Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	REINFORCED CONCRETE DESIGN II
COURSE CODE	:	BFC32803
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	1. OPEN BOOK EXAMINATION 2. ANSWER **ALL** QUESTIONS 3. DESIGN SHOULD BE BASED ON BS EN 1990:2002+A1:2005, BS EN 1991-1-1:2002, BS EN 1992-1-1:2004

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

Q1 A flat roof hospital to be built in highly congested area of Petaling Jaya, Selangor. The isometric view and dimension of the hospital are shown in **Figure Q1**. In the design consideration, the hospital building is subjected to wind load based on the following parameters:

Wind directional multiplier	= 1.0
Shielding multiplier	= 1.0
Hill shape multiplier	= 1.0
Area reduction factor	= 1.0
Combination factor	= 1.0
Local pressure factor	= 1.0
Porous cladding reduction factor	= 1.0
Turbulence intensity	= 2.0
Peak factor	= 3.7
Background factor	= 0.75
Peak factor for resonant response	= 3.0
Size reduction factor	= 0.2
Spectrum of turbulence	= 0.65
Structural to critical damping ratio	= 0.05

Referring to the above parameters and according to MS 1553:2002,

(a) Analyse the windward pressure for each level (Level 1 to 10). Determine the values of P and Q in unit kN.

(15 marks)

(b) Calculate the leeward pressure for each level (Level 1 to 10).

(6 marks)

(c) Draw the windward and leeward pressures acting on the hospital building.

(4 marks)

Q2 (a) A single-storey frame with height of 6000 mm, as shown in **Figure Q2(a)**, consists of in-situ beams and columns. The frame is totally braced and fully fixed at the base. The size of beams and columns are 250 mm x 500 mm and 350 mm x 350 mm respectively. Referring to column C2,

(i) Calculate the effective length of column in accordance with Clause 5.8.3.2 BS EN 1992-1-1:2004.

(6 marks)

(ii) Check whether the column should be designed to consider second order effect. The column carries an ultimate axial load of 700 kN. The top and bottom bending moments are 60 kNm and 35 kNm respectively. Use f_{ck} = 30 N/mm^2 and f_{yk} = 500 N/mm^2.

(10 marks)

(b) **Figure Q2(b)** shows the cross-section detailing of 300 mm x 300 mm column. Check the compliance on biaxial bending effect. The column is short and subjected to an ultimate axial load of 1300 kN. It is also designed to withstand bending moments of 35 kNm and 40 kNm about y-y and z-z axes. Use f_{ck} = 30 N/mm^2, f_{yk} = 500 N/mm^2 and C_{nom} = 35mm.

(9 marks)

Q3 (a) List and briefly describe **THREE (3)** types of foundation that are widely used in Malaysia.

(3 marks)

(b) A pad footing with size of 3500 mm x 3500 mm x 600 mm, as shown in **Figure Q3**, is designed for soil bearing capacity of 150 kN/m^2. The pad footing inherits an ultimate axial load of 1500 kN with an accompanying bending moment of 43 kNm from a square shape of 500 mm x 500 mm column. The specifications of design are f_{ck} = 25 N/mm^2, f_{yk} = 500 N/mm^2, C_{nom} = 30 mm and $\emptyset_{bar}$ = 12 mm.

(i) Check whether the provided size can fully support the service action and design the main reinforcement of pad footing.

(14 marks)

(ii) Verify that the punching shear at 2d from the column face is sufficient to resist cracking and failure.

(8 marks)

Q4 (a) Explain and sketch **THREE (3)** types of failure in retaining wall that are exerted by lateral pressure.

(6 marks)

(b) A cantilever retaining wall, as shown in **Figure Q4**, supports earth backfill of 5000 mm height. The soil in the surrounding area is sandy clay mixture with density of 20 kN/m^3 and internal friction angle of 30°. Meanwhile, the friction coefficient of base-soil is 0.45 and density of concrete is 25 kN/m^3.

(i) Analyse the active and passive soil pressures, positive and negative moments as well as vertical and horizontal loads that may occur on the retaining wall.

(10 marks)

(ii) Check the stability of retaining wall against settlement and sketch the resistant forces.

(9 marks)

– END OF QUESTIONS –

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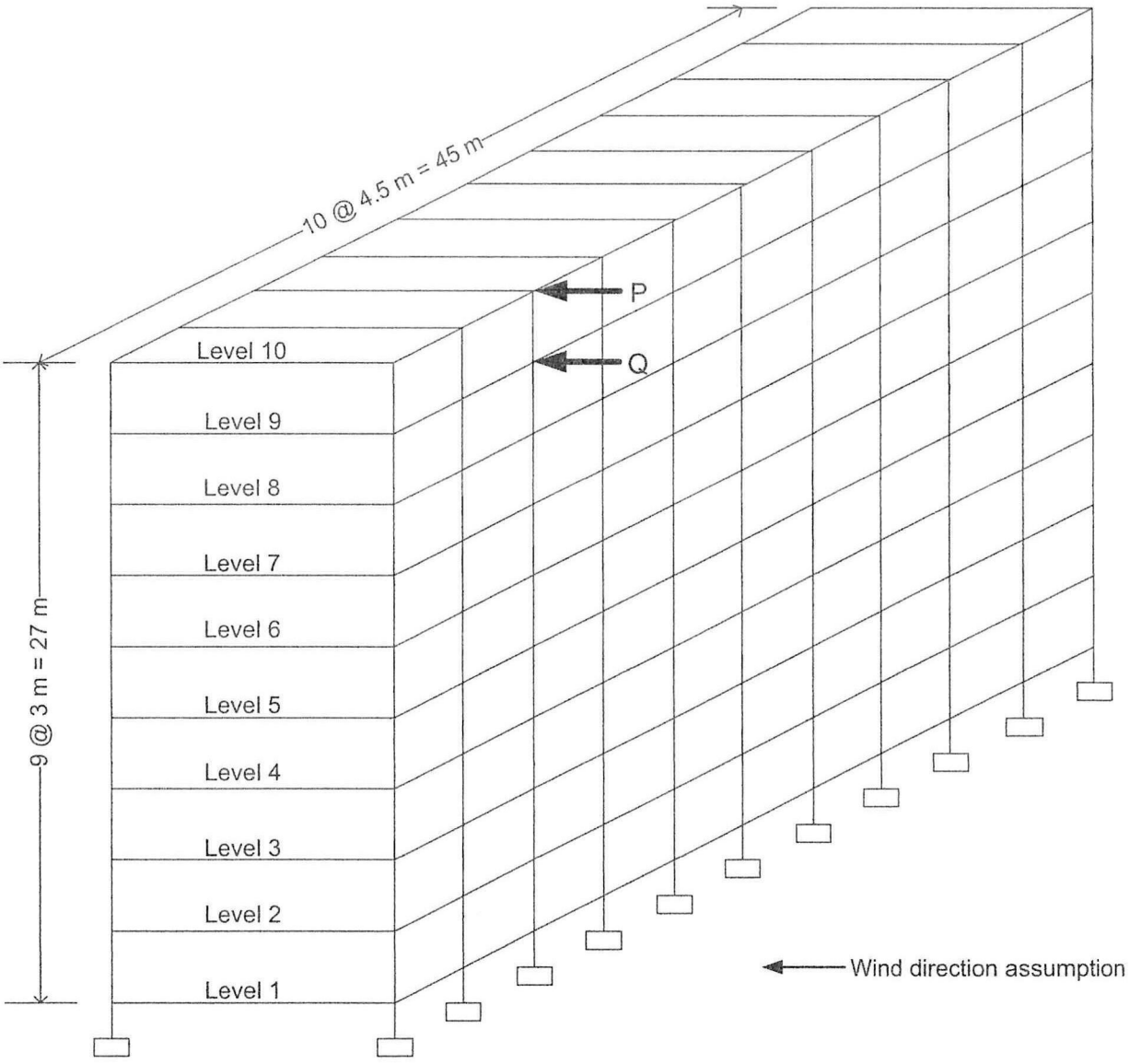

FIGURE Q1

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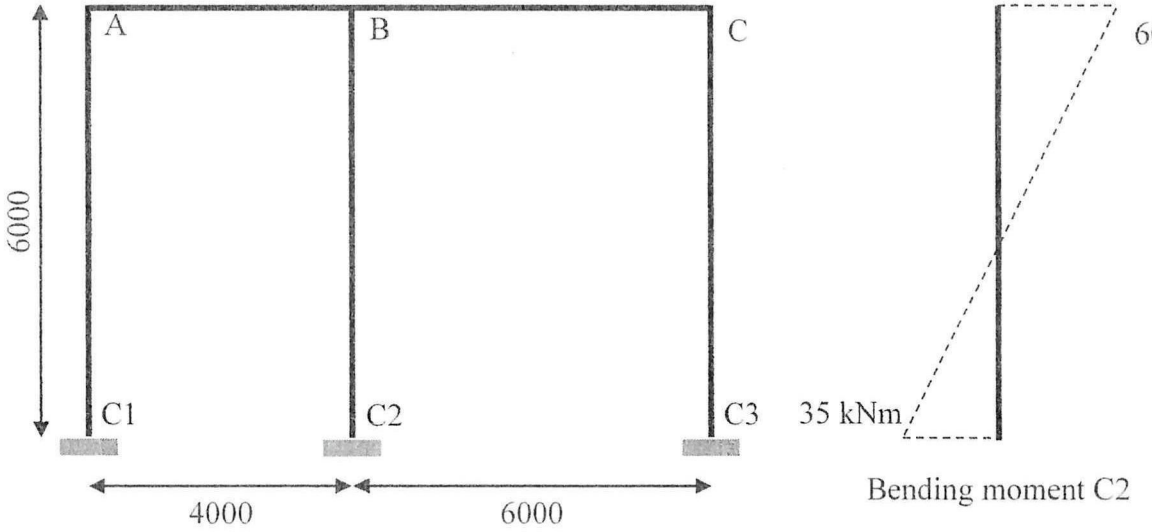

FIGURE Q2(a)

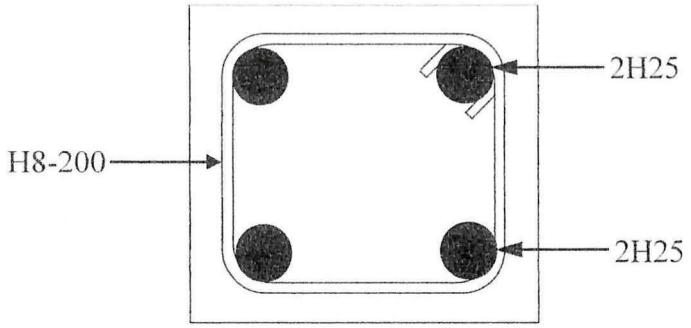

FIGURE Q2(b)

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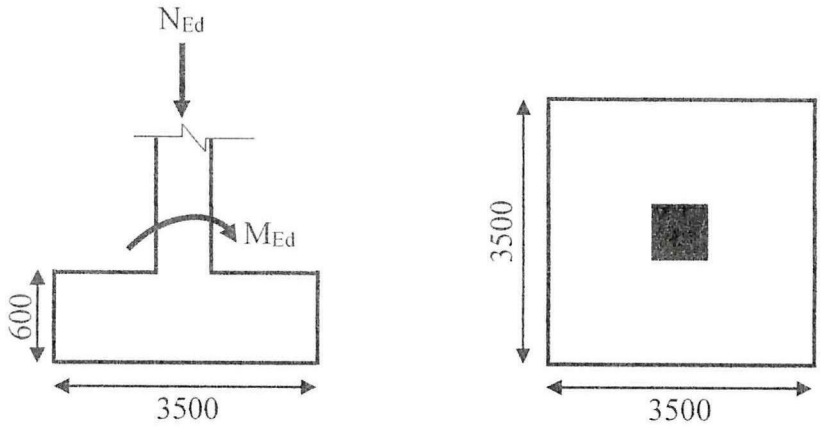

FIGURE Q3

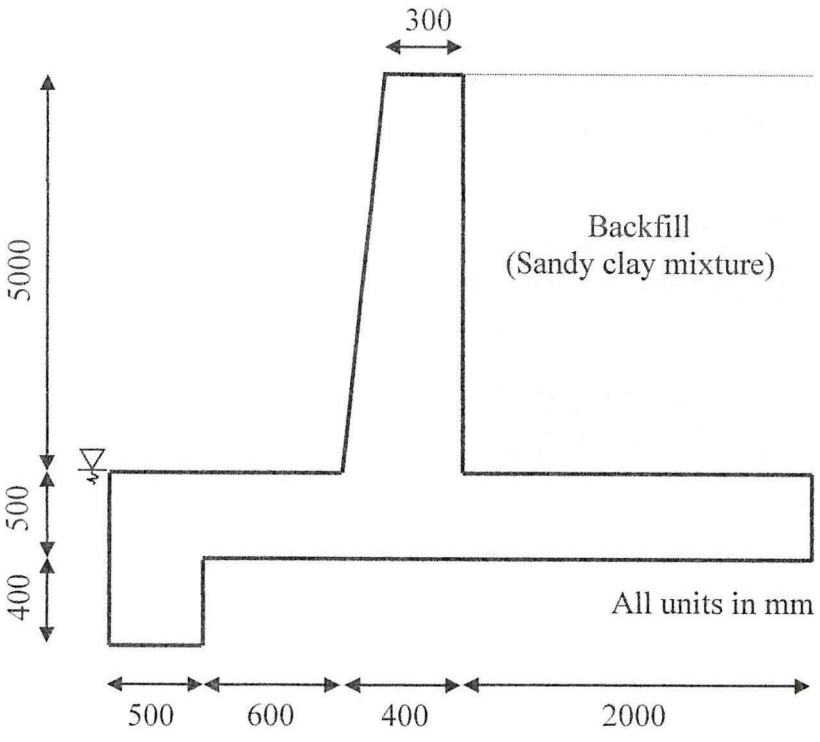

FIGURE Q4

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TABLE 1

Soil Bearing Capacity of Different Types of Soil		
No	**Type of Soil**	**Soil Bearing Capacity (kN/m^2)**
	(A) Cohesionless soil	
1	Gravel, sand and gravel, compact and offering high resistance to penetration	440
2	Coarse sand, compact and dry	440
3	Medium sand, compact and dry	245
4	Fine sand, silt (dry lumps easily pulverized by fingers)	150
5	Loose gravel or sand gravel mixture, loose coarse to medium sand, dry	245
6	Fine sand, loose and dry	100
	(B) Cohesive soil	
7	Soft shale, hand or stiff clay in deep bed, dry	440
8	Medium clay, readily indented with a thumb nail	240
9	Moist clay and sand clay mixture which can be indented with strong thumb pressure	150
10	Soft clay indented with moderate thumb pressure	100
11	Very soft clay which can be penetrated several centimetres with the thumb	50
12	Black cotton soil or other shrinkable or expansive clay in dry condition (50% saturation)	To be determined after investigation