UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	REINFORCED CONCRETE DESIGN 1
COURSE CODE	:	BFC 3142 / BFC 32102
PROGRAMME	:	3 BFF
EXAMINATION DATE	:	JUNE 2012
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **ALL** QUESTION FROM PART A AND **TWO (2)** QUESTIONS FROM PART B

DESIGN SHOULD BE BASED ON:
BS EN 1990:2002+A1:2005
NA BS EN 1990:2002+A1:2005
BS EN 1991-1-1:2002
NA BS EN 1991-1-1:2002
BS EN 1992-1-1:2004
BS 8110:PART 1:1997

THIS QUESTION PAPER CONSIST OF **ELEVEN (11)** PAGES

SECTION A : ANSWER ALL QUESTION

Q1 (a) There are several steps need to be considered to fulfill the structural design process. Describe the design process which involved building form and structural arrangement.

(3 marks)

(b) High yield bars (H) is denoted as a classification of different class of bars. Name the classes of bars that may be used in the concrete design.

(3 marks)

(c) Explain briefly the important of serviceability limit state in the design stage for the structures.

(3 marks)

(d) Figure **Q1** shows part of the ground floor plan of a reinforced concrete office building. Slab thickness is 125 mm. Dimensions of the beams is given in the diagram. The finishes, ceiling and services form a characteristics permanent action of 1.5 kN/m^2. The characteristic variable action is 3.0 kN/m^2. 3.0 m high brickwall weighing 2.6 kN/m^2 is placed over the entire span of all beams. Given the additional following data:

Concrete Grade, f_{ck}	= 25 N/mm^2
Steel reinforcement Grade 500, f_{yk}	= 500 N/mm^2
Weight of concrete	= 25 kN/m^3

(i) Analyze the design action carried by beam B/1-2 and sketch the action distribution on the beam from each slab.

(15 marks)

(ii) Calculate and sketch the bending moment and shear force for beam B/1-2.

(6 marks)

SECTION B : ANSWER TWO (2) QUESTIONS ONLY

Q2 (a) List the assumptions that have been made in design reinforced concrete beam.

(5 marks)

(b) A size of T reinforced concrete beam is h_f = 100 mm, b = 800 mm, b_w = 250 mm, and d = 500 mm. The tension and compression reinforcements provided are 5H32 and 2H12 respectively.

(i) Draw the stress block diagram.

(10 marks)

(ii) Determine the ultimate moment capacity of the section, if f_{ck} = 30 N/mm^2 and f_{yk} = 500 N/mm^2. The depth to compression reinforcement is 50 mm.

(20 marks)

Q3 Figure **Q3** shows an architectural drawing of first floor plan for 3 storey building. Detail specification is given as follows:

Design action, w	=	30.46 kN/m
Characteristic strength of concrete, f_{ck}	=	20 N/mm^2
Characteristic strength of steel bar, f_{yk}	=	500 N/mm^2
Concrete cover, c	=	25 mm

(a) Propose and sketch the structural layout plan.

(3 marks)

(b) From the specification, provide the suitable size for beam 1/A-C.

(2 marks)

(c) Design the main reinforcement for simply supported beam 1/A-C. Please state your assumption in design.

(12 marks)

(d) Design shears reinforcement for beam 1/A-C.

(13 marks)

(e) Verify the crack of the beam if;

Permanent action, G_k	=	20.46 kN/m
Variable action, Q_k	=	10.00 kN/m
Exposure class	=	XC1

(5 marks)

Q4 Figure **Q4** shows the layout plan for the part of the first floor of reinforced concrete buildings. The concrete for slabs and beams are poured together and the thickness of the slab is 175 mm. Detail specification is given as follows:

Design action, n	$= (1.35g_k + 1.5q_k)$	=	15 kN/m^2.
Characteristic strength of concrete, f_{ck}		=	25 N/mm^2
Characteristic strength of steel bar, f_{yk}		=	500 N/mm^2
Concrete cover, c		=	25 mm

(a) Determine the positive and negative moments for Panel S1.

(8 marks)

(b) Determine the minimum and maximum reinforcement area.

(3 marks)

(c) Design the flexural reinforcement required at mid span. Assume bar size of 10 mm.

(9 marks)

(d) Check the deflection for the slab panel.

(15 marks)

BAHAGIAN A: JAWAB SEMUA SOALAN

S1 (a) Beberapa langkah perlu diambilkira di dalam proses merekabentuk struktur bangunan. Terangkan proses rekabentuk yang terlibat di dalam proses susunatur pelan dan struktur bangunan.

(3 markah)

(b) Bar berkekuatan tinggi (H) diklasifikasikan di dalam beberapa kelas yang berbeza. Namakan kelas-kelas bar yang boleh digunakan di dalam rekabentuk konkrit.

(3 markah)

(c) Terangkan secara ringkas kepentingan had kebolehkhidmatan di dalam proses merekabentuk struktur bangunan.

(3 markah)

(d) Rajah **Q1** menunjukkan sebahagian daripada pelan aras bawah sebuah bangunan pejabat konkrit bertetulang. Tebal papak ialah 125 mm. Saiz rasuk diberikan seperti di dalam rajah. Kemasan, siling dan perkhidmatan dalam bangunan adalah beban kekal 1.5 kN/m^2. Beban pelbagai yang dikenakan ialah 3.0 kN/m^2. Tinggi dinding bata ialah 3.0 m dengan berat 2.6 kN/m^2 telah direkabentuk bagi semua rasuk. Data tambahan telah diberi:

Gred konkrit , f_{ck}	= 25 N/mm^2
Gred tetulang keluli, f_{yk}	= 500 N/mm^2
Ketumpatan konkrit	= 25 kN/m^3

(i) Analisis beban rekabentuk yang dihasilkan oleh rasuk B/1-2.

(15 markah)

(ii) Kirakan dan lukiskan gambarajah daya ricih dan momen lentur bagi rasuk B/1-2.

(6 markah)

BAHAGIAN B: JAWAB DUA (2) SOALAN SAHAJA

S2 (a) Senaraikan anggapan-anggapan dalam merekabentuk rasuk konkrit bertetulang.

(5 markah)

(b) Satu rasuk T konkrit bertetulang bersaiz h_f = 100 mm, b = 800 mm, b_w = 250 mm, dan d = 500 mm. Tetulang tegangan dan tetulang mampatan yang dikenakan pada rasuk adalah 5H32 dan 2H12.

(i) Lukiskan gambarajah blok tegasan.

(10 markah)

(ii) Tentukan kapasiti momen muktamad keratan jika f_{ck} = 30 N/mm^2 dan f_{yk} = 500 N/mm^2. Ukurdalam berkesan tetulang mampatan adalah 50 mm.

(20 markah

S3 Rajah **Q3** menunjukkan pelan bangunan tiga tingkat. Spesifikasi bagi bangunan adalah seperti berikut:

Beban rekabentuk ,w	=	30.46 N/m
Kekuatuan ciri konkrit, f_{ck}	=	20 N/mm^2
Kekuatan ciri tetulang keluli,f_{yk}	=	500 N/mm^2
Penutup konkrit, c	=	25 mm

(a) Cadang dan lakarkan susun atur pelan struktur.

(3 markah)

(b) Daripada spesifikasi yang diberikan, tentukan saiz bagi rasuk 1/A-C.

(2 markah)

(c) Rekabentuk tetulang utama rasuk disokong mudah 1/A-C. Sila nyatakan anggapan anda.

(12 markah)

(d) Rekabentuk tetulang ricih untuk 1/A-C.

(13 markah)

(e) Semak keretakan bagi rasuk

Beban mati, G_k	=	20.46 kN/m
Beban hidup, Q_k	=	10.00 kN/m
Kelas Pendedahan	=	XC1

(5 markah)

S4 Rajah **Q4** menunjukkan pandangan plan sebahagian lantai tingkat 1 bangunan konkrit bertetulang. Papak dan rasuk dituang sekali dan tebal papak adalah 175 mm. Spesifikasi perincian seperti di bawah:

Beban rekabentuk, $n = (1.35g_k + 1.5q_k)$	=	15k N/m^2.
Kekuatan ciri konkrit, f_{ck}	=	25 N/mm^2
Kekuatan ciri tetulang keluli, f_{yk}	=	500 N/mm^2
Penutup konkrit, c	=	25 mm

(a) Tentukan moment positif dan negatif panel S1.

(8 markah)

(b) Tentukan luas tetulang minimum dan maksimum.

(3 markah)

(c) Rekabentuk tetulang lenturan yang diperlukan di tengah rentang. Anggap saiz 10 mm.

(9 markah)

(d) Semak lenturan papak.

(15 markah)

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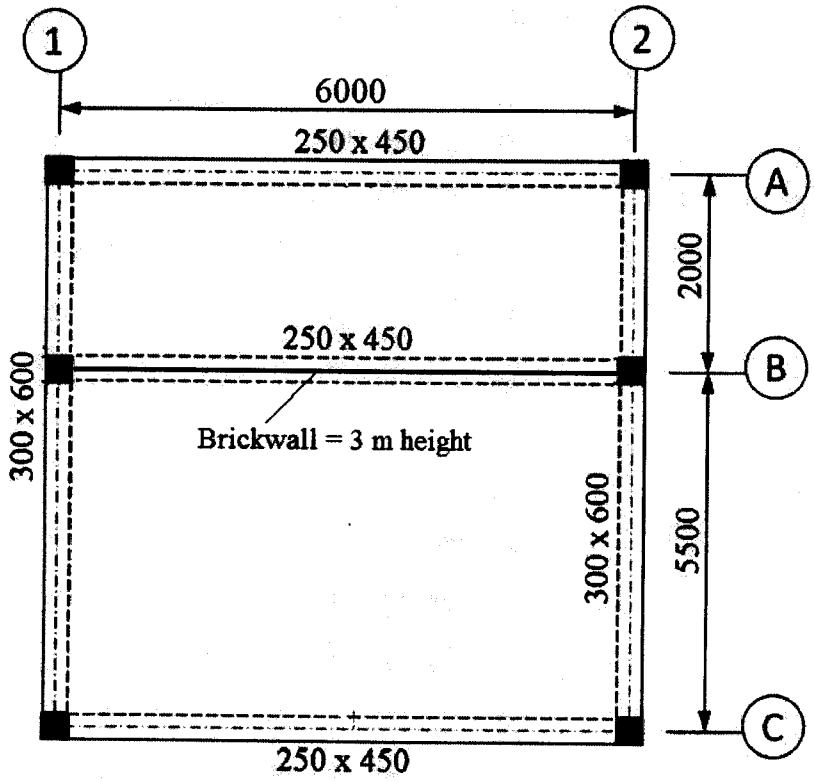

All units in mm

FIGURE Q1

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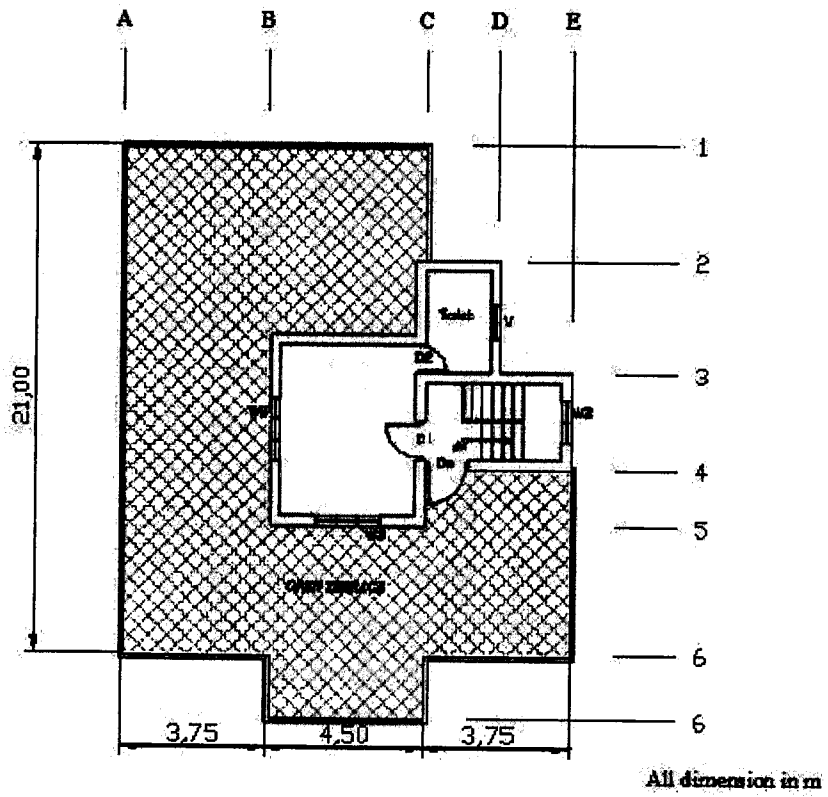

FIGURE Q3

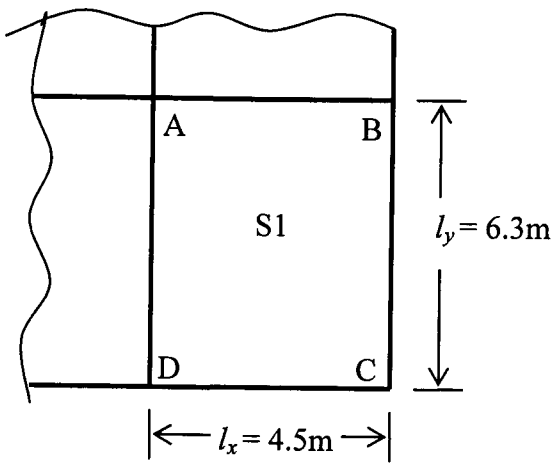

FIGURE Q4

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FORMULA

$$As' = \frac{(K - K_{bal}) f_{ck} bd^2}{0.87 f_{yk} (d - d')}$$

$$As = \frac{K_{bal} f_{ck} bd^2}{0.87 f_{yk} z_{bal}} + As'$$

$$V_{Rd,\max} = \frac{0.36 b_w d f_{ck} (1 - fck/250)}{\cot\theta + \tan\theta}$$

$$\theta = 0.5 \sin^{-1}\left(\frac{V_{Ed}}{0.18 b_w d f_{ck} (1 - f_{ck}/250)} \right)$$

$$\frac{A_{sw}}{s} = \frac{V_{Ed}}{0.78 f_{yk} d \cot\theta}$$

$$\frac{A_{sw\max}}{s} = \frac{0.08 f_{ck}^{1/2} b_w}{f_{yk}}$$

$$f_s = \frac{f_{yk}}{1.15} \left[\frac{G_k + 0.3 Q_k}{1.35 G_k + 1.5 Q_k} \right] \frac{1}{\delta}$$

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Table 1: Cross Sectional Area (mm^2) according to Size and Numbers of Bar

Bar Size (mm)	Number of bar								Perimeter (mm)
	1	2	3	4	5	6	7	8	
6	28.3	56.6	84.9	113	141	170	198	226	18.9
8	50.3	101	151	201	251	302	352	402	25.1
10	78.6	157	236	314	393	471	550	629	31.4
12	113	226	339	453	566	679	792	905	37.7
16	201	402	603	805	1006	1207	1408	1609	50.3
20	314	629	943	1257	1571	1886	2200	2514	62.9
25	491	982	1473	1964	2455	2946	3438	3929	78.6
32	805	1609	2414	3218	4023	4827	5632	6437	100.6
40	1257	2514	3771	5029	6286	7543	8800	10057	125.7

Table 2: Cross Sectional Area (mm^2) for every meter width at distance between bar

Bar Size (mm)	Distance between Bar (mm)								
	50	75	100	125	150	175	200	250	300
6	566	377	283	226	189	162	141	113	94
8	1006	670	503	402	335	287	251	201	168
10	1571	1048	786	629	524	449	393	314	262
12	2263	1509	1131	905	754	647	566	453	377
16	4023	2682	2011	1609	1341	1149	1006	805	670
20	6286	4190	3143	2514	2095	1796	1571	1257	1048
25	9821	6548	4911	3929	3274	2806	2455	1964	1637
32	16091	10728	8046	6437	5364	4598	4023	3218	2682
40	25143	16762	12571	10057	8381	7184	6286	5029	4190