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Instructions –　(1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1.　a)　Attempt any SIX of the following :　　12

(i)　Define axial and eccentric load.

(ii)　Write the value of maximum slope and maximum deflection in case of simply supported beam loaded with centre point load in terms of EI.

(iii)　Write the value for slope and deflection at free end for a cantilever beam having udl over entire span

(iv)　A cantilever of span L carries a point load "W" at L/2 from fixed end. State deflection at free end in terms of EI.

(v)　State any two disadvantages of fixed beam.

(vi)　Define distribution factor.

(vii)　Define carry over moment.

(viii)　Enlist four types of simple frames.

Marks

b) **Attempt any TWO of the following :** 8

    (i)   State limit of eccentricity and middle third rule with reference to a rectangular section.

    (ii)   Draw stress distribution diagram for

        (1) $\sigma_0 > 6_b$

        (2) $\sigma_0 = 6_b$

        (3) $\sigma_0 < 6_b$

    (iii)   Using method of sections determine the forces in member AB and DE for the truss shown in Fig. No. 1.
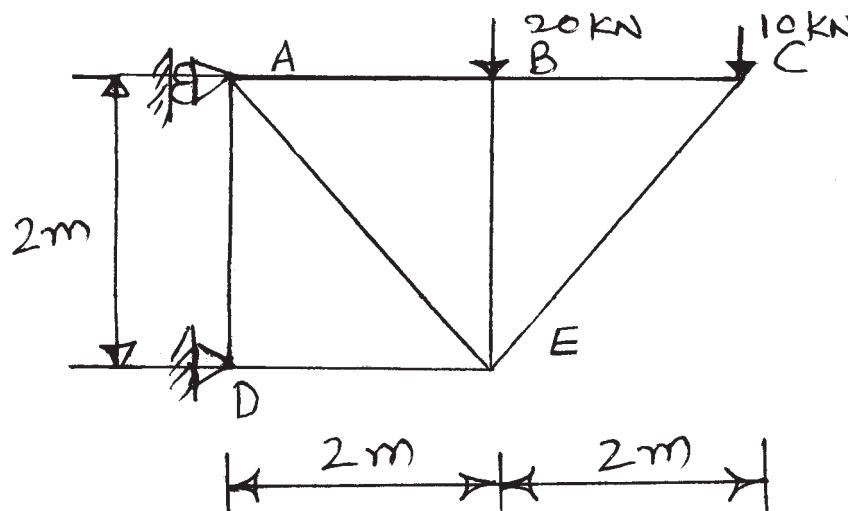

Fig. No. 1

2.   **Attempt any FOUR of the following :** 16

    a)   A square column 150 mm side carried a load of 150 kN at an eccentricity of 50 mm. Find σ_{max} and σ_{min}.

    b)   A hollow circular steel column having external dia 300 mm and thickness 25 mm carries an eccentric load of 100 kN acting at an eccentricity of 100 mm. Calculate the maximum and minimum stresses.

    c)   Calculate core of section for rectangular c/s 300 mm × 500 mm in size and draw correct sketch.

d) A beam of span 3 m is simply supported and carries u.d.l. "w" per unit length, if the slope at the end is not to exceed 1° find maximum deflection.

e) A cantilever of length 2 m carries a u.d.l. of 5 kN/m over half the span from the fixed end. If the section is rectangular 50 mm wide and 100 mm deep. Find the slope and deflection at free end. $E = 2 \times 10^5$ MPa.

f) A continuous beam ABC of uniform M.I. and carries a central point load of 80 kN on span AB. A u.d.l. of 30 kN/m is acting over the entire span BC. AB = 6 m, BC = 4 m. A and C are simply support. Calculate the support moment using three moments theorem only and draw only SFD.

3.   **Attempt any <u>FOUR</u> of the following :**   **16**

a) A simply supported beam of span 5 m carries a point load of 40 kN at 3 m from the left support. Calculate the slope and deflection under the point load in terms of EI. Use Macalay's Method.

b) A simply supported beam of span 6 m carries a point load of 60 kN at 4 m from left support. Find the value of slope under the load. Take $EI = 7800$ kN.m^2.

c) A uniform beam of 6 m span is fixed at A & B. It carries u.d.l. of 3 kN/m over the entire span in addition to a point load of 6 kN at 4 m from B. Calculate the fix end moments.

d) A fixed beam of span 6 m carries a u.d.l. of 20 kN/m over the entire span. Find fixed end moments from the first principle.

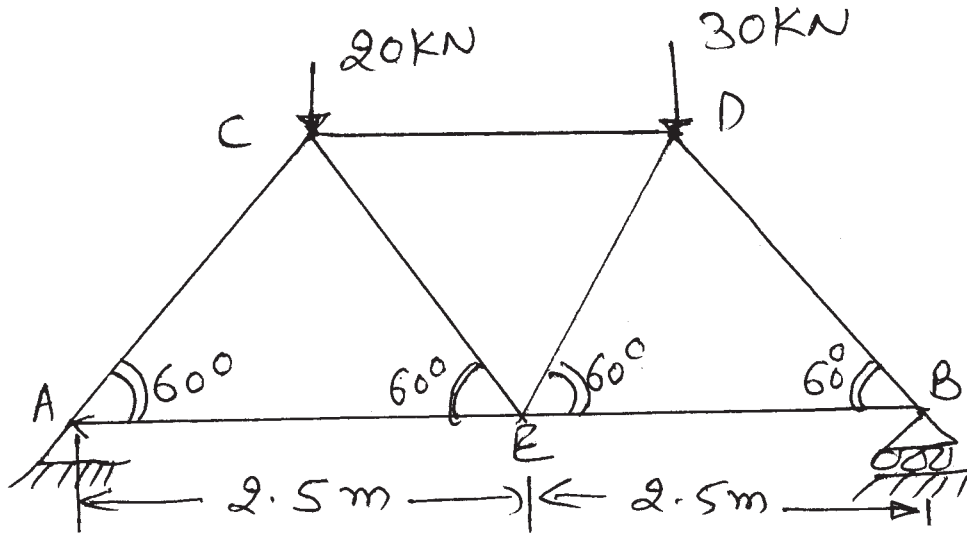e) Using method of joints find the forces in member BE and EC of simple frames shown in Fig. No. 2.

Fig. No. 2

f) Using method of joints, find nature and magnitude of forces in CE, AB, AE and DE in frame as shown in Figure No. 1.

4. **Attempt any FOUR of the following :**   16

a) A continuous beam ABC is supported on three supports at same level AB = BC = 4 m . Both spans carry central point load of 100 kN each. Calculate moment at B using theorem of three moments and draw BMD giving only net B.M.

b) State Clapeyron's theorem of three moments for same EI and different EI and state meaning of each term involved using neat sketch.

c) A continuous beam ABC is simply supported at A, B and C such that AB = BC = 3 m. Span AB carries a u.d.l. of 50 kN/m from A to B. Span BC carries a point load of 30 kN at 1 m from C. Calculate support moment at B using theorem of three moments.

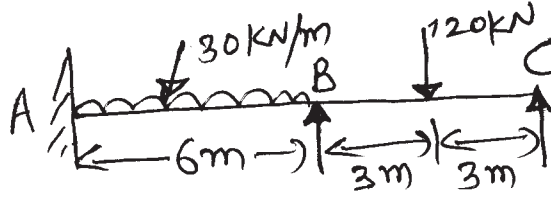d) Find the moments at A, B and C for the continuous beam as shown in Fig. No. 3 below by moment distribution method.

Fig. No. 3

e) Determine distribution factors at continuity for a continuous beam A–B–C–D which is fixed at A and supported over B, C and D. Take AB = BC = 4 m and CD = 5 m. Assume same MI for all spans.

f) Solve Q. 2 (f) using moment distribution method if I_{AB} = 2I and I_{BC} = I.

5. **Attempt any TWO of the following :** 16

a) A tall chimney, hollow square in cross-section is 2 m × 2 m externally and 0.5 m thickness of wall. It is subjected to uniform horizontal wind pressure of 1.25 kPa on one of its faces. The unit weight of masonry is 20 kN/m^3. Calculate the maximum height of chimney for no tension anywhere in the base.

b) A continuous beam ABCD is such that AB = 4 m, BC = 3 m and overhang CD = 1 m. AB carries a point load of 40 kN at 1 m from A, BC carries a u.d.l. of 20 kN/m. A load of 30 kN acts at D. The beam is supported at A, B and C. I_{AB} = I, I_{BC} = 2I. Determine support moment using three moments theorem. Draw B.M. diagram giving net BM only.

c) Determine nature and magnitude of forces in all members of truss given in Fig. No. 2.

Marks

6. **Attempt any TWO of the following :** **16**

a) A cantilever ABCD is fixed at A and carries a u.d.l. of 20 kN/m on the portion AB and a point load of 20 kN at C. AB = 4 m, BC = CD = 2 m. Find the deflection at B and the slope at C in terms of EI.

b) A fixed beam 6 m in span is subjected to two point loads of 18 kN and 30 kN at 2 m and 4 m from left hand support. Calculate net B.M. under point load and draw B.M. diagram showing net bending moments. Draw S.F. diagram.

c) A continuous beam of uniform flexural rigidity is fixed at A and supported over B and C such that AB = 8m, BC = 6 m. A u.d.l. of 12 kN/m acts on AB and a point load of 48 kN acts at the centre of BC. Using Clapeyron's theorem, calculate the support moments and draw B.M.D. showing only points of contraflexure.

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