Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019

COURSE NAME	:	REINFORCED CONCRETE DESIGN 1
COURSE CODE	:	BFC32102
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE / JULY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	1. OPEN BOOK EXAMINATION 2. ANSWER **ALL** 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

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Discuss why partial safety factors need to be applied to the strength of the materials and actions in structural design.

(4 marks)

(b) An architecture plan of ground floor resident house is shown in **Figure Q1**. By using an appropriate approach, produce an engineering layout in meter of respective floor plan. Sketch the loading distribution from slab to all beam members.

(16 marks)

(c) Based on the engineering layout in **Q1(b)** and the critical span, propose a suitable beam size and slab thickness.

(5 marks)

Q2 **Figure Q2** shows a ground floor plan of a reinforced concrete office building. During construction, non-suspended concrete slab is cast with overall thickness of 100 mm. All beams size are 250 mm x 500 mm (b x h). Given the permanent action is 20 kN/m (excluding self-weight) and variable action is 10 kN/m. The characteristic strengths of the concrete and steel are 30 N/mm^2 and 500 N/mm^2 respectively. Assume the design working life is 50 years with exposure class of XC1. By referring to beam 2/A-C;

(a) Determine the cover requirements for bond, durability and fire resistance if the required fire resistance is 90 minutes.

(5 marks)

(b) Analyse the design action carried by beam 2/A-C.

(10 marks)

(c) Design the shear reinforcement and calculate the minimum link required for the beam. Use H8 link.

(10 marks)

Q3 A simply supported flange beam supports the following uniformly distributed actions; permanent action, g_k = 70 kN/m (including self-weight) and variable action, q_k = 37 kN/m. The width of the web, b_w is 250 mm. The effective flange width, b_{eff} is 1000 mm. The span length, L is 6000 mm. Given the following data;

Characteristic strengths of concrete, f_{ck}	= 25 N/mm^2
Characteristic strengths of steel, f_{yk}	= 500 N/mm^2
Slab thickness, h_f	= 100 mm
Size of beam (b x h)	= 250 x 500 mm
Effective depth (tension), d	= 450 mm
Effective depth (compression), d'	= 50 mm

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

(b) Design the bending reinforcement for the beam. Use H25 for tensile bar and H12 for compression bar.
(12 marks)

(c) Check the deflection for the flange beam.
(8 marks)

Q4 **Figure Q4** shows part of the first floor plan of reinforced concrete school building with dimension of 17.5 x 10 m. The characteristic variable action is 4.0 kN/m^2. Given the following data;

Finishes and ceiling	= 1.5 kN/m^2
Characteristic strength of concrete	= 25 N/mm^2
Characteristic strength of steel	= 500 N/mm^2
Fire resistance	= 1 hour and 30 minutes
Design life	= 50 years
Diameter of reinforcement	= 12 mm
Size of beam (b x h)	= 250 x 500 mm
Thickness of slab	= 120 mm

(a) Using the requirement of fire resistance and deflection control, determine the suitable thickness of slab for FS1 to FS5.
(3 marks)

(b) Determine the nominal cover, maximum shear and maximum bending moment using simplified method.
(10 marks)

(c) Determine the longitudinal reinforcement for maximum moment and check the shear capacity.
(9 marks)

(d) Sketch the cross section of slab FS1 to FS5 with the arrangement of reinforcement.
(3 marks)

– END OF QUESTIONS –

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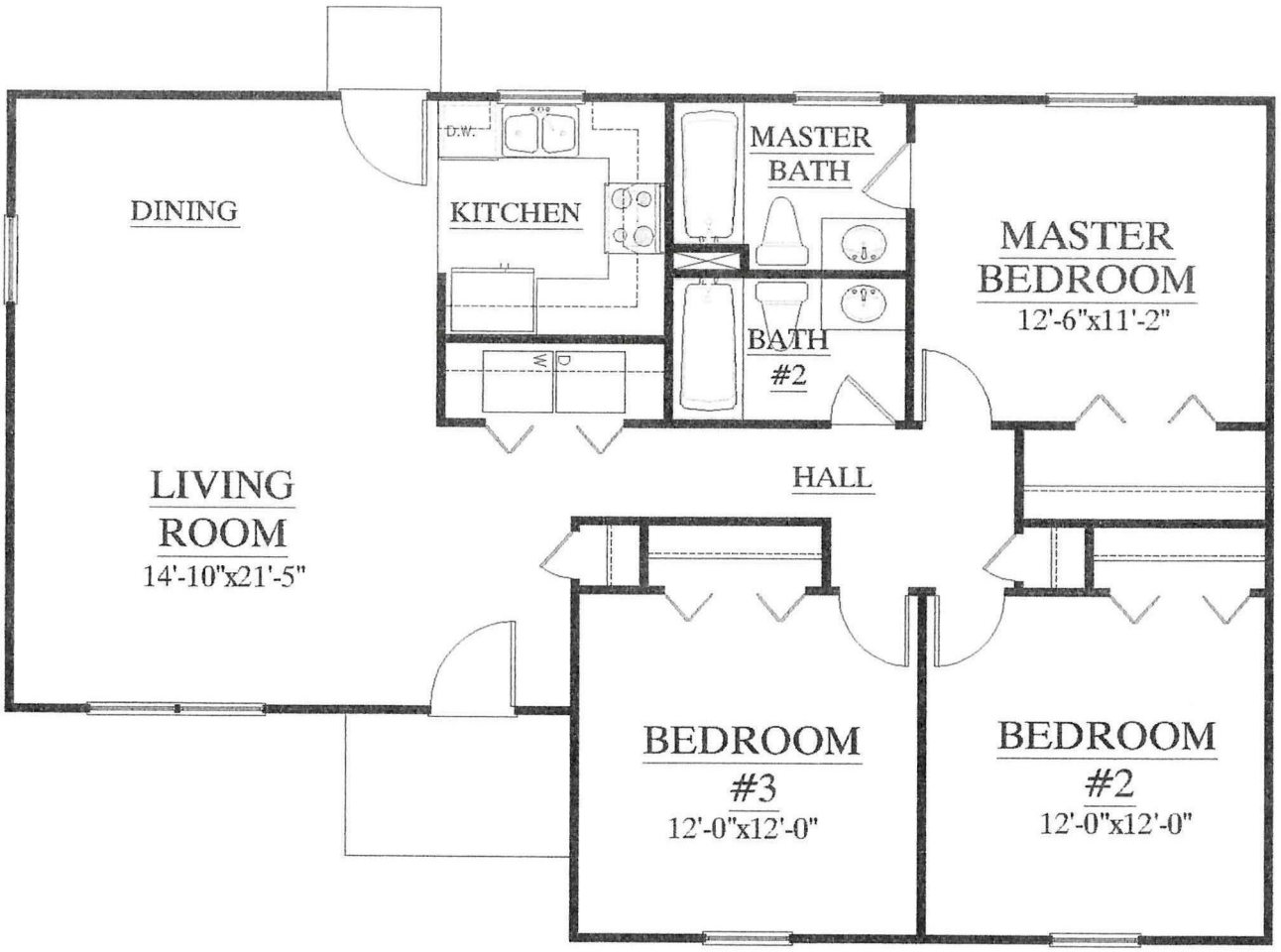

Unit: 1' = 0.305 m

FIGURE Q1

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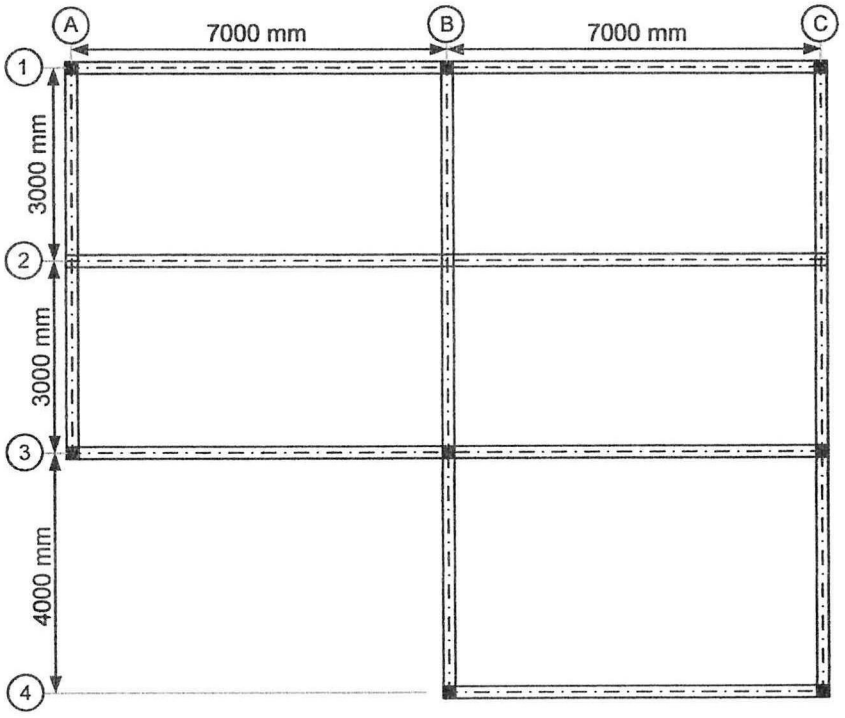

FIGURE Q2

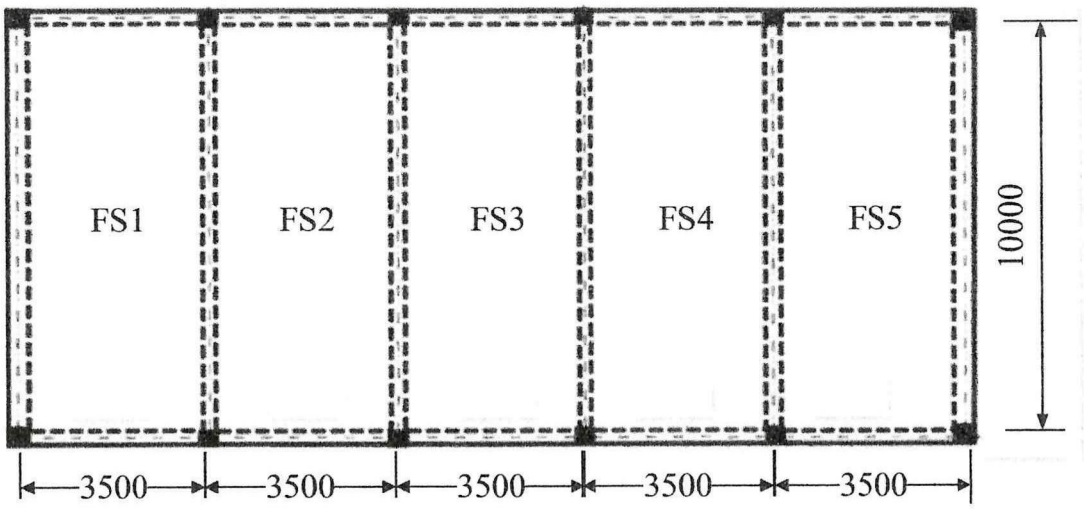

FIGURE Q4