

**CONFIDENTIAL**



**UTHM**

Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER II  
SESSION 2020/2021**

COURSE NAME : REINFORCED CONCRETE DESIGN II /  
REINFORCED CONCRETE DESIGN

COURSE CODE : BFC 32803 / BFC 34803 ✓

PROGRAMME CODE : BFF

EXAMINATION DATE : JULY 2021

DURATION : 3 HOURS

INSTRUCTION : 1. OPEN BOOK EXAMINATION  
2. ANSWER **ALL** QUESTIONS  
3. DESIGN SHOULD BE BASED ON  
BSEN 1990:2002+A1:2005, BS EN  
1991-1-1:2002, BS EN 1992-1-1:2004

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

**TERBUKA**

**CONFIDENTIAL**

**Q1** A front view of a four storey hotel building as shown in **Figure Q1** will be built near the seaside at Desaru, Johor. The building will be exposed to open terrain area with few or no obstructions. The wind load is non-linear, windward wall permeable, neglected leeward wall effect and varies at different height. Based on MS 1553:2002:

- (a) Determine the terrain/height multiplier,  $M_{z,cat}$  for each height of this building with the suitable procedure and  $V_s$  due to area. Use internal pressure coefficient,  $C_{p,i} = 0.6$  and external pressure coefficient,  $C_{p,e} = 0.8$ . (6 marks)
- (b) Sketch a typical plan view with full dimensions of this building, considering the dimensions is similar to any directions and the maximum wind load is acted at sub frame D/1-7. Then, calculate the design wind load and draw the point load for each level of building. (7 marks)
- (c) Referring to Level 5, analyse and draw the axial forces in columns, shear forces and bending moments in beams and columns. Then, calculate and draw the possibilities of axial forces in columns for Level 4 and above only. (12 marks)

**Q2** **Figure Q2** shows a plan and side view of a reinforced concrete structural extension works. The extension works start at 500 mm below the existing ground slab level. The extension works involves footing, column, beam and slab constructions. The existing ground slab is a non-suspended slab. The 3/A-C beam is 350 mm x 550 mm and the B/2-4 beam is 300 mm x 450 mm. Both of this beams are connected four sided to B/3 column. The 350 mm x 550 mm beam is submitted to point load of A1/3-4 and B1/3-4 beam at it middle spans. The characteristic permanent ( $G_k$ ) and variable ( $Q_k$ ) load for beam 3/A-C of 2<sup>nd</sup> and 1<sup>st</sup> level is 90 kN/m and 30 kN/m, respectively. The characteristic permanent ( $G_k$ ) and variable ( $Q_k$ ) load for beam B/2-4 of 2<sup>nd</sup> and 1<sup>st</sup> level is 50 kN/m and 20 kN/m, respectively. The characteristic permanent ( $G_k$ ) and variable ( $Q_k$ ) load for beam A1/3-4 and B1/3-4 of 2<sup>nd</sup> and 1<sup>st</sup> level is 36 kN/m and 12 kN/m, respectively. All columns are 250 mm x 400 mm.

- (a) Determine the design axial load in order to design column B/3 from footing to 1<sup>st</sup> level. (6 marks)
- (b) Determine the design bending moment in order to design column B/3 from footing to 1<sup>st</sup> level. (7 marks)
- (c) Design the main reinforcement bar for column B/3 from footing to 1<sup>st</sup> level by considering biaxial bending checking. Given:

Effective length of column, $L_{oz}$	= 2.396
Effective length of column, $L_{oy}$	= 2.393
Slenderness ratio, $\lambda_z$	= 20.7

TERBUKA



Slenderness ratio, $\lambda_y$	=	33.2
Characteristic strength of concrete, $f_{ck}$	=	30 N/mm <sup>2</sup>
Characteristic strength of steel, $f_{yk}$	=	500 N/mm <sup>2</sup>
Assumed $\varnothing_{link}$	=	10 mm
Assumed $\varnothing_{bar}$	=	20 mm
Concrete cover, $C_{nom}$	=	30 mm

(12 marks)

**Q3** A reinforced concrete internal column with size of 400 mm x 400 mm is subjected to an ultimate load of 1950 kN. The column is reinforced with H25 bars. Due to the obstacles around the column area, one direction of the footing should be limited to 2.2 meter. The overall depth, h of the footing should be based on the maximum punching shear stress at column perimeter, 0.35 N/mm<sup>2</sup>. Given,

Characteristic strength of concrete, $f_{ck}$	=	35 N/mm <sup>2</sup>
Characteristic of steel reinforcement, $f_{yk}$	=	500 N/mm <sup>2</sup>
Concrete cover	=	40 mm
Soil bearing capacity	=	200 kN/mm <sup>2</sup>
Factor to change ultimate load to service load	=	1.45
Effective depth, d	=	430 mm
Steel reinforcement area, $A_s$	=	3454 mm <sup>2</sup> (11H20)

- (a) Propose a suitable size (B x L x h) for the footing. (8 marks)
- (b) Check the vertical shear capacity of the proposed footing and give comment on your findings. (12 marks)
- (c) Check the capacity of maximum punching shear at column perimeter. (2 marks)
- (d) Give your opinion on footing area, soil pressure under the footing and area of steel reinforcement, if the same footing subjected to a combination of axial load and moment from column. (3 marks)

**Q4** A cantilever retaining wall, as shown in **Figure Q4**, supports earth backfill of 5000mm height. The soil in the surrounding area is sandy clay mixture with density, 20 kN/m<sup>3</sup>. Meanwhile, the friction coefficient of base-soil is 0.45 and density of concrete is 25 kN/m<sup>3</sup>. The active soil pressure at any depth, z is expressed by  $p = 6.6z$  kN/m<sup>2</sup>.

- (a) Analyse positive and negative moment, vertical and horizontal load that may occurs in retaining wall. (10 marks)



- (b) Check maximum soil stability and sliding resistance of the retaining wall. (5 marks)
- (c) A proposed new development of residential house will be built nearby the area of an existing retaining wall located and caused the resulting effect of live load surface of 20kN/m. As a consultant engineer, give your thought (with prove of calculation) on safety of the existing retaining wall in term of its stability (10 marks)

**–END OF QUESTIONS–**

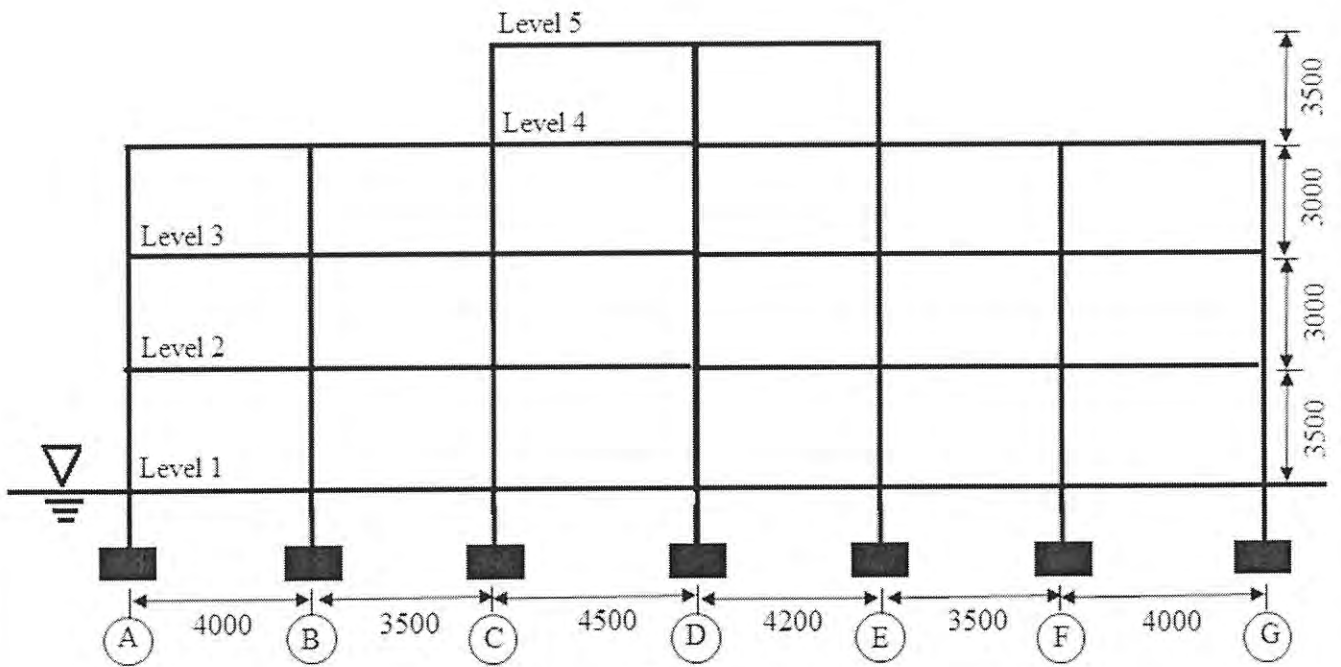
FINAL EXAMINATION

SEMESTER/SESSION : SEM II / 2020/2021

PROGRAMME CODE : BFF

COURSE NAME : REINFORCED CONCRETE DESIGN II /  
REINFORCED CONCRETE DESIGN

COURSE CODE : BFC 32803 /  
BFC 34803



Front view

All units are in mm

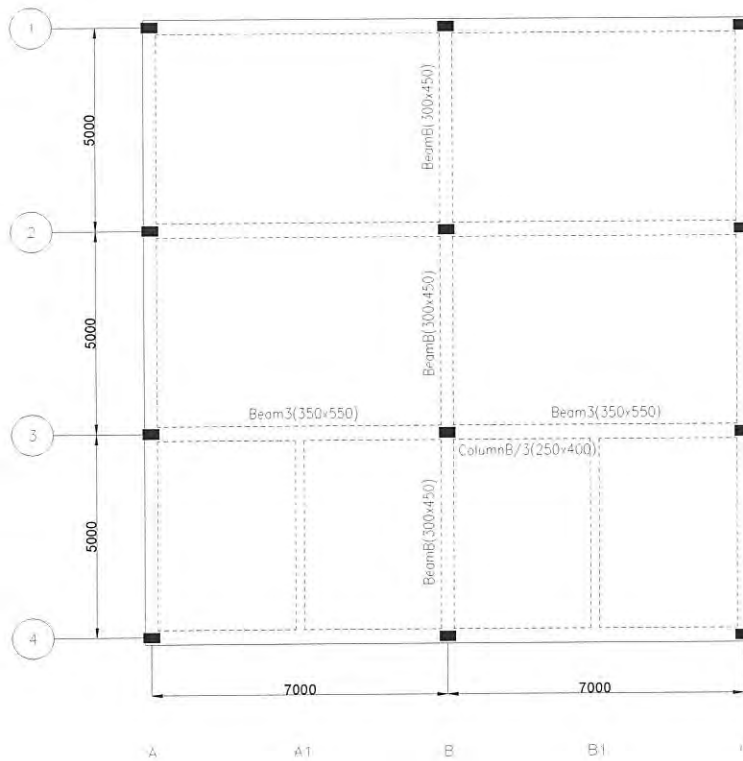
FIGURE Q1

TERBUKA

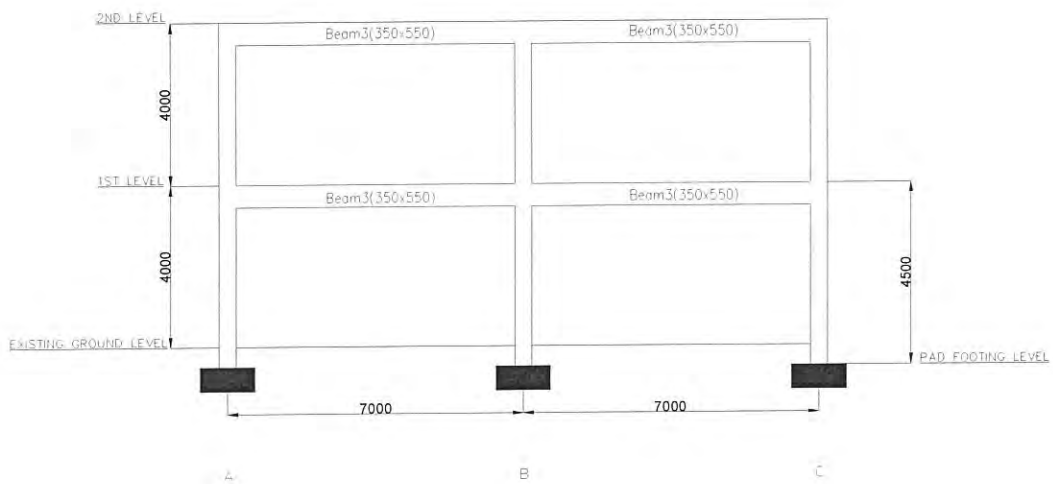
FINAL EXAMINATION

SEMESTER/SESSION : SEM II / 2020/2021  
COURSE NAME : REINFORCED CONCRETE DESIGN II /  
REINFORCED CONCRETE DESIGN

PROGRAMME CODE : BFF  
COURSE CODE : BFC 32803 /  
BFC 34803



LAYOUT PLAN



SIDE VIEW

FIGURE Q2

TERBUKA



FINAL EXAMINATION

SEMESTER/SESSION : SEM II / 2020/2021

PROGRAMME CODE : BFF

COURSE NAME : REINFORCED CONCRETE DESIGN II /  
REINFORCED CONCRETE DESIGN

COURSE CODE : BFC 32803 /  
BFC 34803

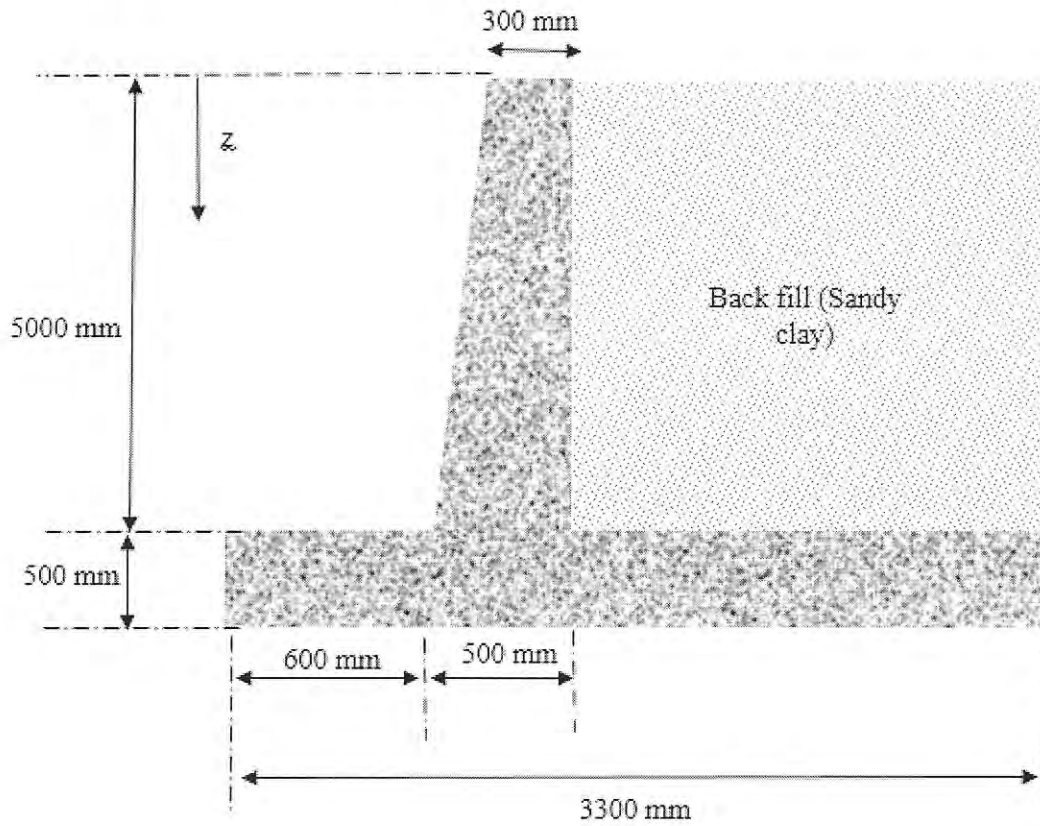


FIGURE Q4

TERBUKA