Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 1
SESSION 2018/2019

COURSE NAME	:	REINFORCED CONCRETE DESIGN 1
COURSE CODE	:	BFC 32102
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	DECEMBER 2018/JANUARY 2019
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	1. OPEN BOOK EXAMINATION
		2. PART A : ANSWER **ALL** QUESTIONS PART B : ANSWER **TWO (2)** 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

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

PART A : ANSWER ALL QUESTIONS

Q1 **Figure Q1(a)** shows part of the plan view of an extension building. The extension part of the floor is using precast concrete slab spanning in one-direction and supported by the cantilever cast in-situ reinforced concrete beam. Due to the mistakes during construction, beam A has been built as trapezoidal section instead of rectangular section. The details of beam A are shown in **Figure Q1(b)** and **Figure Q1(c)**. Given the following data:

Characteristic strength of concrete	= 30 MPa
Characteristic strength of steel reinforcement	= 500 MPa
Unit weight of reinforced concrete	= 25 kN/m^3
Unit weight of precast concrete	= 25 kN/m^3
Unit weight of mortar as the finishes	= 22 kN/m^3
Variable action	= 3 kN/m^2

Prove that moment capacity of beam A is adequate at ultimate limit state.

(30 marks)

PART B : ANSWER TWO (2) QUESTIONS ONLY

Q2 **Figure Q2** shows part of key-plan of an office building that needs to be designed as meeting room. Precast half-slab is considered for area J-H/5-5a, while slab J-H/5a-6 will be constructed using conventional reinforced concrete component. The beams consist of continuous and simply supported with overall size of 250 mm x 500 mm. Given the following specifications:

Fire resistance	= R120
Exposure classes	= XC1
Strength of concrete, f_{ck}	= 27 MPa
Strength of steel, f_{yk}	= 460 MPa
Nominal cover	= 40 mm
Unit weight of concrete	= 25 kN/m^3
Floor finishing	= 1.25 kN/m^2
Diameter of link	= 10 mm

Consider beam 5a/J-H as a secondary beam, which is supported by beams J/5-6 and H/5-6.

(a) Analyze the bending moment and shear force of the beam. The thickness of slab can be taken as 150mm.

(10 marks)

(b) Verify that the designation of 2H20 and 2H12 as tensile and compression reinforcements should be sufficiently allocated for the beam.

(10 marks)

(c) Check the serviceability of the beam in term of deflection requirement.

(10 marks)

(d) Draw the complete detailing of the beam. Provide the maximum allowable spacing of shear reinforcement.

(5 marks)

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Q3 A continuous flange beam in **Figure Q3** has a width, b_w = 250 mm and an effective depth, d = 500 mm with two equal spans, L = 6 m. In the transverse direction, the spacing of beams B = 3.0 m centres with a slab thickness of h_f = 150 mm. The supports have a width of 300 mm. The uniformly distributed ultimate design load is w_u = 200 kN/m. The characteristic strength of the concrete and steel are f_{ck} = 30 N/mm^2 and f_{yk} = 500 N/mm^2.

(a) Determine the maximum shear force, V_{max} and maximum bending moment, M_{max}.
(10 marks)

(b) Verify the longitudinal reinforcement at mid-span of interior first end-span AB. Use H12 and H16
(15marks)

(c) Design the shear link at supports A and C if member inclined at an angle $\vartheta = 22^\circ$ to the horizontal. Use H6 links.
(10 marks)

Q4 **Figure Q4** shows the first floor plan of a double storey house. The concrete slabs and beams are poured together and the thickness of slab is 150 mm. All beams' dimensions are 250 mm x 450 mm. Slab S3 is used to support a rectangular planter box (consider full of soil) with size of 4000mm (L) x 2200mm (W) x 500mm (H). The permanent and variable actions for all slabs are as follows:

Ceiling and tile finishes	= 2.5 kN/m^2
Variable action	= 3.5 kN/m^2
Characteristic strength of concrete, f_{ck}	= C30/37
Characteristic strength of steel, f_{yk}	= 500 N/mm^2
Concrete cover	= 30 mm
Unit weight of concrete	= 25 kN/m^3
Bulk unit weight of soil	= 15 kN/m^3

(a) Evaluate the slab type of S1, S2, S3 and S4 and draw their actions distribution.
(4 marks)

(b) Calculate the design action of slab S3.
(6 marks)

(c) Determine the positive and negative moments of slab S3.
(8 marks)

(d) Determine the minimum and maximum area of reinforcement for slab S3.
(6 marks)

(e) Design the flexural reinforcement required at mid span of slab S3. Assume bar size is 12 mm.
(11 marks)

-END OF QUESTIONS-

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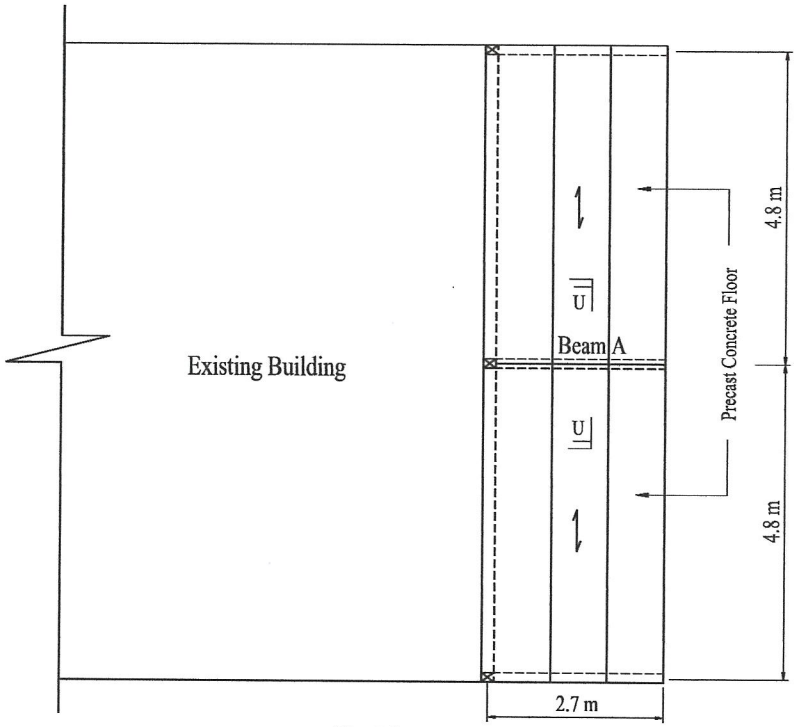
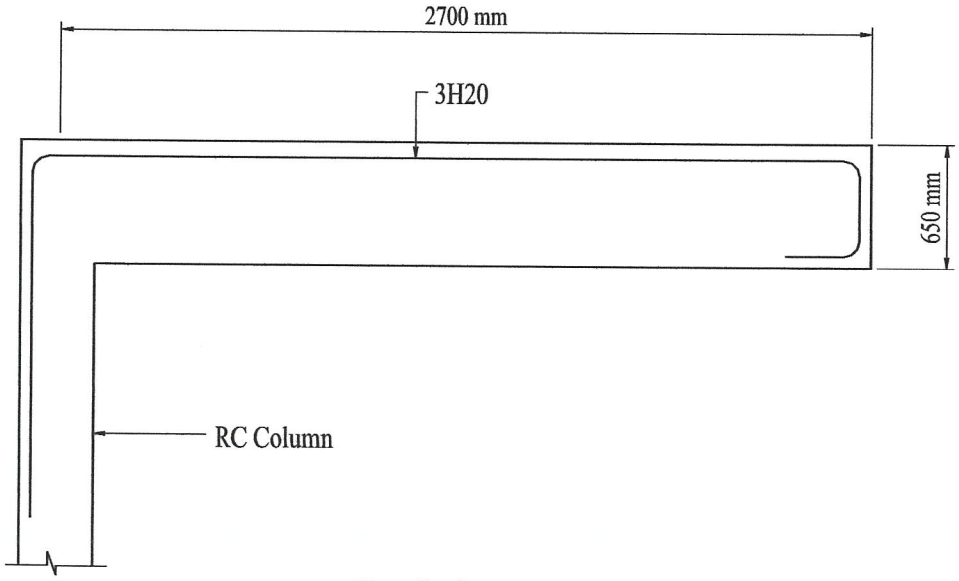


Plan View

FIGURE Q1(a)



Detail of Beam A

FIGURE Q1(b)

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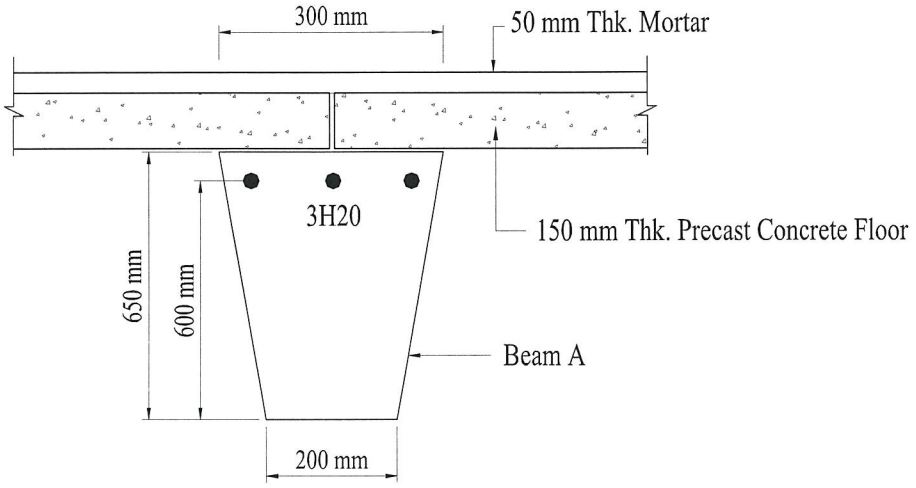
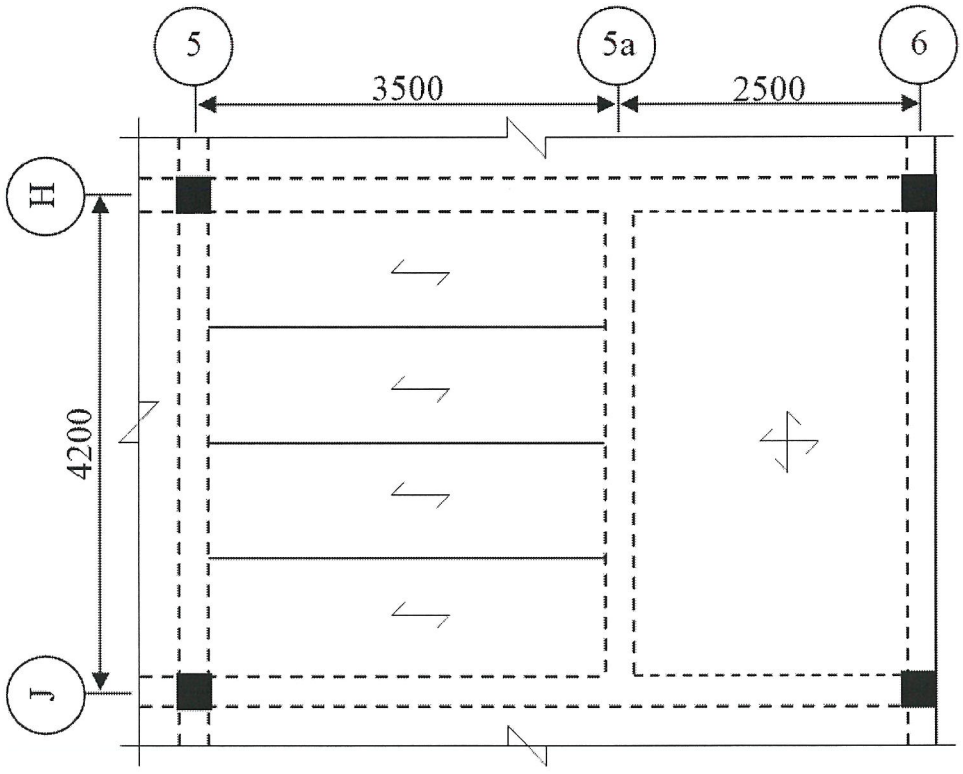


Section U-U

FIGURE Q1 1(c)



All units in mm

FIGURE Q2

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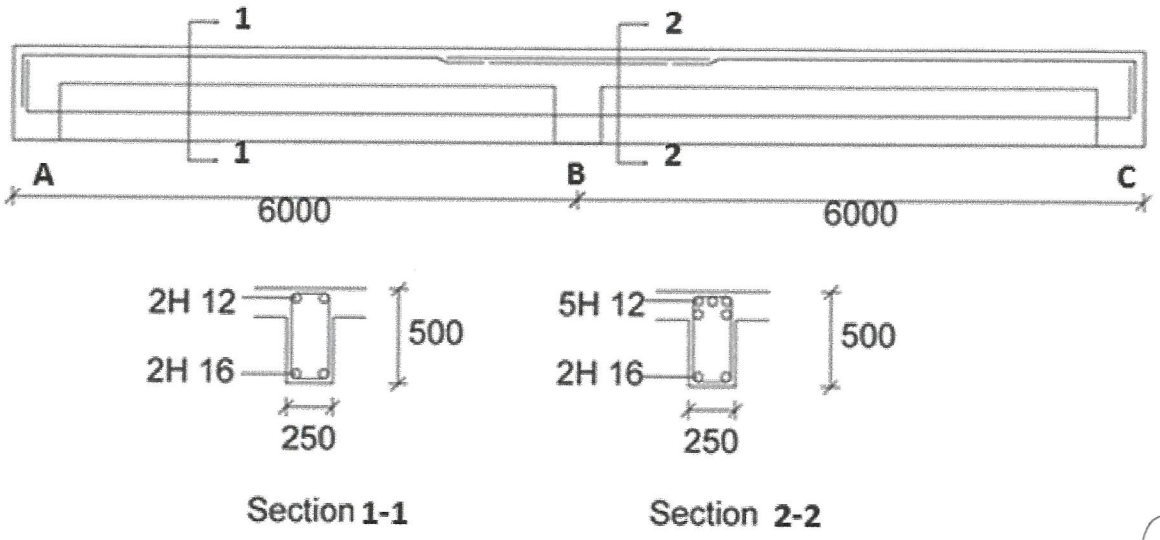

All units in mm

FIGURE Q3

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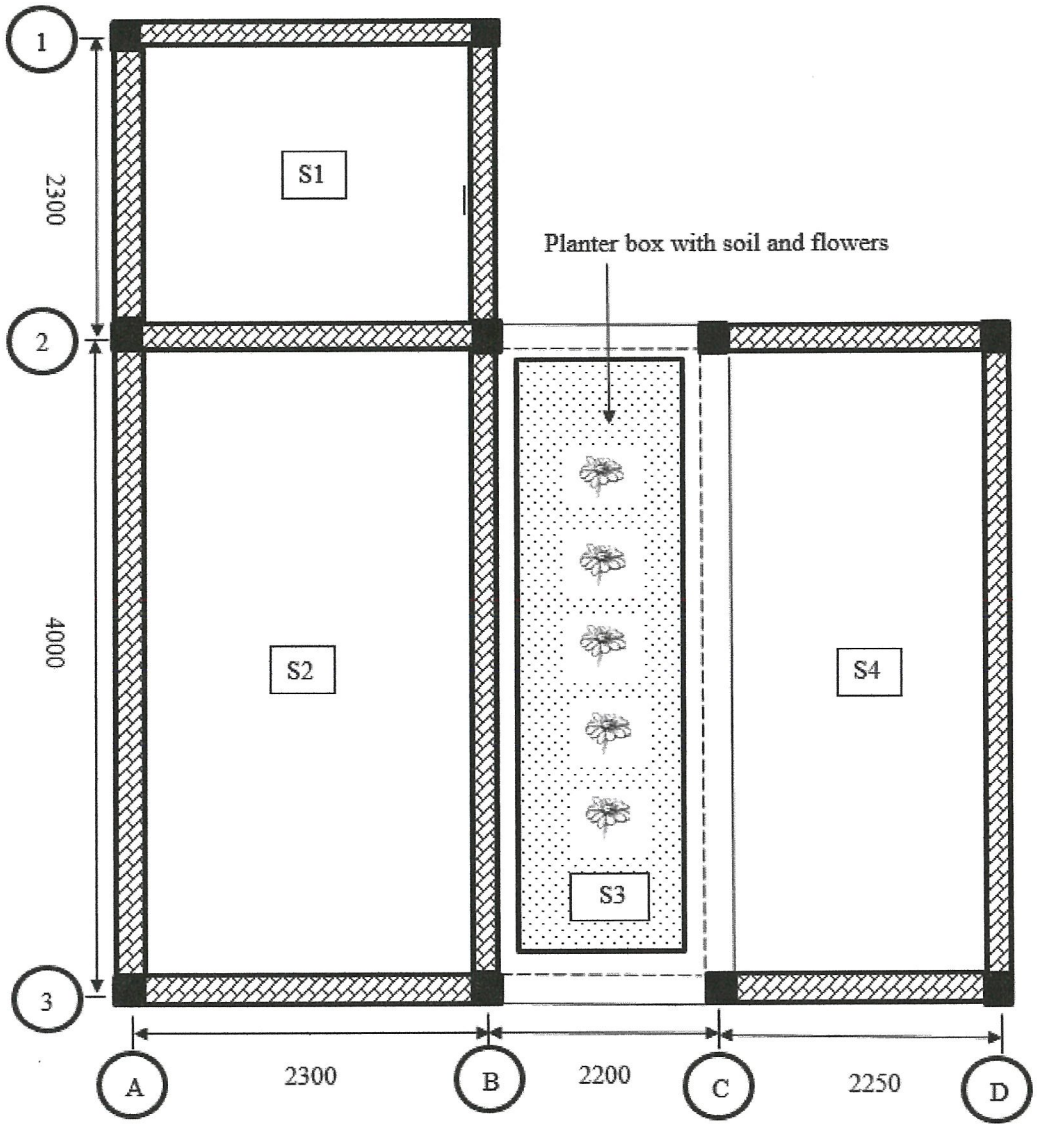

All units in mm

FIGURE Q4

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