3E1411

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B.Tech. (Sem. III) (Main/Back) Examination, January - 2012
Production & Industrial Engg.
3PI1 Mechanics of Solids (Common for ME/AE & PI)

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

Instructions to Candidates :

*Attempt any **five questions** selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. Nil 2. Nil

UNIT - I

1 (a) A bar of 25 mm diameter is subjected to a pull of 40 kN. The measured extension on gauge length of 200 mm is 0.085 mm and the change in diameter is 0.003 mm. Calculate the Poisson's ratio and the values of three elastic modulii. 10

(b) Define and discuss the relationship between Modulus of rigidity and Poisson's ratio. 6

OR

1 (a) Calculate the extension of a Uniformly Tapering rectangular bar of length L and thickness t. The width of bar at one end is b_1 and other end is b_2 having subjected to an axial load P at both ends. 8

(b) A steel rod of 25 mm diameter is placed inside a copper tube of 30 mm internal diameter and 5 mm thickness and the ends are rigidly connected. The assembly is subjected to a tensile load of 250 kN. Determine the stresses induced in the steel and copper tube and also the extension of the rod assuming the rod length to be 400 mm long. Take the modulus of elasticity of steel and copper as 200 Gpa and 80 Gpa respectively.

8

UNIT - II

2 (a) A timber beam of rectangular section is to support a load of 20 kN uniformly distributed over a span of 3.6 m, when the beam is simply supported. If the depth of section is to be twice the breadth and the stress in the timber is not to be exceed 35 N/mm^2. Find the breadth and depth of the cross section. What is the cross section of the beam, if it carries a concentrated load of 20 kN at the mid span of the beam.

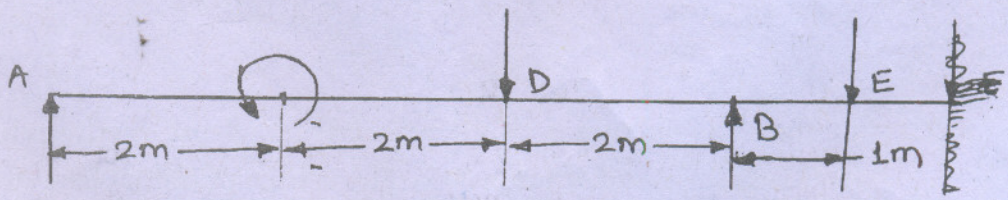
12

(b) State the assumptions made in the theory of a simple bending.

4

OR

2 Draw the shear force and Bending moment diagram for the beam shown below. Also determine and mark the values of the important ordinates.



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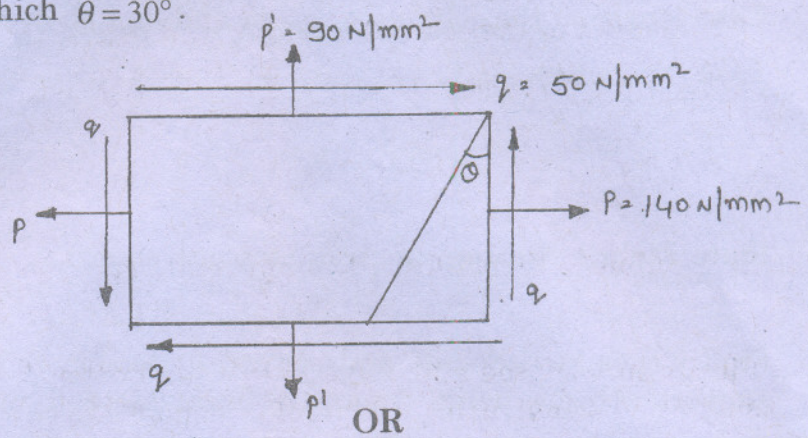
UNIT - III

3 The state of stress at a certain point in a strained material is shown. Calculate (i) Principal stresses (ii) inclination of principal planes (iii) Normal, shear and resultant stresses on the plane MN for which $\theta = 30°$.



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OR

3 (a) Discuss the significance of different theories of failures.

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(b) A body is under the action of two principal stresses of 40 N/mm^2 and -70 N/mm^2 and the third principal stress being zero. If the elastic limit in simple tension as well as compression is 200 N/mm^2. Find the factor of safety based on the elastic limit according to five theories of failures. Take $\mu = 0.3$.

8

UNIT - IV

4 Write short notes on :

(i) Modes of failure of a column

(ii) Slenderness ratio

(iii) Euler's theory of Buckling failure.

6, 4, 6

OR

4 (a) A solid shaft of 250 mm diameter has the same cross sectional area as the hollow shaft of the same material with inside diameter of 200 mm.

(i) Find the ratio of power transmitted by the two shafts for the same angular velocity.

(ii) Compare the angle of twist in equal lengths of these shafts when stressed to the same intensity.

8

(b) Calculate the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at both ends.

Take $E = 205 \text{ kN/mm}^2$.

UNIT - V

5 (a) State Mohr's theorem of Area-moment equation.

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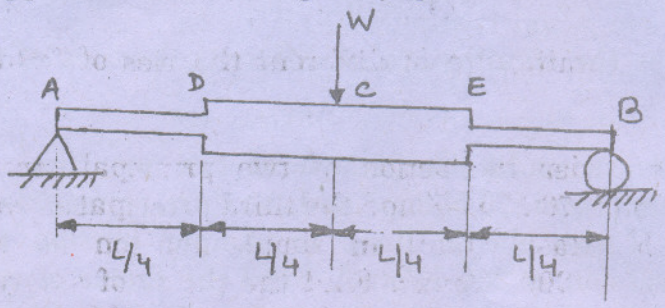
(b) Find slopes at the ends and central deflection for a simply supported beam using conjugate beam method.



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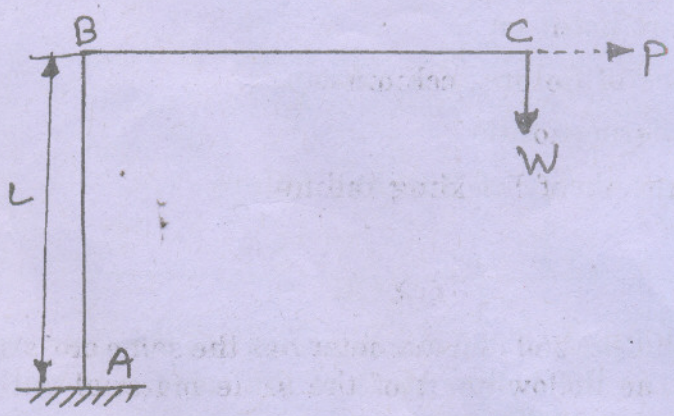
OR

5 A vertical load W is applied to the rigid cantilever frame assuming EI to be constant throughout the frame. Determine the horizontal and vertical displacement of the point C. Neglect axial deformation.



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