Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	STRUCTURAL ANALYSIS
COURSE CODE	:	BFC 21403
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

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

Q1 (a) Truss members are connected as pin connection. List two static equilibrium equations used to analyze a truss by using pinned joint method.

(2 marks)

(b) A bridge truss as shown in **Figure Q1(b)** is loaded at point B, C and D. Parameter members of the truss are Rectangular Hollow Section (RHS) and the area of RHS is 10.6 cm^2. Maximum compressive strength and tensile strength for all members are 150 MPa and 560 MPa respectively.

Based on the information given:

(i) Determine the reactions at point A and E.

(2 marks)

(ii) Check the internal forces of members BC, BG and FG by using cut section method.

(6 marks)

(iii) Check whether member BC and BG is safe or not given the safety factor for maximum strength of the truss member is 0.6.

(3 marks)

(c) A truss as shown in **Figure Q1(c)** is loaded at point C and E. Perimeter members of this truss were high strength steel unequal angle of 152 mm x 102 mm x 19 mm section. Further details for the truss are as follow:

Area
Unequal angle : 44.8 cm^2
Modulus of elasticity
High strength steel : 200 GPa

(i) Determine the horizontal displacement of the truss at point F by using virtual work method. Assume the unit load at point F acting rightward.

(10 marks)

(ii) If vertical displacement at point F 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 redundant structures.
(4 marks)

(b) **Figure Q2(b)** shows a truss system supported by pinned at point A and D. Point loads of 50 kN is applied at point B and C, respectively. The area and modulus of elasticity of each member is constant.

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

(iii) Determine the real internal forces (F') for all members if support D is redundant.
(8 marks)

(c) A point load acts vertically at point B on the truss as shown in **Figure Q2(c).** The area and modulus of elasticity of each member is constant.

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

(ii) Determine the real internal forces (F') for all members by using alternative method, if 1 virtual unit load causes tension forces is applied at member CE.
(9 marks)

Q3 (a) Truss and frame are skeletal structure. List the main differences between truss and frame.
(2 marks)

(b) **Figure Q3(b)** shows a warehouse non-sway frame pinned supported at A and D while fixed support at F. The frame is uniformly loaded throughout span BC and CE with 15kN/m load. Column CD is half the height of column AB. All frame members were made of mild strength steel.

(i) Calculate the reaction for all support.
(15 marks)

(ii) Draw the bending moment diagram for the frame.
(5 marks)

(c) Predict the difference for moment at frame joints when non-sway frames were modified into sway frames.
(3 marks)

Q4 (a) Describe the influence line represent in structure.

(3 marks)

(b) State the differences between influence line and shear and moment diagram.

(4 marks)

(c) The beam in **Figure Q4** is subjected to a single concentrated live load of 8 kN at point D, and a uniformed live load of 4 kN/m along the span.

(i) Determine the maximum reaction at support B.

(6 marks)

(ii) Determine the maximum shear at point C.

(6 marks)

(iii) Determine the maximum positive moment that can be developed at point C if the concentrated live load 8 kN acting at C.

(6 marks)

Q5 (a) Determine the location of maximum stress for the beam in **Figure Q5(a)** including the skecth of fully elastic and fully plastic stress distributions.

(10 marks)

(b) A continuous beam in **Figure Q5(b)** is pinned at point A and supported by rollers at points C, E and H. Point loads of 20λ kN, 15λ kN, 10λ kN and 12λ kN are applied on the beam at point B, D, F and G, respectively. Determine the critical moment value if $\lambda = 1.7$.

(15 marks)

- END OF QUESTIONS –

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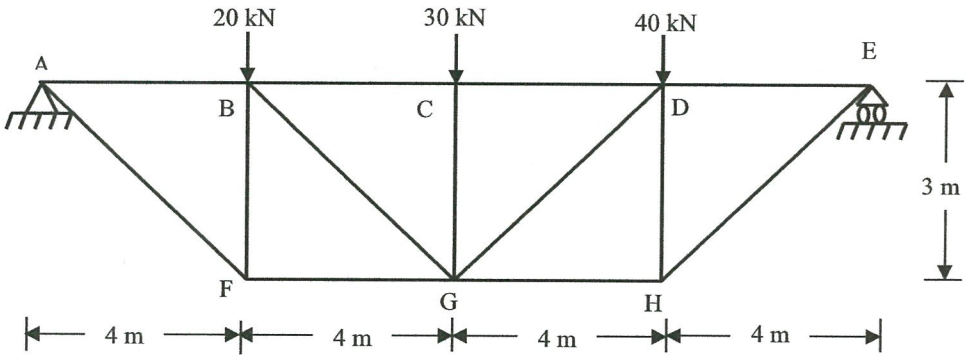

FIGURE Q1(b)

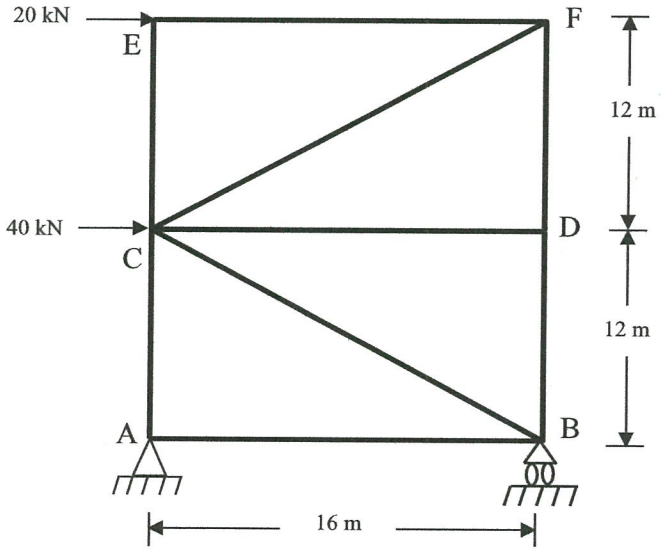

FIGURE Q1(c)

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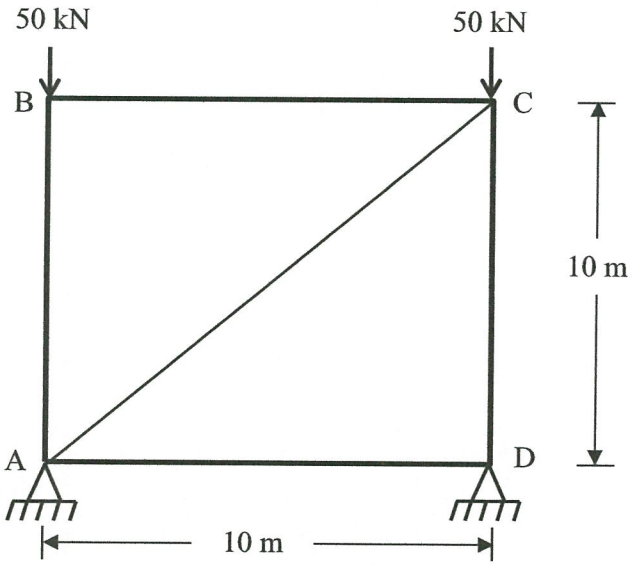

FIGURE Q2(a)

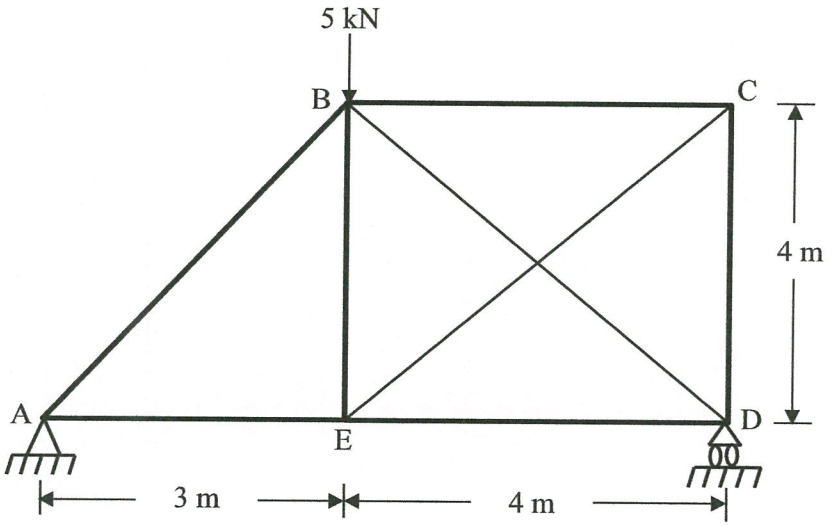

FIGURE Q2(b)

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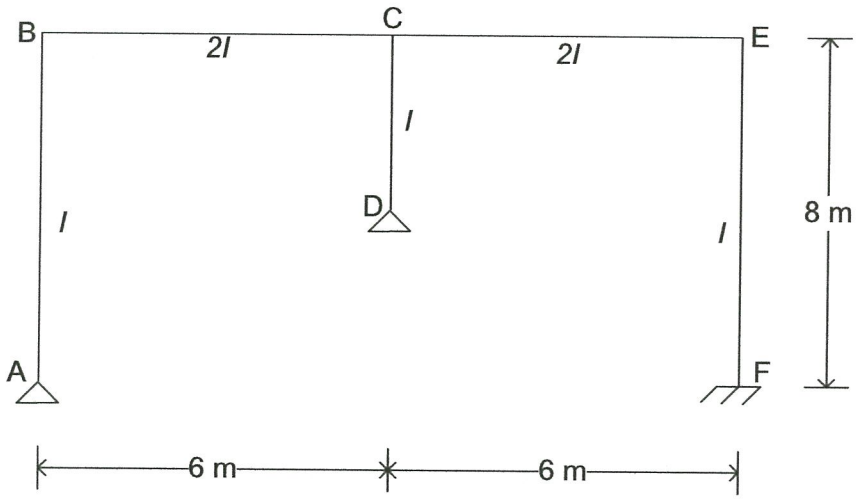

FIGURE Q3(b)

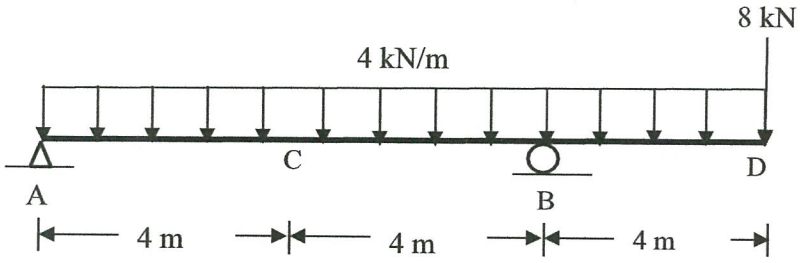

FIGURE Q4

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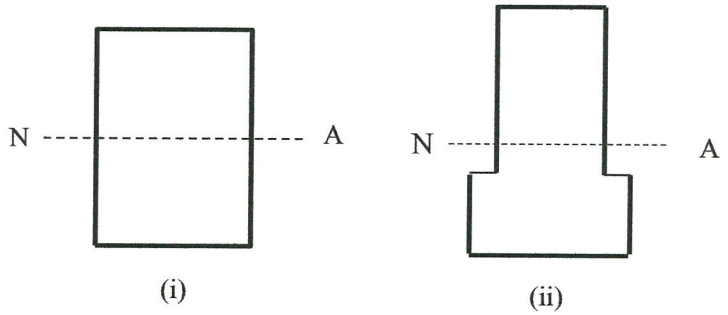

FIGURE Q5(a)

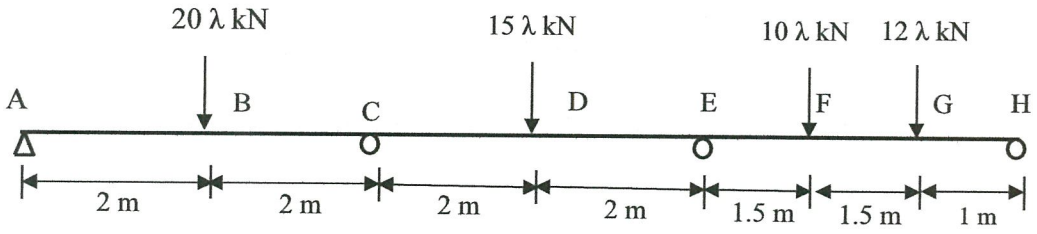

FIGURE Q5(b)

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FIXED END MOMENTS: