Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	ADVANCED STRUCTURE ANALYSIS
COURSE CODE	:	BFS40103
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) List **TWO (2)** advantages and **TWO (2)** disadvantages of indeterminate structure.
(4 mark)

(b) For the indeterminate frame in **Figure Q1(b)** ;

(i) Determine the degree of indeterminacy and draw the deflection curve.
(2 marks)

(ii) Derive the compatibility equation.
(3 marks)

(iii) Using the Force Method and compatibility equation, determine the reactions at supports A and C.
(12 marks)

(iv) Draw the shear force and bending moment diagram for the frame. EI is constant.
(4 marks)

Q2 (a) A statically indeterminate truss shown in **Figure Q2** is subjected to a vertical load of 30 kN and horizontal load of 15 kN at joint 1. Determine the Global Stiffness matrix, K. Given E = 20 GPa
(12 marks)

(b) Develop the [b] matrix such that $\{P\} = [b]\{D\}$
(4 marks)

(c) Calculate the joint displacement of the truss
(9 marks)

Q3 (a) Derive the equation for Euler buckling load for column sopported by pin at its both ends.
(12 marks)

(b) An 8 m long steel column having an Elastic Modulus of 200 kN/mm^2 and the cross section shown in **Figure Q3(b)** is to be used in a building. The safety factor is taken as 2.0. Assumed both ends of the column are pinned.

(i) Determine the slenderness ratio of the column
(3 marks)

(ii) Calculate the critical load (P_{cr})
(7 marks)

(iii) Determine the maximum allowable axial load (P_{allow})
(3 marks)

Q4 (a) Describe briefly the two terms below:

(i) Isotropic slab
(ii) Orthotropic slab
(6 marks)

(b) **Figure Q4(b)** shows an isotropic slab, simply supported at edge AB and DE, and fixed at edge EF and AF. The slab sustains uniform distributed load of 15 kN/m^2. The negative resistance moment, m' is equal to positive resistance moment, m. The distance x is from point G to point C. Distance GC is equal to CH. Determine the maximum resistance moment for the yield line shown.
(19 marks)

Q5 (a) The indeterminate frame in **Figure Q5(a)** has **seven (7)** possible collapse mechanisms. Draw all the possible mechanisms.
(7 marks)

(b) A continuous beam shown in **Figure Q5(b)** is loaded with distributed load of 10 kN/m for span AB, and point loads of 40 kN and 60 kN at 4 m from point B for span BC, and 3 m from point C for span CD, respectively. Determine the maximum plastic moment for the beam.
(18 marks)

– END OF QUESTIONS –

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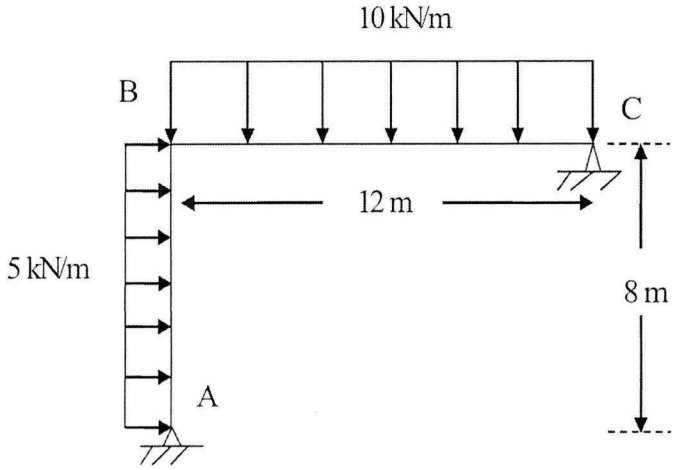

FIGURE Q1(b)

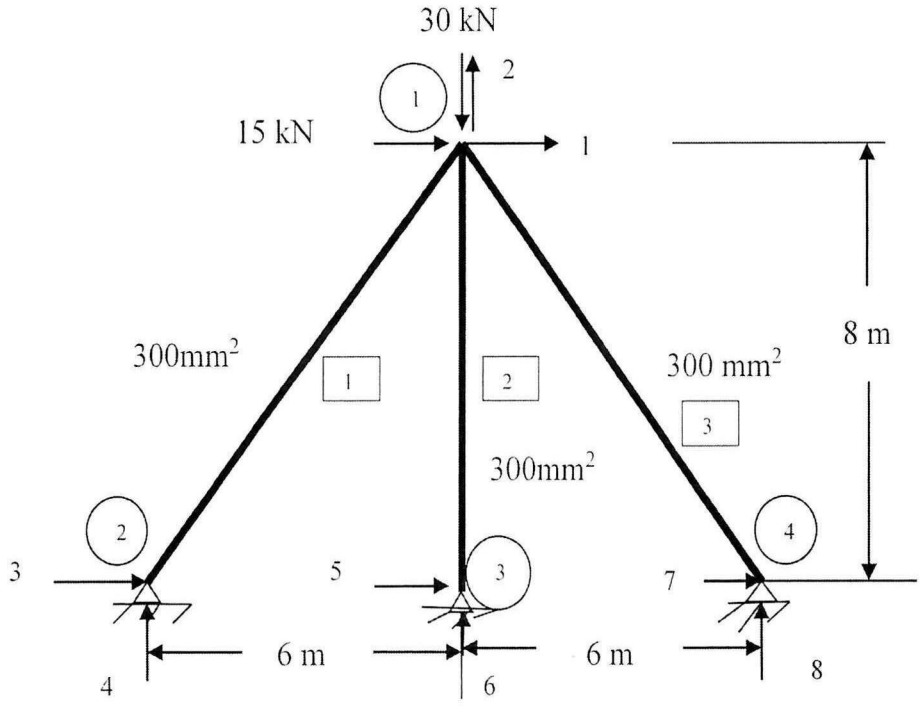

FIGURE Q2

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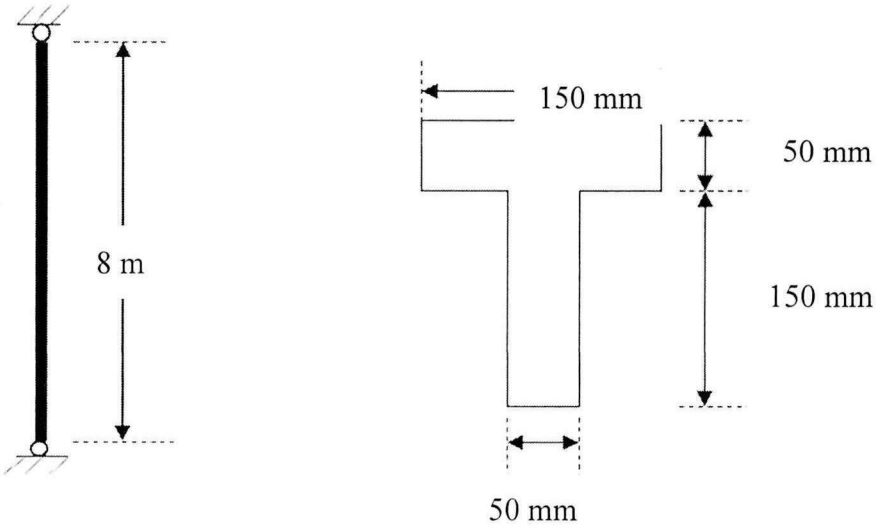

FIGURE Q3(b)

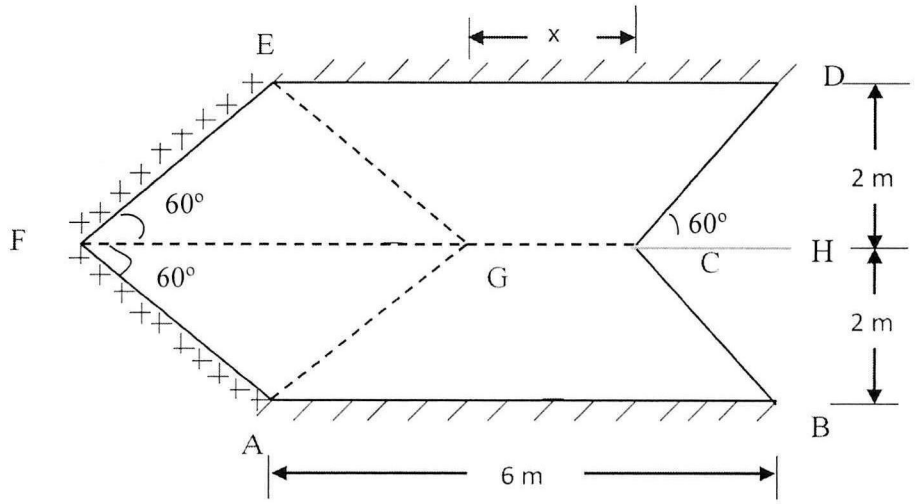

FIGURE Q4(b)

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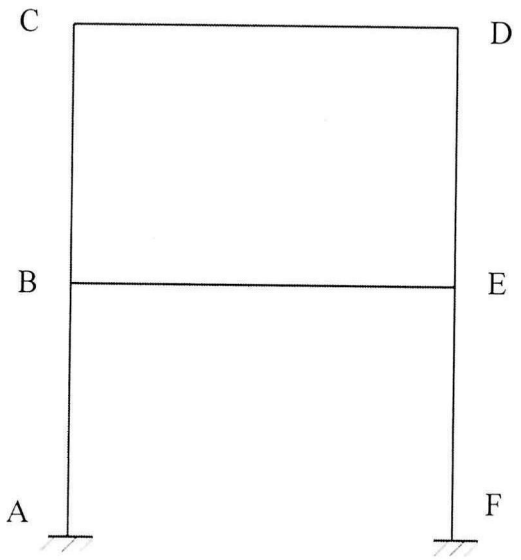

FIGURE Q5(a)

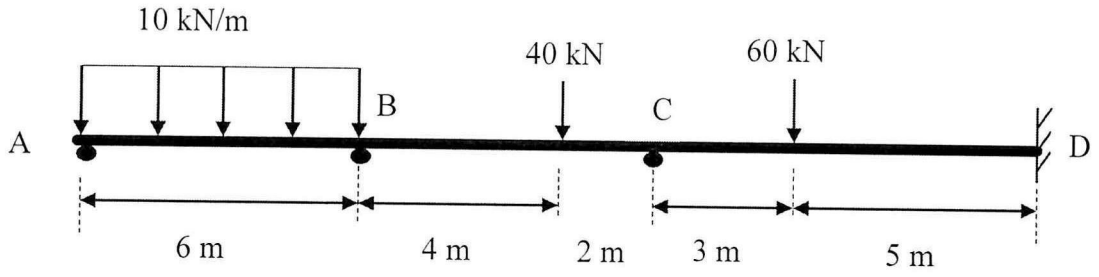

FIGURE Q5(b)

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FORMULA

$$k = \frac{EA}{L}\begin{bmatrix} \lambda_x{}^2 & \lambda_x\lambda_y & -\lambda_x{}^2 & -\lambda_x\lambda_y \\ \lambda_x\lambda_y & \lambda_y{}^2 & -\lambda_x\lambda_y & -\lambda_y{}^2 \\ -\lambda_x{}^2 & -\lambda_x\lambda_y & \lambda_x{}^2 & \lambda_x\lambda_y \\ -\lambda_x\lambda_y & -\lambda_y{}^2 & \lambda_x\lambda_y & \lambda_y{}^2 \end{bmatrix}$$