Prelim Paper **17422**

3 Hours / 100 Marks **Theory of Structures**

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.

1. (a) Attempt any **SIX** of the following : **[12]**

(i) Define "Core of a Section." Sketch resultant stress diagram if load acts on the boundary of core of section.

(ii) Write the differential equation for slope and deflection and state terms used in equation.

(iii) What do you understand by boundary conditions of a beam? State the boundary condition for two different nature of beam support.

(iv) A cantilever of span L carries point load W at L/2 from fixed end. State value of slope at free end.

(v) State the two situations where Macaulay's method is used for finding slope and deflection of beam.

(vi) Define "fixing" and "fixed beam".

(vii) At a continuity, adjoining spans have their distribution factors as 0.43 and 0.57. What is the meaning of these values?

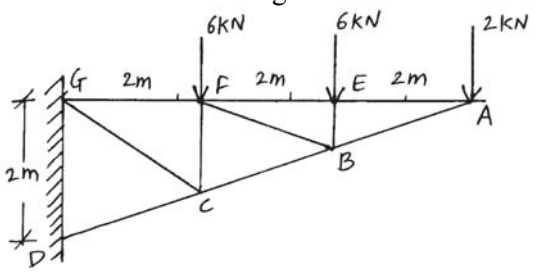
(viii) Define perfect and imperfect frame.

(b) Attempt any **TWO** of the following : **[8]**

(i) A pillar is square in section and has side 1 m. Values of axial and bending stress are 300 kN/m^2 and 287 kN/m^2 respectively. Determine resultant stresses. Draw resultant stress distribution diagram. Also state whether the load line is within the core or not.

(ii) A short column of external diameter 250mm and internal diameter 200mm carries an eccentric load. Find the eccentricity for no tension condition.

(iii) Determine the forces in the members FE, FB and CB using method of section for the truss shown in Figure.



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

(a) A chimney having external diameter 5 m and 50 m high. It is subjected to horizontal wind pressure of 7 KPa normal to the chimney. Find the maximum bending stresses in the chimney. (C = 0.7)

(b) A hollow circular column having external diameter 2 m, carries load of 460 kN at an eccentricity of 0.8 m. Draw resultant stress diagram. (For this column Area = 2.356 m^2 and $I_{xx} = I_{yy} = 0.7363\ m^4$)

(c) A retaining wall 6 m high has uniform thickness 2 m. It retains water upto top. Determine total water pressure and net stresses at base. Draw stress diagram. Use unit wt. of water 10 kN/m^3 and unit wt. of wall motored is 18 kN/m^3.

(d) A beam of span 2.5 m is simply supported and carries UDL w/unit length, if slope at the end is not to exceed 1.5°. Find the maximum deflection.

(e) A cantilever beam has cross section 120 mm wide and 200 mm deep. If load of 6 kN acting at the free end, calculate the span of beam if slope at free end of beam is 1.5×10^{-3} radians. Take E = 100 kN/mm^2.

(f) Calculate limit of eccentricity for rectangular section having width 'b' and depth 'd' and show it on sketch.

3. Attempt any **FOUR** of the following : **[16]**

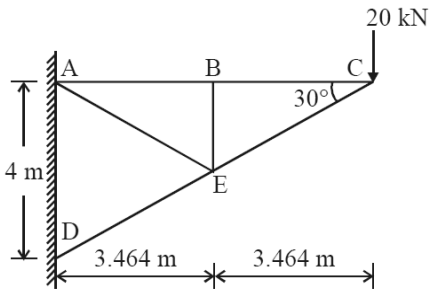
(a) A simply supported beam of span 6m, carries a point load of 60KN at 2m from left hand support. Calculate deflection under the point load. Use Macaulay's method

(b) A simply supported beam of span 9 m carries two point loads of equal magnitude 36 kN at 3 m from both ends. Calculate values of integration constants and write Macaulay's slope and deflection equation.

(c) State advantages and disadvantages of fixed beams

(d) A fixed beam of span 8m carries a point load W at distance 'x' from left hand support. If the moment at the left end is twice the moment at right end evaluate 'x'.

(e) For the truss shown in fig. below, determine nature and magnitude of forces in members BC, CE, AE and DE. Use method of joints.



(f) A propped cantilever AB of span 5m carries u.d.l of 10Kn/m over entire span. A is fixed and B is simply supported using three moment theorem find support moment and draw B.M.D

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

(a) State Clapeyron's theorem for a continuous beam having same moment of inertia as well as for different moment of inertia. State meaning of each term with sketch.

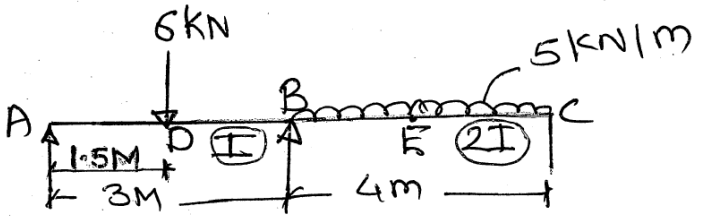
(b) A propped cantilever AB of span 4m is fixed at A and propped at B Carrying Udl Of 20KN/m. Calculate support moment using Clapeyron's theorem. Draw SFD and BMD.

(c) A beam ABC is simply supported at A B and C. span AB and BC are of span 4m and 6m respectively. AB carries a central point load of 50KN and BC carries a udl of 15KN/m over the entire span. Calculate support moment at B using three moment theorem.

(d) Beam ABCD is simply supported at A & D and is continuous over B & C. Determine distribution factors. (AB = BC = CD = 6 m) (IAB = I, IBC = 2I, ICD = 1.5 I).

(e) A beam ABC is fixed at A and is supported at B and C. 20 kN/m u.d. load acts on AB and 40 kN point load acts at centre of BC. If DF_{BA} = 0.57 and DF_{BC} = 0.43. Determine support moment using moment distribution method. l(AB) = 6 m and l (BC) = 4 m.

(f) Calculate support moments for given continuous beam by moment distribution method.

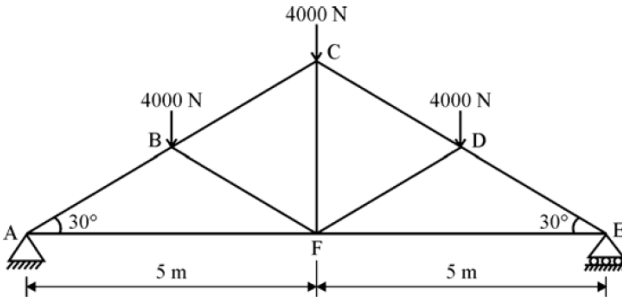


5. Attempt any **TWO** of the following : **[16]**

(a) A circular chimney has external diameter 60% more than internal diameter. The height of chimney is 32 m and is subjected to a horizontal wind pressure of 1.75 kN/m^2. Find out the diameter of chimney so as to avoid tension at the baseof chimney and also draw stress distribution diagram unit wt of chimney material is 18 kN/m^3 and c = 0.60.

(b) A beam ABCD is simply supported at A,B,C and CD is overhang. AB = 6 m BC = 4 m and CD = 1.5 m. Span AB carried udl of 15KN/m over entire span and BC carries point load of 30 KN at 1 m from support B and a point load of 15 KN acts at free end. Determine support moments using moment distribution method and draw BMD.

(c) Determine the nature and magnitude of forces in the members (AB, BC, FD & CF) of frame as shown in fig. Also find support reaction using method of joints.

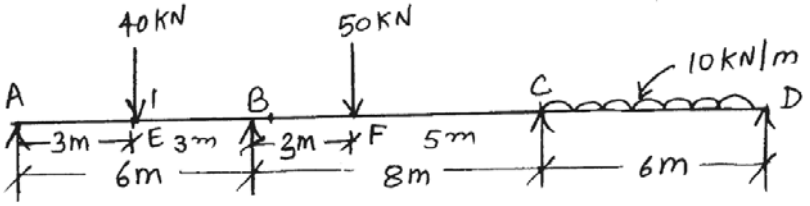


6. Attempt any **TWO** of the following : **[16]**

(a) A simply supported beam is subjected to two point loads 25 KN and 35 KN at 1 m and 3 m from the left support respectively. Span of the beam is 5 m. Calculate deflection under 25 KN. Load by Macaulay's method.
Take $E = 2 \times 10^5$ N/mm^2, $I = 3 \times 10^8$ mm^4.

(b) A fixed beam of span 8 m carries 5 kN/m udl over entire length along with a point load of 40 kN at 2 m from left hand support. Find net BM at point load and draw BMD and SFD.

(c) A continuous beam is loaded as shown in Figure below. Find support moments and support reactions. Solve by three moment theorem only.



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