317

6/342

3E2011

Roll No. : ______________________

Total Printed Pages : 4

3E2011

B. Tech. (Sem. III) (Main/Back) Examination, January - 2013
Civil Engg.
3CE1 Strength of Materials and Mechanics of Structures-I

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

*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) Prove that the total elongation of a uniformly tampering rod of length 'L' and end diameters D_1 and D_2, when rod is subjected to an axial force P is given by

$$dl = \frac{4PL}{\pi E D_1 D_2}$$

8

(b) A steel rod of 30 mm diameter and 5 m long is connected to two grips and the rod is maintained at a temperature of 95°C. Determine the stress and pull exerted when the temperature falls to 30°C, if :
(i) The end do not yield
(ii) The end yield by 1.2 mm.
Take $E = 2 \times 10^5$ N/mm^2 and coefficient of thermal expansion $\alpha = 12 \times 10^{-6}$/°C .

8

OR

1 (a) Find the axial deformation of the rod as shown in **fig. 1**. Take $E = 2.05 \times 10^5$ N/mm^2. Given $AB = CD = 1$ m and $BC = 1.2$ m. Diameters of portions AB and CD = 30 mm and diameter of portion BC = 35 mm.

318

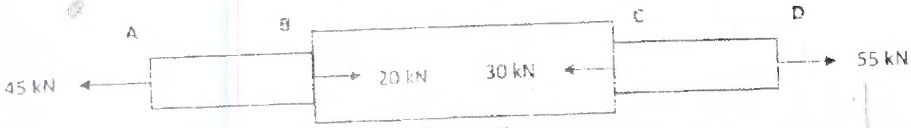

Fig. 1

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(b) Define Strain Energy and Resilience. Write formulae for stress produced and strain energy due to gradually applied load, suddenly applied load and impact load. 6

UNIT - II

2 (a) A point in strained material is subjected to normal tensile stresses of 120 N/mm^2 and 60 N/mm^2 on mutually perpendicular planes together with a shear stress of 70 N/mm^2. Find the Principal Stresses, position of Principal planes and maximum shear stress in the block. 8

(b) Explain clearly, the Mohr's Circle method of finding out stresses in a rectangular element subjected to normal stresses p_1 and p_2 along with a shear stress q. 8

OR

2 (a) Define slenderness ratio of a column. What is its importance? Write down the values of effective length of a column for different end conditions. 8

(b) Compare the crippling loads given by Euler's and Rankine formulae for a 3 m long hollow steel column having inner and outer diameters as 48 mm and 52 mm respectively. The column is pin jointed at both the ends. The yield stress is 320 N/mm^2. Rankine's constant is 1/7500 and Modulus of Elasticity (E) = 2×10^5 N/mm^2. 8

UNIT - III

3 Determine Centroidal Moments of Inertia, Product Moment of Inertia and Principal Moments of Inertia of an L-Section as shown in **Fig. 2**.

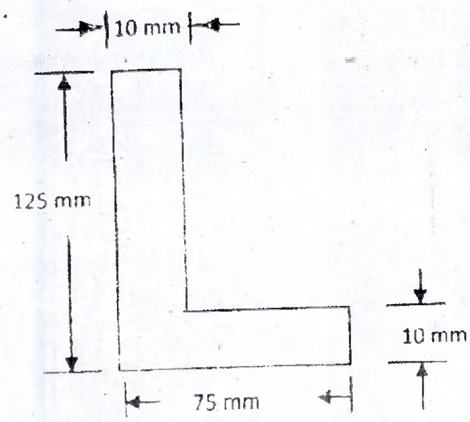


Fig. 2

16

OR

3 Write the assumptions made in analysis of a truss by the method of joints. Determine the forces in all the members of a pin-jointed truss as shown in **fig. 3** having hinge support at A and roller support at E. Length $AE = ED = DC = 3$ m.

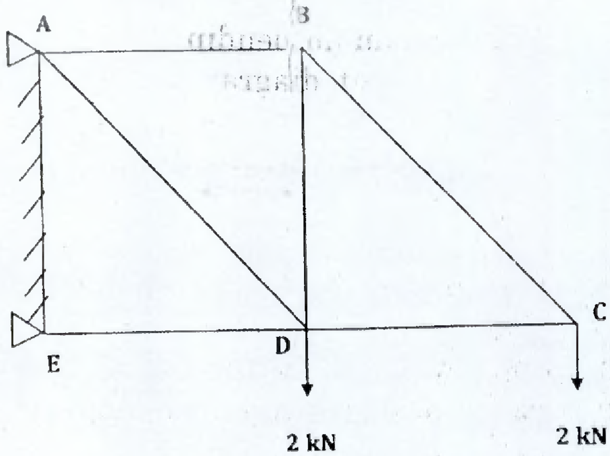
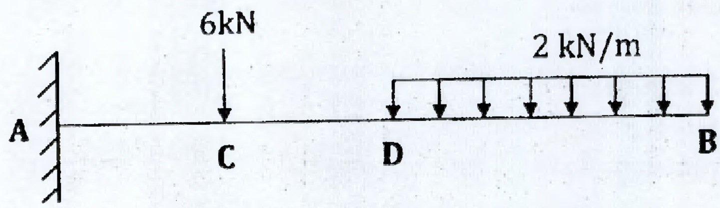


Fig. 3

16

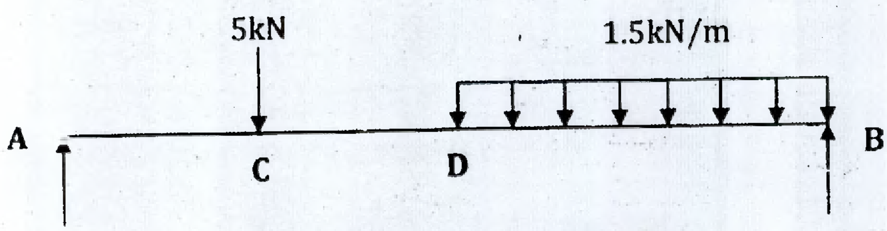
UNIT - IV

4 Draw Shear Force and Bending Moment diagrams for the beams as shown in **fig. 4 (a)** and **(b)**.



AC = CD = 3 m and DB = 6 m

Fig. 4 (a)



AC = CD = 2.5 m and DB = 5 m

Fig. 4 (b)

8+8

OR

320

4 A 20 m long girder carrying a uniformly distributed load of 2 kN/m is to be supported on two piers, 12 m apart, in such a way that the maximum bending moment in the girder is as small as possible. Determine the distance of the piers from the end of the girders and the maximum bending moment. Draw the Shear Force and bending moment diagrams. 15

UNIT - V

5 (a) A composite beam is made by placing two steel plates, 12 mm thick and 240 mm deep, one each on both sides of a wooden section 90 mm wide nad 240 mm deep. Determine moment of resistance of the section of the beam. Given the ratio of modulus of elasticity of steel and wood $(E_s/E_w) = 15$, the stress in wood should not exceed 7 N/mm^2. 10

(b) Show that for a beam of circular cross-section, the maximum shear stress is 4/3 times the average shear stress. 6

OR

5 (a) Define Unsymmetrical Bending and Principal Moment of Inertia. 6

(b) Locate approximately the position of shear centre (C) for the unequal I-section shown in **fig. 5**. Widths of large and small flanges are b_1 and b_2 and thicknesses are t_1 and t_2 respectively.

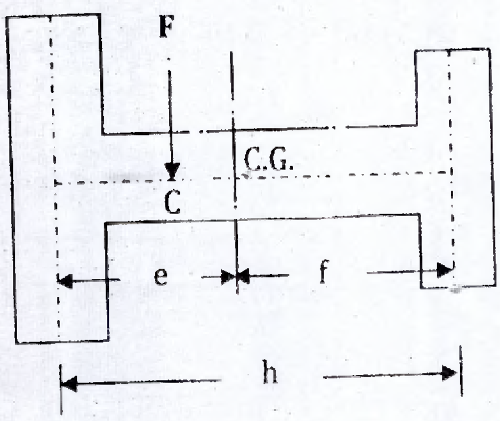


Fig. 5

10