PVP 19

Code: 19CE3401

II B.Tech - II Semester – Regular Examinations – AUGUST 2021

MECHANICS OF SOLIDS
(CIVIL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 5 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each question carries 12 marks.
4. All parts of Question paper must be answered in one place

PART – A

1. a) State Hook's law. How it is related to elastic modulus?
   b) Define Shear force and bending moment.
   c) List out the stresses that develop on inclined plane on block subjected to normal stress and shear stress along two planes at right angles.
   d) What is the formula for the maximum shear stress in rectangular and triangular sections?
   e) Define Torsional rigidity.

PART – B

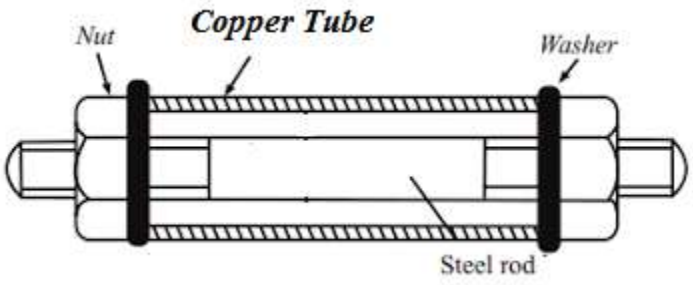
UNIT – I

2. a) State Hooke's law and explain its assumptions. Draw the stress-strain curve of mild steel. Explain the salient features of the stress-strain curves. 6 M

b) Determine the maximum load that can be supported by a 10 m long steel rope comprising of 11 wires of 3 mm diameter, if the working stress is 230 MPa and E = 200 GPa. The rope should not elongate more than 10 mm under the load. 6 M

OR

3. A steel rod of 20 mm diameter passes through a copper tube of 25 mm internal and 35 mm external diameters. The assembly is provided with nuts as shown in the below figure. The nuts are tightened to stress the steel bar to 150 N/mm^2. Determine the stresses in copper tube, if the tube is lathe cut to remove 2.5 mm from its thickness along half of its length. Assume that Young's modulus of steel is twice that of copper. Determine the maximum compressive load that the system can sustain, if the stress in copper is limited to 180 N/mm^2. 12 M



UNIT – II

4. a) Write about the various types of beams with neat sketches describing the various reaction components under various loads. 6 M

b) Draw the bending moment and shear force diagram for a cantilever beam with a concentrated load "P" at the free end and uniformly distributed load throughout its span. 6 M

OR

5. a) Draw the shear force and bending moment diagram of a simply supported beam having effective span of 6m, when it is subjected to an uniformly distributed load of 15 kN/m in the middle portion of length 2m and a concentrated load of 50 kN at a distance of 2 m from the left support. 9 M

b) State the relationship between load, shear force and bending moment. 3 M

UNIT-III

6. a) A square bar of size 20 x 20 mm is subjected to direct tensile force. Find the largest value of tensile force the bar can sustain, if its shear strength is 100 MPa. Determine the stresses on a plane inclined at 45° with the bar axis under the maximum load. 8 M

b) Discuss about the different stresses on the Mohr's circle. 4 M

OR

7. An element in plane stress is subjected to stresses σ_x = -50 MPa, σ_y = 10 MPa and τ_{xy} = -40 MPa. Using Mohr's circle, determine (a) the stresses acting on an element rotated through an angle θ = 45°, (b) the principal stresses, and (c)the maximum shear stress. Show all results with neat sketches. 12 M

UNIT – IV

8. a) Determine the section modulus of an unsymmetrical steel I-section having top flange thickness of 100 mm and width of 700 mm; bottom flange thickness of 50 mm and width of 400 mm, overall depth of the I-section is 900 mm, web width is 200 mm. 6 M

   b) Derive the expression for flexural strength for a beam of length 'L' and two concentrated loads 'P' acting at one-third points of the beam. 6 M

OR

9. a) Write the assumptions of bending theory. Define moment of inertia and modulus of a section. 6 M

   b) Show that the maximum shear stress in a rectangular section is 1.5 times the average shear stress. 6 M

UNIT – V

10. a) A closely coiled helical spring is to carry a load of 700 N. Its mean coil diameter is to be 10 times that of wire diameter. Calculate these diameters if the maximum shear stress in the material of spring is to be 90 N/mm^2. 6 M

    b) What is the difference in the behavior of hollow circular and solid circular shafts subjected to Torsion? 6 M

OR

11. a) State the assumptions in Torsional analysis. Write the Torsional equation and indicate the various terms with suitable units. 6 M

    b) A solid circular shaft of length 2 m stores 300 N-m of energy when transmitting 1.0 MW at 4000 rpm. Determine the shaft diameter, assuming the maximum allowable shear stress is 100 N/mm^2 and G = 65 GPa for the material. 6 M