Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	STRUCTURAL ANALYSIS
COURSE CODE	:	BFC 21403
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

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Q1 (a) Describe the main difference between frame and truss.

(2 marks)

(b) Check the determinacy for truss shown in **FIGURE Q1**

(2 marks)

(c) A truss as shown in **FIGURE Q1** is loaded with 1.3 tonne box through a frictionless pulley at point E, point loads P and Q at point B and G respectively. Value of P is 15 kN and Q is twice the value of P. Perimeter members of this truss were high strength steel unequal angle of 152 x 102 x 19 mm section. The rest of the members were mild strength equal angle of 102 x 102 x 19 mm section. Further details for the truss are as follow:

Area	
Equal angle	: 35.1 cm^2
Unequal angle	: 44.8 cm^2
Modulus of elasticity	
High strength steel	: 200 GPa
Mild strength steel	: 150 GPa
Gravity acceleration	: 10 m/s^2

Based on the information given:

(i) Determine the reactions at point A and D

(3 marks)

(ii) Calculate internal forces for all truss members

(6 marks)

Determine the vertical displacement of the truss at point C by using virtual work method. Assume the unit load at point C acting downward.

(10 marks)

If vertical displacement at point C needs to be reduced, suggest 2 modifications on the truss without changing the loading and determinacy of the truss.

(2 marks)

Q2 (a) Differentiate the statically determinate structures and statically indeterminate structures.

(4 marks)

(b) **FIGURE Q2** shows a truss system which supported by roller support at point A, C and E. The modulus of elasticity of each member is constant with the cross section area of 20 cm^2.

(i) Check the stability and determinacy of the truss.

(2 marks)

(ii) Calculate the reaction forces.

(5 marks)

(iii) Determine the real forces of all members if member BF is redundant.

(14 marks)

Q3 (a) List the assumptions made in slope-deflection method.

(2 marks)

(b) From the beam shown in **FIGURE Q3,** use the moment distribution with stiffness modification method to,

(i) Calculate the fixed end moments for all members

(4 marks)

(ii) Determine all the reactions at supports

(14 marks)

(iii) Draw the shear force and bending moment diagrams

(5 marks)

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Q4 (a) Give the reasons how the influence lines could play an important part in the designs of the heavy structures such as bridges, industrial crane rails, conveyor and other structures where loads move across their span.

(3 marks)

(b) **FIGURE Q4(a)** shows a beam carring a uniform distributed load of 5 kN/m along AB and triangular load of 10 kN/m at span BC. Construct;

(i) the influence line for R_A and R_C.

(4 marks)

(ii) the influence line for V_B an M_B.

(6 marks)

(c) **FIGURE Q4(b)** shows a truss system which carries a uniform live load of 12 kN/m along the upper cord. Determine:

(i) the influence line for the force in member CD and CF.

(8 marks)

(ii) the maximum compression and tensile forces for the same members

(4 marks)

Q5 (a) What is plastic hinge?

(2 marks)

(b) The structure shown in **FIGURE Q5 (a)** has a plastic moment capacity of 135 kNm. Determine the value of **P** required to cause collapse.

(5 marks)

(c) A rectangular portal frame with fixed support as in **FIGURE Q5(b)** carries a vertical point load V kN at the centre of a beam member where as a horizontal load H kN at the top of one column.

(i) Sketch the possible collapse load mechanism

(4 marks)

(ii) Discuss the possible collapse mechanisms which is the most critical depend on the of V, H, l and h.

(14 marks)

- END OF QUESTIONS -

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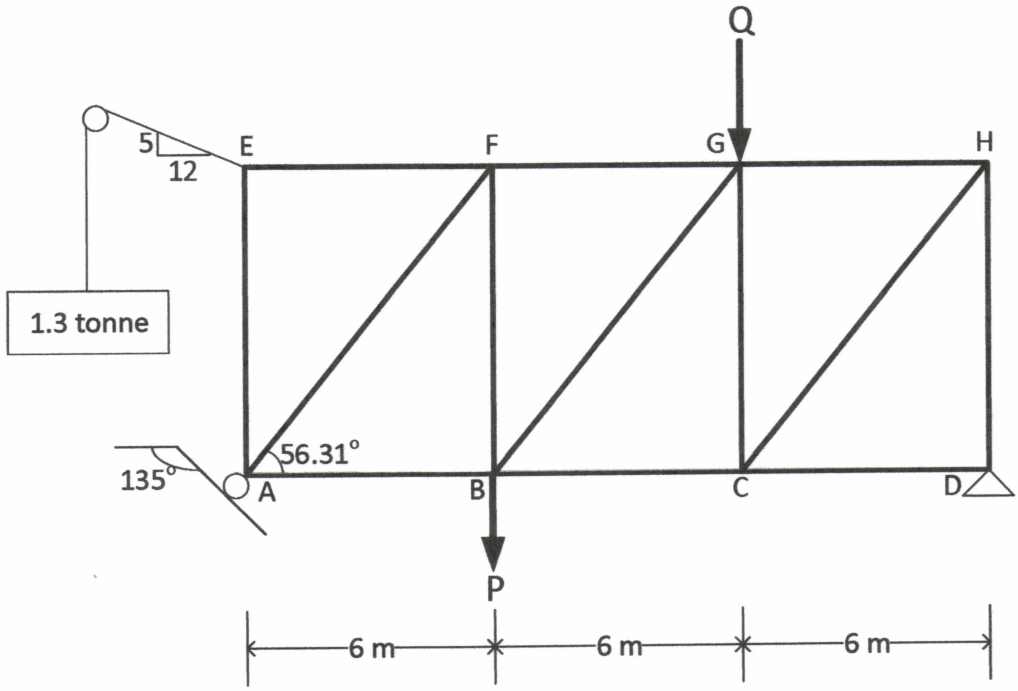

FIGURE Q1

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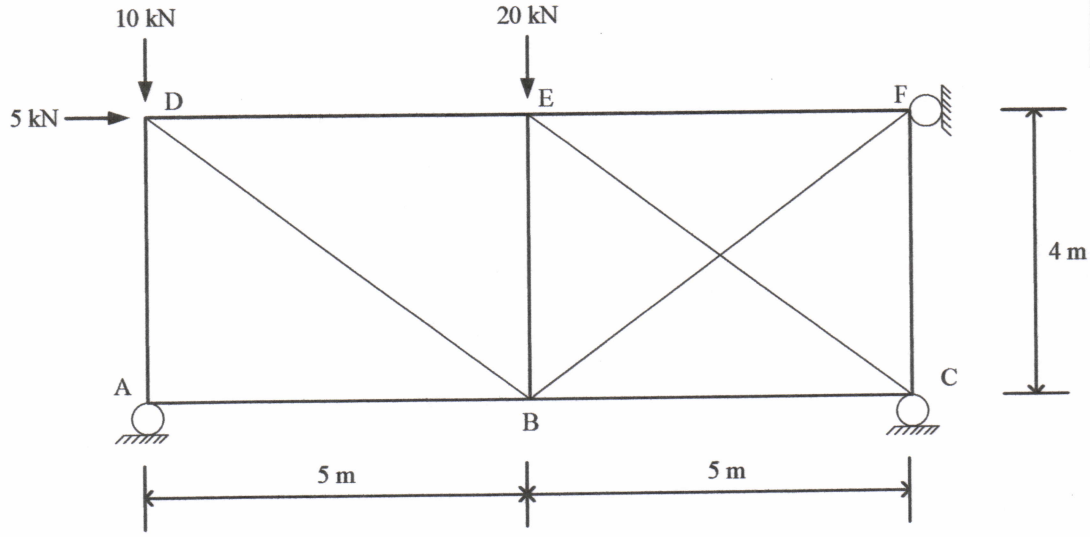

FIGURE Q2

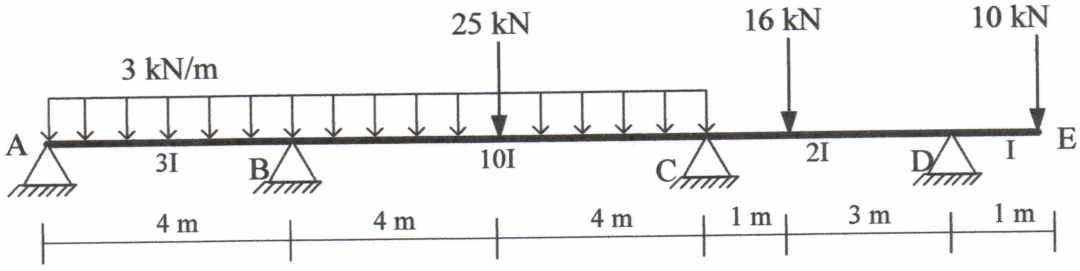

FIGURE Q3

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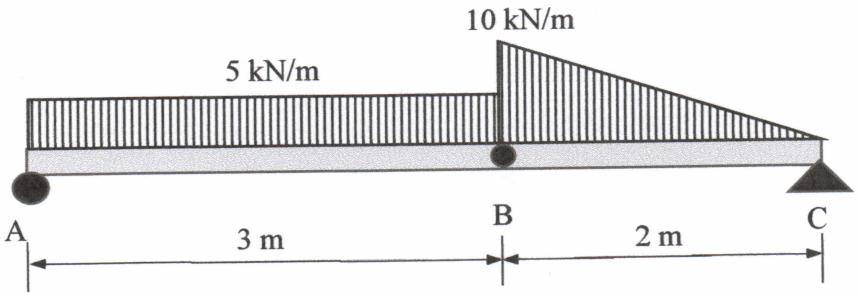

FIGURE Q4 (a)

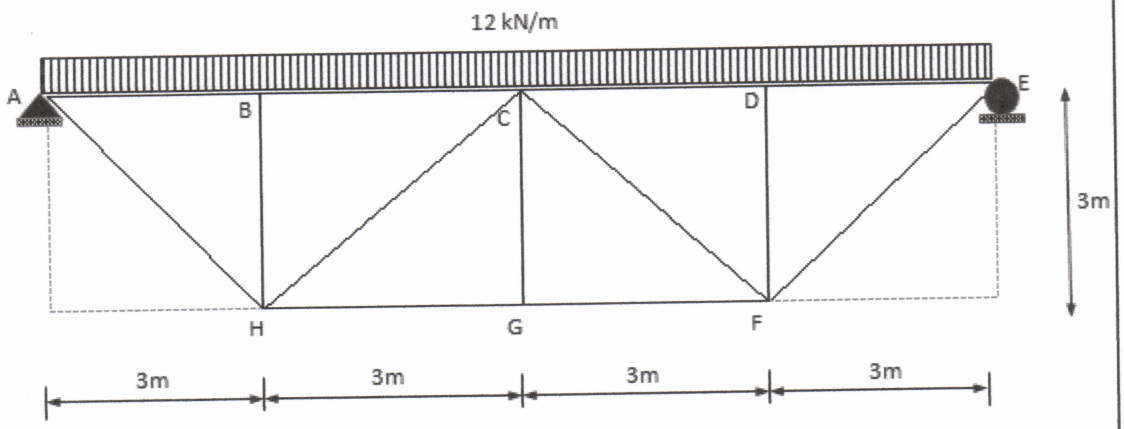

FIGURE Q4 (b)

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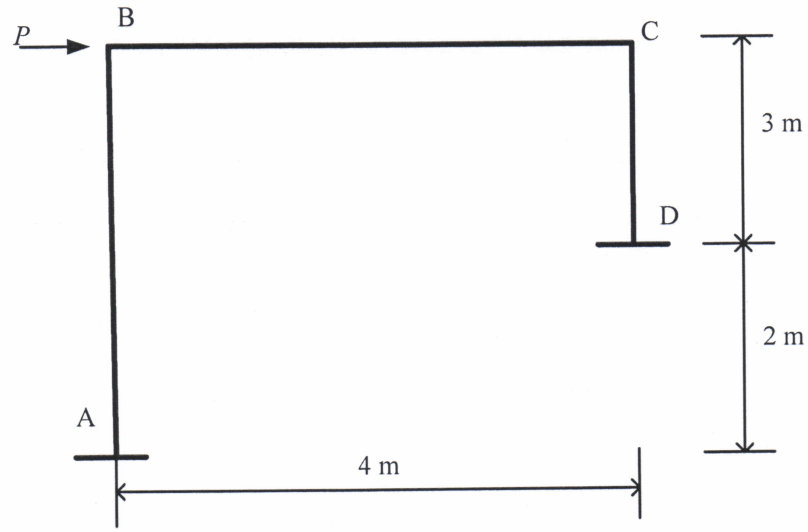

FIGURE Q5 (a)

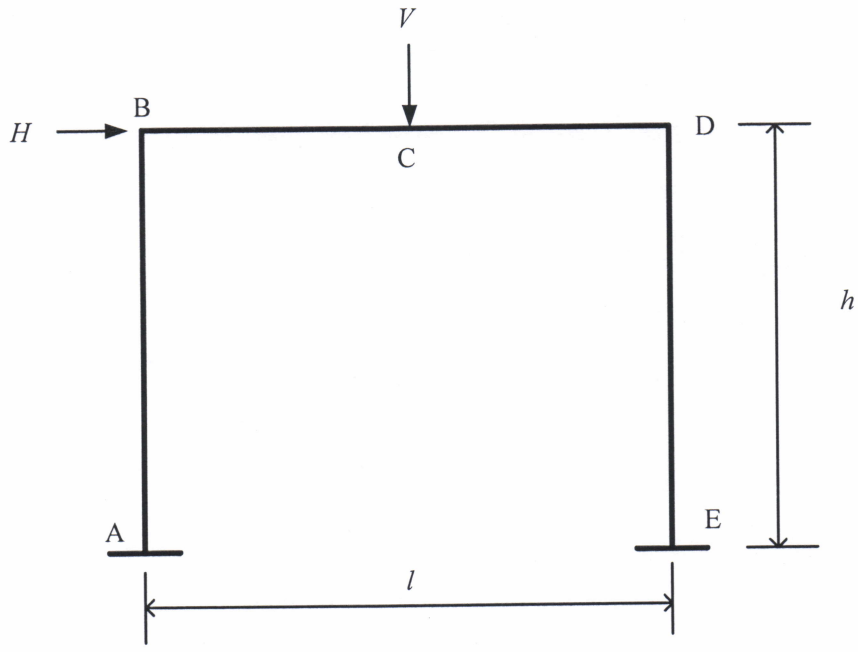

FIGURE Q5 (b)

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FIXED END MOMENTS: