



UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018**

COURSE NAME : REINFORCED CONCRETE DESIGN 1
COURSE CODE : BFC 32102
PROGRAMME CODE : BFF
EXAMINATION DATE : JUNE / JULY 2018
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 **SIX (6)** PAGES

PART A : ANSWER ALL QUESTIONS

- Q1** (a) Briefly explain stress strain relationship for concrete and steel in reinforced concrete design. (5 marks)
- (b) Serviceability limit state verification includes crack width control. Explain the measurement required to control cracks in reinforced concrete according to EC2. (6 marks)
- (c) An architecture plan of the first floor resident house is shown in **FIGURE Q1**. By using an appropriate approach, produce an engineering layout of the respective floor plan. (10 marks)
- (d) Based on the engineering layout in **Q1(c)**, propose a suitable beam size and slab thickness. (3 marks)
- (e) Describe the main steps to determine shear reinforcement in simply supported beam subjected to bending. (6 marks)

PART B : ANSWER TWO (2) QUESTIONS ONLY

- Q2** A simply supported beam with a span of 1000 mm carries a distributed permanent load of 50 kN/m (excluded beam self-weight) and a variable action of 10 kN/m. The size of beam is 250 mm x 500 mm (b x h). Take $f_{ck} = 25 \text{ N/mm}^2$ and $f_{yk} = 500 \text{ N/mm}^2$. The beam is located inside the building (XC 1), subjected to 1 hour fire resistance and design life of 50 years. Assume diameters of bar used are 10 mm for compression (if required) and 16 mm for tension.
- (a) Determine nominal concrete cover for the beam. (5 marks)
- (b) By using the equilibrium of forces, sketch the moment resistance of a simply supported beam. (10 marks)
- (c) Design the main reinforcement and minimum shear resistance. (18 marks)
- (d) Sketch simple detailing of the beam based on **Q2(c)**. (2 marks)

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Q3 (a) **FIGURE Q3** shows a plan view of slab-beam system in a building. Due to construction works, beam and a part of the slab has to act as flanged beam. Beam size is 250 mm x 500 mm. Determine the effective width for beam A, B and C if the beams are simply supported with 7.5 m length.

(12 marks)

(b) Design the reinforcement required for beam C from **Q3(a)** which is subjected to an ultimate moment of 900 kNm with 450 mm effective depth. Given the slab thickness is 100 mm. The concrete is grade 30/37 and 500 for steel reinforcement.

(17 marks)

(c) What is the consequence if the design bending moment obtained from elastic analysis is greater than the result of **Q3(b)**? As a design engineer, suggest the solutions.

(6 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' size are 250 mm x 450 mm. The permanent and variable actions for all slabs are as follows:

Ceiling and tile finishes	=	2.5 kN/m ²
Variable action	=	3.0 kN/m ²
Concrete strength class	=	C30/37
Characteristic strength of steel, f_{yk}	=	500 N/mm ²
Concrete cover	=	30 mm

(i) Calculate the design action of slab S2.

(6 marks)

(ii) Determine the positive and negative moments of slab S2.

(8 marks)

(iii) Determine the minimum and maximum area of reinforcement for slab S2.

(6 marks)

(iv) Design the flexural reinforcement required at mid span of slab S2. Assume bar size is 12 mm.

(12 marks)

(v) Sketch the cross section of slab S2 with the arrangement of reinforcement.

(3 marks)

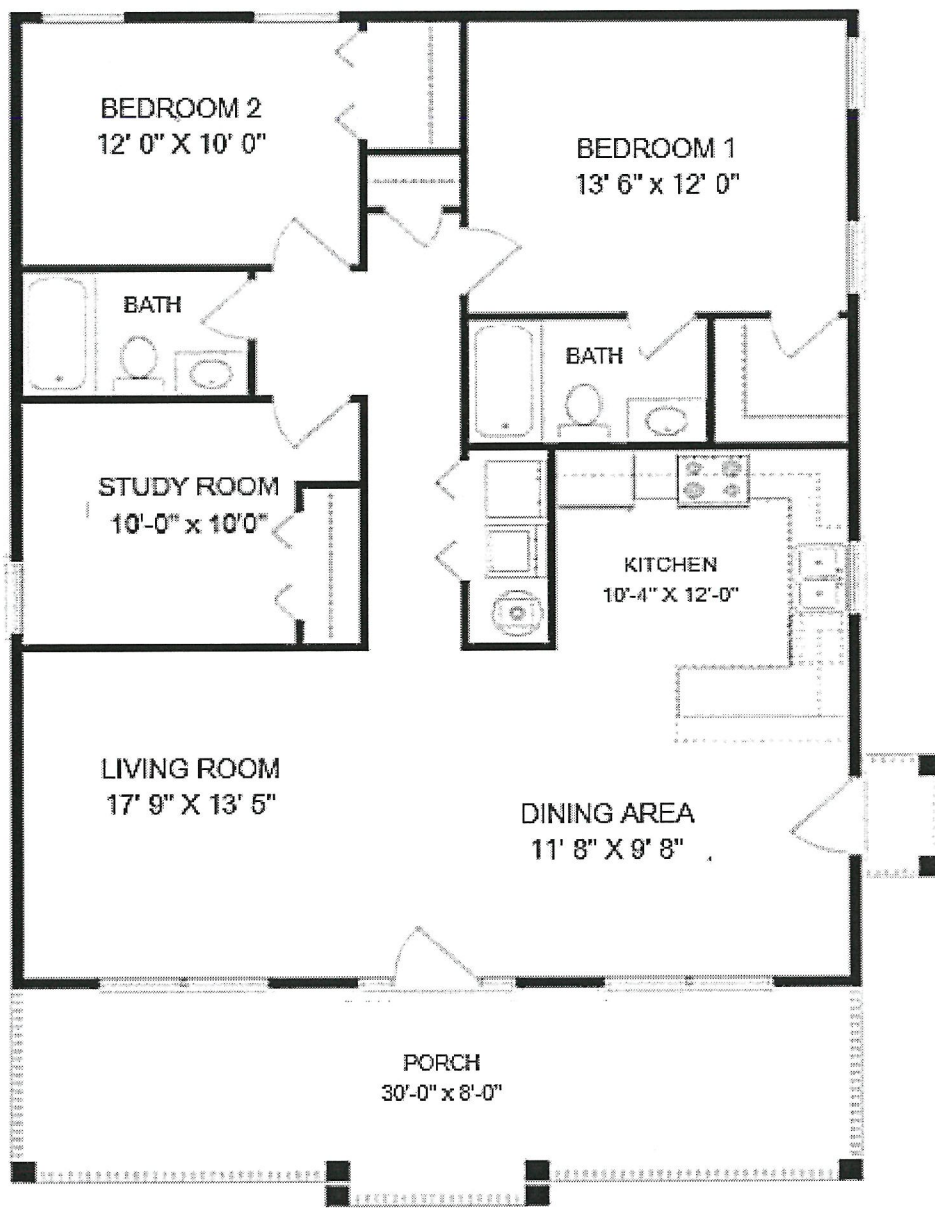
-END OF QUESTIONS-

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1' = 0.305m

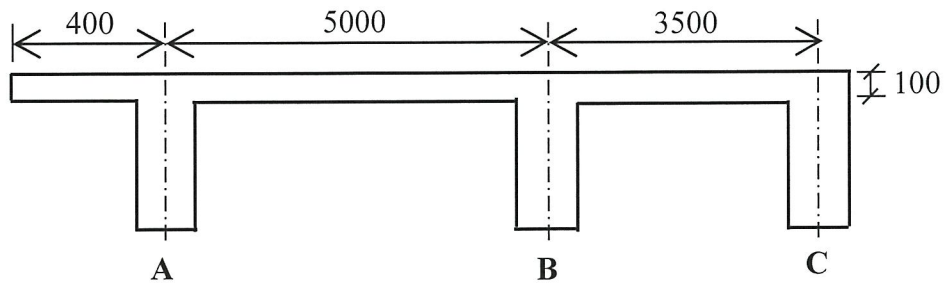
FIGURE Q1

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All units in mm

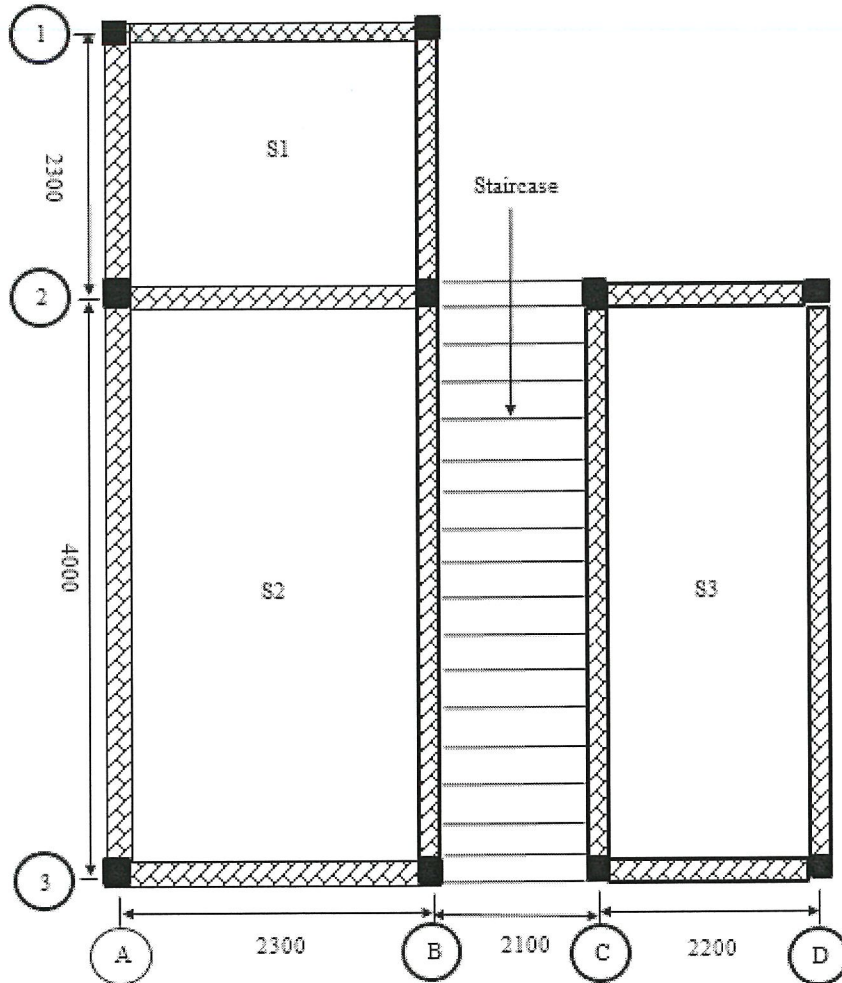
FIGURE Q3

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All unit in mm

FIGURE Q4

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