BANGLADESH UNIVERSITY OF PROFESSIONALS
Military Institute of Science and Technology
B.Sc. in Civil Engineering, Term Final (Spring) Examination 2024: Oct 2024 - Nov 2024

Student Group: Earned Credit Hours ≥ 108

Subject: CE 411, Structural Analysis and Design II

Time: 3.00 hours **Full Marks: 180**

INSTRUCTIONS:

a. Use **SEPARATE** answer scripts for each section.
b. **Question-1** in **Section-A** and **Question-5** in **Section-B** are compulsory.
c. Answer any other **TWO** out of the remaining **THREE** questions from each section.
d. Figures in the margin indicate full **marks**.
e. Assume reasonable data if necessary.
f. **Symbols** and **abbreviations** used have their usual meanings.

SECTION-A

Question 1 (Compulsory)

a. Determine support moments and reactions for the beam shown in fig 1(a). **15**

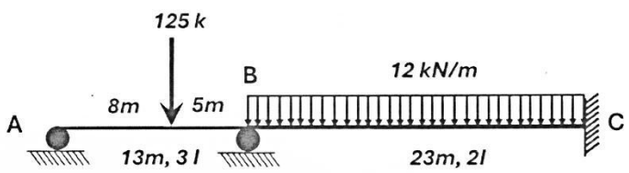


Figure 1a

b. Determine bar forces of the frame (figure 1b) using stiffness method. Cross sectional areas (in square inch) are given in parenthesis. **15**

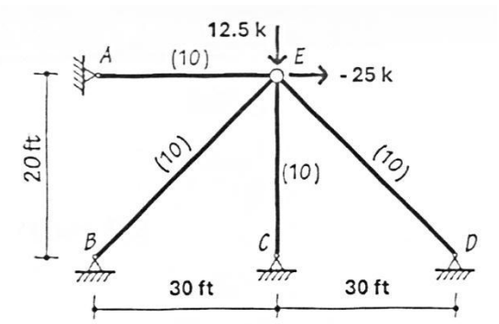


Figure 1b

Question 2

a. Determine reactions of the frame (figure 2a) using direct stiffness matrix method. **15**

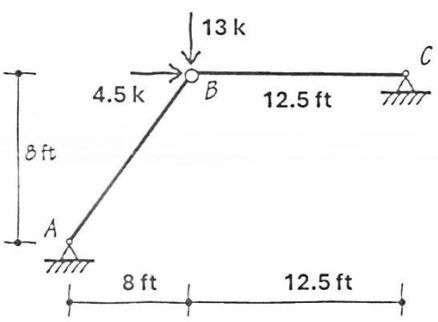


Figure 2a

b. Determine support moments for the beam shown in figure 2b (EI constant). **15**

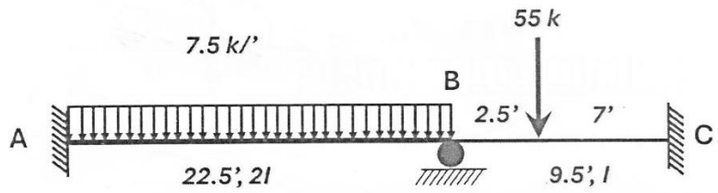


Figure 2b

Question 3

a. Determine support moments due to the loading and support movements (figure 3a). Support 'A' rotates 0.03 radian clockwise and support 'D' moves up by 0.15 feet. (EI=3000 k-ft^2) **15**

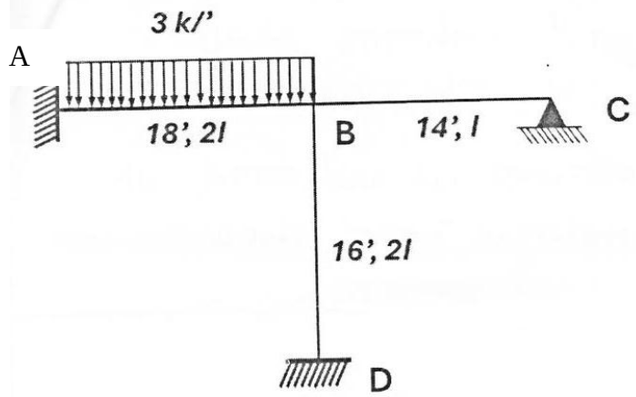


Figure 3a

b. Determine the internal moments of the frame as indicated in figure 3b. **15**

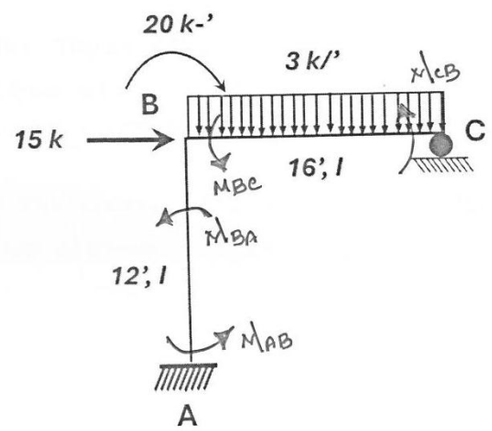


Figure 3b

Question 4

a. Determine bar forces of the truss (figure 4a) using stiffness method. Cross sectional areas (in square inch) are given in parenthesis. **15**

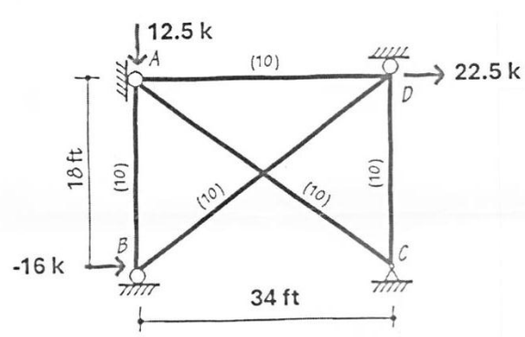


Figure 4a

b. Determine all reactions of the beam (figure 4b) using direct stiffness matrix method. **15**

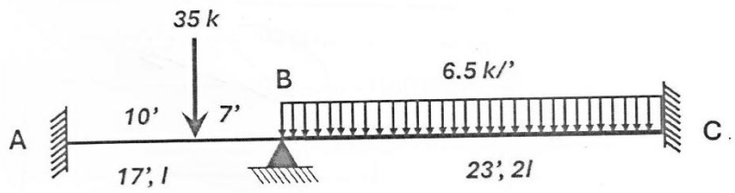


Figure 4b

SECTION-B

Question 5 **(Compulsory)**

a. Find the influence line for the reaction at support 'a' and the bar force in member 'aB' of the truss as shown in figure 5(a). Cross- sectional area (in^2) of each bar is provided in bracket. **20**

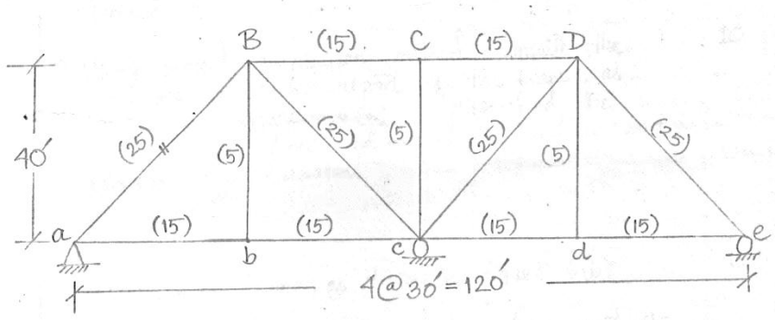


Figure 5a

b. Draw shear force and bending moment diagrams of the frame as shown in figure 5(b). Also draw the qualitative deflection diagram. Consider, sideway prevention of the frame and EI= constant. **20**
Use, moment distribution method.

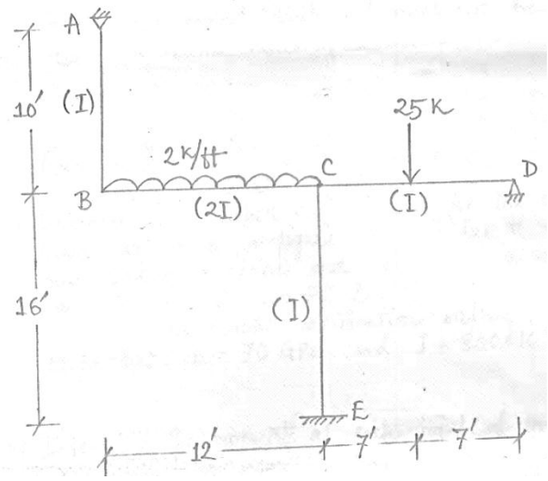


Figure 5b

Question 6

a. Using moment distribution method, compute the reaction of each support of the beam, as shown in figure 6(a). Also, find the internal force and moment at section a-a. Consider, EI=constant. **10**

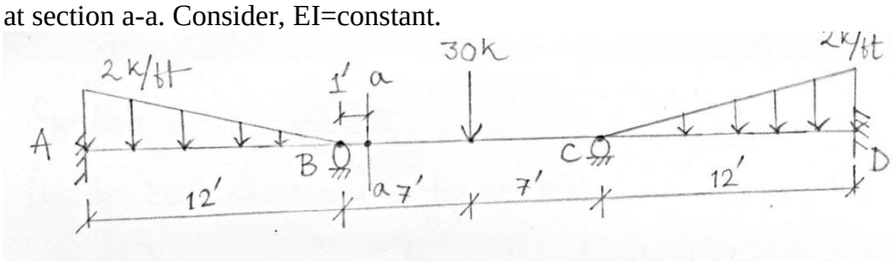


Figure 6a

b. For the frame, as shown in figure 6(b) **15**

i) Draw the qualitative influence line for moment at point G which is just right of joint D.

ii) Draw the influence line for reaction at point A, (R_A) with numerical values at each ¼ th the distance of the span: AB, BC and CD. Assume, E=constant. Unit load moves over the beam AD. The relative values of I are shown in figure.

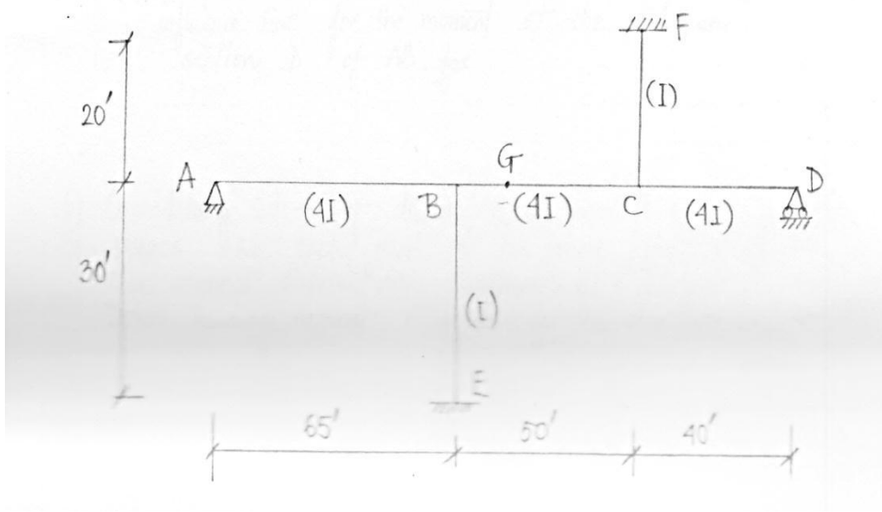


Figure 6b

Question 7

a. Determine the member end moments for the continuous beam, as shown in figure 7(a) due to the given loading condition and due to the settlement of 20 mm at support B. **10**

Use the moment distribution method. Given that, E=70 GPa and I=800×10^6 mm^4

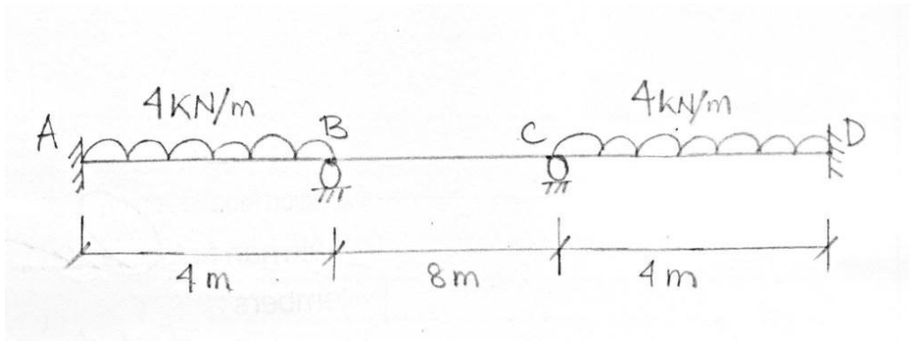


Figure 7a

b. Determine the moments at each joint of the frame, then draw the moment diagram for members BCE, BA & CD. Assume B.C and E are fixed connected and A,D are pins. Given that, E=29×10^3 ksi. Use, moment distribution method. Consider, sideway prevention of the frame [(figure 7(b)]. **15**

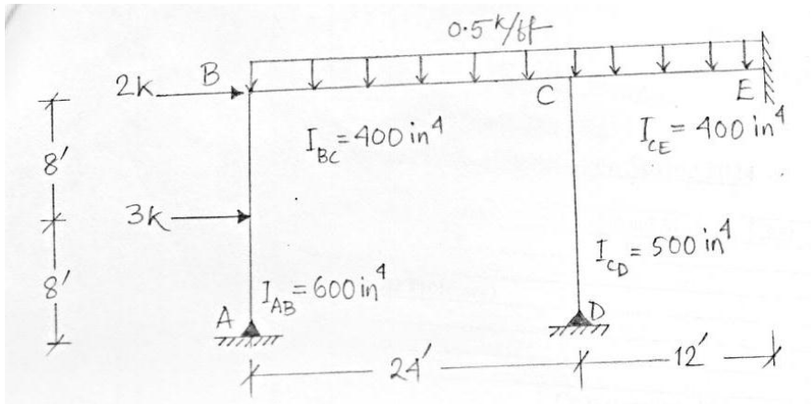


Figure 7b

Question 8

a. For the beam, as shown in figure 8(a) **10**

i) Draw the qualitative influence line for shear at point E.

ii) Draw the qualitative influence line for reactions at point C

iii) Compute the ordinates at 2' intervals of the influence line for the moment at the mid span section D of AB

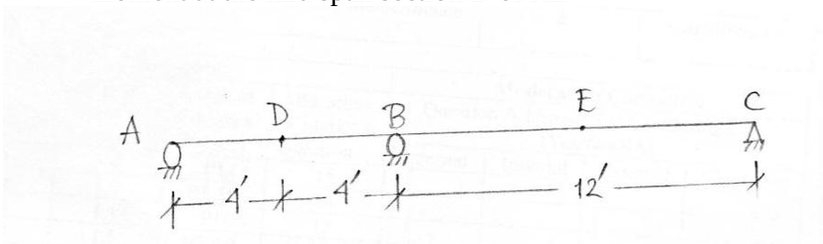


Figure 8a

b. Considering side-sway, determine the moments and shears at each joint of the frame [figure 8(b)]. Use moment distribution method. EI= constant. Draw bending moment diagram for the structure. **15**

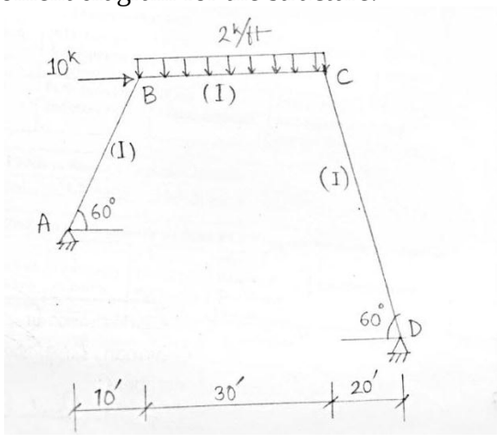


Figure 8b