Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	INDUSTRIALISED BUILDING SYSTEMS
COURSE CODE	:	BFP 40603
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JUNE / JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

Q1 (a) Construction industry in Malaysia is known and perceived as 'Dangerous, Difficult and Dirty' (3D), besides too dependent on foreign labour, pervasive levels of unskilled workers and a rise in both labour and material costs. In order to revive and to further improve the image of the construction industry, Industrialised Building Systems (IBS) has been promoted as a solution, given its advantages as an innovative construction method to the construction industry.

Discuss the impact of IBS approach in a construction project in the following aspects:

(i) Sustainability

(12 marks)

(ii) Safety and health

(4 marks)

(iii) Construction period

(4 marks)

(b) With the aid of a diagram(s), explain how structural integrity of a single-storey house constructed using blockwork system can be achieved.

(5 marks)

Q2 (a) You are a design-and-build contractor for an upcoming project of 'Construction of 100 units of double-storey terrace houses'. The client requests to construct the houses using IBS method instead of traditional method, and also request the project team to propose the best type of IBS to be used. Discuss your proposal by comparing your selection with other IBS types.

(15 marks)

(b) Differentiate open system and close system in IBS construction.

(5 marks)

(c) Discuss the importance of implementation of Modular Coordination (MC) in IBS project.

(5 marks)

Q3 (a) **Figure Q3(a)** shows a typical floor layout plan of 10-storey condominium unit.

(i) Based on **Figure Q3(a)** and the details given in **Table Q3(a)(i) – (v)**, calculate the IBS score for this unit. Prepare your answer in **Table Q3(a)(vi)**.

(13 marks)

(ii) If the project undertaken is a government project, justify whether the contractor can be exempted from paying levy to CIDB.

(2 marks)

(b) List **five (5)** strategies to enhance constructability in IBS project during 'design and procurement' phase.

(10 marks)

Q4 (a) The precast slabs normally used for the floor system are either precast hollow core slabs or precast planks. With sketches, discuss how the monolithic characteristic can be achieved in the following precast floor slabs:

(i) Precast concrete hollow core slab

(5 marks)

(ii) Precast plank

(5 marks)

(b) A precast concrete structure is deemed to have the structural integrity if it is able to withstand the localised damage or failure of one component without causing progressive collapse to the neighbouring components. This may be achieved by tying loose precast components together using steel ties.

Figure Q4 shows a precast concrete frame structure which consists of beams, column and slabs. The slabs are 'untopped' precast hollow core slabs.

(i) Propose by showing (sketch) in **Figure Q4**, the arrangement of **five (5)** horizontal ties or vertical ties in order to ensure the structural integrity of the precast concrete structure.

(5 marks)

(ii) Based on your answer in **Q4 (b)(i)**, explain each ties.

(10 marks)

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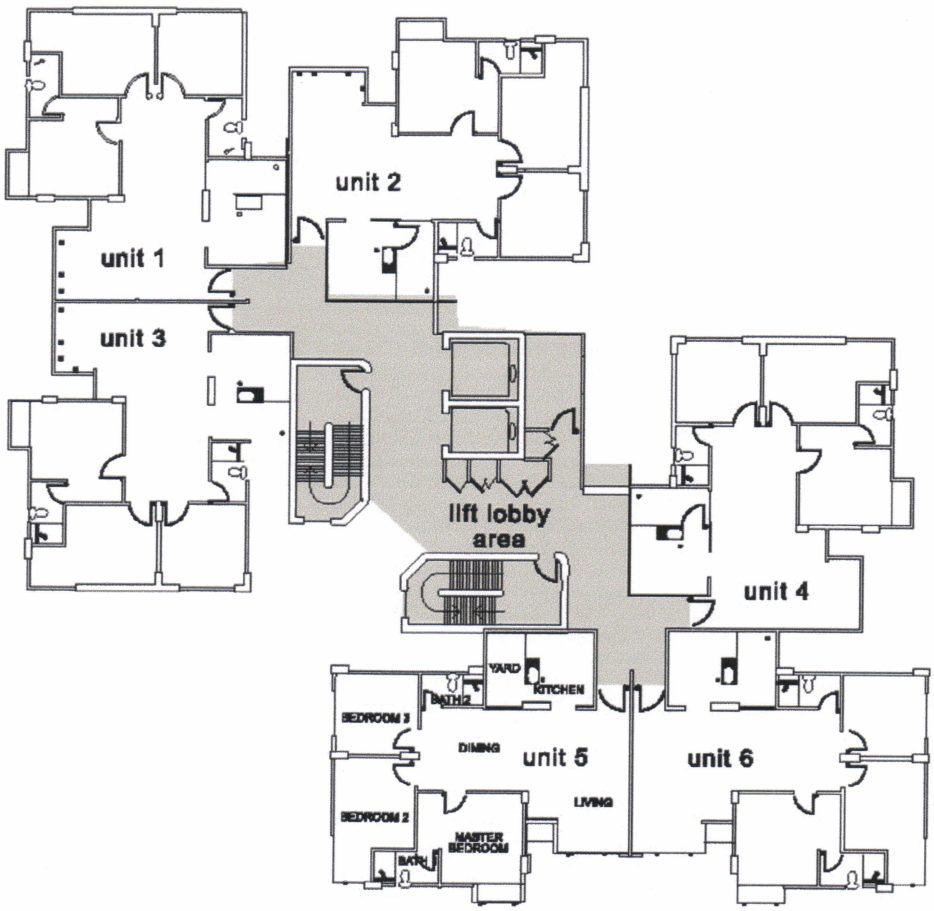

Figure Q3(a)

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Table Q3(a)(i)

No.	Assessment criteria	Details
1.	**Construction area**	
	i) Area for 1 unit of condominium	94.4m^2
	ii) Lift lobby area	140.0m^2
	iii) Area for 1 floor	= [94.4 x 6 units +140] = 706.4 m^2
2.	**Structural Systems**	
	i) Beam	Precast concrete beam
	ii) Column	Precast concrete column
	iii) Floor slab	Precast half slab
	iv) Roof truss	Prefabricated steel roof truss
3.	**Wall System (6 units + lift area)**	
	i) Internal wall	Blockworks 525m length
	ii) External wall	Precast concrete panel 405m length
4.	**Other simplified construction solutions**	
	i) Beams	60% complies to MS 1064
	ii) Column	60% complies to MS 1064
	iii) Windows and doors	80% complies to MS1064
	iv) Horizontal and vertical repetition	100%

Table Q3(a)(ii)
IBS factor for structural systems

SYSTEM	FLOOR / COLUMN / BEAM [6]	Precast concrete slab[1]	In-situ concrete on permanent metal formwork	In-situ concrete using reusable[3] system formwork	In-situ concrete using timber[4] formwork	Steel flooring system	Timber frame flooring system	No Floor[6]
CONCRETE	Precast column and beam	1.0	0.9	0.7	0.6	1.0	1.0	1.0
	Precast column and in-situ beams using reusable[3] system formwork	0.9	0.8	0.6	0.5	0.9	0.9	0.8
	Precast column and in-situ beams using timber[4] formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.7
	Precast beams and in-situ columns with reusable[3] system formwork	0.9	0.8	0.6	0.5	0.9	0.9	0.8
	Precast beams and in-situ columns using timber[4] formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.7
	In-situ column and beams using reusable[3] system formwork	0.7	0.6	0.5	0.3	0.7	0.7	0.6
	In-situ column and beams using timber[4] formwork	0.6	0.5	0.3	0.0	0.6	0.6	0.0
LOAD BEARING BLOCKWORK[7]	Vertical and horizontal member systems / structure	0.8	0.7	0.6	0.5	0.8	0.8	0.7
STEEL	Steel columns and beams	1.0	0.9	0.7	0.6	1.0	1.0	1.0

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Table Q3(a)(iii)
IBS factor for roof structural systems

NO	ROOF SYSTEM	IBS FACTOR
a.	Prefab timber roof truss	1.0
b.	Prefab metal roof truss	1.0
c.	Precut[1] metal roof truss	0.5
d.	Timber roof trusses[2]	0.0

Table Q3(a)(iv)
IBS factor for wall systems

NO	WALL SYSTEM	IBS FACTOR
1	Precast concrete panel[1]	1.0
2	Wall cladding[2]	1.0
3	Prefabricated timber panel	1.0
4	Full height glass panel[3]	1.0
5	Dry wall system[4]	1.0
6	In-situ concrete with reusable[5] system formwork	0.5
7	In-situ concrete with timber[6] formwork	0.0
8	Blockwork system[7]	0.5
9	Pre-assemble brickwall / blockwall[8]	1.0
10	Common brickwall	0.0

Table Q3(a)(v)
IBS factor for simplified construction solutions

No	DESCRIPTION	UNIT	IBS SCORE	
			PERCENTAGE OF USAGE	
			50% ≤ x <75%,	75% ≤ x ≤100%
1	**UTILISATION OF STANDARDISED COMPONENTS BASED ON MS 1064**			
	i) Beams [1]	Nos	2	4
	ii) Columns [1]	Nos	2	4
	iii) Walls [1]	m	2	4
	iv) Slabs [1]	m^2	2	4
	v) Doors [2]	Nos	2	4
	vi) Windows [3]	Nos	2	4
2	**REPETITION OF STRUCTURAL LAYOUT**			
	a) For building more than 2 storeys			
	i) Repetition of floor to floor height	Nos	1	2
	ii) Vertical repetition of structural floor layout	Nos	1	2
	iii) Horizontal repetition of structural floor layout	Nos	1	2
	b) For building 1 or 2 storeys			
	Horizontal repetition of structural floor layout	Nos	3	6

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Table Q3(a)(vi)

ELEMENTS	AREA (m^2)/ Length	IBS FACTOR	COVERAGE	IBS SCORE
Part 1: Structural Elements				
			Total Part 1	
Part 2: Wall System				
			Total Part 2	
Part 3: Other Simplified Solutions				
			Total Part 3	
IBS Score of Project = Part1 + Part 2 + Part 3				

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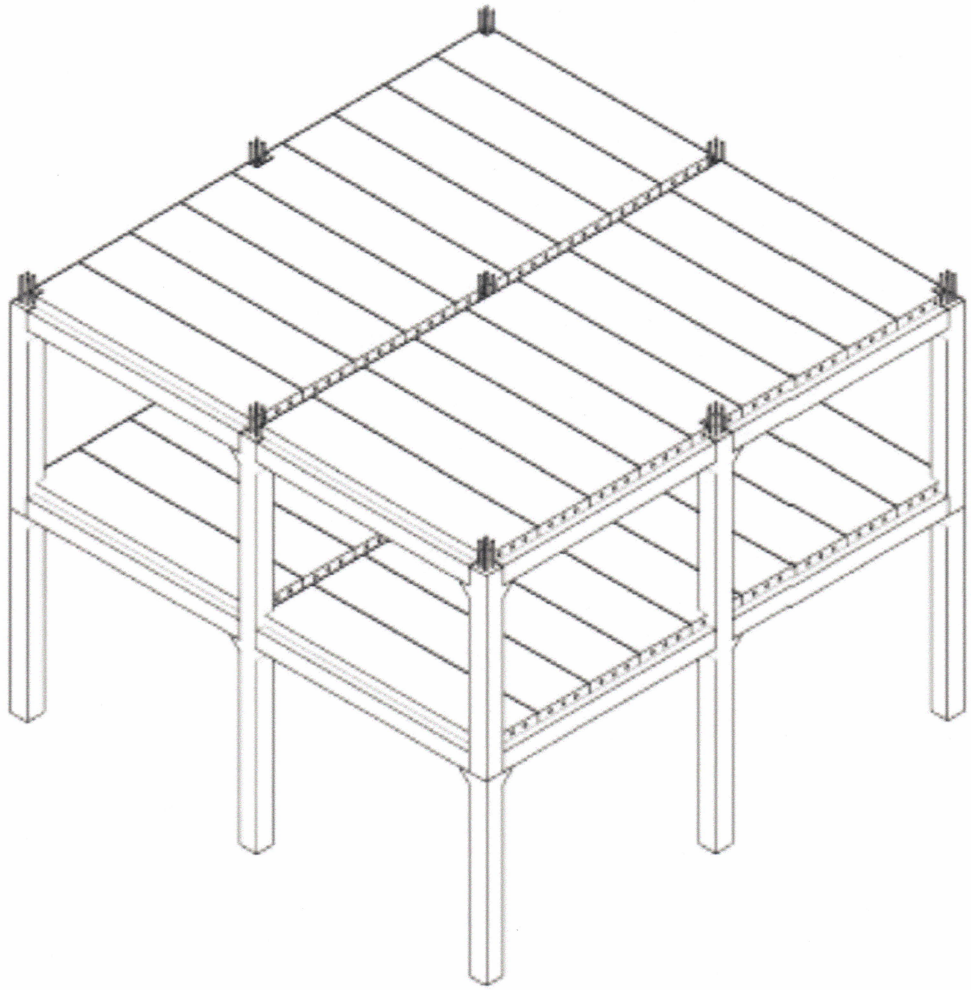

Figure Q4