutive law for Isotropic materials. **(04 Marks)**
c. Draw Stress-Strain curve for cost iron material. **(04 Marks)**

Module-2

3 a. Explain Euler-Bernoulli assumption with its implications, write the equations. **(08 Marks)**
b. A beam of T-section has a span of 4m and is subjected to a point load as shown in Fig.Q3(b). Calculate the compressive bending stress and plot the stress distribution across the cross section of the beam. The maximum tensile stress is limited to 300 MPa. Calculate the value of 'W'.

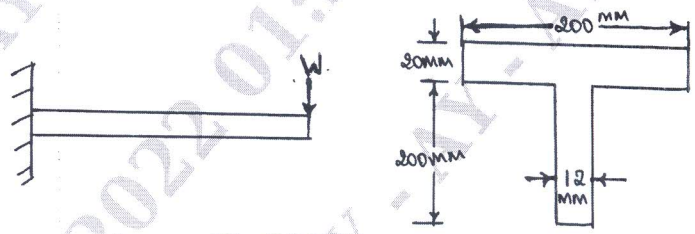

Fig.Q3(b) **(08 Marks)**

OR

4 a. What is three-dimensional beam theory? Give its kinematic description. **(08 Marks)**
b. What are the governing equations of a three dimensional beam. **(08 Marks)**

Module-3

5 a. Determine the rate of twist and the shear stress distribution in a circular section bar of radius 'R' which is subjected to equal and opposite torque 'T' at each of its free end. **(08 Marks)**
b. A 2 meters long hollow cylinders shaft has 80mm outer diameter and 10mm wall thickness. When the torsional load on the shaft is 6 kN-m, determine (i) Maximum shear stress induced (ii) Angle of twist. Also draw the distribution of shear stress in the wall of the shaft. Take $G = 80\ kN/mm^2$. **(08 Marks)**

OR

6 a. Derive equation for shear flow distribution in open section beams. **(08 Marks)**

b. Calculate the position of the shear center of the thin walled channel section shown in Fig.Q6(b). The thickness 't' of the wall is constant.

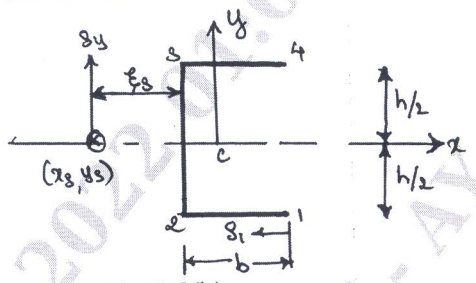

Fig.Q6(b) **(08 Marks)**

Module-4

7 a. Define principle of virtual work for a particle. Obtain the equilibrium of a particle. **(08 Marks)**

b. List the difference between principle of virtual work and principle of complementary virtual work. **(08 Marks)**

OR

8 a. Explain : (i) Maxwell's theorem (ii) Castiglione's theorem. **(08 Marks)**

b. A simply supported beam of length 'L' carries a UDL of load 'W' per unit length over the entire span length. Determine the strain energy stored by the beam. **(08 Marks)**

Module-5

9 a. Explain Tresca's and Von Mises criterions. **(08 Marks)**

b. A rigid rod PQR is supported by two wires and a hinge as shown in Fig.Q9(b). Determine stress and elongations of the two wires. Take $E_A = 70$ GPa and $E_s = 200$ GPa.

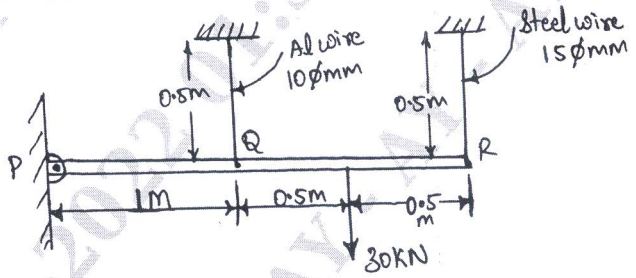

Fig.Q9(b) **(08 Marks)**

OR

10 Derive the following equations of Kirchhoff's plate:

(i) 6 – Strain Displacement equations

(ii) 5 – Equilibrium equations. **(16 Marks)**

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