



# UTHM

Universiti Tun Hussein Onn Malaysia

## UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : STRUCTURAL DESIGN  
COURSE CODE : BFC34702  
PROGRAMME CODE : BFF  
EXAMINATION DATE : JULY 2021  
DURATION : 2 HOURS AND 30 MINUTES  
INSTRUCTION : 1. ANSWER ALL QUESTIONS  
2. OPEN BOOK EXAMINATION  
3. DESIGN SHOULD BE BASED ON:  
BS EN1990:2002+A1:2005  
BS EN1991-1-1:2002  
BS EN1992-1-1:2004  
BS 8110: 1: 1997  
MS 544: PART 1 & 2: 2001

THIS PAPER CONSIST OF SEVEN (7) PAGES

- Q1** (a) Illustrate typical stress-strain curve for concrete and steel. Explain the characteristic point that determine the action of those material. (4 marks)
- (b) Considering the octagonal floor plan shown in **Figure Q1(b)**, categorize and determine the one-way and two-way spanning slabs and magnitude of loading for each supporting beams with sketch of aid. (6 marks)
- (c) **Figure Q1(c)** shows an architectural ground floor layout plan of a bungalow house. As a structural designer at a consulting engineer firm, you are required to perform the following tasks.
- (i) Propose the ground floor structural layout plan of the house by indicating all the structural elements based on your judgment (assume the ground floor slab is a suspended slab). (5 marks)
- (ii) Based on the structural layout plan proposed in Q1(c)(i), examine and calculate the permanent and variable actions acting on beam B/4-11 by considering the following data:

Slab thickness	: 125 mm
Finishes	: 1.5 kN/m <sup>2</sup>
Variable action	: 1.8 kN/m <sup>2</sup>
Beam size	: 150 mm x 450 mm
Unit weight of concrete	: 24 kN/m <sup>2</sup>
Brick wall height	: 3000 mm
Brick wall weight	: 2.6 kN/m <sup>2</sup>

(15 marks)

- Q2** **Figure Q2** shows the ground floor plan office building that has been designed using Esteem software. As a design checker, you are assigned to check the continuous beam section C/ 1-4. All beams are exposed to XC 1 conditions, with a fire resistance of 1 hour and a design life of 50 years. The beams did not support any brickwall and finish load for all slabs is 1.5 kN/m<sup>2</sup>. Given the following design specification:

Characteristic strength of concrete, $f_{ck}$	= 30 N/mm <sup>2</sup>
Characteristic strength of steel, $f_{yk}$	= 30 N/mm <sup>2</sup>
Characteristic strength of link, $f_{yk}$	= 30 N/mm <sup>2</sup>
Unit weight of reinforced concrete	= 25 kN/m <sup>3</sup>
Finishes load and services	= 1.5 kN/m <sup>2</sup>
Variable action (all slab)	= 3.0 kN/m <sup>2</sup>
Nominal concrete cover, $C_{nom}$	= 30 mm
Assume: $\phi_{bar1} = 16$ mm; $\phi_{bar2} = 12$ mm; $\phi_{link} = 8$ mm;	

- (a) Determine the design action for beam C/1-4 and sketch the shear force diagram (SFD) and bending moment diagram (BMD) (15 marks)
- (b) Design the longitudinal reinforcement at midspan C1-C2 and at support C2 if  $b_{eff}$  is 1010 mm (10 marks)
- (c) Design the shear reinforcement for span C1-C2. (10 marks)

**Q3** (a) Explain the term of sawn timber below:

- (i) Rough Sawn/Full Sawn Timber  
(ii) Dressed on Surface Timber (5 marks)

(b) **Figure Q3 (b)** shows a timber floor beam with 4500 mm length supports flooring system with a permanent and variable action 3.5 kN/m including its self-weight over its span. The beam is bolted at 150 mm wide walls on either side. The beam size is 100 mm x 150 mm standard grade Keranji section, Strength Group 3 of timber with 19% moisture content.

- (i) Examine the capacity of the beam for bending and shear stress. (8 marks)
- (ii) Examine and make the judgements for the size of the beam to satisfy the deflection. (10 marks)
- (iii) Using the shearing criteria only, judge and determine the required size of the select grade if the bottom notched at each end have a 25 mm deep and 150 mm long. (12 marks)

- END OF QUESTIONS -

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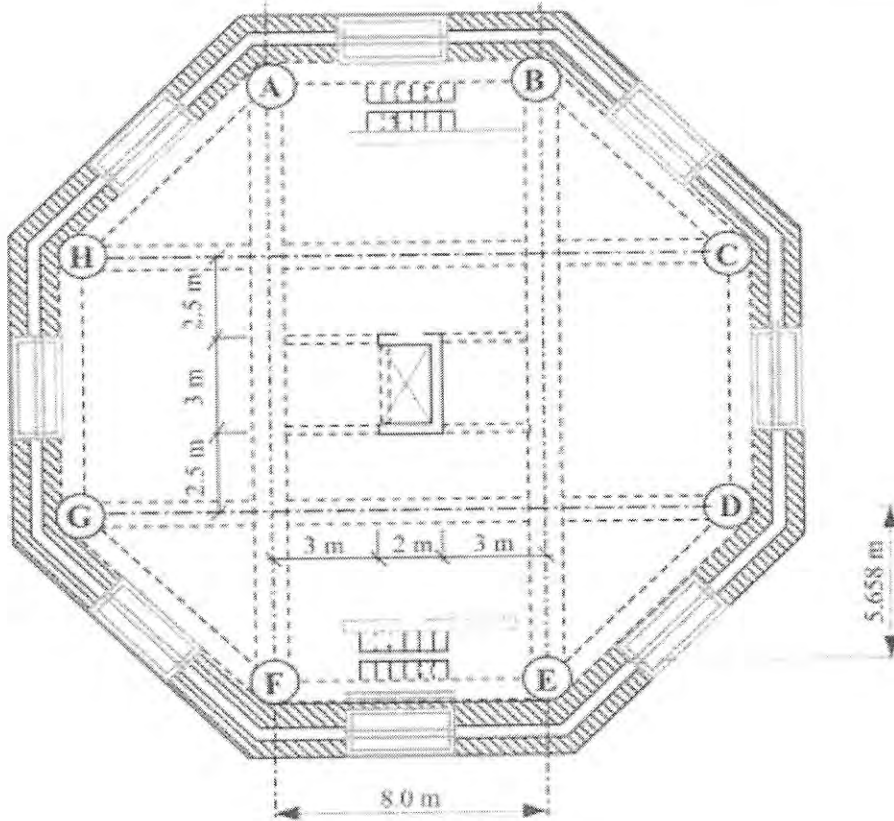


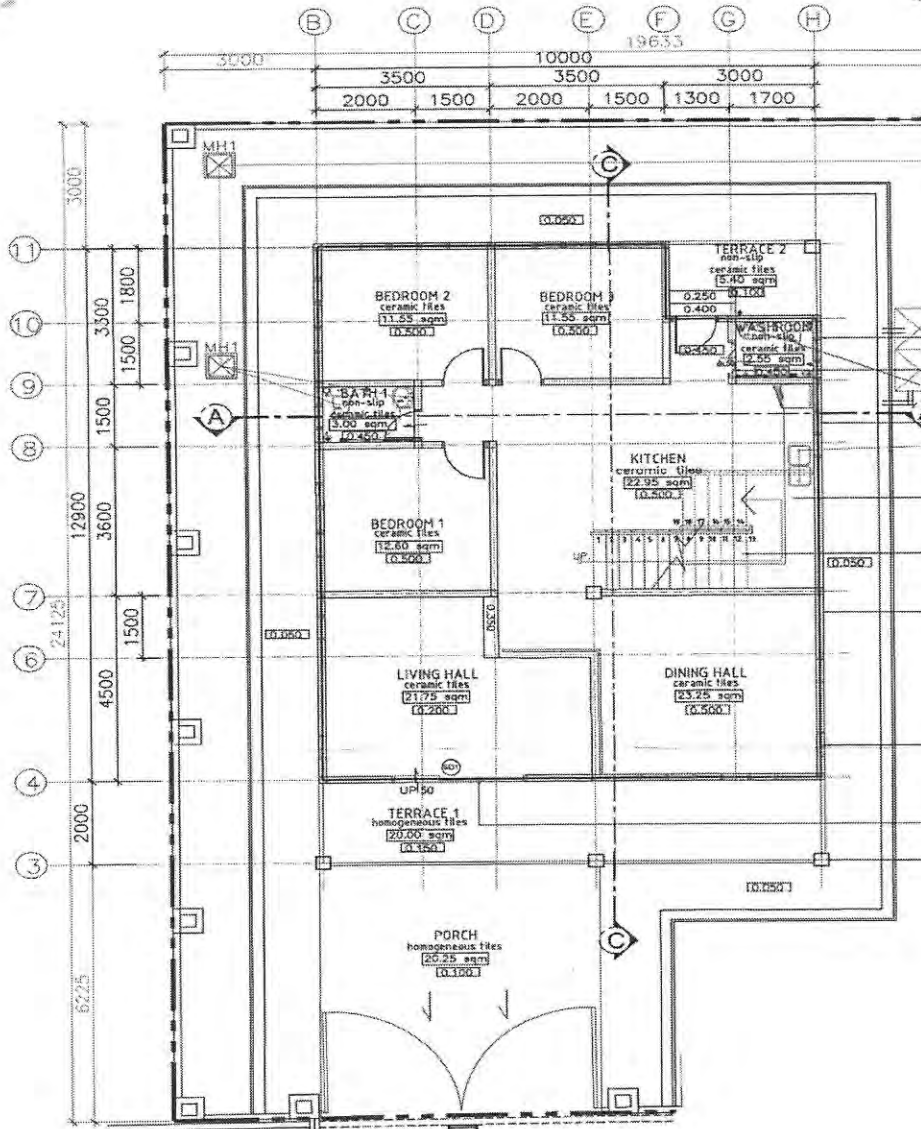
FIGURE Q1(b)



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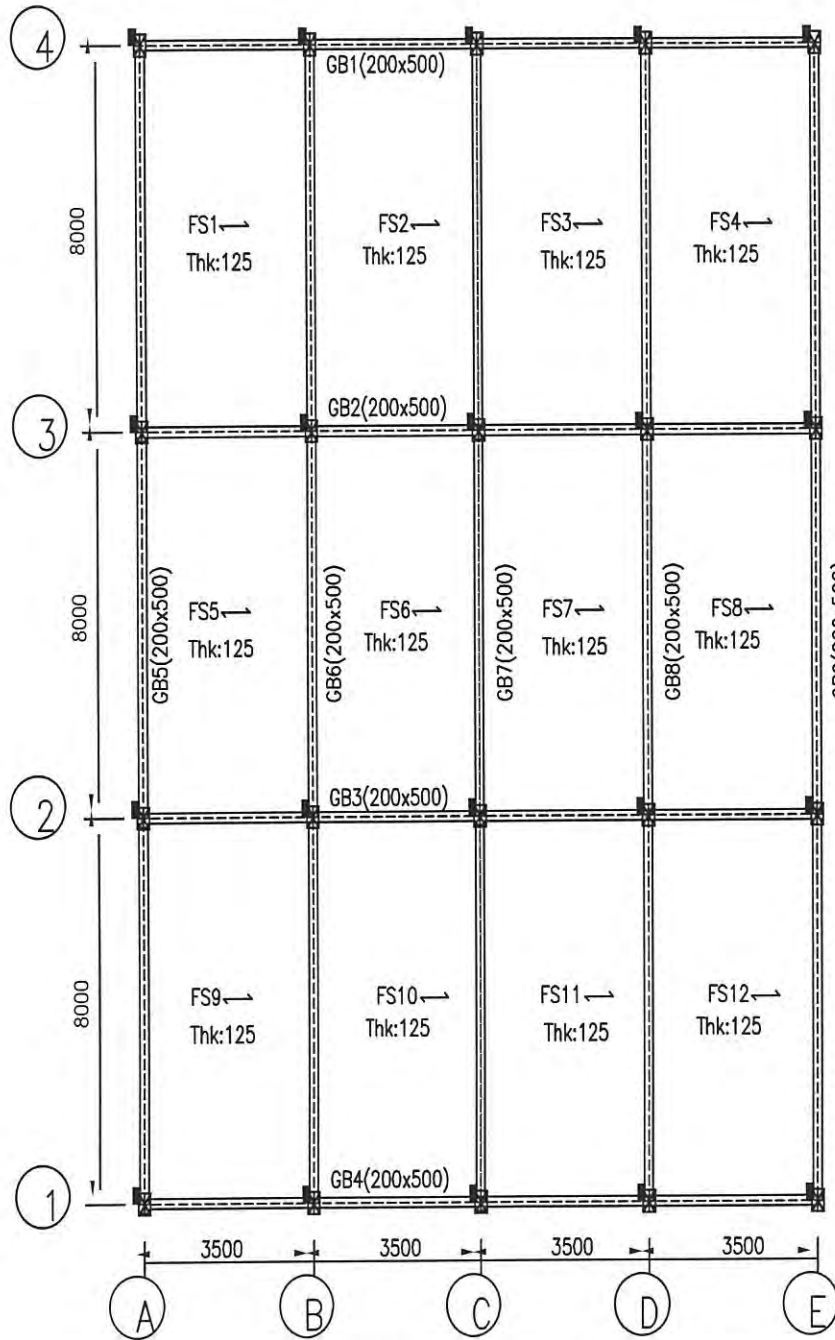
(All dimension in mm)  
**FIGURE Q1(c)**



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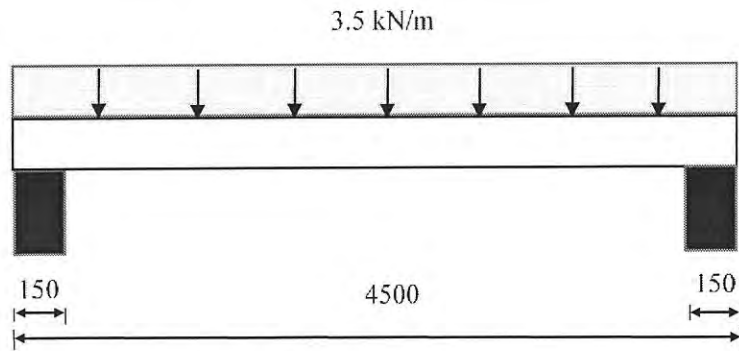
GROUND FLOOR PLAN  
ALL SLAB THICKNESS = 125 MM THK.  
FIGURE Q2



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All units in mm

**FIGURE Q3**