



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

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

COURSE NAME : STRUCTURE ANALYSIS AND DESIGN

COURSE CODE : BNP 20803

PROGRAMME CODE : BNA / BNB / BNC

EXAMINATION DATE : JULY 2022

DURATION : 3 HOURS

INSTRUCTION : 1. ANSWER ALL QUESTIONS

2. THIS FINAL EXAMINATION IS CONDUCTED OFFLINE AND CLOSED BOOK

3. STUDENTS ARE PROHIBITED TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

- Q1** (a) To ensure the structural engineering process is in an effective process, list the **FOUR (4)** important aspects that should be included in this process. (2 marks)
- (b) One continuous beam is loaded with a concentrated load and uniform load as shown in **Figure Q1 (b)**. The support at A and C are fixed and support at B is roller. The cross section and Young Modulus of the beam are constant.
- (i) Calculate the end moment at the joints by using moment distribution method. (12 marks)
- (ii) Determine the support reactions. (5 marks)
- (iii) Sketch the shear force diagram. (3 marks)
- (iv) Sketch the bending moment diagram. (3 marks)

Q2 Layout in **Figure Q2** is a plan for the part of the ground floor of a reinforced concrete buildings. By assuming ground beam B/1-4 as a rectangular beam and ignoring the beam flange answer all the question below. Given:

Slab thickness = 110 mm
 Weight of brickwork = 2.6 kN/m² (3 m high)

Characteristic Actions:

Finishes etc = 1.5 kN/m² (excluding self-weight)
 Variable, q_k = 3.0 kN/m²

Materials:

Unit Weight of Concrete = 25 kN/m³
 Characteristic strength of concrete, f_{ck} = 25 N/mm²
 Characteristic strength of steel, f_{yk} = 500 N/mm²
 Characteristic strength of link, f_{yk} = 500 N/mm²
 Use nominal cover = 30 mm
 Weight of brickwork = 2.6 kN/m²
 Use assumed size of bar as below:
 Ø_{bar1} = 20 mm
 Ø_{bar2} = 16 mm
 Ø_{link} = 6 mm

- (a) Calculate the design load transfer from slab to beam B/1-4. (4 marks)
- (b) By using simplified method referring Table 3.5 BS8110-1:1997.
 (i) Analyse the maximum shear force for beam B/1-4 and, (1 marks)

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- (ii) Analyse the maximum bending moment for beam B/1-4. (1 marks)
- (c) Design the main reinforcement of beam B/1-4. (8 marks)
- (d) Design the shear reinforcement of beam B/1-4 and ignore additional longitudinal reinforcement for tensile force. (8 marks)
- (e) Check the deflection of beam B/1-4. (3 marks)
- Q3** By referring **Figure Q2** again, the reinforced concrete slab FS8 is assigned as simply supported with thickness 125 mm. Detail specification is given as follows:

Characteristic Actions:

Finishes etc	= 1.5 kN/m ² (excluding self-weight)
Variable, q_k	= 3.0 kN/m ²
Design life	= 50 years
Fire resistance	= R90
Exposure classes	= XC3

Materials:

Unit Weight of Concrete	= 25 kN/m ³
Characteristic strength of concrete, f_{ck}	= 25 N/mm ²
Characteristic strength of steel, f_{yk}	= 500 N/mm ²
Use assumed size of bar as below:	
\varnothing_{bar}	= 12 mm

- (a) Determine the nominal concrete cover for slab FS8. (3 marks)
- (b) Determine the shear force and bending moment for slab FS8. (4 marks)
- (c) Design the reinforcement for slab FS8. (11 marks)
- (d) Check the deflection for slab FS8. (5 marks)
- (e) Check the cracking for slab FS8. (2 marks)

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- Q4** (a) A two-way restrained reinforced concrete slab is only provided with reinforcement for bending moment. The slab is subjected to an ultimate shear force of 120 kN. The thickness of slab is 150 mm, concrete cover is 20 mm, and diameter of main bar is 10 mm. If the material strength $f_{ck} = 30 \text{ N/mm}^2$, and $f_{yk} = 500 \text{ N/mm}^2$, analyse whether the slab is adequate for shear. (10 marks)
- (b) With reference to **Figure Q4 (b)**, slab AB12 is applied with the design load of 15 kN/m^2 . If the thickness of slab is 140 mm and concrete cover used is 25 mm, analyse the suitability of main reinforcement arrangement used for the **short span** to resist the bending moment. The material strength used are $f_{ck} = 25 \text{ N/mm}^2$, and $f_{yk} = 500 \text{ N/mm}^2$. (10 marks)
- (c) With reference to question **Q4 (b)**, determine whether the design has fulfilled the checking for cracking requirement. (5 marks)

-END OF QUESTIONS-

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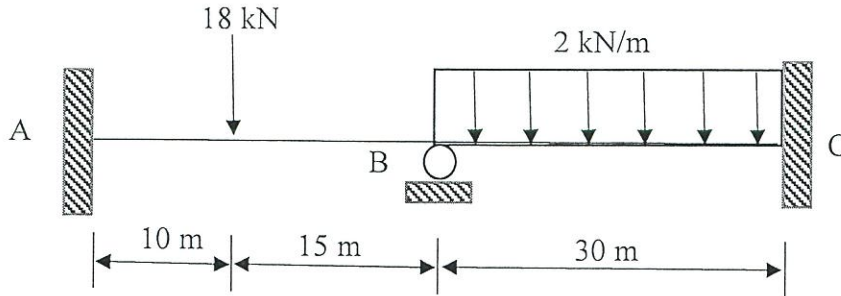
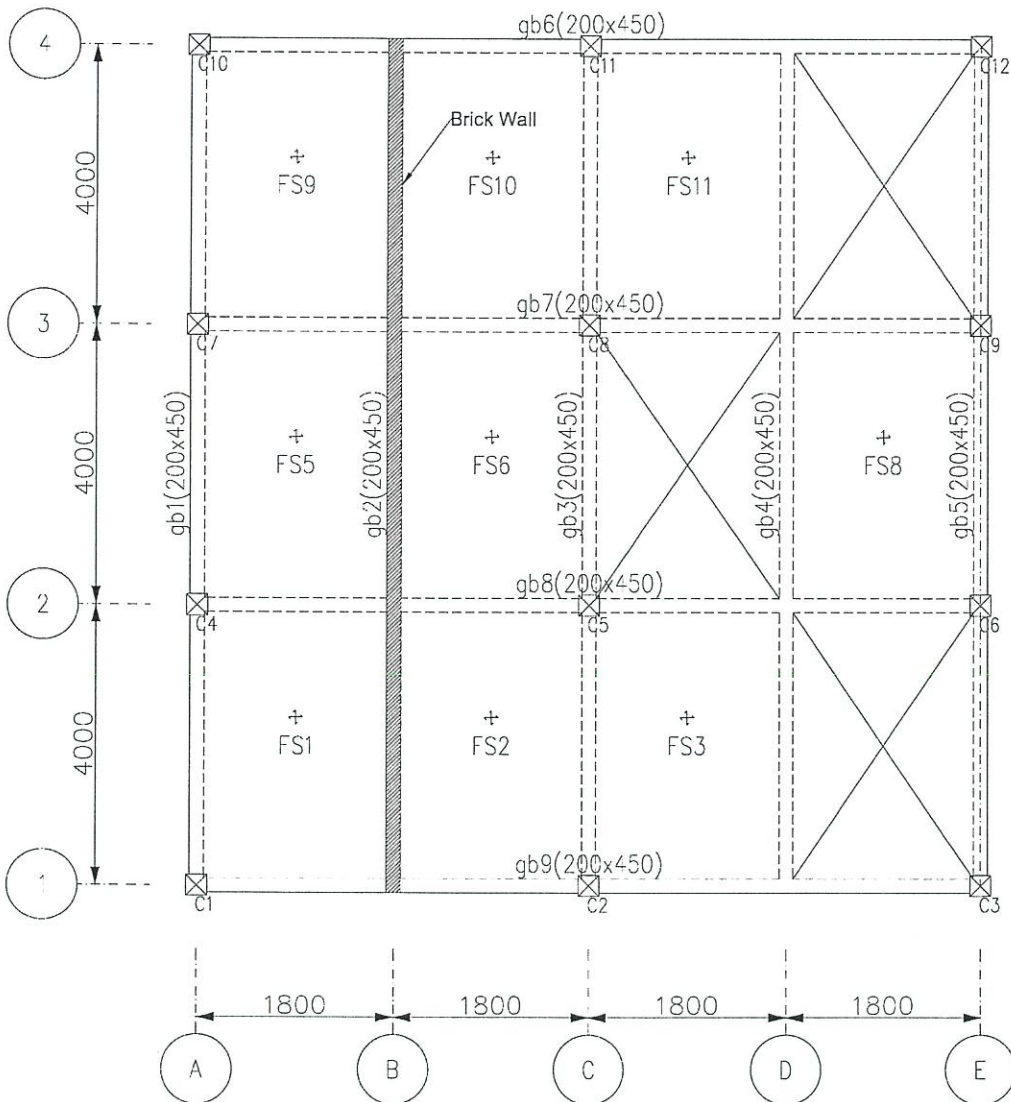


Figure Q1 (b): Continuous beam



FLOOR KEY PLAN: gb
 ALL SLAB THICKNESS = 125MM TH.K. U.N.O

Figure Q2: Floor Key Plan



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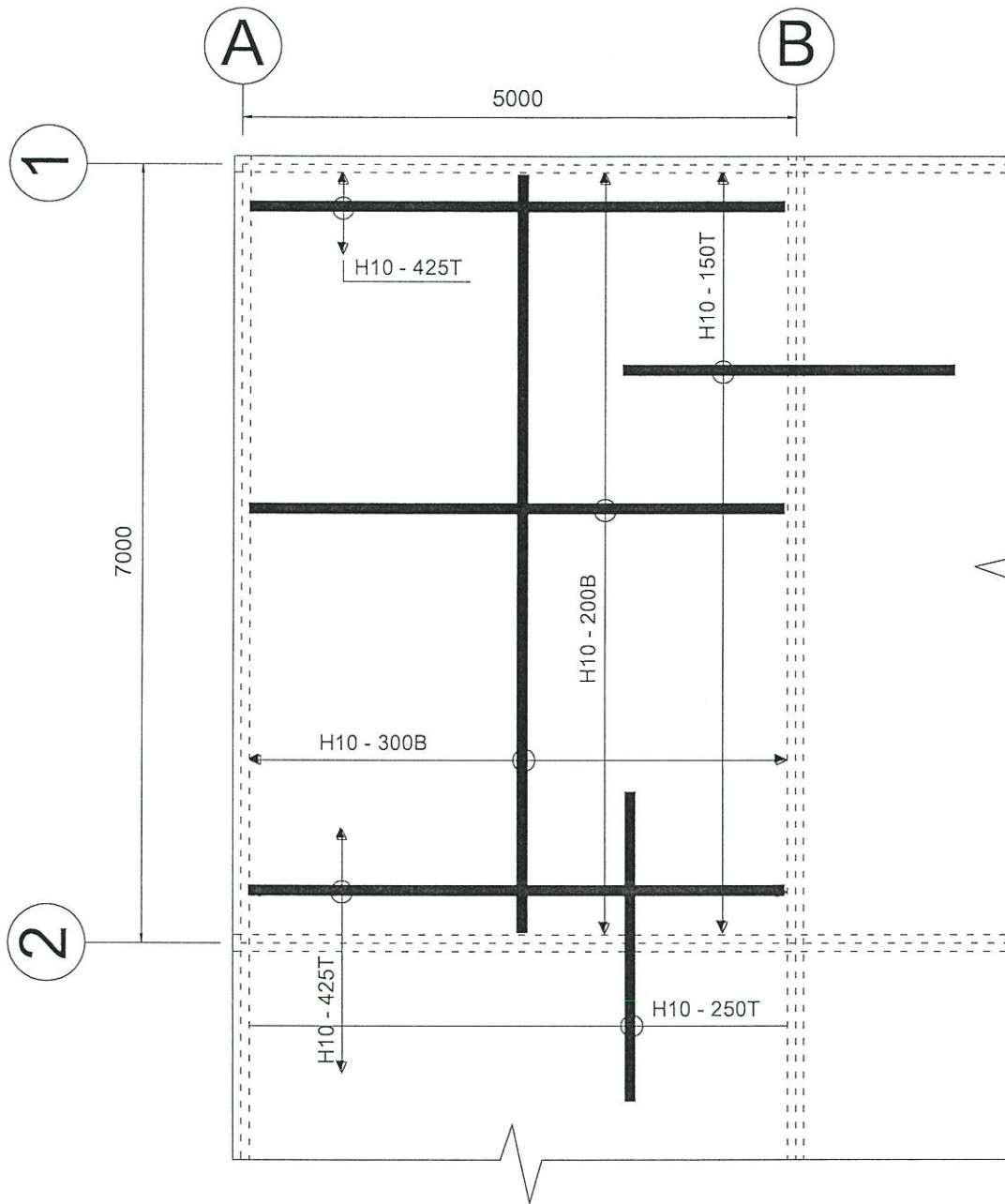


Figure Q4 (b): Reinforcement Detail of Slab

