

Theory of Structure (315313)

MSBTE Diploma · K-Scheme · Model Question Paper — Set C

Time: 4 Hours**Max. Marks: 70****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 the examination hall.

Q.1 Attempt any FIVE of the following:**10**

- a) Define slope and deflection of a beam and state their units.
- b) Write the differential equation of the elastic curve of a beam and state the meaning of each term.
- c) Define deficient frame and redundant frame.
- d) Define stiffness factor and carry-over factor.
- e) State any two advantages of a fixed beam over a simply supported beam.
- f) State any two assumptions made in the analysis of simple trusses.
- g) State the sign convention used in the moment distribution method.

Q.2 Attempt any THREE of the following:**12**

- a) A simply supported beam of span 6 m carries a UDL of 15 kN/m over the whole span. If the maximum deflection is not to exceed span/325, find the required moment of inertia of the section. Take $E = 2 \times 10^5 \text{ N/mm}^2$.
- b) A timber cantilever 2.5 m long carries a UDL of 8 kN/m over its entire length. The section is 120 mm wide and 250 mm deep. Find the slope and deflection at the free end. Take $E = 12 \text{ kN/mm}^2$.

- c) A cantilever AB of span 3 m is fixed at A. It carries a point load of 15 kN at 1 m from the fixed end and a point load of 10 kN at the free end B. Using Macaulay's method, find the slope and deflection at the free end and under the 15 kN load in terms of EI.

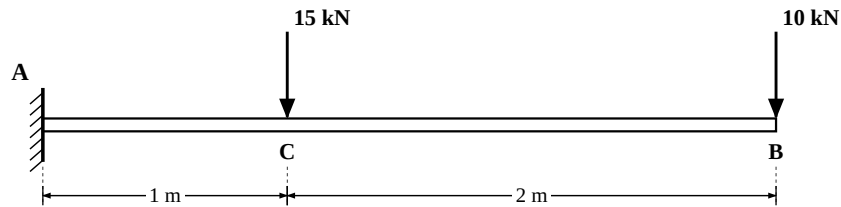


Fig. No. 1

- d) Calculate the fixed end moments and draw the BMD for the fixed beam shown in Fig. No. 2.

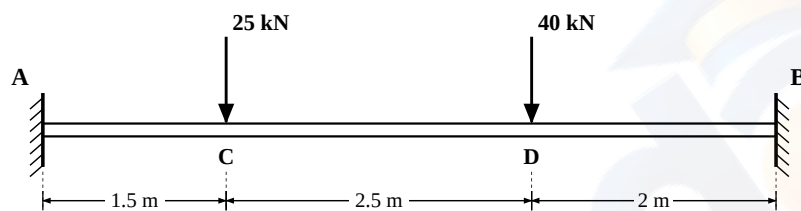


Fig. No. 2

Q.3 Attempt any THREE of the following:

12

- Compare a fixed beam with a simply supported beam (any four points).
- State Clapeyron's theorem of three moments. Explain how it is applied when one end of the continuous beam is fixed.
- A beam ABCD is simply supported at A, fixed at D and continuous over B and C. $AB = 5$ m, $BC = 4$ m, $CD = 6$ m; $I_{AB} = I$, $I_{BC} = 1.5I$, $I_{CD} = 2I$. Find the distribution factors at all the joints.
- A continuous beam ABC is simply supported at A, B and C. Span $AB = 6$ m (M.I. = $2I$) carries a UDL of 15 kN/m and span $BC = 4$ m (M.I. = I) carries a point load of 50 kN at 1 m from B. Find the support moment at B using the theorem of three moments.

Q.4 Attempt any THREE of the following:

12

- Differentiate between the method of joints and the method of sections (any four points).
- A fixed beam of span 6 m carries a central point load of 48 kN. Find the fixed end moments from first principles and draw the BMD.
- Compare symmetrical and unsymmetrical portal frames with neat sketches (any four points).
- Explain perfect, deficient and redundant frames with neat sketches.

- e) Derive the relation $M = EI \frac{d^2y}{dx^2}$ and state the relations of slope, shear force and rate of loading with deflection.

Q.5 Attempt any TWO of the following:

12

- a) A continuous beam ABCD of three spans is simply supported at A, B, C and D and loaded as shown in Fig. No. 3. EI is constant. Using the theorem of three moments, find the support moments and draw the SFD and BMD.

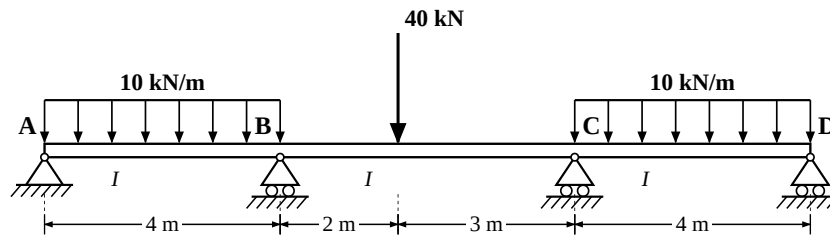


Fig. No. 3

- b) A simply supported beam AB of span 6 m carries a UDL of 20 kN/m over a length of 3 m from A and a point load of 30 kN at 4.5 m from A. Using Macaulay's method, locate the point of maximum deflection and find the maximum deflection in terms of EI.

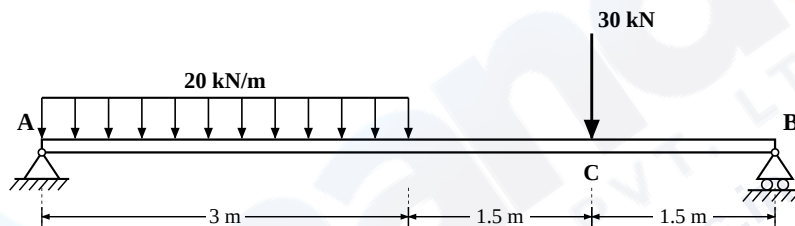


Fig. No. 4

- c) Using the moment distribution method, find the support moments for the continuous beam shown in Fig. No. 5 and draw the SFD and BMD.

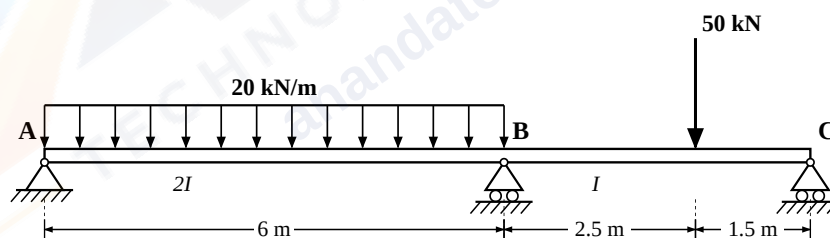


Fig. No. 5

Q.6 Attempt any TWO of the following:

12

- a) A continuous beam ABCD is fixed at A and D and supported on B and C, loaded as shown in Fig. No. 6. EI is constant. Analyse the beam by the moment distribution method and draw the BMD.

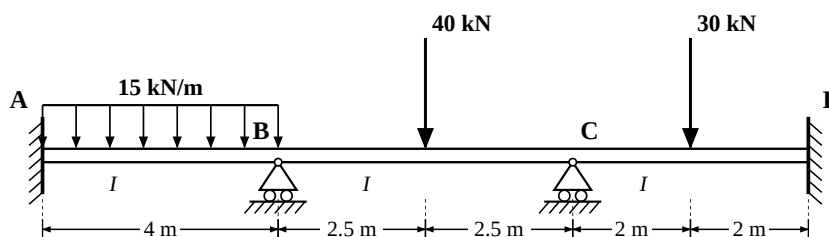


Fig. No. 6

- b) Find the support reactions and the forces in all the members of the roof truss shown in Fig. No. 7 by the method of joints. (B and D are mid-points of AC and CE.)

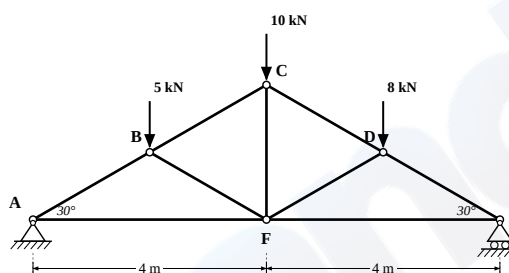


Fig. No. 7

- c) Using the method of sections, find the forces in members BC, CE and DE of the truss shown in Fig. No. 8.

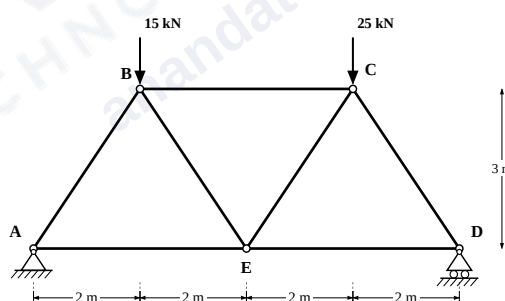


Fig. No. 8

Note: This is a **model question paper prepared by Ananda Technologies** only for practice and exam preparation, based on the pattern of previous MSBTE question papers and the K-scheme syllabus. It is **not an official MSBTE paper**, and it does **not** mean that these questions will come in the exam. Answers follow standard textbook points; marks shown are indicative. Free for students — anandatechnologies.in