UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	ADVANCED STRUCTURE DESIGN
COURSE CODE	:	BFS40903
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE/ JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS OPEN BOOK EXAMINATION

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

Q1 (a) Discuss briefly the function of shear connectors in composite beam.

(2 marks)

(b) **Figure Q1 (a)** shows part of concrete slab supported by steel beams. The total thickness of the slab is 110 mm with the concrete volume on the steel profile is 0.091 m^3/m^2. Finishes load on the beam (inclusive beam selfweight) is 1.0 kN/m, and the variable action is 7 kN/m. Concrete grade is C25/30 and density is 25 kN/m^3.

(i) Determine the ultimate moment, M_{Ed} and ultimate shear force, V_{Ed} of the composite beam B/2-3.

(4 marks)

(ii) Calculate the effective breadth of the slab for composite beam B/2-3.

(2 marks)

(iii) Calculate and sketch the position of plastic neutral axis of the composite beam B/2-3. Steel grade is 355 N/mm^2.

(3 marks)

(iv) Determine the moment capacity of composite beam.

(2 marks)

(v) Design the shear connector on composite beam B/2-3 for full shear connection. Given f_u = 450 N/mm^2, d = 19 mm, h_{sc} = 100 mm, b_o = 110 mm, E_{cm} = 31 kN/mm^2.

(4 marks)

(vi) **Figure Q1(b)** shows the section of composite slab, calculate the sagging moment capacity ($M_{pl.Rd}$) of the composite slab A-A1/2-3. Steel profile deck grade is 350 N/mm^2 and area is 1137 mm^2/m.

(5 marks)

(vii) Sketch the cross section of composite slab and stress block based on **Q1 (vi)** that shows the forces in concrete and steel beam, plastic neutral axis, h_c, h_p and $M_{pl.Rd}$.

(3 marks)

Q2 **Figure Q2 (a)** shows a part of concrete flat slab for a building. The spacing between column is 7 m for both directions. The diameter of the column is 600 mm. The slab supports 1 kN/m^2 of finishes and a variable action of 3 kN/m^2. The characteristic material strengths of concrete (f_{ck}) and steel (f_{yk}) are 30 N/mm^2 and 500 N/mm^2 respectively. Unit weight of the concrete is 25 kN/m^3.

(a) Sketch (with dimension) the column strip and middle strip of the slab; and determine the value of bending moment coefficient in both directions for panel 1-2/A-B.

(5 marks)

(b) From **Q2 (a)**, calculate the design load on the slab and the effective span of the slab 1-2/A-B.

(4 marks)

(c) Calculate the moment of the column and middle strip. Given negative moment distribution for column strip is 60% and middle strip 40%, positive moment distribution for column strip is 50% and middle strip 50%.

(3 marks)

(d) Design the main reinforcements for hogging moment at column strip 2/A-B. Use Φ_{bar} = 12 mm, concrete cover = 25 mm.

(5 marks)

(e) For column B/2, check the shear force and shear resistance at the face of the column and 2d from column face.

(8 marks)

(f) Based on punching shear check in **Q2 (e)**, determine the dimension of A, B, C, and D as in **Figure Q2 (b)**.

(5 marks)

Q3 (a) Discuss briefly on the improvement of thermal crack in concrete structure.

(2 marks)

(b) Discuss briefly about shrinkage crack.

(2 marks)

(c) **Figure Q3** shows the section of a rectangular water tank.

(i) Sketch and determine the value of pressure distribution from soil and water imposed to the concrete wall. Given, $P_w = \gamma_w h$, $P_s = K_a \gamma_s h$ (kN/m^2) with $K_a = (1 - \sin \emptyset/(1 + sin\ \emptyset)$.

(4 marks)

(ii) If the wall is fully restrained at its end and subjected to a direct tension force at SLS of 50 kN/m width. Determine the suitable reinforcement arrangement for 0.2 mm maximum crack width by doing a check due to thermal and shrinkage cracking and direction tension. Given E_s = 200 kN/mm^2, E_c= 33 kN/mm^2, f_{ck} = 30 N/mm^2, f_{yk} = 500 N/mm^2, f_{ctm} = 2.9 N/mm^2 and $k_c = k$ = 1.0, α_e = 7.0, initial $\emptyset_{bar}$ = 16 mm.

(12 marks)

END OF QUESTIONS

FINAL EXAMINATION

SEMESTER/SESSION: SEMESTER II/2018/2019 PROGRAMME CODE : BFF
COURSE : ADVANCED STRUCTURE DESIGN COURSE CODE : BFS40903

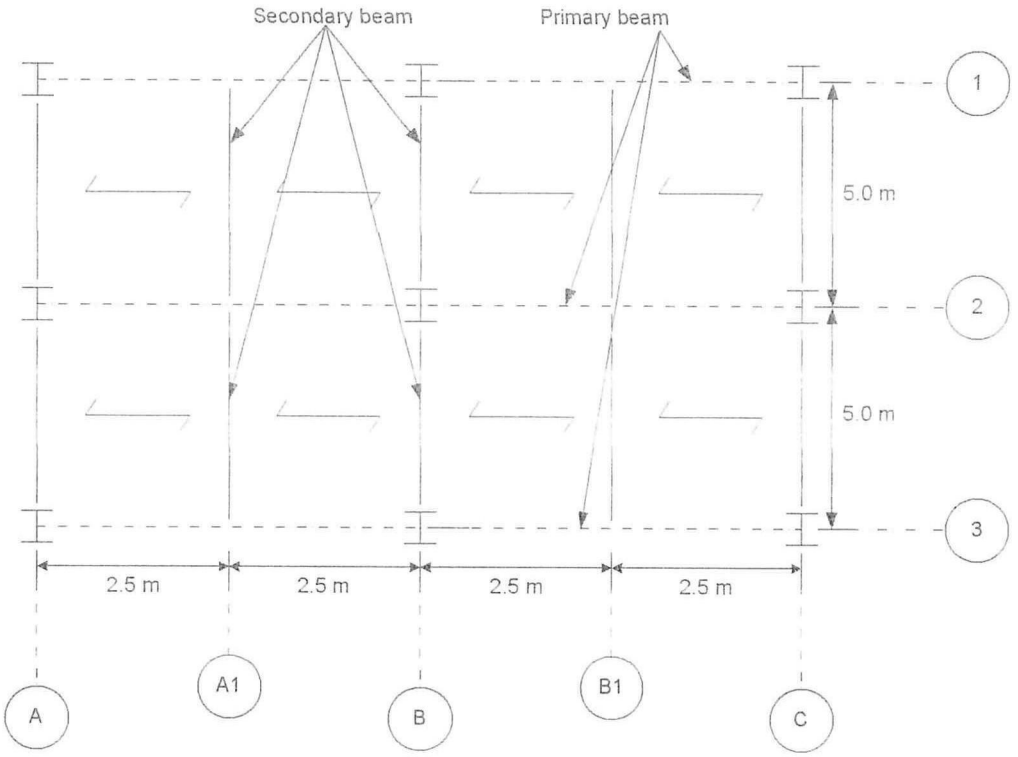

FIGURE Q1 (a)

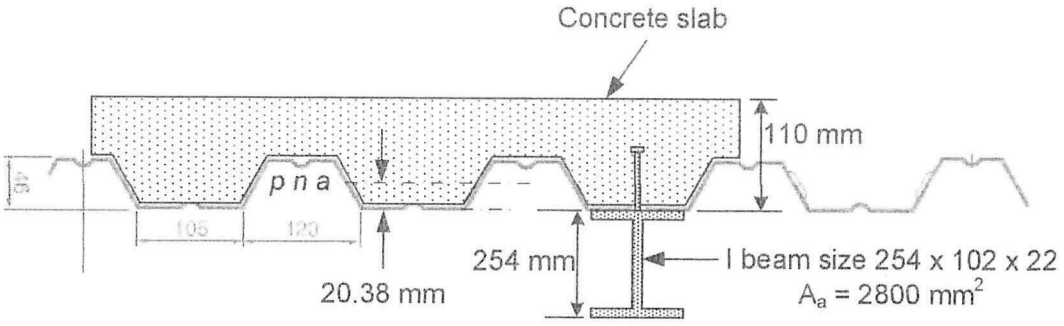

FIGURE Q1 (b)

FINAL EXAMINATION

SEMESTER/SESSION : SEMESTER II/2018/2019 PROGRAMME CODE : BFF
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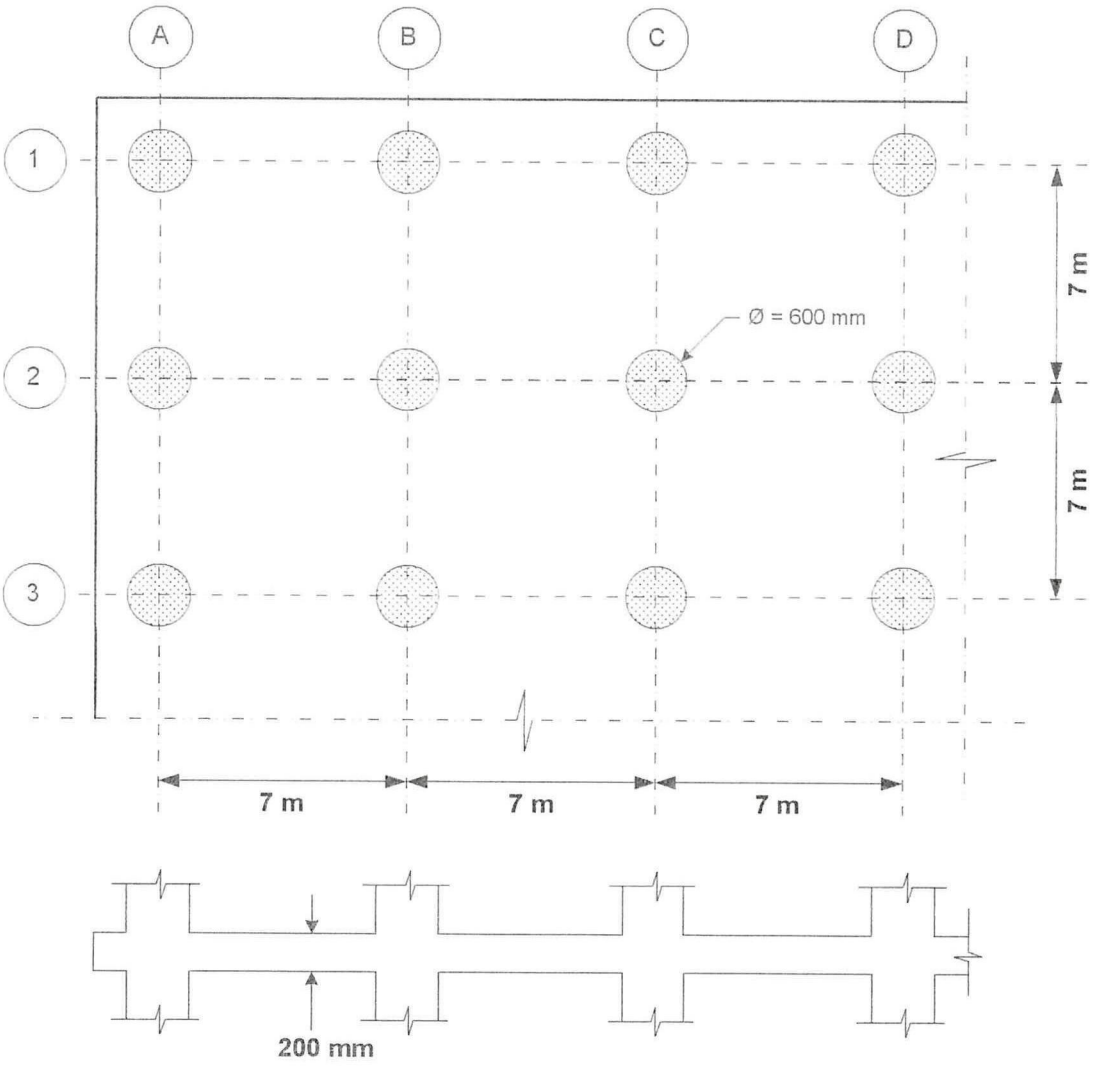

FIGURE Q2 (a)

FINAL EXAMINATION

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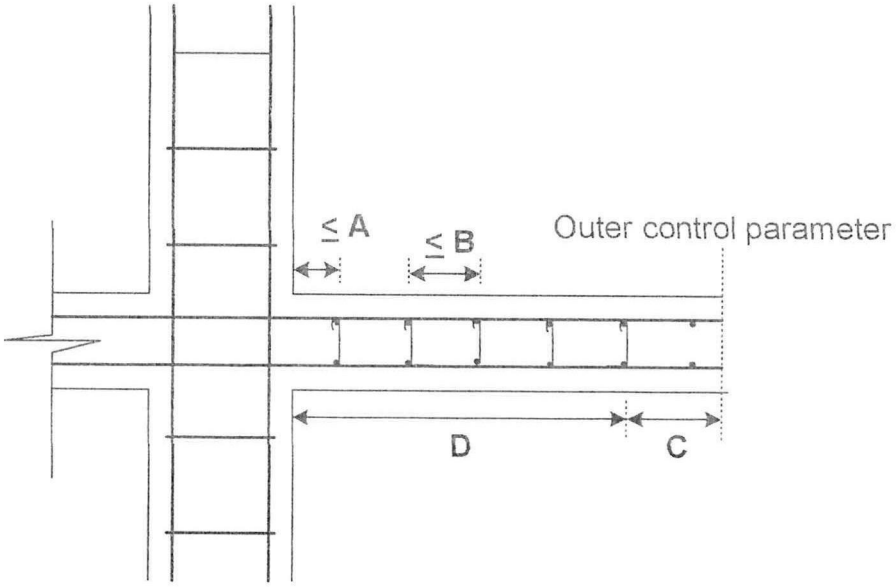

FIGURE Q2 (b)

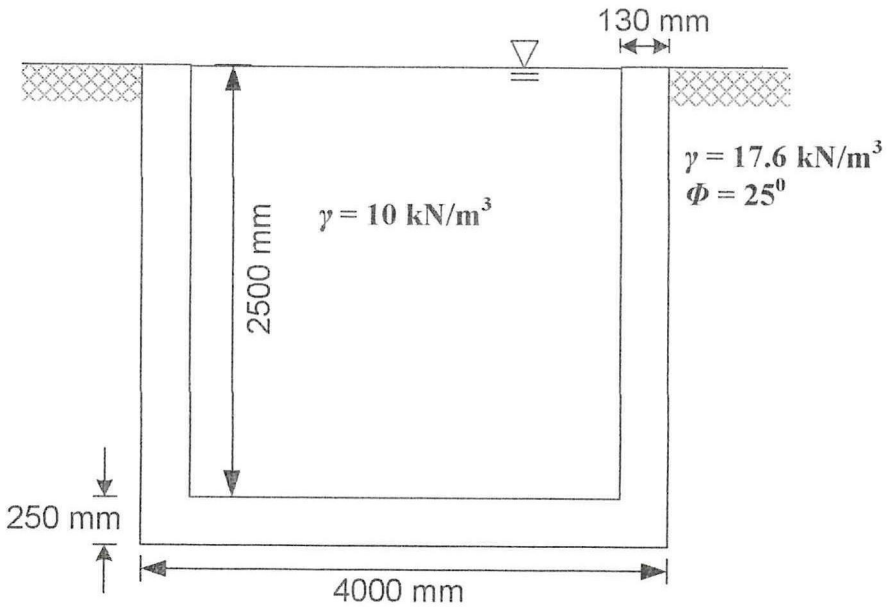

FIGURE Q3