

CONFIDENTIAL



**UTHM**

Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2022/2023**

COURSE NAME : STRUCTURAL ANALYSIS

COURSE CODE : BFC 21403

PROGRAMME CODE : BFF

EXAMINATION DATE : FEBRUARY 2023

DURATION : 3 HOURS

INSTRUCTION : 1. ANSWER ALL QUESTIONS  
2. THIS FINAL EXAMINATION IS CONDUCTED VIA **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 **EIGHT (8)** PAGES

- Q1** (a) Determine the types of frames and the truss classification in **Figure Q1(a)**.  
(8 marks)
- (b) **Figure Q1(b)** shows a statically determinate plane truss subjected to a vertical and horizontal concentrated load at joint B, C and E, respectively. The truss is made using steel and the cross-section area for all members are given in **Table Q1**. Find the displacement at joint G, if P value is the last digit in your matric card, plus with number two and multiplied with number ten. Value of E is 210 GPa.  
(15 marks)
- (c) If the truss displacement exceeds the allowable displacement, what is the approach that must be implemented?  
(2 marks)

- Q2** **Figure Q2** shows an indeterminate continuous beam fixed at support A and pinned at supports B, C, D and E. Assume EI is constant.
- (a) Analyze the beam by using moment distribution method.  
(13 marks)
- (b) Determine the reactions at supports  
(4 marks)
- (c) Draw the shear force and bending moment diagram  
(6 marks)
- (d) Determine the maximum moment for span AB  
(2 marks)

- Q3** (a) Draw the shear force influence line at support E and moment influence lines at point B for beam in **Figure Q3(a)**.  
(12 marks)
- (b) Determine the maximum axial force in member BC of the Warren truss due to a series of four moving concentrated loads as shown in **Figure Q3(b)**.  
(13 marks)

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- Q4** (a) Explain **TWO (2)** advantages of employing plastic analysis approach in steel structures. Briefly explain **THREE (3)** differences between a load factor and a shape factor in structural analysis.
- (5 marks)
- (b) For the cross-section shape of a steel beam shown in **FIGURE Q4(a)**, calculate plastic moment ( $M_p$ ), plastic modulus ( $Z_p$ ) and shape factor ( $S$ ). Assume the yield stress ( $\sigma_y$ ) of steel beam to be  $250 \text{ N/mm}^2$ .
- (10 marks)
- (c) **FIGURE Q4(b)** shows a beam with a total length of 6m, subjected to a uniform distributed load of  $6 \text{ kN/m}$  between A to B. Also, an external load of  $18 \text{ kN}$  at distance of 5 m from point A is applied. Supports at points A and B are pin and at C is roller.
- (i) Show all the possible collapse mechanisms.
- (2 marks)
- (ii) Calculate the plastic moments of the beam using virtual work method.
- (8 marks)

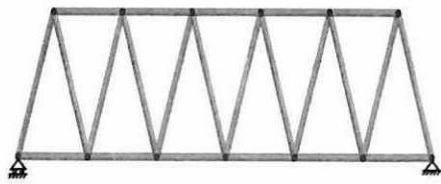
–END OF QUESTIONS –

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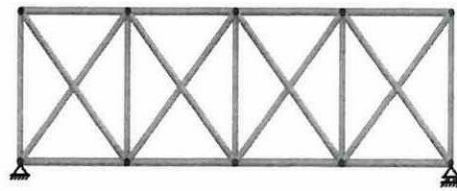
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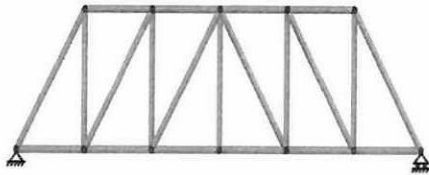
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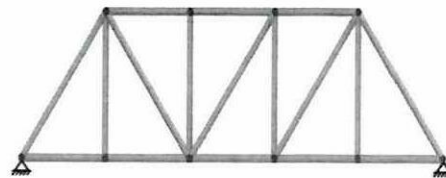
(i)



(ii)



(iii)



(iv)

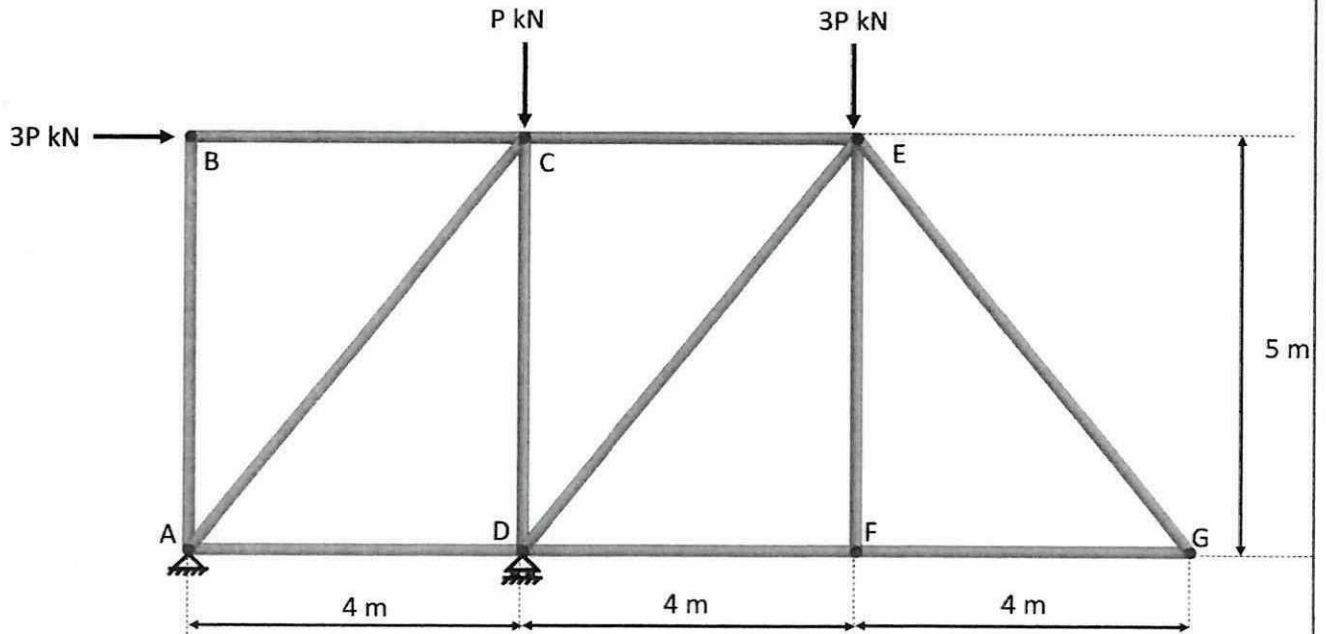
**FIGURE Q1 (a)**

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**FIGURE Q1 (b)**

**TABLE Q1**

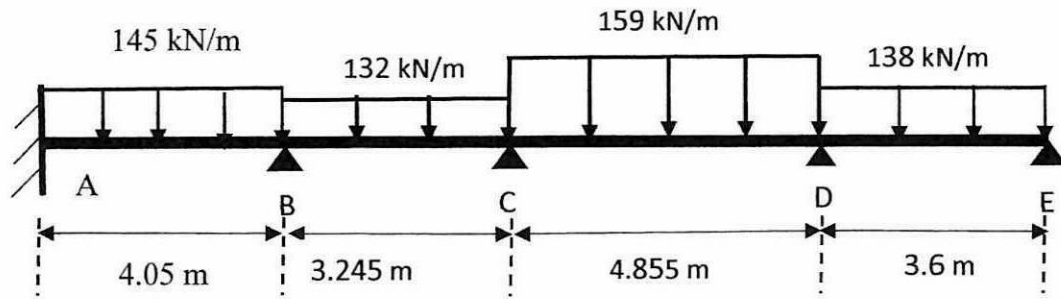
Member	Area ( $\times 10^3$ mm)
AB	2
AC	5
AD	5
BC	2
CD	2
CE	5
DE	5
DF	2
EG	2
EF	5
FG	5

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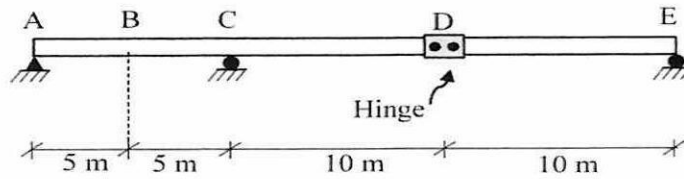
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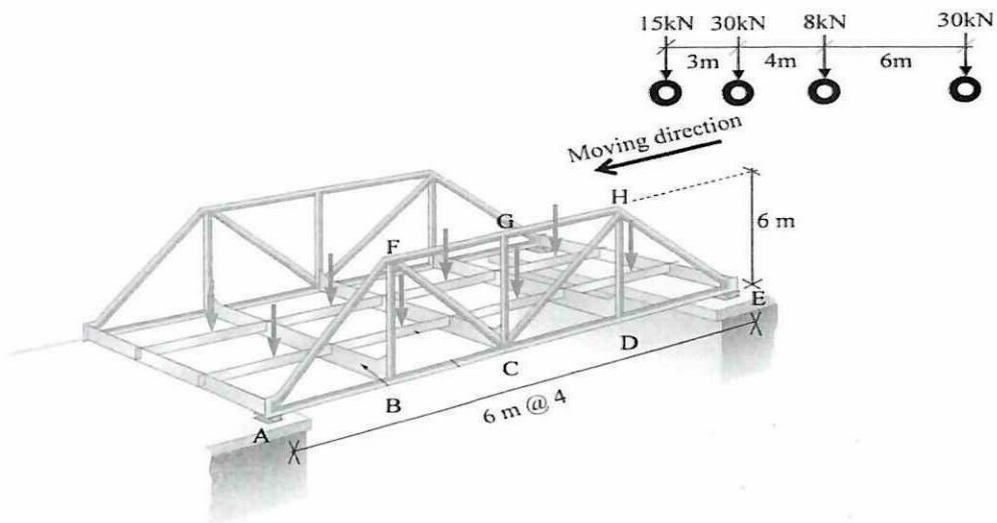
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**FIGURE Q2**



**FIGURE Q3(a)**



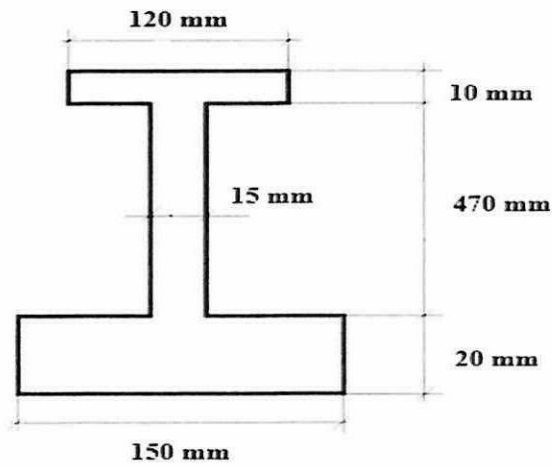
**FIGURE Q3(b)**

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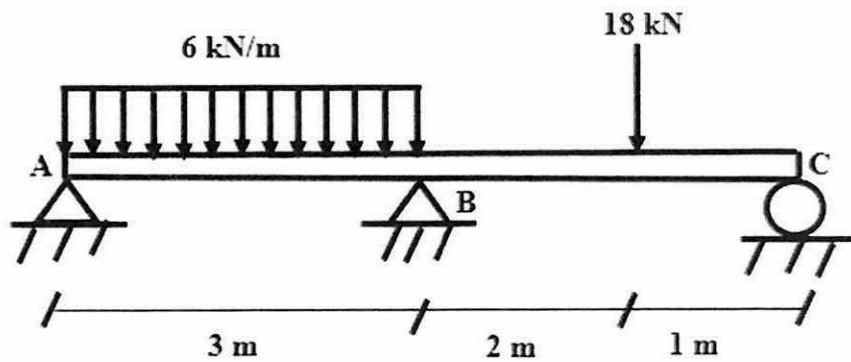
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**FIGURE Q4(a)**



**FIGURE Q4(b)**

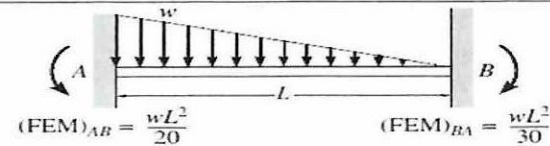
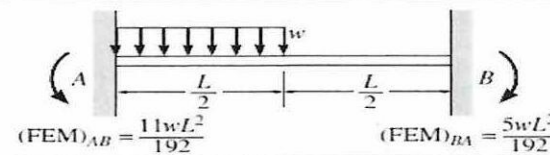
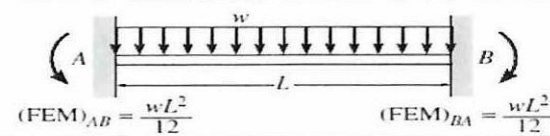
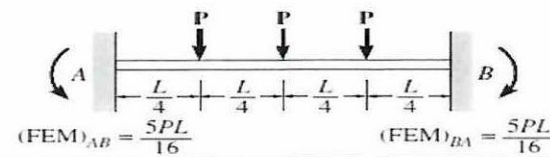
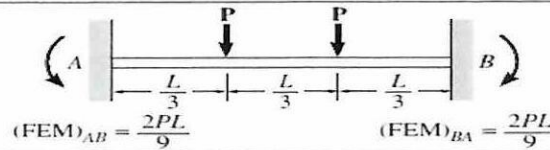
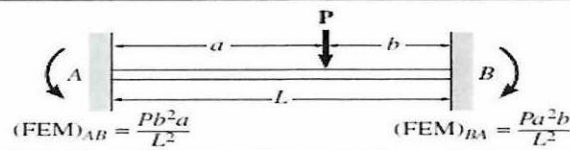
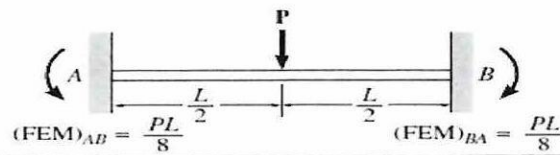
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Fixed End Moment:



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