PVP 20

Code: 20CE3404

II B.Tech - II Semester – Regular Examinations – JULY 2022

MECHANICS OF SOLIDS
(CIVIL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. State Hooke's law. Draw stress-strain diagram for mild steel specimen tested under uni-axial tension till fracture and explain the salient points. 14 M

OR

2. a) Derive the relationship between modulus of elasticity and modulus of rigidity and bulk modulus. 6 M

   b) A steel rod of 4 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter of 4 cm. The composite bar is then subjected to an axial pull of 60 kN. If the length of each bar is equal to 200 mm. Determine
      (i) The stresses in the rod and tube
      (ii) Load carried by each bar.

   Take $E_s = 2.1 \times 10^5$ N/mm^2 and $E_c = 1.1 \times 10^5$ N/mm^2. 8 M

UNIT – II

3. a) Define shear force, bending moment and point of contraflexure. 6 M

   b) A simply supported beam of span 6 m carries point loads of 10 kN and 15 kN at a distance of 2 m and 4 m from the left end along with a UDL of intensity 10 kN/m for full span. Draw shear force and bending moment diagrams for the beam. 8 M

OR

4. A cantilever 1.5 m long is loaded with a uniformly distributed load of 2 kN/m run over a length of 1.25 m from the free end. It also carries a point load of 3 kN at a distance of 0.25 m from the free end. Draw the shear force and bending moment diagrams of the cantilever beam. 14 M

UNIT-III

5. a) At a point in a strained material, the principal stresses are 100 N/mm^2 tensile and 40 N/mm^2 compressive. Determine the resultant stress in magnitude and direction on a plane inclined at 60^o to the axis of the major principal stress. What is the maximum intensity of shear stress in the material at that point? 7 M

   b) The element is subjected to two mutually perpendicular tensile stresses in x and y directions. Derive the expression for normal and shear stresses at an oblique plane making an angle θ with horizontal. 7 M

OR

6. The tensile stresses at a point across two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined at 30º to the axis of minor stress. 14 M

UNIT – IV

7. a) State the assumptions made in theory of simple bending. 7 M

   b) Find the ratio of maximum shear stress to average shear stress is 1.5 in case of rectangular section. 7 M

OR

8. A beam having rectangular cross section 350 mm x 500 mm is used over a span of 5 m. The safe longitudinal and shear stress in the beam material are 20 N/mm^2 and 8 N/mm^2 respectively. Determine the maximum value of UDL which the beam can carry over its entire length. 14 M

UNIT – V

9. a) Derive an expression for pure torsion stating necessary assumptions. 8 M

   b) A solid shaft of 150 mm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft, if the maximum shear stress induced to the shaft is 45 N/mm^2. 6 M

OR

10. The stiffness of a close coiled helical spring is 1.5 N/mm of compression under a maximum load of 60 N. The maximum shearing stress produced in the wire of the spring is 125 N/mm^2. The solid length of spring (when coils are touching) is given as 5 cm. Find

(i) Diameter of wire

(ii) Mean diameter of coils

(iii) Number of coils required.

Take $G = 4.5 \times 10^4$ N/mm^2. 14 M