Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022

COURSE NAME	:	ADVANCED STRUCTURE ANALYSIS
COURSE CODE	:	MFA 10203
PROGRAMME CODE	:	MFA
EXAMINATION DATE	:	JANUARY / FEBRUARY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWER **ALL QUESTIONS** 2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSE BOOK**

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 **(a)** Yield line is an ultimate load theory for slab design. The assumptions of this theory was based on collapse mechanisms and plastic properties of under reinforced slabs. Define assumptions considered in yield line theory.

(2 marks)

(b) Sketch the yield line pattern for the slabs shown in **Figure Q1 (a)**.

(3 marks)

(c) **Figure Q1(b)** shows a rectangular slab with an opening. This slab has been designed for three storey multipurpose building. In the design, three sides AB, BD and CD are fixed supports. However, 15 years after construction, side CD suddenly collapse due to overloading and causes it is failed in moment. The slab also carrying a 900 mm height brickwall and point load, P is 15kN. Given the following data:

Brick thickness	=	115 mm
Slab thickness	=	200 mm
Finishes	=	1.5 kN/m^2
Density of concrete	=	24 kN/m^3
Imposed load	=	5.0 kN/m^2
Density of brick	=	26.6kN/m^3

(i) Define and draw the yield line of the slab results after the failure of side CD.

(4 marks)

(ii) Identify the collapsed moment for each direction after the slab CD failure.

(16 marks)

Q2 **(a)** Consider a column AB of length,L hinged at both its ends A and B carries an axial buckling load at A. Derive the formula for buckling load when the both ends of the column are hinged.

(8 marks)

(b) **Figure Q2** shows a pin-pin aluminium column with length of 8m and cross-section of column, respectively.

(i) Evaluate the critical load of a pin-pin column if E is 200GPa.

(12 marks)

(ii) If the allowable compressive stress in the aluminum column is 240 MPa. Find that the column is more likely to buckle or yield.

(3 marks)

(iii) If the safety factor = 2, define the allowable buckling load.

(2 marks)

Q3 (a) Describe and draw **THREE (3)** common types of elements used in finite element method.

(6 marks)

(b) **Figure Q3(a)** shows a cantilever beam attached with 5kg and 10kg steel buckets at point B and C, respectively. Meanwhile, there is moment, M1 with 20kNm acting at point C. Determine the internal forces and the deflections of the cantilever beam using flexibility method (assume gravity acceleration is 10 m/s^2 and EI is constant).

(19 marks)

Q4 (a) Identify and sketch the possible collapse mechanisms for the structure shown in **Figure Q4(a).**

(5 marks)

(b) **Figure Q4(b)** shows a frame has been subjected to a concentrated load at point B, C and F. All columns have the same plastic moment 3Mp except for members GH. Meanwhile, all beams have similar plastic moment, Mp. Determine the critical load P (answers in Mp and L).

(20 marks)

-END OF QUESTIONS-

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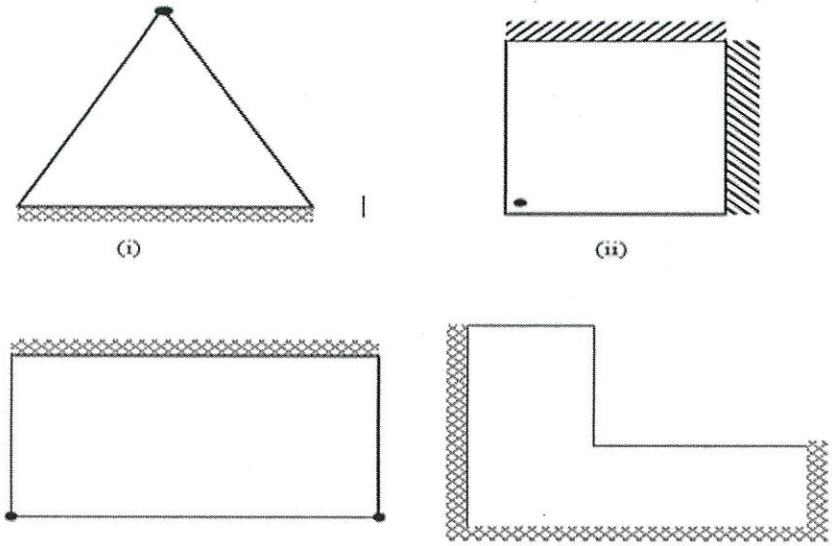

Figure Q1 (a): Slabs pattern

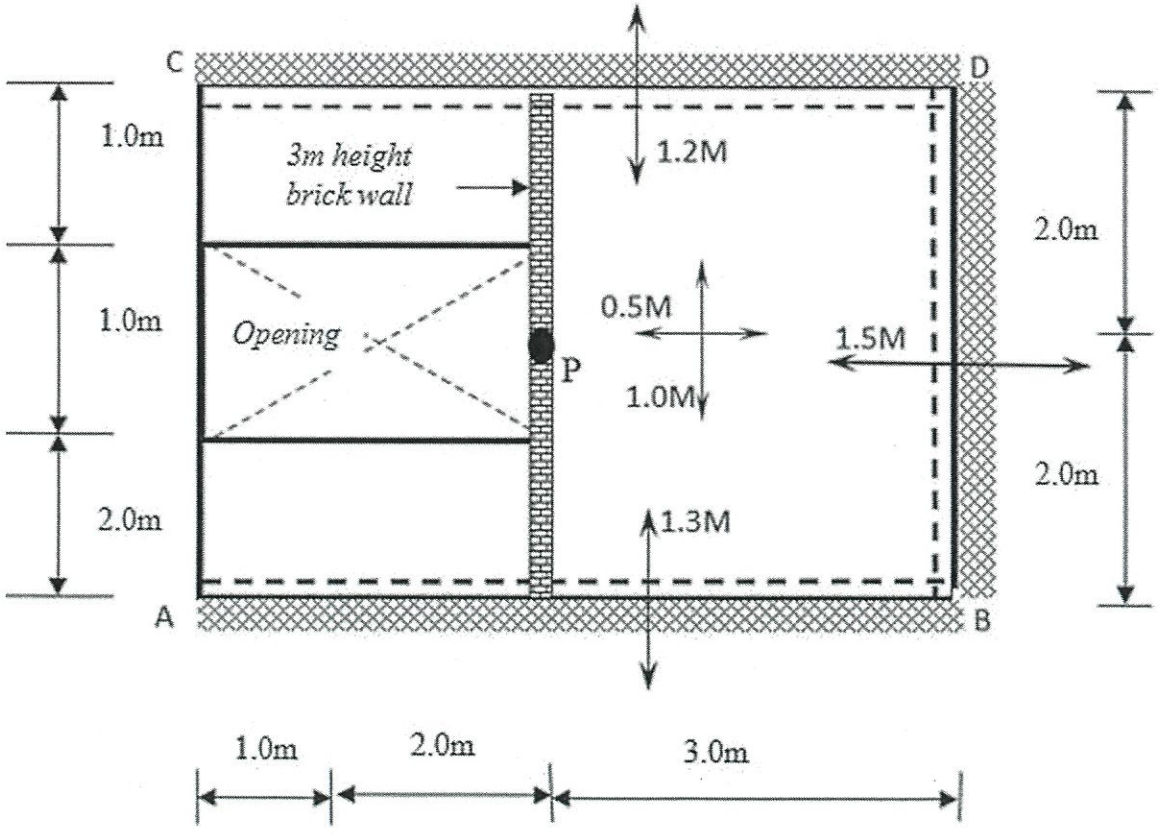

Figure Q1 (b): Rectangular slab

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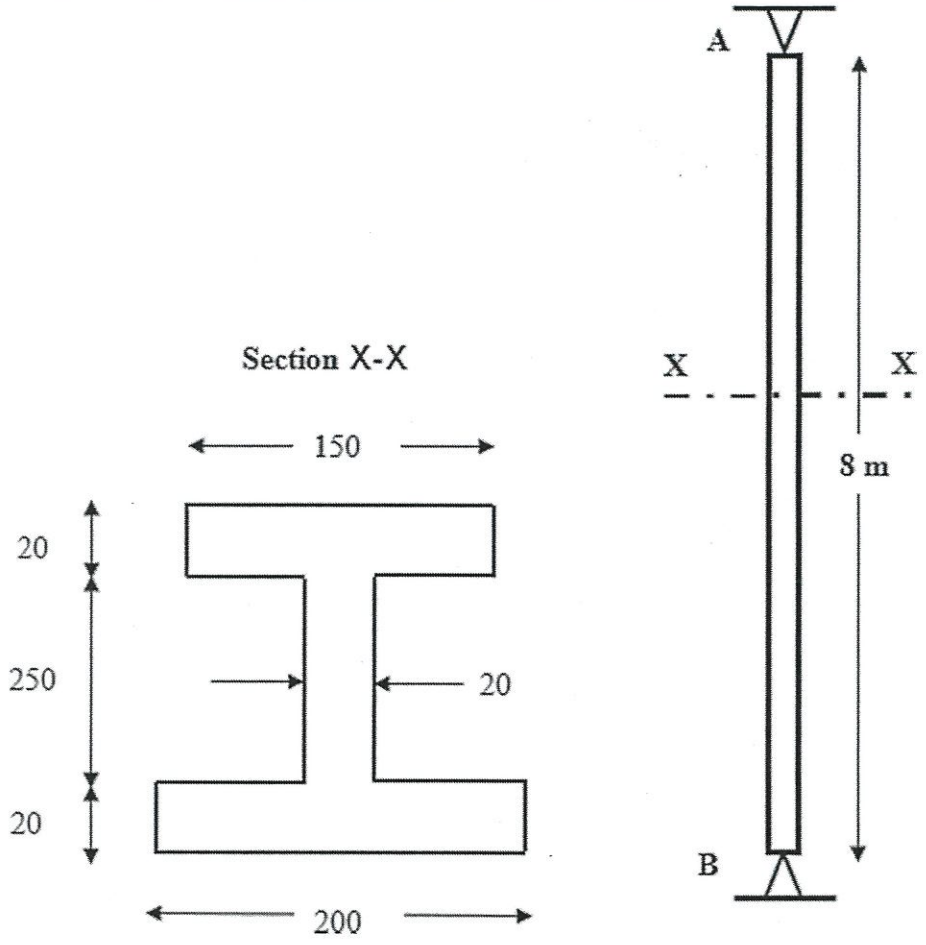

Figure Q2: Pin-pin aluminium column

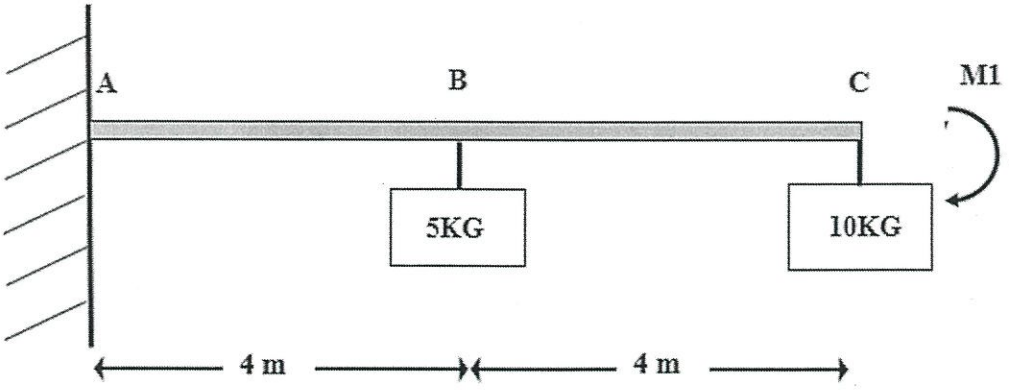

Figure Q3(a): Cantilever beam

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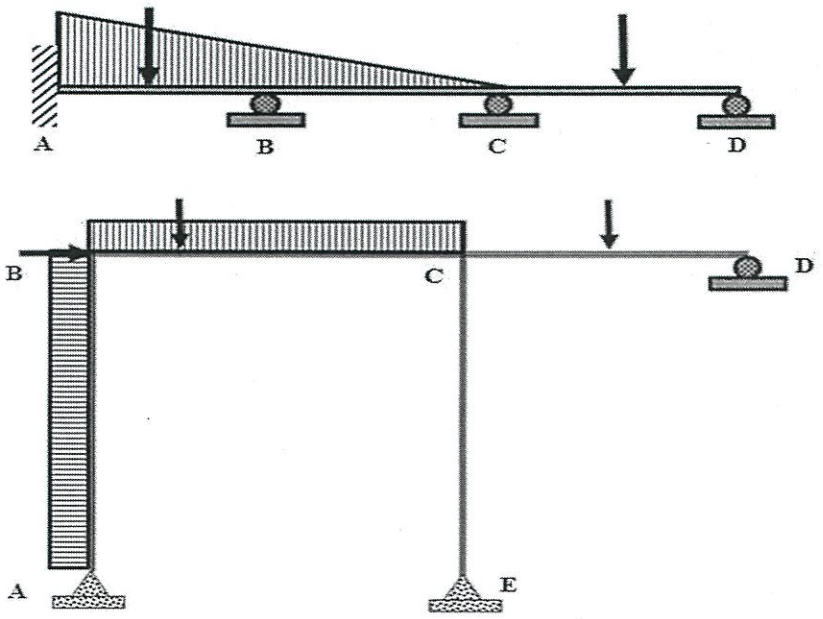

Figure Q4(a): Structure

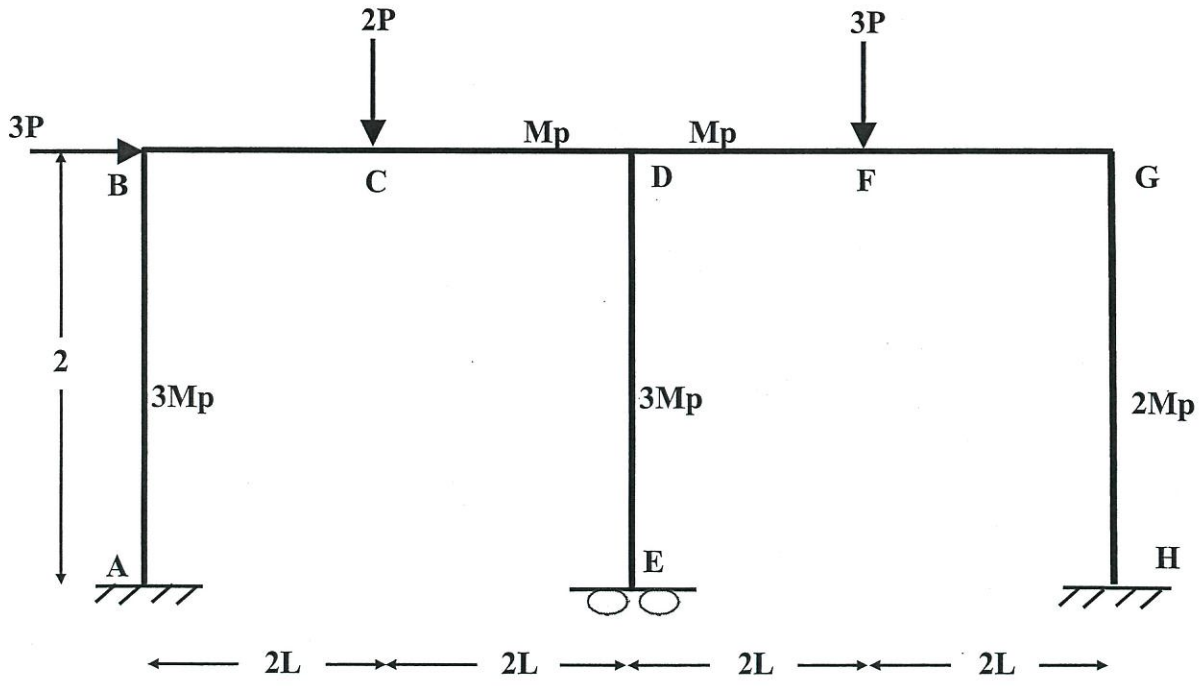

Figure Q4(b): Frame