Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2023/2024

COURSE NAME	:	STRUCTURAL ANALYSIS
COURSE CODE	:	BFC21403
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JANUARY/FEBRUARY 2024
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER **ALL** QUESTIONS IN PART A. ANSWER ONLY 3 QUESTIONS FROM PART B. 2. THIS FINAL EXAMINATION IS CONDUCTED VIA ☐ Open book ☒ Closed book 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

PART A

Q1 **Figure Q1.1** shows the part of the architectural drawing for structural building. Answer the following questions.

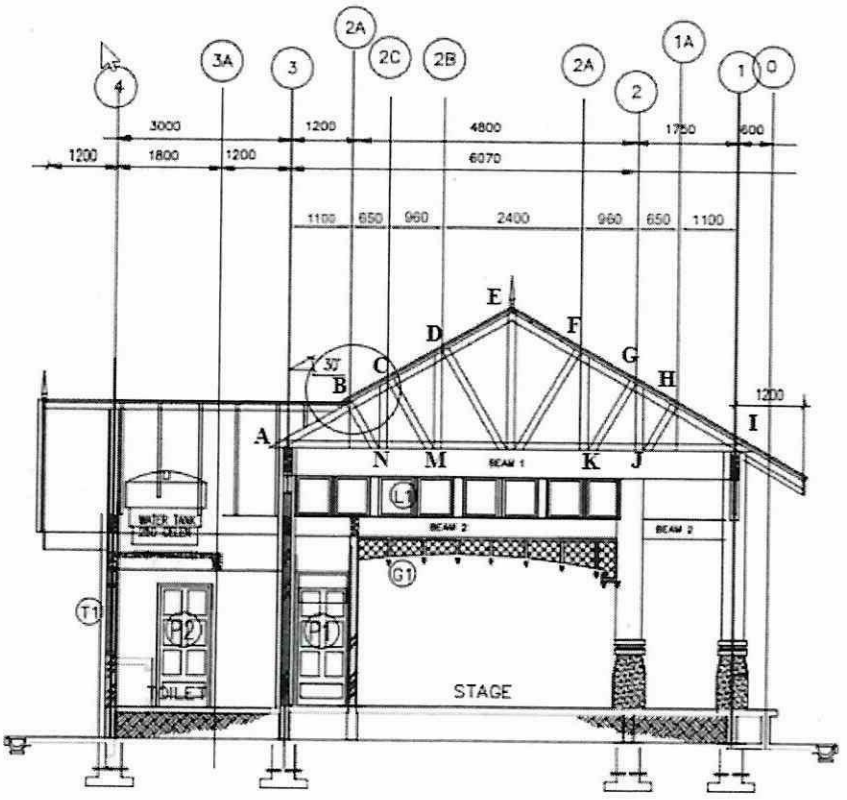


Figure Q1.1

(i) Draw the idealized roof truss with nodal loads, assume 1.5kN vertical load at outer nodes and 3kN vertical load at each internal nodes with downward direction.

(2 marks)

(ii) Check the stability and determinacy of the roof truss.

(3 marks)

(iii) Calculate the reaction of the truss support if the support at A is considered as pinned meanwhile the support at I is roller.

(5 marks)

(iv) Calculate the member forces of BC, BA and BN.

(10 marks)

(v) Member of BN and HJ need to be removed due to certain reasons. Discuss the action taken in analysing the truss structure, sketch also the new free body diagram after member removal.

(5 marks)

PART B

Q2 **Figure Q2.1** shows a frame with fixed connection at A, B and D. If the EI is constant, determine;

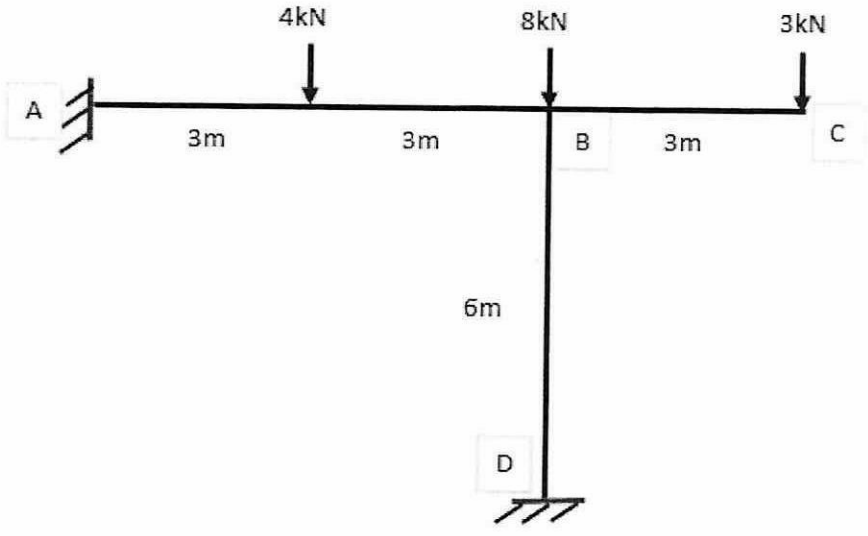


Figure Q2.1

(i) Fixed end moment for each member.

(2 marks)

(ii) Slope-deflection equation for each member.

(3 marks)

(iii) Slope at B, $\emptyset_B$

(5 marks)

(iv) End moment for each member.

(5 marks)

(v) Reactions at supports A and D.

(5 marks)

(vi) Shear force diagram and moment bending diagram.

(5 marks)

Q3 Answer the following questions.

(a) Describe the concept of 'carryover moment' in moment distribution method.

(2 marks)

(b) **Figure Q3.1** shows a continuous concrete beam with fixed supports at both ends labelled as point A and D and pinned supports at point B and C. The beam is subjected to a point load of 200 kN and uniform distributed load of 30 kN/m.

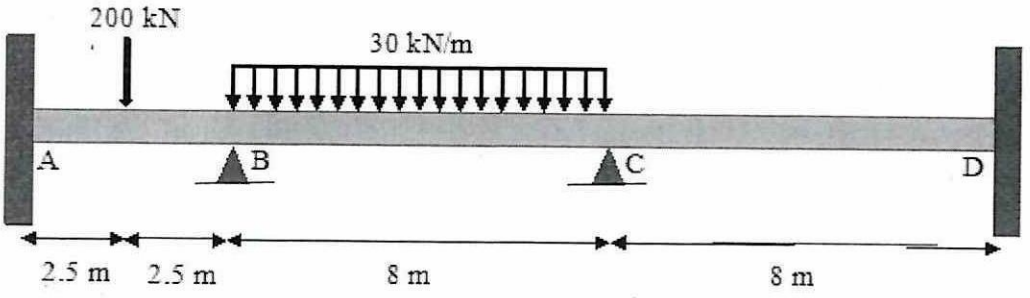


Figure Q3.1

(i) Determine the stiffness and distribution factors of each member of the beam.

(13 marks)

(ii) Calculate the internal moments within the member of continuous beam.

(10 marks)

Q4 Influence line represents the variation of the shear and moment at a specific point in a member. The simply supported beam with overhang as shown in **Figure Q4.1**.

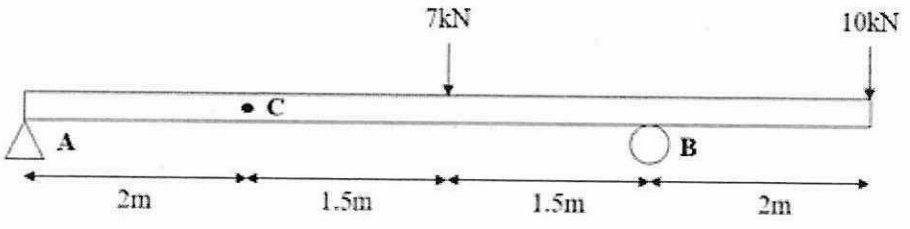


Figure Q4.1

(a) Construct the influence line for the shear at point C.

(9 marks)

(b) Construct the influence line for the moment at point C.

(6 marks)

(c) If point load of 7kN and 10kN stop at the position as shown in **Figure Q4.1**:

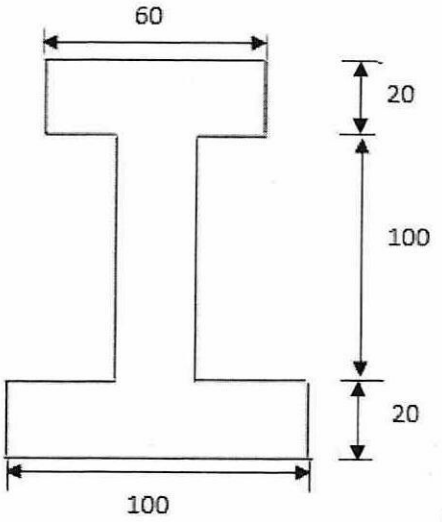
(i) Determine the shear force at C

(5 marks)

(ii) Determine the moment at C

(5 marks)

Q5 **Figure Q5.1** shows the cross-sectional area of beam. Given, σ_y = 250 N/mm^2. Permissible stress, σ_b = 175 N/mm^2. Calculate the following;



(all unit in mm)

Figure Q5.1

(i) Elastic Modulus

(6 marks)

(ii) Yield moment, M_y

(4 marks)

(iii) Plastic moment, Mp

(6 marks)

(iv) Plastic modulus, Zp

(3 marks)

(v) Shape Factor, S

(3 marks)

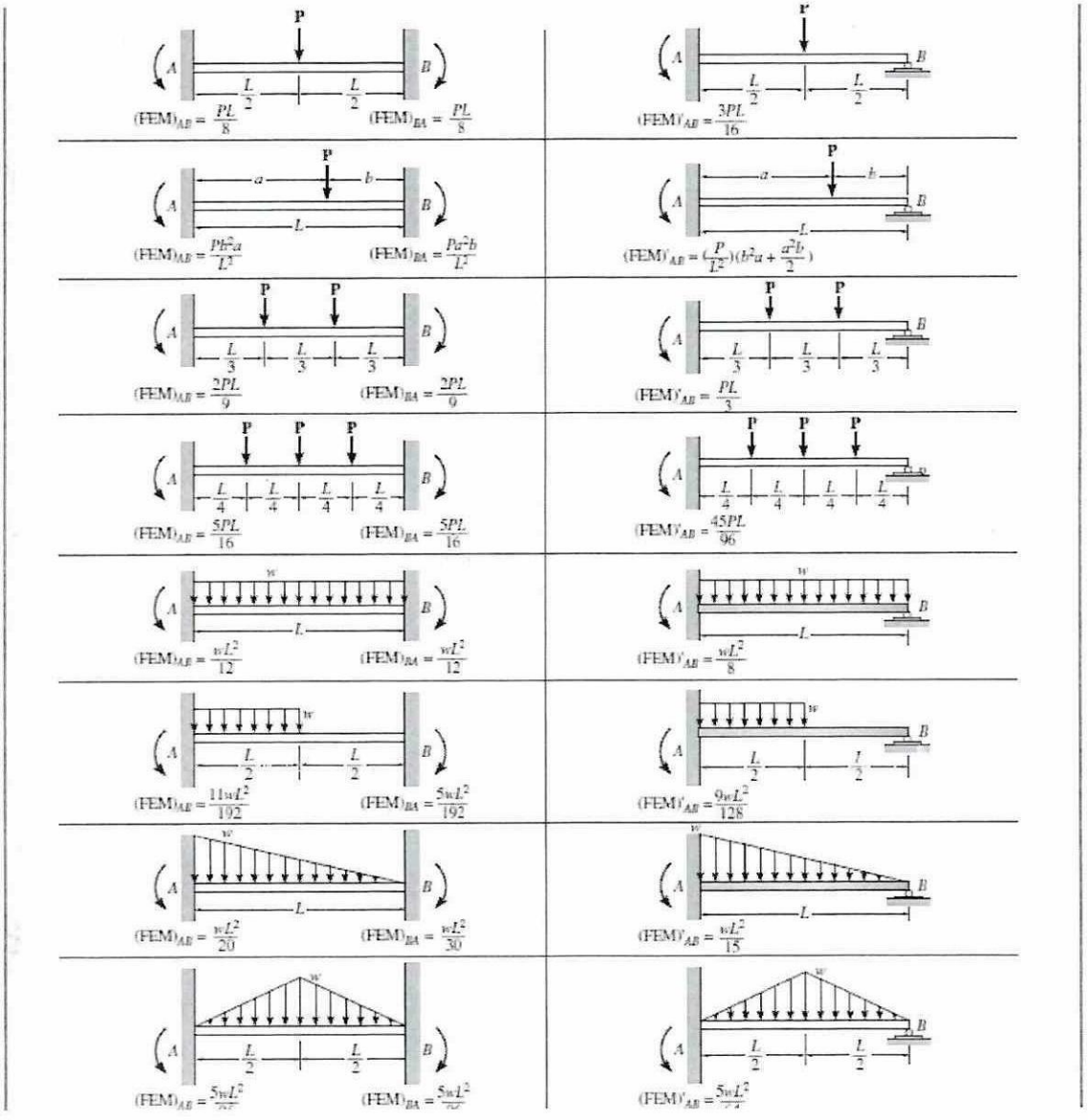
(vi) Load factor, λ

(3 marks)

- END OF QUESTIONS -

APPENDIX A

FIXED END MOMENT



APPENDIX B

GENERAL FORMULATION FOR SLOPE DEFLECTION EQUATIONS

$$M_{XY} = \frac{4EI\theta x}{L} + \frac{2EI\theta y}{L} - \frac{6EI\Delta}{L^2} + M_{XY}^F$$

$$M_{YX} = \frac{4EI\theta y}{L} + \frac{2EI\theta x}{L} - \frac{6EI\Delta}{L^2} + M_{YX}^F$$

Or can be write down as:

$$M_{XY} = \frac{2EI}{L}\left[2\theta_X + \theta y - \frac{3\Delta}{L}\right] + M_{XY}^F$$

$$M_{YX} = \frac{2EI}{L}\left[2\theta_Y + \theta x - \frac{3\Delta}{L}\right] + M_{YX}^F$$

M_{XY}^F *also known as Fixed end moment(FEM)*