Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

COURSE NAME	:	STRUCTURAL ANALYSIS
COURSE CODE	:	DAC 21703
PROGRAMME CODE	:	DAA
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 **SIX (6)** PAGES

Q1 (a) List five (5) classifications of structures based on the primary forces that they resist.

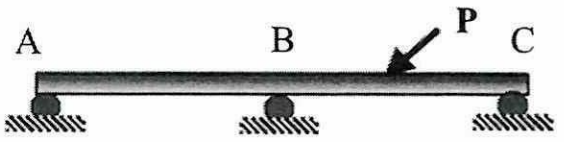
(5 marks)

(b) Describe the differences between internal forces and external forces.

(4 marks)

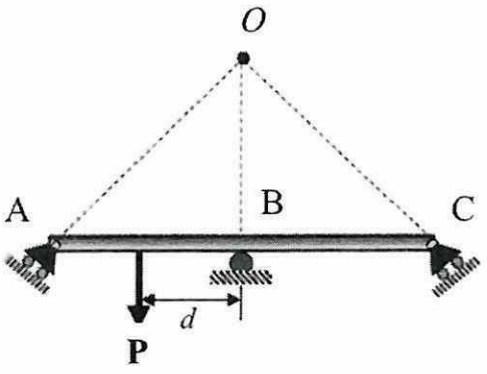
(c) Draw the free-body diagram for the following structure:

(i)



(2 marks)

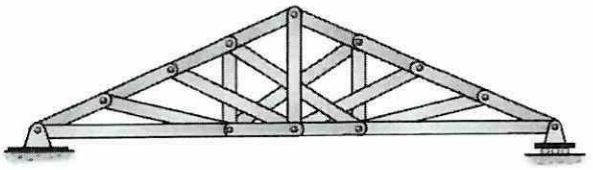
(ii)



(2 marks)

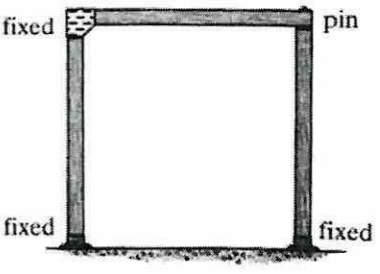
(d) Classify the following structures as statically determinate, statically indeterminate, or unstable. If the indeterminate structure, state its degree of indeterminacy.

(i)



(3 marks)

(ii)



(4 marks)

(e) **Figure Q1.1** shows a truss subjected to corresponding loads with pinned support at A and roller support at E. Determine the support reaction force at points A and E.

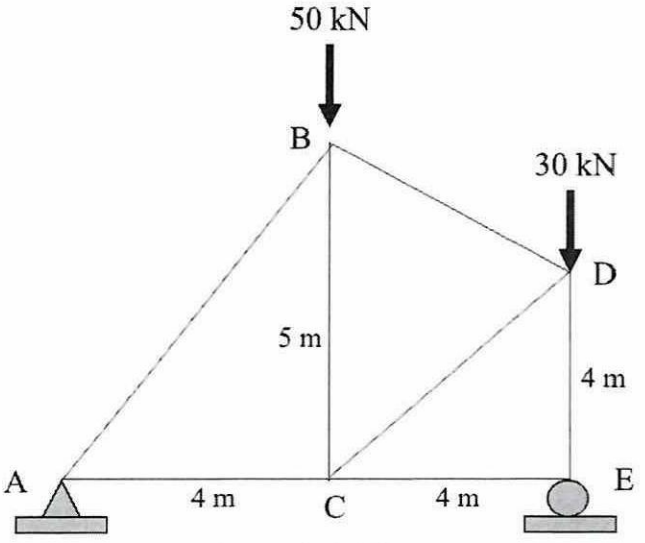


Figure Q1.1 Truss

(5 marks)

Q2 (a) Define the Principle of Virtual Work.

(2 marks)

(b) Identify four (4) methods for truss analysis.

(4 marks)

(c) A simply supported steel truss is subjected to external force, P as shown in **Figure Q2.1**. Given E = 200 MPa and P = 10 kN.

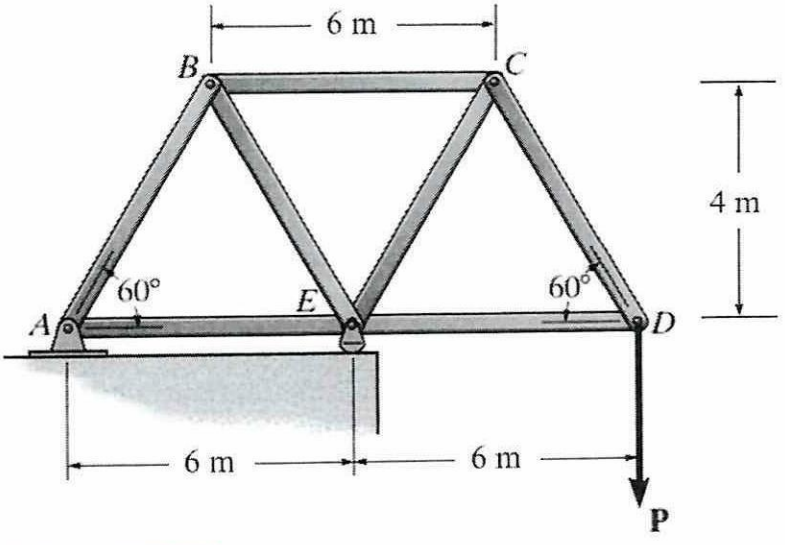


Figure Q2.1 Truss

(i) Determine the reaction force at supports A and E.

(5 marks)

(ii) By using the Method of Joints, determine the internal force in all members.

(14 marks)

Q3 (a) Explain three (3) advantages of an indeterminate truss over a determinate truss.

(6 marks)

(b) **Figure Q3.1** shows a truss is pinned support at A and roller support at both C and D. A vertical load of 75 kN is subjected at B.

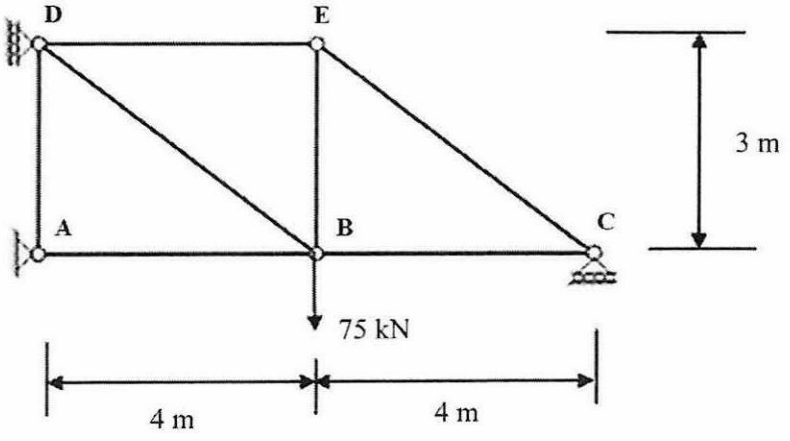


Figure Q3.1 Truss

(i) Determine the support reaction force of the truss by eliminating support at C.

(5 marks)

(ii) Calculate the internal forces due to the 100 kN force by eliminating support at C.

(7 marks)

(iii) Remove the external load and apply a unit load vertically upward at C. Calculate the internal forces in the truss due to the unit load.

(7 marks)

Q4 (a) Define the space frame with the aid of a figure.

(3 marks)

(b) Assume all supports are ball-and-socket in the space frame as shown in **Figure Q4.1**. Point loads are applied at points E and D with the origin at point A.

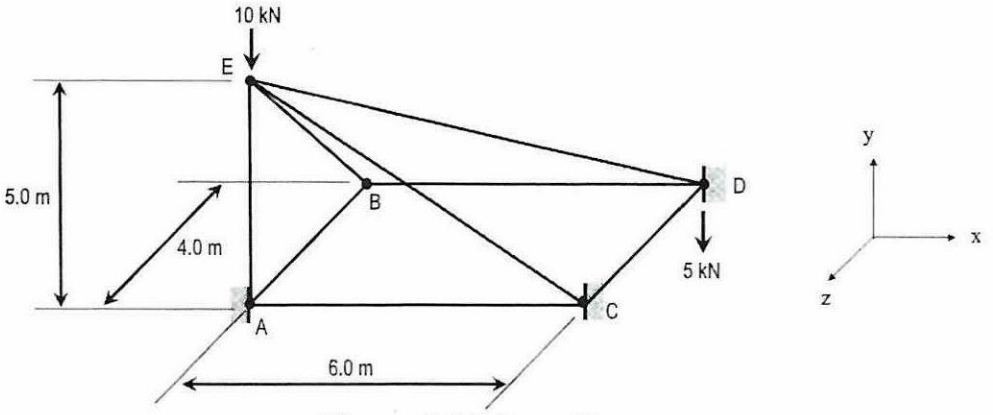


Figure Q4.1 Space Frame

(i) Find the total reaction force in the space frame.

(2 marks)

(ii) Determine the coordinates of the joints A, B, C, D, and E.

(5 marks)

(iii) Calculate the coefficients of the DC and DE members in the space frame.

(6 marks)

(c) A continuous beam that is built-in at A and C is subjected to loads as shown in **Figure Q4.2**.

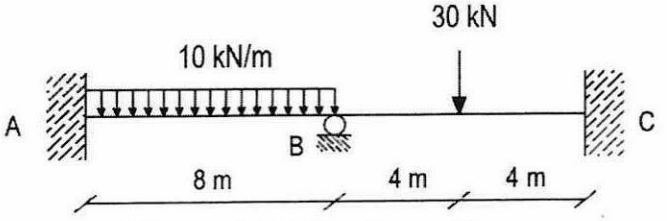


Figure Q4.2 Continuous Beam

(i) Determine the degree of indeterminacy of the beam.

(4 marks)

(ii) Write down the slope-deflection equation for span AB and BC.

(4 marks)

(iii) Determine rotation, θ_A at support B.

(1 marks)

- END OF QUESTIONS -

APPENDIX A

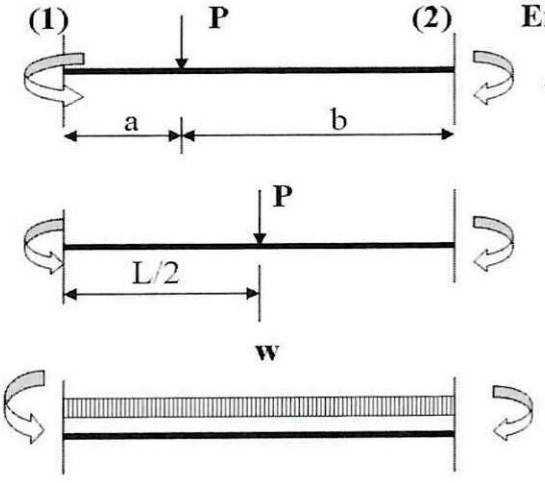
$$r = 3n \qquad \frac{d^2v}{dx^2} = \frac{M}{EI}$$

$$m + r = 2j$$

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

$$R_A = -\frac{\delta_A}{\delta_{AA}} \qquad P = N + R_A n$$

Formula for fixed-end-moment



	End (1)	End (2)
	- Pab^2/L^2	**+ Pa^2b/L^2**
	-PL/8	**+ PL/8**
	- $wL^2/12$	**+ $wL^2/12$**

$M_{1-2} = 2EI/L\ (2\theta_1 + \theta_2 - 3\partial/L) + M^F_{12}$.....(1)

$M_{2-1} = 2EI/L\ (2\theta_2 + \theta_1 - 3\partial/L) + M^F_{21}$..... (2)