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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	STRUCTURAL ANALYSIS
COURSE CODE	:	DAC 31502
PROGRAMME CODE	:	DAA
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	SECTION A :ANSWER ALL QUESTIONS SECTION B : ANSWER **TWO (2)** QUESTIONS ONLY

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

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SECTION A

Q1 (a) Differentiate the internal forces and external forces.

(4 marks)

(b) Classify the following trusses as shown in **Figure 1(b)** as statically determinate, statically indeterminate or unstable. If indeterminate structure, state its degree of determinacy.

(10 marks)

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

(i) By using method of inspection, determine the force in each member of the truss if P = 8kN.

(6 marks)

(ii) If the maximum force that any member can support is 8kN in tension and 6kN in compression, determine the maximum force P that can be supported at joint D.

(5 marks)

Q2 (a) Define the Principle of Virtual Work.

(2 marks)

(b) **Figure 2(b)** shows a truss with pinned and roller support at A and E respectively. The truss is subjected to 18kN force at D.

(i) Determine the actual forces.

(10 marks)

(ii) Determine the virtual forces if vertical displacement at joint D.

(10 marks)

(ii) Determine the vertical displacement of joint D of the truss. The modulus of elasticity and cross sectional area of each bar is given in **Table 1**.

(3 marks)

SECTION B

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

(6 marks)

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

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

(3 marks)

(ii) Identify the possible redundant members or supports. Justify your answer.

(4 marks)

(iii) Calculate the force/reaction on the redundant member/support by eliminating support at C.

(10 marks)

(iv) Determine the force in EC and BC members.

(2 marks)

Q4 (a) Define space frame.

(3 marks)

(b) Describe three 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 member of EF is at height of 5m above base and load at joint E and F act in a horizontal plane. Calculate internal forces in all members.

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

(5 marks)

(ii) Calculate internal forces in all members.

(11 marks)

Q5 (a) Define each of the following;

(i) Plastic Moment

(ii) Load Factor

(iii) Shape Factor

(3 marks)

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

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

(2 marks)

(ii) Calculate the end moments of the beam.

(5 marks)

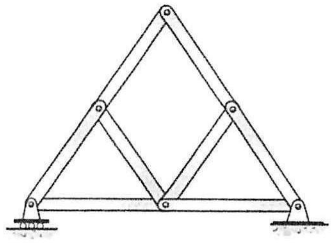
(iii) Determine the reactions on supports.

(6 marks)

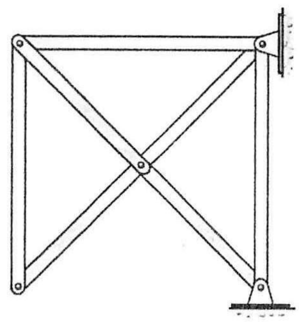
(iv) Draw the bending moment and shear force diagram of the beam. Assume no settlement at support occurred and the rigidity, EI is constant.

(9 marks)

-END OF QUESTIONS-



(i)



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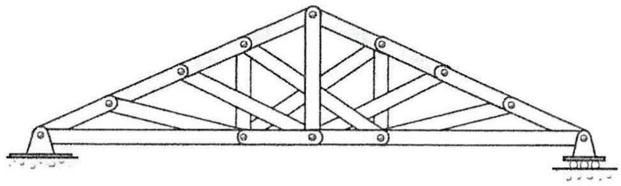

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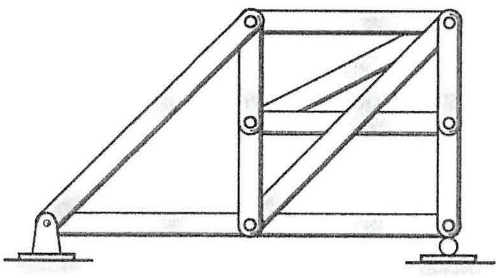

(iv)

Figure 1 (b)

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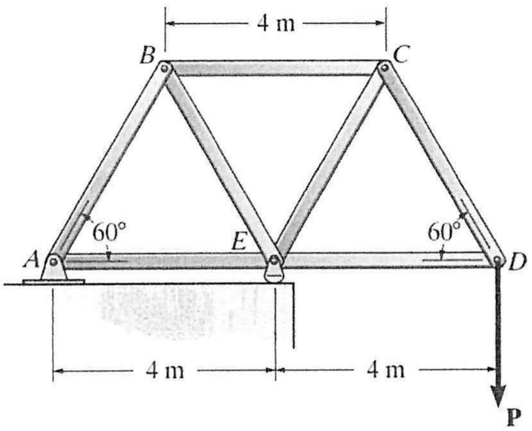

Figure 1 (c)

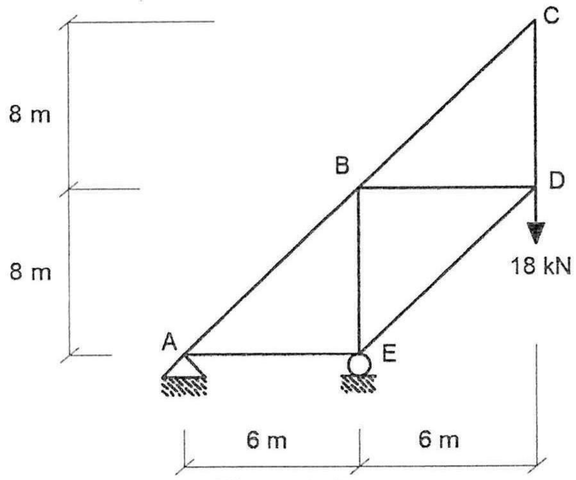

Figure 2 (b)

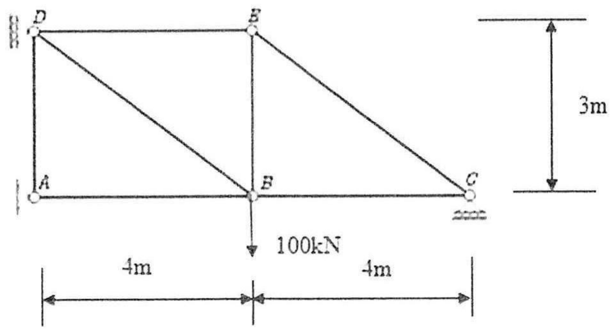

Figure 3(b)

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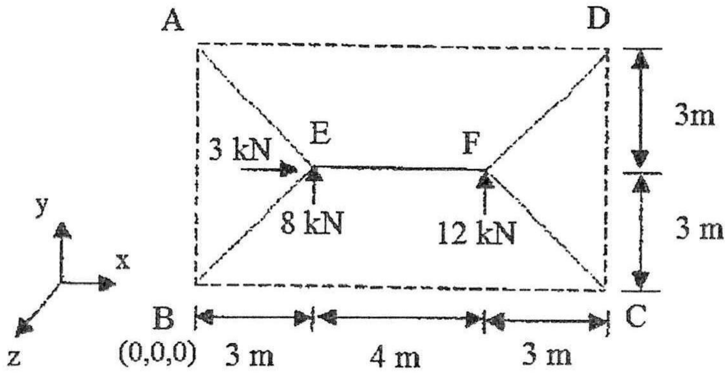

Figure 4(c)

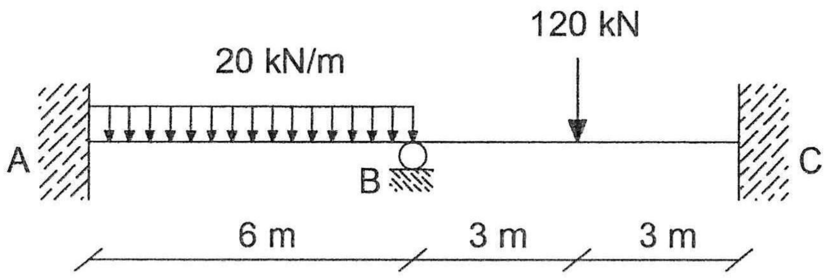

Figure 5(b)

Table 1

Member	AB	AE	BC	BD	BE	CD	DE
Cross Sectional Area (mm^2)	150	150	200	150	100	200	100
Modulus of Elasticity (kN/mm^2)	200	200	200	200	200	200	200

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$$r = 3n$$

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

$$m + r = 2j$$

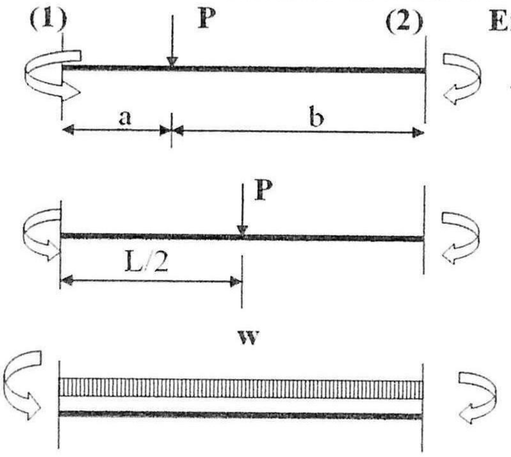
$$1 \cdot \Delta_A = \sum \frac{nNL}{AE}$$

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

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

$$P = N + R_A n$$

Formula for fixed-end-moment



	End (1)	End (2)
Point load P at distance a from (1), b from (2)	$-Pab^2/L^2$	$+Pa^2b/L^2$
Point load P at L/2	$-PL/8$	$+PL/8$
Uniform load w	$-wL^2/12$	$+wL^2/12$