Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER I
SESSION 2020/20201

COURSE NAME	:	STRUCTURAL ANALYSIS
COURSE CODE	:	DAC 21503
PROGRAMME CODE	:	DAA
EXAMINATION DATE	:	JANUARY 2021/FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	SECTION A : ANSWER **ALL** QUESTIONS SECTION B : ANSWER **TWO (2)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

SECTION A

Q1 (a) Describe the differences between internal forces and external forces.

(4 marks)

(b) Classify the following trusses in **Figure Q1(b)(i)** and **Figure Q1(b)(ii)** as statically determinate, statically indeterminate or unstable. If indeterminate structure, state its degree of determinacy.

(i)

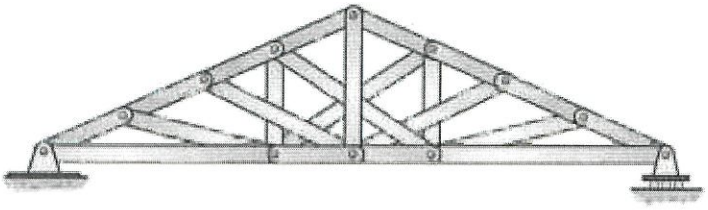


Figure Q1(b)(i)

(3 marks)

(ii)

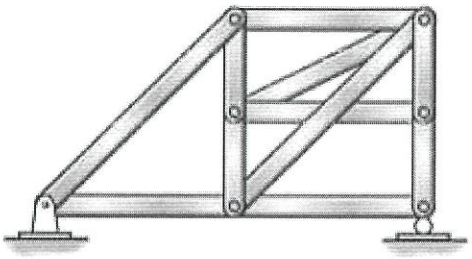


Figure Q1(b)(ii)

(3 marks)

(c) The support and connection of a structure is shown in the **Figure 1(c)**. Classify the structures whether statically determinate, statically indeterminate or unstable. If this structure is indeterminate, specify the degree of indeterminacy.

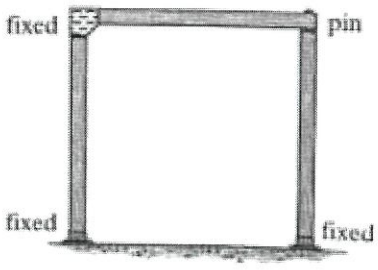


Figure 1(c)

(3 marks)

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

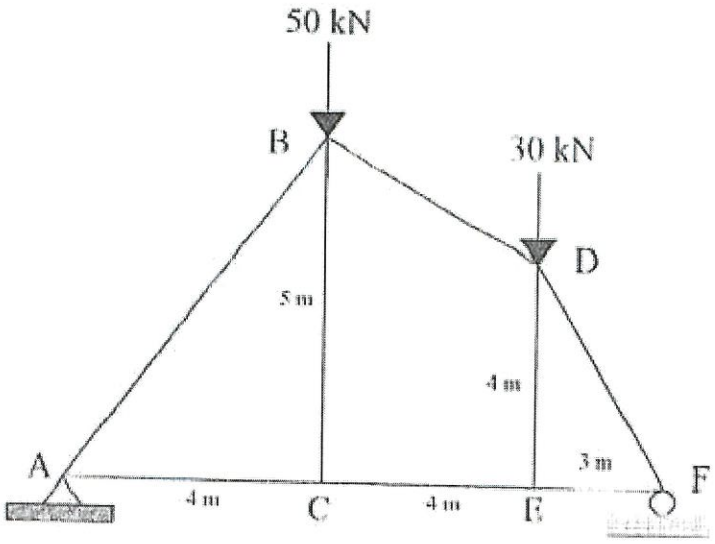


Figure 1(d)

(i) Determine the support reaction force at point A and F

(5 marks)

(ii) Calculate the forces in all members with taken E = 200MPa.

(7 marks)

Q2 (a) Define the Principle of Virtual Work.

(2 marks)

(b) **Figure 2(b)** shows a truss with pinned and roller support at C and F respectively. Assume the members are pin connected at their ends. Take cross sectional area, A = 100 mm^2 and modulus of elasticity, E = 200 GPa for each member. By using the method of virtual work ;-

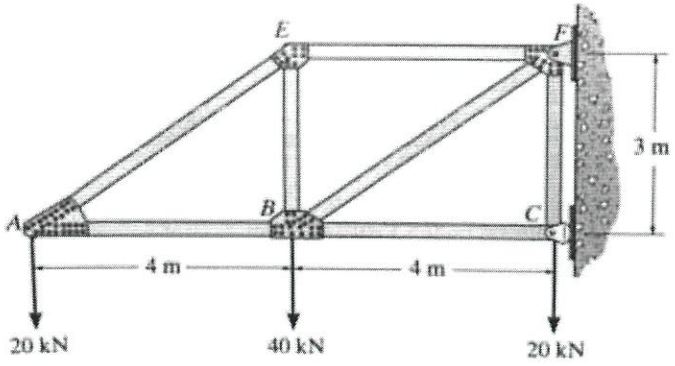


Figure 2(b)

(i) Determine the support reactions at C and F.

(6 marks)

(ii) Determine the internal forces for all member due to the external load.

(7 marks)

(iii) Determine the virtual forces due to 1 unit load applied vertically downward at A.

(7 marks)

(iv) Determine the vertical displacement of joint A of the truss

(3 marks)

SECTION B

Q3 (a) State **TWO (2)** advantages and **ONE (1)** disadvantage of indeterminate truss over a determinate truss.

(3 marks)

(b) **Figure 3(b)** shows a truss is pinned support at A and roller support at both C and D. A vertical load of 100 kN is subjected at B.

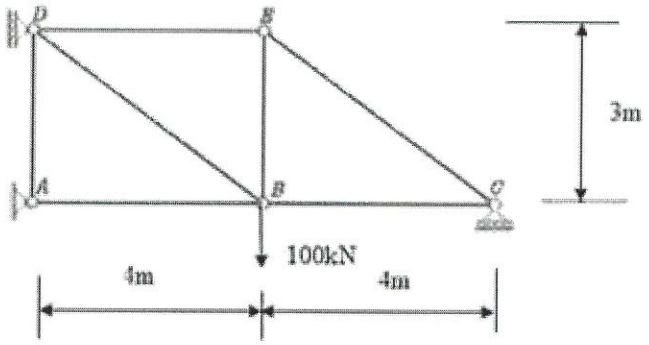


Figure 3(b)

(i) Prove that the truss is statically indeterminate and determine the determinacy of the structure.

(3 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)

(iv) Determine the final force in all members.

(5 marks)

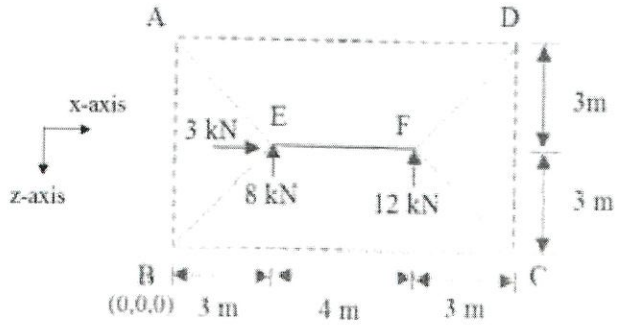
Q4 (a) Define space frame.

(3 marks)

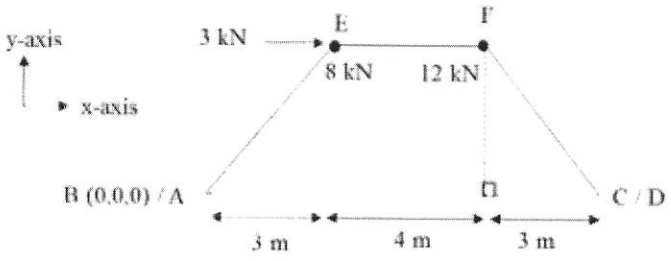
(b) Describe **THREE (3)** common types of member arrangement that result in zero force member.

(6 marks)

(c) A space frame in **Figure 4(c)** are connected at A, B, C and D in a horizontal plane through ball and socket joint. The joint of EF is at 5m height above base and load at joint E and F act in a horizontal plane.



Plan view



Side view

Figure 4(c)

(i) Determine the coordinate each points and length each members.

(5 marks)

(ii) Calculate internal forces in all members.

(11 marks)

Q5 (a) In slope-deflection equation, the end moment is affected by two behaviors. Name these **TWO (2)** behavior.

(2 marks)

(b) A continuous beam that built-in at A and C is subjected to loads as shown in **Figure 5(b)**.

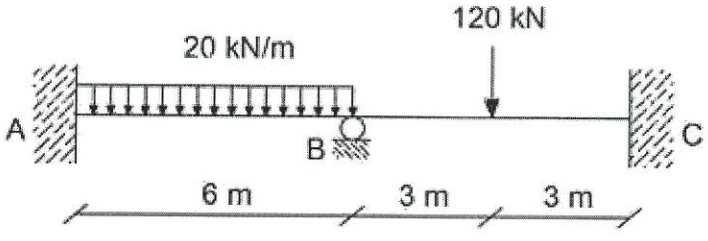


Figure 5(b)

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

(2 marks)

(ii) Calculate the end moments of the beam.

(5 marks)

(iii) Determine the reactions on supports.

(6 marks)

(iv) Draw the bending moment and shear force diagram of the beam. Assume no settlement at support occurred and the rigidity, EI is constant

(10 marks)

-END OF QUESTIONS

FINAL EXAMINATION

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$$r = 3n$$

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

$$m + r = 2j$$

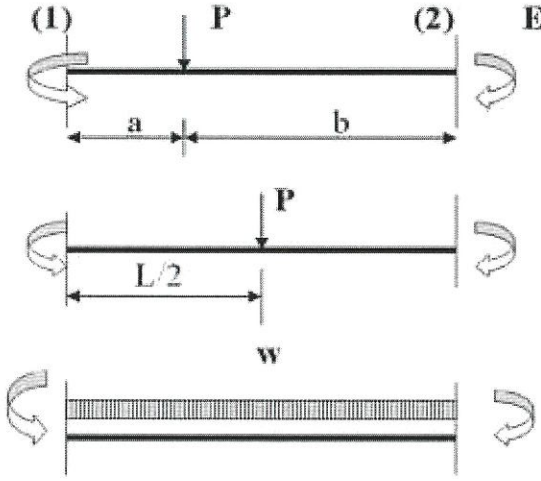
$$1 \cdot \Lambda_A = \sum \frac{nNL}{AE}$$

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

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

$$P = N + R_A n$$

Formula for fixed-end-moment



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