Code No: **20CE3T01** **R20**

II B. TECH I SEMESTER REGULAR EXAMINATIONS, FEB - 2022
STRENGTH OF MATERIAL – 1
(CIVIL ENGINEERING)

Time: 3 Hours **Max. Marks: 70**

Note: Answer **ONE** question from each unit **(5 × 14 = 70 Marks)**

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UNIT-I

1. a) Deduce the relation between the Modulus of Elasticity and Modulus of Rigidity. [5M]

   b) A mild steel rod of 20mm diameter and 300mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter of 25mm. The ends of the tube and rods are brazed together, and the composite bar is subjected to an axial pull of 40kN. If E for steel and copper is 200GN/m^2 and 100GN/m^2 respectively, find the stresses developed in the rod and tube. Also find the extension of the rod. [9M]

(OR)

2. a) A tensile test was conducted on a mild steel bar. The following data was obtained from the test. [8M]
   (i) Diameter of the bar = 3cm. (ii) Gauge length of the bar = 20cm. (iii) Load at elastic limit = 250kN. (iv) Extension at a load of 150kN = 0.21mm. (v) Maximum load = 380kN. (vi) Total extension = 60mm. (vii) Diameter of the bar at the failure = 2.25cm. Determine the (a) Young's Modulus (b) Stress at elastic limit (c) Percentage elongation (d) Percentage decrease in area.

   b) A Rod 12.5mm in diameter is stretched 3.2mm under a steady load of 10KN. What stress would be produced in the bar by a weight of 700N, falling through 75mm before commencing to a stretch, the rod being initially unstressed? The value of E may be taken as 2.1x10^5N/mm^2. [6M]

UNIT-II

3. a) A cantilever 2m long is loaded with a uniformly distributed load of 2kN/m run over a length of 1m from the free end. It also carries a point load of 4kN at a distance of 0.5m from the free end. Draw the Shear force Diagrams and Bending Moment diagrams. [8M]

   b) Draw the shear force and bending moment diagrams for simply supported beam carrying a uniformly varying load from zero at left end to w per unit length at the right end. [6M]
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(OR)

4. a) An overhanging beam is shown in fig.1. Draw the S.F and B.M diagrams. [10M]

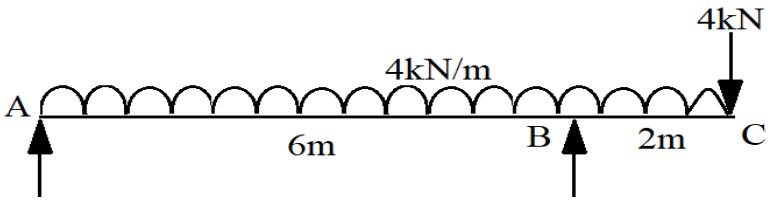

Fig.1

b) What are the different types of loads acting on a beam? Differentiate between a point load and uniformly distributed load. [4M]

UNIT-III

5. a) Find the slope and deflection of simply supported beam of span L, carrying [10M]
   i) a point load P at the center,
   ii) a U.D.L of w KN/m over the entire span, using the moment area method.

   b) Explain the following: [4M]
   (i) Mohr's theorems. (ii)The elastic line of beam.

(OR)

6. a) Determine: [8M]
   i) slope at the left support,
   ii) deflection under the load and
   iii) maximum deflection of a simply supported beam of length 6m, which is carrying a point load of 5kN at a distance of 2m from left end. Take E = $2x10^5 N/mm^2$ and I = $10^8 mm^4$.

   b) Derive the relation between slope, deflection and radius of curvature. [6M]

UNIT-IV

7. a) A 'T – section beam' with 100mm x 15mm flange and 150mm x 15mm web is subjected to a shear force of 10kN at a section. Draw the variation of shear stress across the depth of the beam and obtain the value of maximum shear stress of the section. [12M]

   b) What is neutral axis in case of bending? [2M]

(OR)

8. a) Derive the pure bending equation. Write any three assumptions made in Pure bending? [10M]

   b) State the formula for average shear stress and maximum shear stress for rectangular section and circular section. [4M]

UNIT-V

9. a) Determine the diameter of a solid steel shaft which will transmit 90kW at 160rpm. Also determine the length of the shaft if the twist must not exceed 1^0 over the entire length. The maximum shear stress is limited to 60N/mm^2. Take the value of modulus of rigidity = 8x10^4 N/mm^2. [8M]

   b) What is a spring? Name the two types of spring and explain them. [6M]

(OR)

10. a) A closely coiled helical spring of mean diameter 20cm is made of 3cm diameter rod and has 16 turns. A weight of 3kN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 18cm. Take modulus of rigidity = 8x10^4 N/mm^2. [7M]

    b) The maximum allowable shear stress in a hollow shaft of external diameter equal to twice the internal diameter, is 80 N/mm^2, determine the diameter of the shaft if it is subjected to a torque of 4 x 10^6 N-mm and a bending moment of 3 x 10^6 N-mm. [7M]

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