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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2021/2022**

- COURSE NAME : REINFORCED CONCRETE DESIGN
- COURSE CODE : BFC 34803
- PROGRAMME CODE : BFF
- EXAMINATION DATE : JANUARY / FEBRUARY 2022
- DURATION : 3 HOURS
- INSTRUCTION : 1. ANSWER **ALL** QUESTIONS.
2. DESIGN SHOULD BE BASED ON BSEN 1990:2002+A1:2005, BS EN 1991 1 1:2002, BS EN 1992-1-1:2004, MS 1553:2002.
3. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **OPEN BOOK**.

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

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Q1 Figure Q1 shows a single-storey military building that will be constructed on top of a hill in Cameron Highland. The height of the building is 5 meters with a length of 19.5 meters and a width of 10 meters. The roof is flat and inaccessible. Based on the special requirement, the building should not have any obstructions as its intended purpose is to observe and control the security of the city.

(a) If the building receives a total wind pressure of 5.324 kN/m^2 from the west, analyse the bending moments and shear forces of the roof beams and columns. (19 marks)

(b) Draw the bending moments and shear forces diagrams. (6 marks)

Q2 Figure Q2 shows a five-storey braced column. The bottom column with a height of 3500 mm is subjected to 2100 kN ultimate axial load and bending moment at both axes. The column is constructed using C30/37 concrete, S500 steel reinforcement and a nominal cover of 30 mm.

(a) Briefly explain the difference between slender and non-slender columns. (2 marks)

(b) Determine classification of the column using the simplified method. Take the effective length factor as 0.75 where effective length, l_o is equal to factor multiply with clear height. (8 marks)

(c) Design the longitudinal reinforcement and links for the column. Diameter for the main reinforcement and link reinforcement are 25 mm and 10 mm respectively. (15 marks)

Q3 (a) Foundation is a structure that is placed below the soil datum. List **TWO (2)** essential requirements in the design of foundation. (2 marks)

(b) A five storey shop lot building will be constructed at soft soil area in Parit Raja. A pile foundation needs to be designed and required to support a 4500 kN permanent axial load and 2000 kN variable load. The micropile precast with 550 mm diameter 2000 kN service load will be used. Given the following data,

Characteristic strength of concrete, f_{ck}	=	C35/45
Characteristic strength of steel, f_{yk}	=	500 N/mm ²
Unit weight of concrete	=	25 kN/m ³
Diameter of reinforcement, ϕ_{bar}	=	25 mm
Nominal concrete cover, c	=	75 mm



Column size	=	450 x 450 mm
Spacing factor of pile, k	=	2.5

- (i) Using **Table Q3**, determine the required number of piles and the size of pile cap. (4 marks)
- (ii) Draw the pile cap complete with the dimension and design the main reinforcement (7 marks)
- (iii) Verify that the shear resistance and punching shear are sufficient to resist cracking and failure (9 marks)
- (iv) Draw the detailing of the pile cap. (3 marks)

Q4 Figure Q4 shows the cross-section of cantilever retaining wall that will be constructed for a rural road development at Batu Pahat. The wall is to be monolithically cast into the footing of 0.5 m thickness and will retain a granular fill to a height of 3.5 m. Given the following data,

Characteristic strength of concrete, f_{ck}	=	30 MPa
Characteristic strength of steel reinforcement, f_{yk}	=	500 MPa
Unit weight of reinforced concrete	=	25 kN/m ³
Concrete cover	=	40 mm
Diameter of reinforcement	=	16 mm
Safe bearing pressure, q	=	300 kN/m ²

- (a) Determine the earth and hydrostatic pressure along with the depth of the retaining wall. (4 marks)
- (b) Analyse the positive and negative moments as well as the vertical and horizontal loads that may occur in the retaining wall. (10 marks)
- (c) Determine the possible bending moment at the base and design the main reinforcement of the footing. (11 marks)

- END OF QUESTION -

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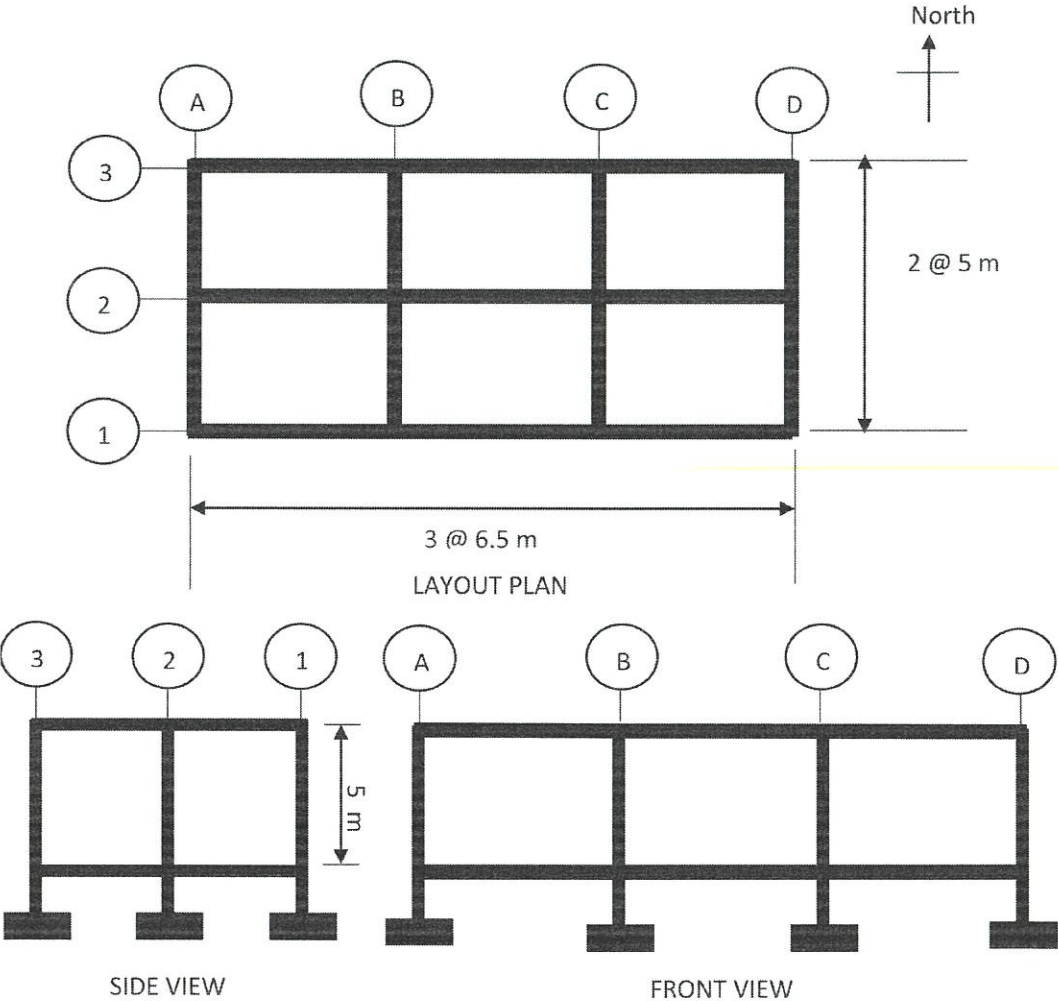


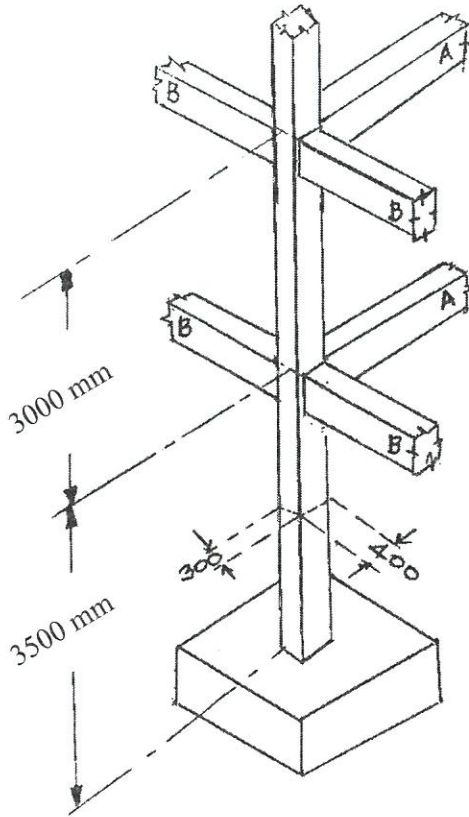
FIGURE Q1

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Beam A:
300 x 600
L = 7000 mm

Beam B:
300 x 600
L = 4500 mm

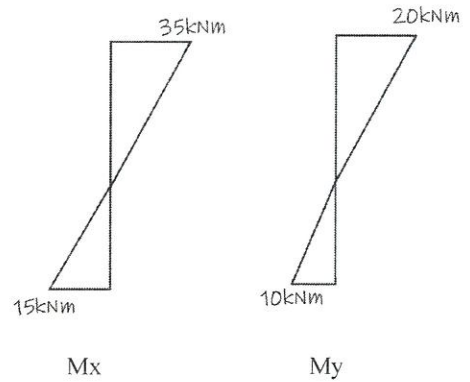


FIGURE Q2

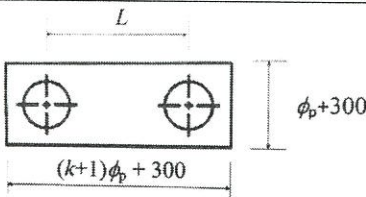
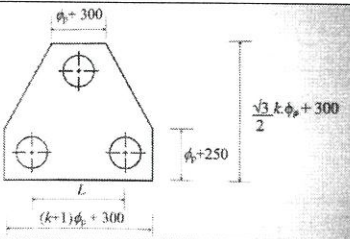
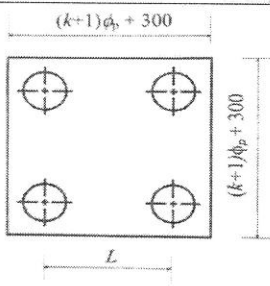
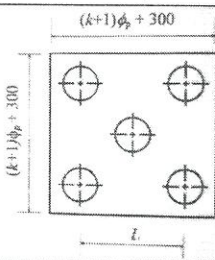
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TABLE Q3

		$\frac{NL}{4d}$
		$\frac{NL}{9d}$
		$\frac{NL}{9d}$
		$\frac{NL}{10d}$

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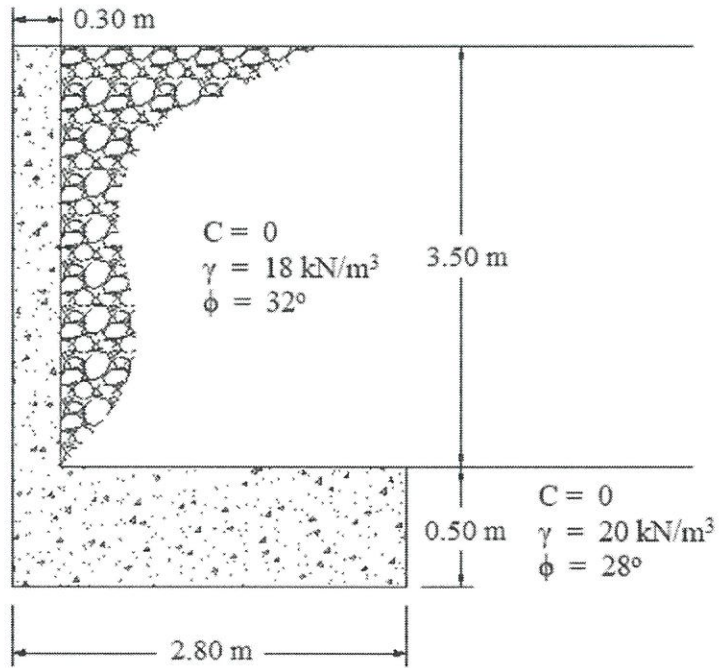


FIGURE Q4

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