UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	MATERIALS OF CIVIL ENGINEERING
COURSE CODE	:	BFC 10502
PROGRAMME	:	BFA
EXAMINATION DATE	:	DECEMBER 2012/JANUARY 2013
DURATION	:	2 HOURS
INSTRUCTION	:	1. QUESTION IN PART A IS **COMPULSORY**. 2. CHOOSE **THREE (3)** QUESTIONS IN PART B. 3. ATTACH THE APPENDIX I, II, III, IV AND V IN YOUR ANSWER SCRIPT.

THIS QUESTIONS PAPER CONSISTS OF **TWELVE (12)** PAGES

PART A

Q1 You are assigned to complete the laboratory experiment. The objective is to complete the mix design form according to DOE method. Before doing the concrete mix, you need to carry out the sieve analysis in determining the percentage passing of 600μm.

Given,

i. Characteristic compressive strength, 32 N/mm^2 at 28 days with a 10% defective rate (k = 1.28)
ii. Ordinary Portland cement
iii. Slump required, 10 – 30 mm
iv. Maximum crushed aggregate size, 20mm,
v. Relative density of crushed aggregate (SSD), 2700 kg/m^3
vii. Standard deviation is 8 N/mm^2
viii. Trial mix (cube size) is 100mm x 100mm x 100mm

(a) State the purpose of sieve analysis test for fine aggregate.

(5 marks)

(b) **Table 1** shows the result of sieve analysis for fine aggregate. Complete and fill up the table in **APPENDIX 1.**

(14 marks)

(c) As the result of percentage passing for 600μm that obtained in **Table 1** to complete the Design Mix Form using **APPENDIX 2**. Use all the given information.

(12 marks)

(d) Discuss the effect of following issues in concreting work,

(i) Placing method
(ii) Compaction method
(iii) Curing method

(9 marks)

PART B

Q2 (a) Clarify **two (2)** standard tests for cement.

(6 marks)

(b) State of **two (2)** types of Portland Cement and explain it.

(6 marks)

(c) Explain the understanding of high alumina cement.

(5 marks)

(d) Describe the cement hydration process.

(3 marks)

Q3 (a) Bricks bonding is the final process of finishing a brick wall to produce a neat surface. Draw **five (5)** types of common bricks bonding applied in the construction.

(10 marks)

(b) Describe the procedure for absorption test for bricks according to expertly set:

(i) On site
(ii) In the laboratory

(8 marks)

(c) Discuss the properties and applications of

(i) Calcium silicate brick
(ii) Concrete brick
(iii) Concrete hollow block

(12 marks)

Q4 (a) Explain **three (3)** differences between hardwood and softwood properties.

(6 marks)

(b) Give **two (2)** advantages and **two (2)** disadvantages of using timber as a construction material.

(4 marks)

(c) Preservation of wood can be done using several methods. Describe the various treatment processes.

(6 marks)

(d) State **two (2)** methods to determine the timber standard testing and its importance for construction.

(4 marks)

Q5 (a) List **four (4)** classification of steel.

(4 marks)

(b) Explain the process involved in Bessemer process and sketch the diagram of Bessemer converter.

(8 marks)

(c) Give **three (3)** differences between mild steel and high carbon steel.

(6 marks)

(d) As an Engineer of Quality Assurance in steel factory. You are assigned to determine the hardenability of steel. What are you going to do.

(2 marks)

Q6 Briefly discusses the role of the following topics as civil engineering materials:

(a) Bitumen

(5 marks)

(b) Elastomer Rubber

(5 marks)

(c) Polymer

(5 marks)

(d) Fiber Reinforcement Polymer

(5 marks)

TERJEMAHAN BAHASA MALAYSIA

BAHAGIAN A

S1 Anda ditugaskan untuk menjalankan eksperimen makmal. Objektifnya adalah untuk melengkapkan borang rekabentuk campuran konkrit berdasarkan kaedah DOE. Sebelum melakukan campuran konkrit, anda perlu menjalankan analisis ayakan untuk mendapatkan peratus melepasi 600μm.

Diberi;

i. Kekuatan mampatan ciri, 32 N/mm^2 pada hari ke-28 dengan kadar peratus rosak 10% (k = 1.28)
ii. Normal Portland Simen
iii. Slump yang dikehendaki, 10 – 30 mm
iv. Saiz maksimum agregat terhancur, 20 mm
v. Ketumpatan bandingan agregat terhancur, 2700 kg/m^3
vi. Kadar peratus rosak 8%
vii. Campuran percubaan (saiz kiub):100mm x 100mm x 100mm

(a) Nyatakan tujuan ujian analisis pengasingan untuk batu baur halus.

(5 markah)

(b) **Jadual 1** menunjukkan keputusan analisis pengasingan untuk batu baur halus. Lengkapkan jadual dalam **LAMPIRAN 1**.

(14 markah)

(c) Menggunakan keputusan peratus melepasi 600μm yang diperolehi dari **Jadual** 1, lengkapkan borang rekabentuk campuran konkrit menurut kaedah DOE menggunakan **LAMPIRAN 2**. Gunakan semua maklumat yang diberikan.

(12 markah)

(d) Bincangkan kesan isu-isu berikut di dalam kerja konkrit,

(i) *Placing method*
(ii) *Compaction method*
(iii) *Curing method*

(9 markah)

BAHAGIAN B

S2 (a) Jelaskan **dua (2) ujian** standad untuk simen.

(6 markah)

(b) Nyatakan **dua (2)** jenis Portland Simen dan terangkan.

(6 markah)

(c) Terangkan pemahaman simen alumina yang tinggi.

(5 markah)

(d) Terangkan proses hidrasi simen.

(3 markah)

S3 (a) Ikatan bata adalah proses akhir kemasan dinding bata untuk menghasilkan permukaan yang kemas. Lukiskan **lima (5)** jenis bata ikatan yang biasa digunakan dalam pembinaan.

(10 markah)

(b) Terangkan prosedur untuk ujian penyerapan untuk bata mengikut piawai :

(i) Di lokasi
(ii) Dalam makmal

(3 markah)

(c) Bincangkan ciri-ciri dan aplikasi;

(i) Bata kalsium silikat
(ii) Bata Konkrit
(iii) Konkrit blok berongga

(12 marks)

S4 (a) Senaraikan **tiga (3)** perbezaan sifat di antara kayu keras dan kayu lembut.

(6 markah)

(b) Berikan **dua (2)** kebaikan dan **dua (2)** keburukan menggunakan kayu sebagai bahan pembinaan.

(4 markah)

(c) Pengawetan kayu boleh dijalankan dengan menggunakan beberapa kaedah. Huraikan kaedah *Various treatment processes.*

(6 markah)

(d) Nyatakan **dua (2)** kaedah untuk menentukan ujian piawai kayu serta kepentingan kepada pembinaan.

(4 markah)

S5 (a) Senaraikan **empat (4)** klasifikasi besi.

(4 markah)

(b) Terangkan proses yang terlibat dalam Bessemer dan lakarkan rajah Bessemer converter.

(8 markah)

(c) Berikan **tiga (3)** perbezaan antara *'mild steel'* dan *'high carbon steel'*.

(6 markah)

(d) Sebagai Jurutera Kualiti di kilang besi. Anda ditugaskan untuk mendapatkan *'hardenability'* besi. Apa yang perlu anda lakukan?

(2 markah)

S6 Secara ringkas bincangkan peranan topik berikut sebagai bahan kejuruteraan awam:

(a) *Bitumen.*

(5 markah)

(b) *Elastomer Rubber*

(5 markah)

(c) *Polymer*

(5 markah)

(d) *Fiber Reinforcement Polymer*

(5 markah)

APPENDIX 1

FINAL EXAMINATION

SEMESTER/SESSION : 1 / 2012-2012 PROGRAMME : BFA

COURSE NAME : MATERIALS OF CIVIL ENGINEERING COURSE CODE : BFC 10502

NAME : _____

STUDENT ID. NO: _____ I/C NO or PASSPORT NO. : _____

LECTURER NAME: _____

SECTION NO. : _____

Table 1: Result of Sieve Analysis

Sieve size (mm)	Weight of aggregate retained (g)	Percentage retained	Cumulative percentage passing
5.00mm	0		
2.36mm	35		
1.18 mm	42		
600μm	45		
300μm	50		
150μm	34		
Pan	10		

APPENDIX II

NAME : _____

STUDENT ID. NO: _____ I/C NO or PASSPORT NO. : _____

LECTURER NAME: _____

SECTION NO. : _____

Design Mix Form

Job title .....

Stage	Item		Reference or calculation	Values
1	1.1	Characteristic strength	Specified	..... N/mm² at ..... days Proportion defective ..... %
	1.2	Standard deviation	Fig 3	..... N/mm² or no data ..... N/mm²
	1.3	Margin	C1 or Specified	(*k* = ...) ..... × ..... = ... N/mm² ..... N/mm²
	1.4	Target mean strength	C2	..... + ... = ... N/mm²
	1.5	Cement strength class	Specified	42.5/52.5
	1.6	Aggregate type: coarse Aggregate type: fine		Crushed/uncrushed Crushed/uncrushed
	1.7	Free-water/cement ratio	Table 2 Fig 1	.....
	1.8	*Maximum free-water/ cement ratio*	*Specified*	..... Use the lower value [ ]
2	2.1	Slump or Vebe time	Specified	Slump ..... mm or Vebe time ..... s
	2.2	Maximum aggregate size	Specified	..... mm
	2.3	Free-water content	Table 3	..... [ ] kg/m³
3	3.1	Cement content	C3	..... + ... = ... kg/m³
	3.2	*Maximum cement content*	*Specified*	..... kg/m³
	3.3	*Minimum cement content*	*Specified*	..... kg/m³
				use 3.1 if ≤ 3.2 use 3.3 if > 3.1 [ ] kg/m³
	3.4	Modified free-water/cement ratio		..... [ ]
4	4.1	Relative density of aggregate (SSD)		..... known/assumed
	4.2	Concrete density	Fig 2	..... kg/m³
	4.3	Total aggregate content	C4	..... − ..... − ..... = ... kg/m³
5	5.1	Grading of fine aggregate	Percentage passing 600 µm sieve	..... %
	5.2	Proportion of fine aggregate	Fig 3	..... %
	5.3	Fine aggregate content	C5	..... × ..... = [ ] kg/m³
	5.4	Coarse aggregate content	C5	..... − ..... = [ ] kg/m³

Quantities	Cement (kg)	Water (kg or litres)	Fine aggregate (kg)	Coarse aggregate (kg) 10 mm	20 mm	40 mm
per m³ (to nearest 5 kg)	.....	.....	.....	.....	.....	.....
per trial mix of ..... m³	.....	.....	.....	.....	.....	.....

Items in italics are optional limiting values that may be specified (see Section 7).

Concrete strength is expressed in the units N/mm². 1 N/mm² = 1 MN/m² = 1 MPa. (N = newton; Pa = pascal.)

The internationally known term 'relative density' used here is synonymous with 'specific gravity' and is the ratio of the mass of a given volume of substance to the mass of an equal volume of water.

SSD = based on the saturated surface-dry condition.

APPENDIX III

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Table 2: Approximate compressive strengths of concrete made with a free water/cement ratio of 0.5 according to the DOE Method

Type of cement	Cement strength class	Type of coarse aggregate	Compressive strength* (MPa(psi)) at the age of (days)			
			3	7	28	91
Ordinary Portland (Type I)	42.5	Uncrushed	22 (3200)	30 (3200)	42 (6100)	49 (7100)
Sulfate-resisting Portland (Type V)		Crushed	27 (3900)	36 (5200)	49 (7100)	56 (8100)
Rapid-hardening Portland (Type III)	52.5	Uncrushed	29 (4200)	37 (5400)	48 (7000)	54 (7800)
		Crushed	34 (4900)	43 (6200)	55 (8000)	61 (8900)

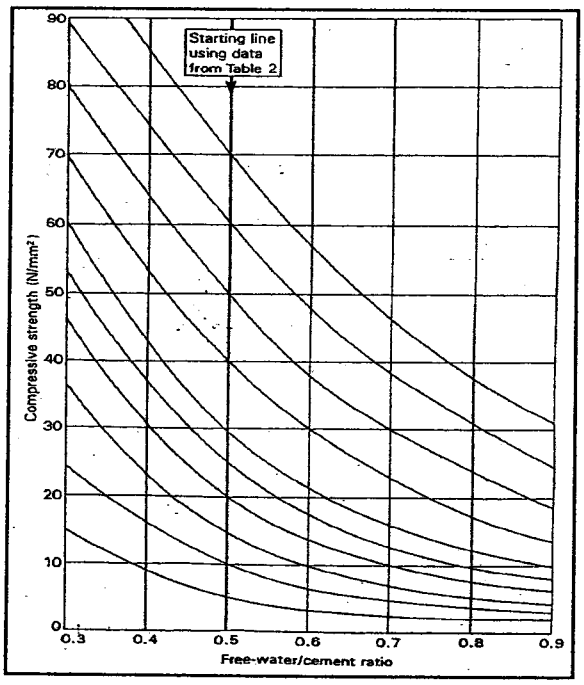

Figure 1: Relationship between cube compressive strength and free water/cement ratio

APPENDIX IV

FINAL EXAMINATION

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Table 3 Approximate free-water contents (kg/m³) required to give various levels of workability

Slump (mm)		0–10	10–30	30–60	60–180
Vebe time (s)		>12	6–12	3–6	0–3
Maximum size of aggregate (mm)	Type of aggregate				
10	Uncrushed	150	180	205	225
	Crushed	180	205	230	250
20	Uncrushed	135	160	180	195
	Crushed	170	190	210	225
40	Uncrushed	115	140	160	175
	Crushed	155	175	190	205

Note: When coarse and fine aggregates of different types are used, the free-water content is estimated by the expression:

$$\frac{2}{3} W_f + \frac{1}{3} W_c$$

where W_f = free-water content appropriate to type of fine aggregate
and W_c = free-water content approporiate to type of coarse aggregate.

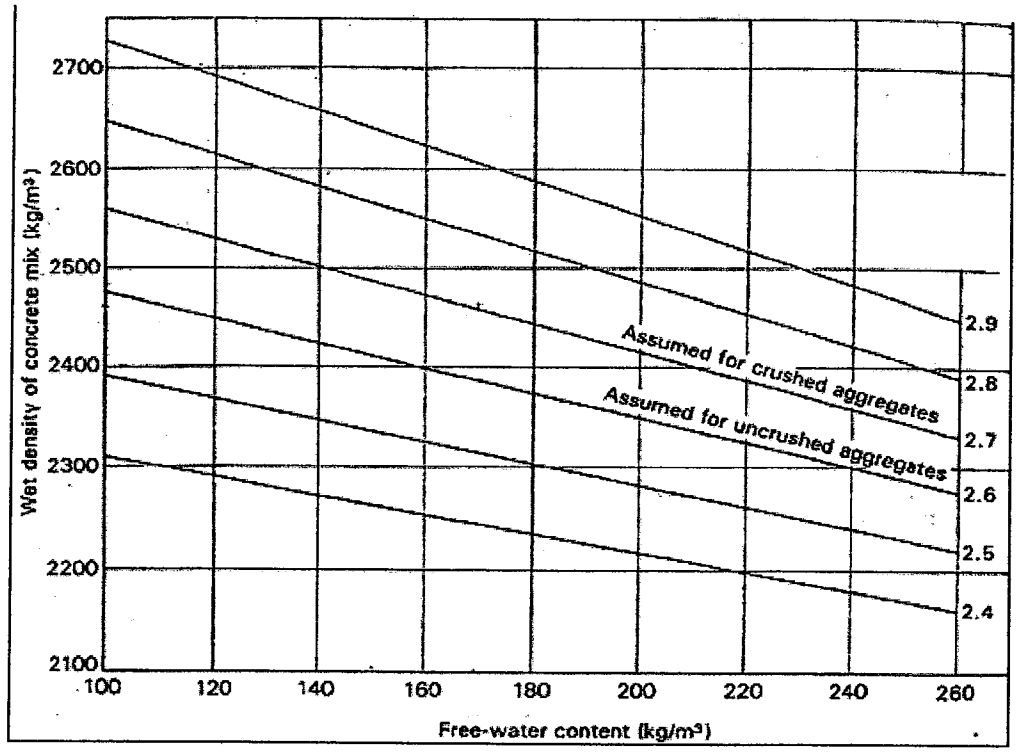

Figure 2: Estimate wet density of fully compacted concrete

APPENDIX V

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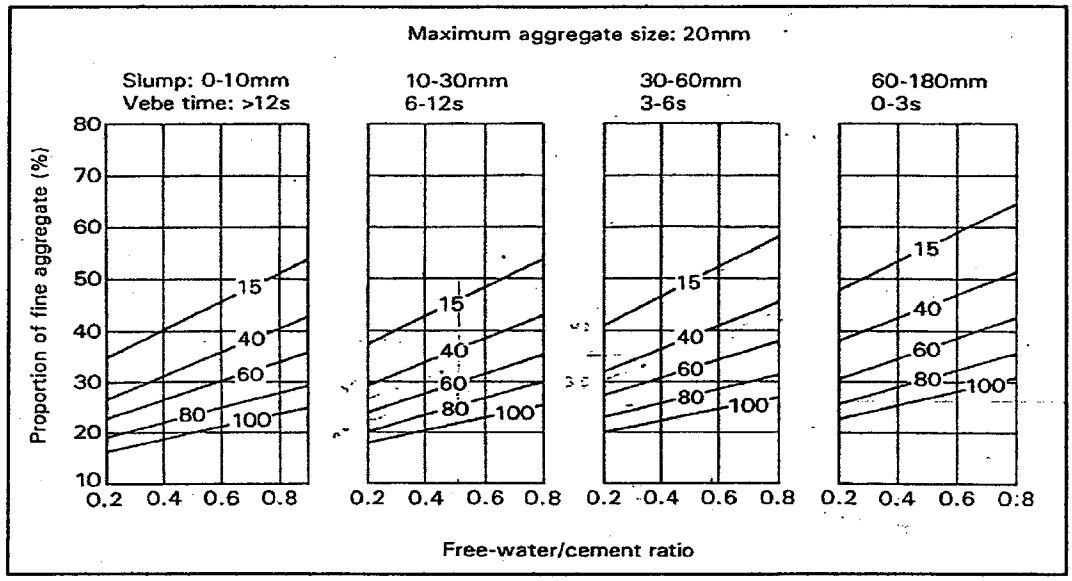

Figure 3: Proportions of fine aggregates for grading zones 1,2,3,4