

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. NIL2. NIL

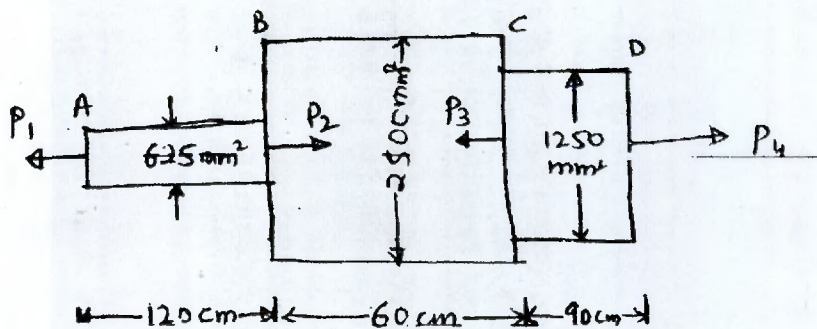
UNIT - I

1 (a) Explain the following :

- (i) Tensile stress
- (ii) Compressive stress
- (iii) Shear stress
- (iv) Hook's law

8

(b) A member ABCD is subjected to point load P_1 , P_2 , P_3 and P_4 as shown in Fig.



Calculate the force P_2 necessary for equilibrium, if $P_1 = 45$ kN, $P_3 = 450$ kN and $P_4 = 130$ kN. determine the total elongation of member, assuming the modulus of elasticity to be 2.1×10^5 N/mm².

8

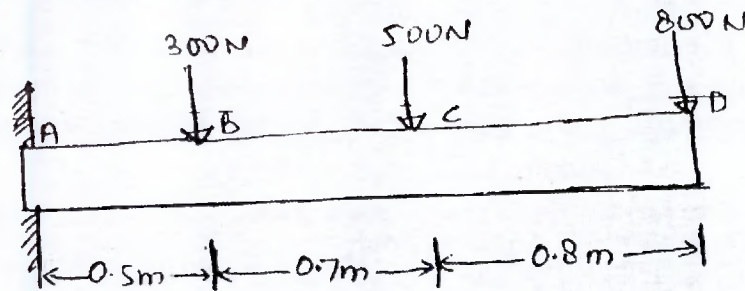
OR



- 1 (a) Explain stress-strain curve. 6
 (b) Derive the relation between modulus of elasticity (E); modulus of rigidity (C) and Bulk modulus (K). 10

UNIT - II

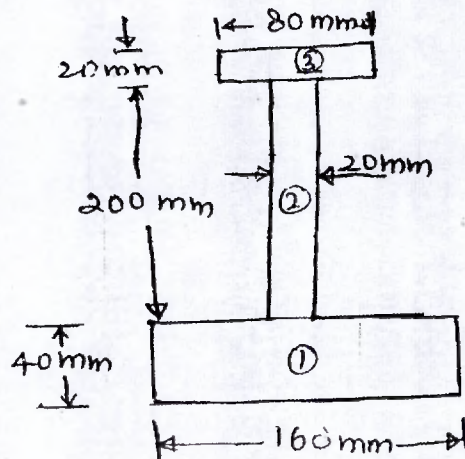
- 2 (a) A cantilever beam of length 2m carries the point load as shown in Fig. Draw the shear force and B.M. diagram for cantilever beam.



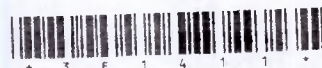
- 12
- (b) Explain pure bending or simple bending. 4

OR

- 2 (a) Derive the Relation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$. 8
- (b) A cast iron beam is of I-section as shown in fig. The beam is simply supported on a span of 5 meters. If the tensile stress is not to exceed 20 N/mm^2 . Find the safe uniformly load which the beam can carry. Find also the maximum compressive stress.



8



UNIT - III

- 3 (a) Derive the relation for Normal stress (σ_n) and Tangential stress (σ_t) for a member subjected to like direct stresses in two mutually perpendicular direction on a oblique plane having angle of obliquity ' θ ' with axis of minor stress.

10

- (b) Write short note on MOHR's circle of stresses.

6

OR

- 3 (a) Explain maximum principal strain theory.

6

- (b) At a point in a strained material the principal tensile stresses across two perpendicular planes, 80 N/mm^2 and 40 N/mm^2 . Determine normal stress, shear stress and the resultant stress on a plane inclined at 20° with the major principal plane. Determine also the obliquity. What will be the intensity of stress, which acting alone will produce the same maximum

strain if Poisson's ratio = $\frac{1}{4}$.

10

UNIT - IV

- 4 (a) Prove that Torque transmitted by solid shaft when subjected to torsion is given by

$$T = \frac{\pi}{16} \tau D^3$$

D - dia of shaft, τ - max. shear stress.

8

- (b) Using Euler's formula, calculate the critical stresses for a series of struts having slenderness ratio of 40, 80, 120, 160 and 200 under the following condition.

- (i) Both end hinged
(ii) Both ends fixed

8

OR



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- 4 (a) Prove that $\frac{\tau}{R} = \frac{c\theta}{L} = \frac{T}{J}$ where
 J - Polar moment, T - Torque Transmitted
 R - radius of shaft, L - Length of shaft, C - modulus of rigidity,
 τ - shear stress, θ - angle of twist. 8
- (b) Explain terms column, strut and crippling load. 8

UNIT - V

- 5 (a) Prove that the deflection at center of simply supported beam, carrying a point load at the center is given by

$$y_c = \frac{WL^3}{48EI}$$
 where
 W - point load,
 L - Length of beam,
 E - Elastic constant, I - MOI 8
- (b) A beam of length 5 m and of uniform rectangular section is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run over the entire length. Calculate the width and depth of the beam if permissible bending stress is 7 N/mm² and central deflection is not to Exceed 1 cm. 8

OR

- 5 (a) Explain Maxwell theorem of reciprocal deflection. 6
- (b) A simply supported beam of length 4m carries a point load of 3 kN at a distance of 1m from each end. If $E = 2 \times 10^5$ N/mm² and $I = 10^8$ mm⁴ for the beam, then using conjugate beam method determine :
 (i) slope at each end and under each load
 (ii) deflection under each load and at the center. 10

