



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : STRUCTURAL ANALYSIS

COURSE CODE : DAC 21703 / DAC21503

PROGRAMME CODE : DAA

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 **SEVEN (7)** PAGES

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Q1 (a) List **FOUR (4)** classifications of structures. (4 marks)

(b) Classify the condition of trusses in **Figure Q1(b)** as statically determinate, statically indeterminate, or unstable. State the degree of determinacy, if the structure is statically indeterminate structure.

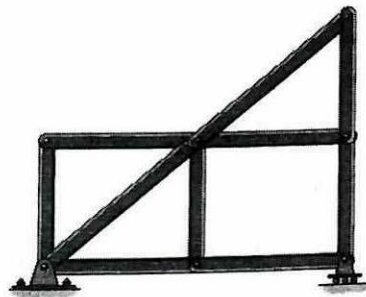


Figure Q1(b)

(3 marks)

(c) Classify each of the structures in **Figure 1(c)(i)** and **Figure 1(c)(ii)** whether statically determinate, statically indeterminate, or unstable. If this structure is indeterminate, specify the degree of indeterminacy.

(i)



Figure 1(c)(i)

(3 marks)

(ii)

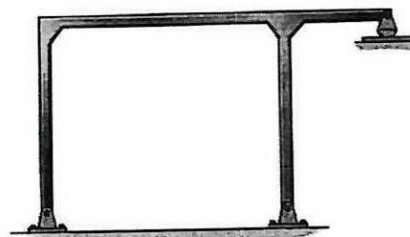


Figure 1(c)(ii)

(3 marks)

(d) **Figure 1(d)** shows a truss subjected to corresponding loads with pinned support at F and roller support at C. By using a method of inspection,

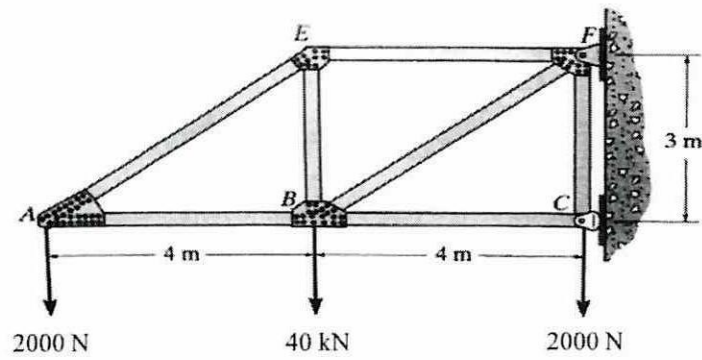


Figure 1(d)

- (i) Determine the reaction force at supports C and F. (5 marks)
- (ii) Calculate the internal forces in all members with taken $E = 200\text{MPa}$. (7 marks)

Q2 (a) Give **TWO (2)** situations that make the structure become a statically indeterminate truss. (2 marks)

(b) **Figure 2(b)** shows a truss that is pinned supported at B, C, and D with a vertical load and horizontal load of 6 kN and 4 kN respectively subjected at joint A. AE is constant.

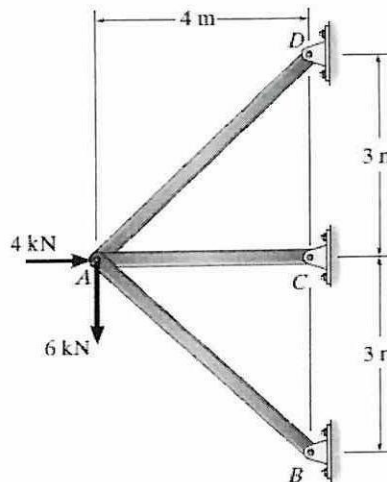


Figure 2(b)

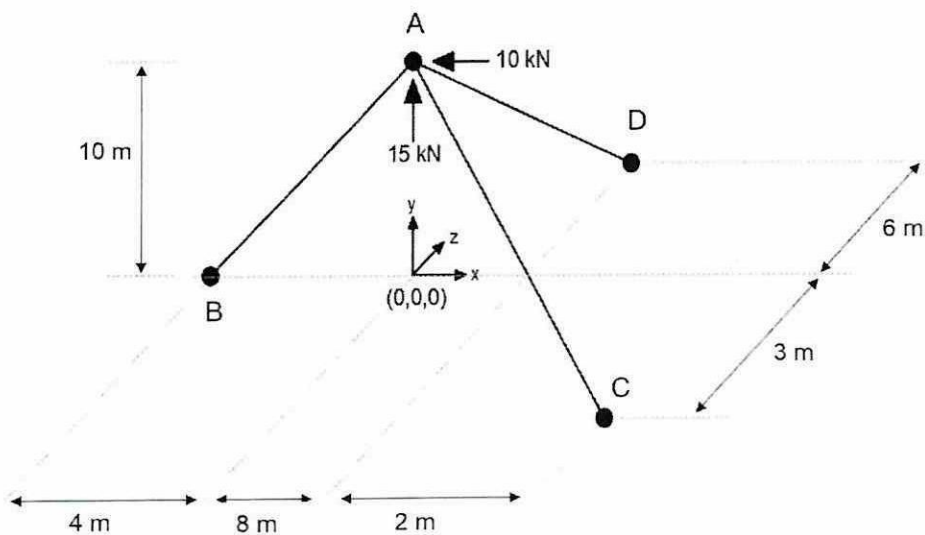
- (i) Prove that the truss is a statically indeterminate condition and determine the determinacy of the structure. (5 marks)

- (ii) Calculate the internal force due to redundant members by eliminating member AD. (10 marks)

- (iii) Determine the internal force in AB and AC members using the Method of Joints. (8 marks)

Q3

As an intern at Bina JuruTerer Sdn Bhd, you have been assigned to analyze the space frame as shown in **Figure Q3**. Your task is to determine the forces in each cable by using the tension coefficient method learned in the Structural Analysis subject, determine the followings:



***Drawing is not to scale*

Figure Q3

- (a) Write down the coordinates for each point. (4 marks)
- (b) The following calculation has **SIX (6)** mistakes in determining the coefficient equation. Identify the mistakes and re-write the **CORRECT** equation.

x-direction;

$$t_{AB}(-4-0) + t_{AC} \cdot (0-0) + t_{AD}(8-0) = 0$$

y-direction;

$$t_{AB}(0-10) + t_{AC} \cdot (-3-0) + t_{AD}(6-0) + 15 = 0$$

z-direction;

$$t_{AB}(0-10) + t_{AC} \cdot (0-10) + t_{AD}(6-0) = 0$$

(6 marks)

- (c) Based on your answer in Q3(b), obtain the constant for t_{AB} , t_{AC} , and t_{AD} . (6 marks)
- (d) By using Pythagoras's theorem, determine the length of each cable. (3 marks)
- (e) Calculate the forces in each cable. (3 marks)
- (f) Based on your understanding and sample calculation in Q3(b), indicate the point of reference and justify the selection. (3 marks)

- Q4**
- (a) List **FOUR (4)** principles Methods of Execution in analyzing the indeterminate structure. (4 marks)
 - (b) Calculate fixed end moment (FEM) for member BC, CB, CD, and DC at continuous beam shown in **Figure Q4(b)**.

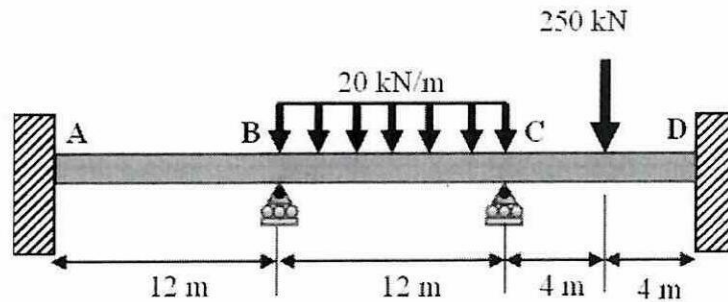


Figure Q4(b)

(4 marks)

- (c) **Figure Q4(c)** shows a continuous beam with fixed-end support at the ends and two rollers supports at B and C. The beam carried uniformly distributed load and point load. **Table 1** is the data given to find the following.

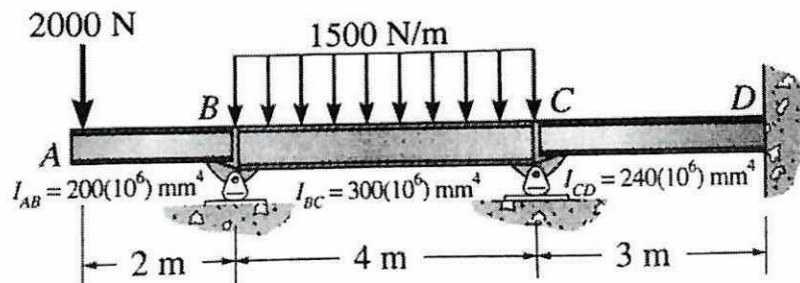


Figure Q4(c)

Table 1: Stiffness factor

Member	Stiffness Factor (K)
AB	0
BC	$300 (10^6)E$
CD	$320 (10^6)E$

- (i) Determine the distribution factor for members BC, CB, CD, and DC.
(4 marks)
- (ii) Calculate fixed end moments for member BA, BC, and CB.
(3 marks)
- (ii) Determine the internal moments at each member of the beam. Show the calculation until 5 times carry over (CO) in table form.
(10 marks)

-END OF QUESTIONS

FINAL EXAMINATION

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$$r = 3n$$

$$\frac{d^2v}{dx^2} = \frac{M}{EI}$$

$$m + r = 2j$$

$$1 \cdot \Delta_A = \sum \frac{nNL}{AE}$$

$$1 \cdot \Delta_{AA} = \sum \frac{n^2L}{AE}$$

$$R_A = -\frac{\delta_A}{\delta_{AA}}$$

$$P = N + R_A n$$

Formula for fixed-end-moment

