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Roll No.

8323

Printed Pages : 3

BT-3 / D-13

**STRENGTH OF MATERIALS-I
(COMMON WITH AUTOMOBILES)**

Paper-ME-203 E, Option-II

Time allowed : 3 hours]

[Maximum marks : 100

Note : Attempt five questions, selecting at least one question from each unit.

Unit-I

1. Derive relationship for sharing of load by a composite section. A load of 2 MN is applied on a short concrete column 500 mm × 500 mm. The column is reinforced with 4 steel bars of 10 mm diameter, one in each corner. Find the stresses in steel bars. Take E for steel as 2.1×10^5 N/mm² and bar concrete as 1.4×10^5 N/mm². 20
2. (a) Define Principal planes and Principal stresses and explain their uses. 5
 (b) A piece of material subjected to three mutually perpendicular stresses of 70, 56 and 84 MPa. If $E = 200$ GPa, Poisson's ratio = 0.28, determine :
 (i) Principal strains,
 (ii) Shear modulus, and
 (iii) Bulk modulus. 15

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Unit-II

3. A beam 8 m long rests on two supports one at right end and the other 2 m from its left hand end. The beam carries a U.D.L. of 15 kN/m over its entire length and a concentrated load of 80 kN at the middle of 6 m span. Draw the bending moment and shear force diagram. 20
4. 500 kW power is to be transmitted at 100 r.p.m. Determine the necessary diameter of the (i) solid circular shaft (ii) diameter of hollow shaft if the inside diameter is 0.8 times the outside diameter, if the allowable shear stress is 75 N/mm². What is the saving in material when a hollow shaft is used? 20

Unit-III

5. A beam AB is supported at its end has span of 2 m and carries a u.d.l. of 200 kN/m over the entire span. The cross-section of the beam is a T-section having flange width 125 mm, flange thickness 25 mm, web thickness 25 mm and overall depth 200 mm. Calculate maximum shear stress in the beam. Also draw shear stress distribution marking principal values. 20
6. (a) Explain the concept of instability and buckling in columns with illustration. 6
 (b) A steel column has Proportional limit 240 MPa and Modulus of elasticity 210 GPa. Find the minimum value of slenderness ratio upto which Euler's formula may be used to determine the buckling load of the column. 14

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Unit-IV

7. (a) Explain Macaulay's method for determining the slope. 8
- (b) A beam AB simply supported at the ends is 4 m long. It carries a U.D.L. of intensity 20 kN/m over a length of 2 m starting at a distance of 1 m from left end support together with a point load 40 kN at a distance 3 m from the left end support. Calculate the deflection at the centre. Take $E = 210 \text{ GPa}$, $I = 9600 \text{ cm}^4$. 12
8. A fixed beam of 12 m span carries two point loads of 20 kN at 3 m from each end. Find support moments. Calculate deflection at centre $I = 10^8 \text{ mm}^4$ and $E = 205 \text{ GPa}$. 20