Total No. of printed pages = 6

CE 181402

Roll No. of candidate

03/07/23

2023

B.Tech. 4th Semester End-Term Examination

STRUCTURAL ANALYSIS – II

New regulation (w.e.f. 2017-2018) &

New Syllabus (w.e.f. 2018-2019)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *four* from rest.

1. Pick up the correct answer : $(10 \times 1 = 10)$

   (i) The ratio of the central deflection of the fixed beam to the central deflection of the simply supported beam carrying the uniformly distributed load over the whole span is

   (a) 5

   (b) $\dfrac{1}{5}$

   (c) 4

   (d) $\dfrac{1}{4}$

   (ii) When the ends of a fixed beam are at different levels (δ), the fixing moment at each end is

   (a) $\dfrac{6\,E\,I\delta}{l^2}$

   (b) $\dfrac{6\,EI\,\delta}{l^3}$

   (c) $\dfrac{6\,EI\delta^2}{l^2}$

   (d) $\dfrac{6\,EI\,\delta^2}{l^3}$

Where EI is the flexural rigidity and I is the span of the beam

[Turn over

(iii) The maximum hogging bending moment in fixed beam carrying uniformly distributed load occurs at _____

(a) Mid span   (b) One third of the span

(c) Supports   (d) Half of the span

(iv) A propped cantilever of uniform section is subjected to a moment at the free end only. Then the moment required to rotate at the free end to produce unit slope is

(a) $\dfrac{5EI}{l}$ (b) $\dfrac{4EI}{l}$

(c) $\dfrac{3EI}{l}$ (d) $\dfrac{2EI}{l}$

Where EI is the flexural rigidity and I is the span of the beam

(v) A continuous beam ABC of uniform section consists of two spans AB = 4 meters and BC = 3 meters. The end A is fixed and C is simply supported. The distribution factors at joint B are

(a) 0.55 for span BA and 0.55 for span BC

(b) 0.52 for span BA and 0.52 for span BC

(c) 0.50 for span BA and 0.50 for span BC

(d) 0.48 for span BA and 0.48 for span BC

(vi) One of the assumptions of the cantilever method for analysis of the lateral loads is

(a) Direct stresses in the columns are proportional to their distances from the extreme left of the frame

(b) Direct stresses in the columns are proportional to their distances from the extreme right of the frame

(c) Direct stresses in the columns are proportional to their distances from the centroidal horizontal axis of the frame

(d) Direct stresses in the columns are proportional to their distances from the centroidal vertical axis of the frame

(vii) The height of the Influence line diagram (ILD) for a moving load for the bending moment at a given section D of a beam AB of length / is

(a) $\dfrac{a}{a(l-a)}$

(b) $\dfrac{l}{a(l-a)}$

(c) $\dfrac{a(l-a)}{l}$

(d) None of the above

Where AD = a

(viii) For drawing ILD, what value of test load is assumed?

(a) 1 unit

(b) Arbitrary

(c) Depends upon structure

(d) Zero

(ix) The shape factor of a circular section of radius R is

(a) 1.5

(b) $1.5 \times R$

(c) 1.698

(d) $1.698 \times R$

(x) The shape factor may be defined as the

(a) Plastic moment capacity × Yield moment capacity

(b) $\dfrac{\text{Plastic moment capacity}}{\text{Yield moment capacity}}$

(c) $\dfrac{\text{Yield moment capacity}}{\text{Plastic moment capacity}}$

(d) None of the above

2. (a) Derive an expression for maximum deflection of a fixed beam carrying a point load at mid point. (9)

(b) A beam AB of span 6 m fixed at both ends carries uniformly distributed load of 20 kN/m over the whole span. The right end supports B sinks by 10 mm, Determine the fixed end moments and the reactions at the supports. Take $E = 210 \text{ kN/mm}^2$ and $1 = 6 \times 10^7 \text{ mm}^4$. (6)

3. (a) Prove the Clapeyron's theorem of three moments of the continuous beam. (9)

(b) A beam ABC of length 10 m consists of spans AB and BC each 5 m long and simply supported at A, B, C. The beam carries a uniformly load of 20 kN/m on the whole length. Find the reactions at the supports and the support moments. (6)

4. Analyse the portal frame shown in figure 1 using moment distribution method. Draw the bending moment diagram (BMD). (15)
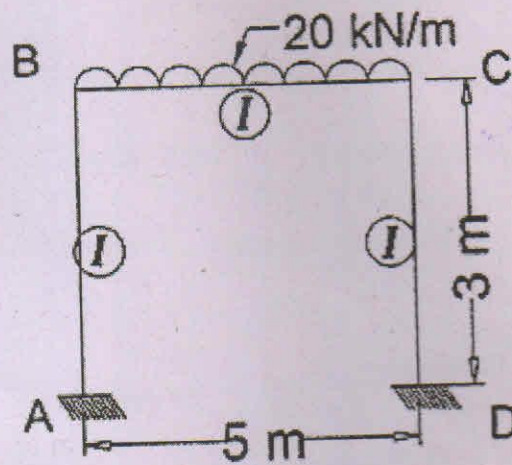
Figure 1

5. A beam ABC 10 meter long consists of spans AB and BC of lengths 6 m and 4 m respectively. It is fixed at the end A and C and simply supported at B. The span carries a UDL of 15 kN/m while the span BC carries a UDL of 10 kN/m. Determine the moments at the supports using slope deflection methods. (15)

6. (a) The load system shown in figure 2 moves from left to right on a girder 20 m. Find the maximum bending moment occurs under 130 KN load. (6)
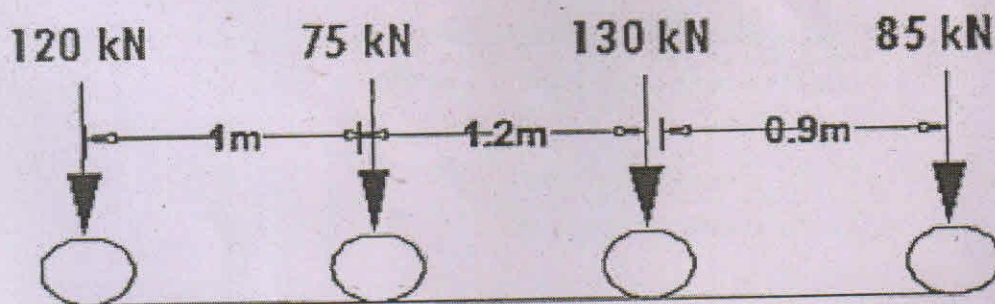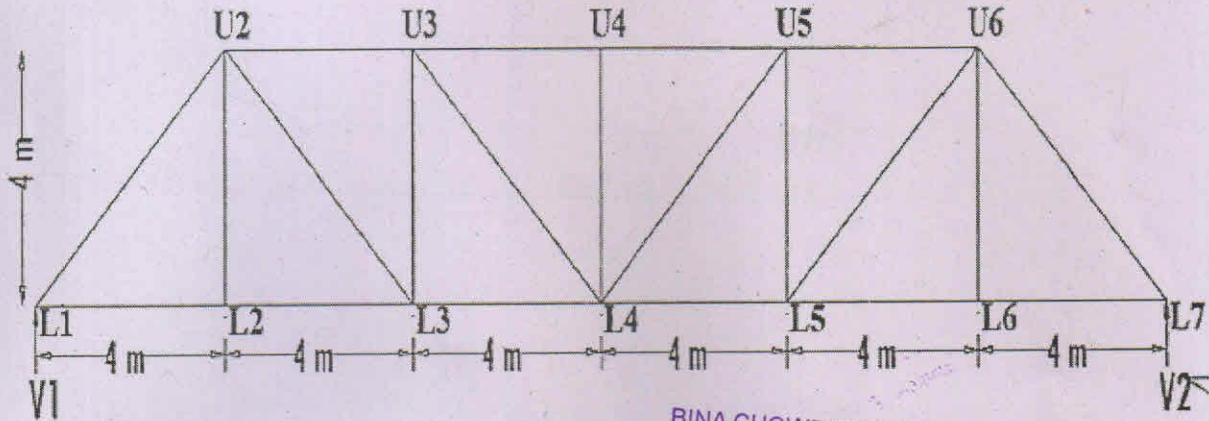

Figure 2

(b) Draw the influence line diagram for the forces in the members L_2L_3, U_3U_4 and U_3L_3 of the through type bridge truss shown in figure 3. (9)

Figure 3

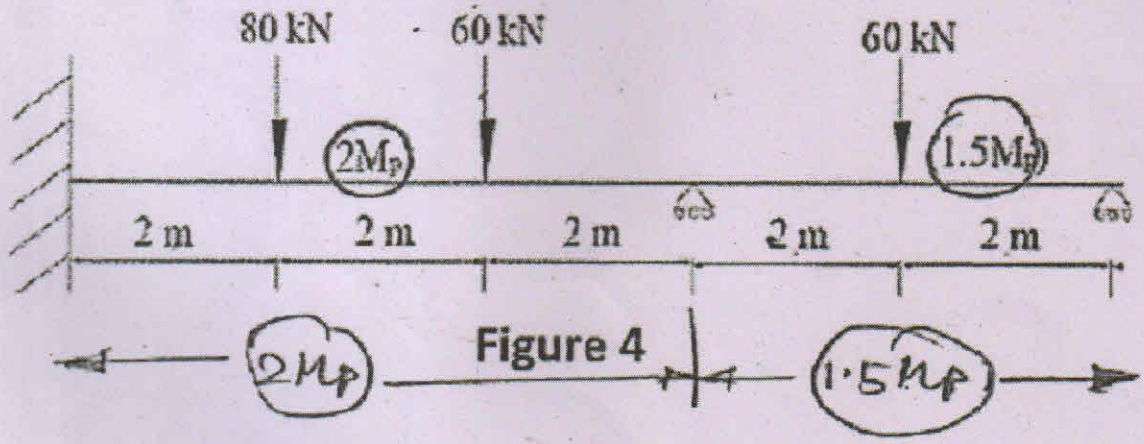7. Determine the collapse load in the continuous beam as shown in figure 4. (15)

Figure 4

8. Analyse the frame shown in figure 5 and calculate the values of moment and force in all the members. Assume any necessary data required. (15)
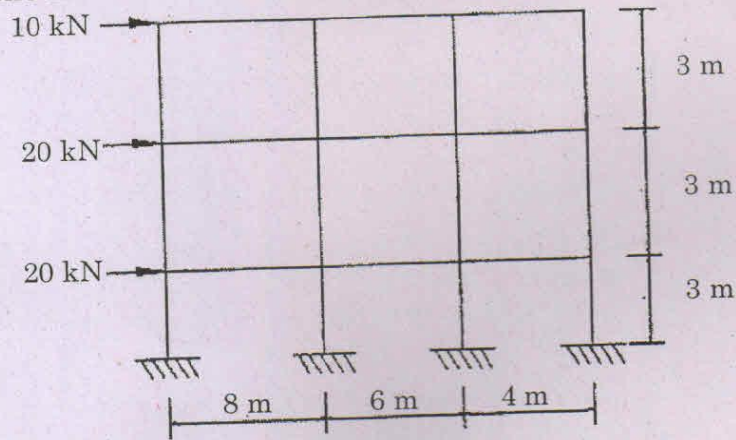

Figure 5