Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	STRUCTURE ANALYSIS
COURSE CODE	:	BFC 21403
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2024
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER ALL QUESTIONS

2. THIS FINAL EXAMINATION IS CONDUCTED VIA
   - ☐ Open book
   - ☒ Closed book

3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 **Figure Q1.1** shows a statically indeterminate truss with pin supports at points A and H. Vertical external loads of 4 kN, 10 kN and 5 kN are acting on points B, D and F, respectively. A horizontal 3 kN load is acting at point G. AE is constant.

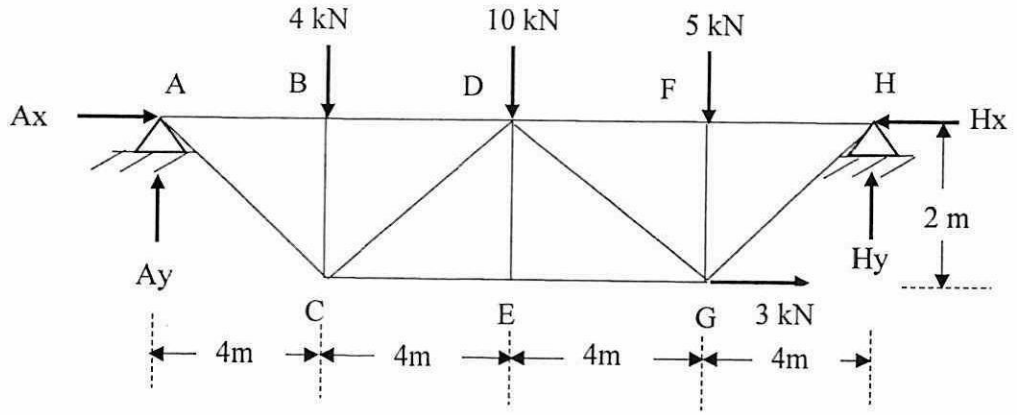

Figure Q1.1 Statically Indeterminate Truss

(a) Determine the degree of static indeterminacy for the truss system.

(2 marks)

(b) Using virtual work method and alternative method, determine the actual internal forces in all the truss members. Take horizontal force at H as redundant.

(17 marks)

(c) If both pin at support A and H are changed to roller support, what will happen to the truss system? Explain in term of its determinacy and stability.

(6 marks)

Q2 **Figure Q2.1** shows a continuous beam fixed at both ends A and D. The flexural rigidity of the beam is not constant; for span AB and CD, it is EI, and for span BC, it is 3EI. Assume that the supports at A and D are fixed, while supports at B and C are rollers.

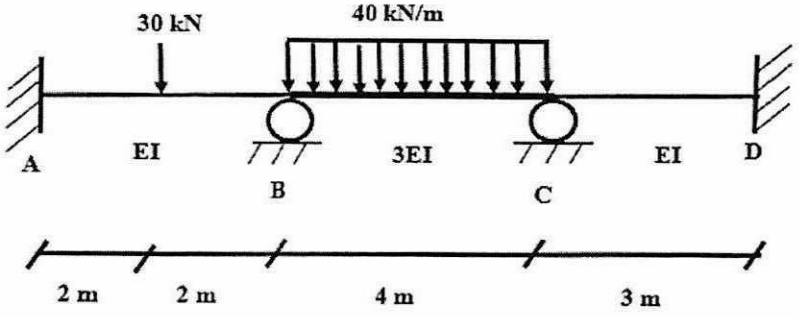

Figure Q2.1 Continuous Beam

(a) Calculate Distribution Factor (DF) and Fixed End Moment (FEM) for each span of the beam.

(7 marks)

(b) Determine the internal moments using the moment distribution method.

(9 marks)

(c) Determine the internal moments in the indeterminate frame depicted in **Figure Q2.2** using the method of slope deflection. Assume that the supports at A and C are fixed, and EI is constant.

(9 marks)

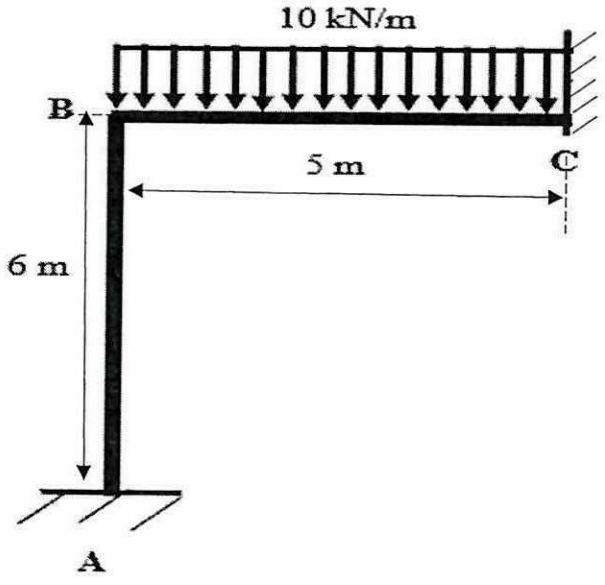

Figure Q2.2 Indeterminate Frame

Q3 **Figure Q3.1** shows a continuous beam with pin support at its left end and roller support at its right end. A roller support is located 4 m from the left.

(a) Construct the shear force influence line for support E and sketch the moment influence lines for point B, situated at the midpoint of span AB.

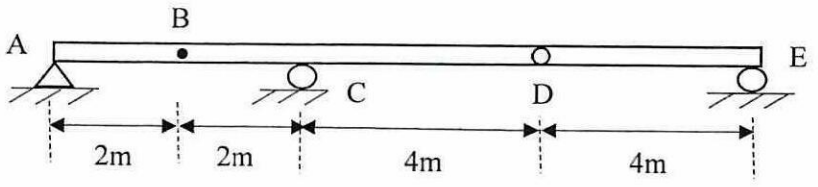

Figure Q3.1 Continuous Beam

(10 marks)

(b) Construct the influence line for the force in member FG in the 2-D truss illustrated in **Figure Q3.2.**

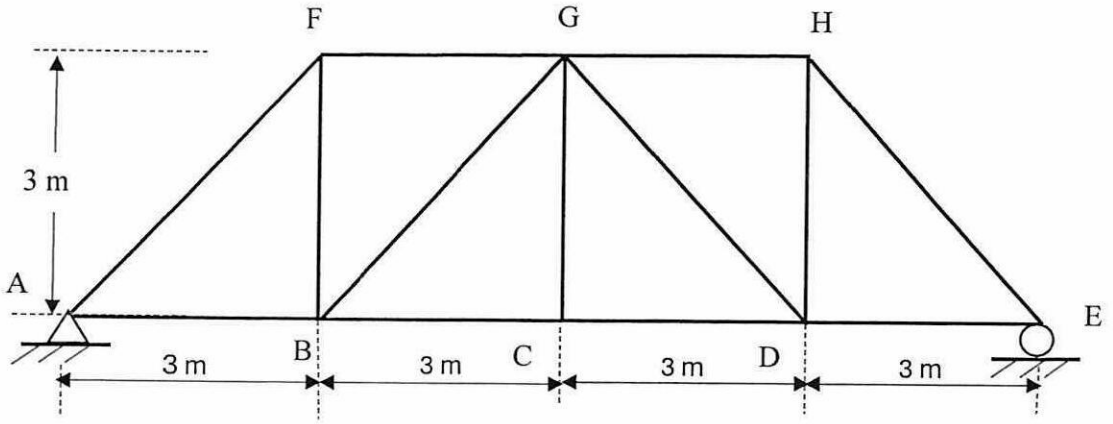

Figure Q3.2 2-D Truss

(11 marks)

(c) Explain briefly the difference between shear influence line and shear force diagram.

(4 marks)

Q4 **Figure Q4.1** shows a simply supported I cross section beam with dimension as shown.

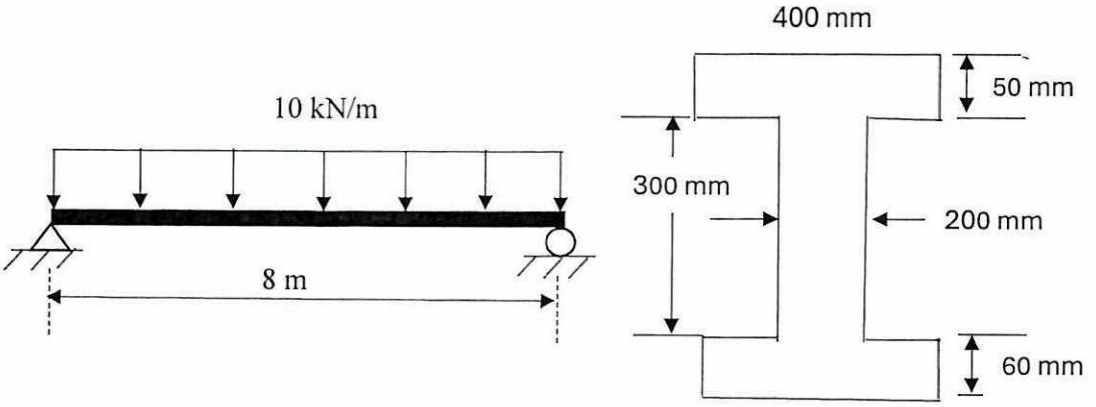

Figure Q4.1 Simply Supported Beam with I Cross Section

(a) Determine the centroid ($\bar{x}$, $\bar{y}$) of the cross section

(4 marks)

(b) Determine the moment of inertia, Ixx

(1 mark)

(c) Determine the maximum and minimum stress of the beam

(2 marks)

(d) Draw the stress block at its elastic, elastic-plastic and fully plastic condition.

(3 marks)

(e) A statically indeterminate beam with fix supports at A and D, and roller supports at points B and C, carries load as shown in **Figure Q4.2**. Sketch all the possible mechanisms for the beam system and show all the hinges developed.

(3 marks)

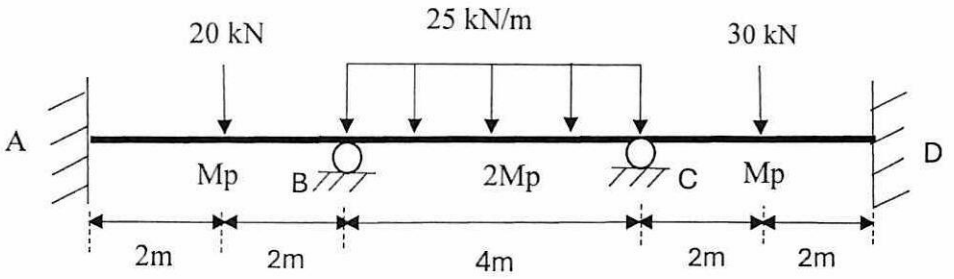

Figure Q4.2 Statically Indeterminate Beam

(f) Determine the maximum plastic moment for the beam.

(7 marks)

(g) If the load 20 kN and 30 kN are taken away, will the number of hinges developed along the span increase or decrease? Justify your answer.

(5 marks)

- END OF QUESTIONS -