UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	CIVIL ENGINEERING MATERIALS
COURSE CODE	:	BFC 1032 / BFC 10502
PROGRAMME	:	BFF
EXAMINATION DATE	:	JUNE 2012
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER QUESTION **Q1** AND **THREE (3)** OTHER QUESTIONS ATTACH THE **DOE FORM** TOGETHER WITH YOUR ANSWER SCRIPT.

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) What is the main purpose of concrete compaction?

(2 marks)

(b) List and explain briefly **Two (2)** methods of concrete compaction

(4 marks)

(c) Give your opinion about the adverse effect if the concrete is not properly compacted.

(4 marks)

(d) What is definition of shrinkage in concrete? List **Two (2)** types of shrinkage strains in concrete.

(3 marks)

(e) List **Two (2)** methods of concrete mix design.

(2 marks)

(f) Complete the concrete mix design form provided according to the DOE method.

Given,

i. Characteristic compressive strength, 30 N/mm^2 at 28 days with a 5% defective rate (k = 1.64)
ii. Portland cement class 42.5
iii. Slump required, 30 – 60 mm
iv. Maximum crushed aggregate size, 20mm,
v. Relative density of crushed aggregate, 2700 kg/m^3
vi. Maximum free-water/ cement ratio 0.56
vii. Percentage passing 600μm sieve is 40%

(10 marks)

Q2 (a) Explain briefly the process to produce cement based on wet and dry methods with the aid of sketches, flow chart and labels.

(10 marks)

(b) List **Four (4)** types of Portland cements. Then, briefly explain **Two (2)** of them

(9 marks)

(c) What are the definitions of initial setting time, final setting time and hardening of cement?

(6 marks)

Q3 (a) Steel is an important building material used in Malaysia construction industry. Briefly describe **Four (4)** characteristics of related steel.

(8 marks)

(b) Describe **Four (4)** advantages and disadvantages of steel.

(8 marks)

(c) List **Four (4)** manufacturing process of steel.

(4 marks)

(d) You are assigned to design a laboratory structure. Choose appriopriate steel cross section for each structural element i.e beam column and truss with aid of sketches.

(5 marks)

Q4 (a) List **Three (3)** example of timber structure application in housing construction industry.

(3 marks)

(b) Wood drying process is to raduce of moisture or liquids in the airway cells in the timber. Please describe **Three (3)** purpose of timber drying before being applied in construction.

(3 marks)

(c) Calculate the percentage of moisture content of wood after 24 hours of drying.

Wood size	:	50 mm x 50 mm x 500 mm
Initial weight	:	300 g
Final weight	:	256.4 g

(3 marks)

(d) List **Three (3)** advantages and disadvantages of timber as construction material.

(6 marks)

(e) Briefly describe **Five (5)** types of timber defects.

(10 marks)

Q5 (a) List **Four (4)** types of brick available in the market.

(4 marks)

(b) Write the procedure involved in determining the compressive strength for brick.

(6 marks)

(c) The data below is obtained from brick test in the laboratory.

Brick size A: 220 mm x 110 mm x 65 mm
Brick size B: 219 mm x 112 mm x 64 mm

Mass of dried brick size A: 2.65 kg
Mass of wet brick size A: 2.9 kg

Mass of dried brick size B: 2.70 kg
Mass of wet brick size B: 2.88 kg

Calculate the average percentage of water absorption and average density.

(4 marks)

(d) Explain the process involved in brick manufacturing with aid of sketches.

(8 marks)

(e) Write and sketch **Three (3)** types of bricks bonding and arrangement.

(3 marks)

Q6 (a) List **Five (5)** testing method and specific ASTM standard Of bitumen.

(5 marks)

(b) Discuss **Five (5)** Application of bitumen in civil engineering.

(5 marks)

(c) List **Five (5)** properties of elastomer rubber.

(5 marks)

(d) List **Five (5)** characteristic of Plastic.

(5 marks)

(e) Discuss **Five (5)** main application of FRP component in construction application.

(5 marks)

S1 (a) Apakah tujuan utama pemadatan konkrit?

(2 markah)

(b) Senaraikan dan terangkan dengan ringkas **Dua (2)** kaedah pemadatan konkrit

(4 markah)

(c) Beri pandangan anda berkenaan kesan buruk jika pemadatan konkrit tidak dilakukan dengan sempurna.

(4 markah)

(d) Apakah definisi pengecutan dalam konkrit dan senaraikan **Dua (2)** jenis pengecutan dalam konkrit.

(3 markah)

(e) Senaraikan **Dua (2)** kaedah rekabentuk bancuhan konkrit.

(2 markah)

(f) Lengkapkan borang rekabentuk bancuhan konkrit yang disediakan berdasarkan kaedah DOE.

Diberi,

i. Sifat kekuatan konkrit , 30 N/mm^2 pada 28 hari dengan 5% kadar kecacatan (k = 1.64)
ii. Kelas Portland simen 42.5
iii. Runtuhan yang diperlukan, 30 – 60 mm
iv. Saiz maksimum aggregate hancur, 20mm,
v. Ketumpatan relative agregat dihancurkan, 2700 kg/m^3
vi. Nisbah air simen maksimum 0.56
vii. Peratus melepasi 600μm ayakan ialah 40%

(10 markah)

S2 (a) Terangkan secara ringkas proses menghasilkan simen berdasarkan kaedah kering dan basah dengan bantuan lakaran, carta alir dan label.

(10 markah)

(b) Senaraikan **Empat (4)** jenis Portland simen. Kemudian, dengan ringkas terangkan dua daripadanya

(9 markah)

(c) Apakah yang dimaksudkan masa *setting* permulaan, masa *setting* akhir dan pengerasan simen?

(6 markah)

S3 (a) Keluli merupakan bahan binaan yang penting yang digunakan di dalam industri pembinaan di Malaysia. Huraikan dengan ringkas **Empat(4)** sifat keluli.

(8 markah)

(b) Terangkan **Empat (4)** kebaikan dan keburukan keluli.

(8 markah)

(c) Senaraikan **Empat (4)** proses pembuatan keluli.

(4 markah)

(d) Anda ditugaskan untuk merekabentuk satu struktur makmal keluli. Pilih keratan keluli yang sesuai bagi setiap elemen struktur seperti rasuk, tiang dan kekuda dengan bantuan gambarajah.

(5 markah)

S4 (a) Berikan **Tiga (3)** contoh aplikasi kayu dalam industri pembinaan perumahan.

(3 markah)

(b) Terangkan **Tiga (3)** tujuan pengeringan kayu sebelum diaplikasikan dalam pembinaan.

(3 markah)

(c) Kirakan peratus kandungan lembapan kayu tersebut selepas 24 jam dikeringkan.

Saiz kayu	:	50 mm x 50 mm x 500 mm
Berat awal	:	300 g
Berat akhir	:	256.4 g

(3 markah)

(d) Senaraikan **Tiga (3)** kebaikan dan keburukan kayu sebagai bahan binaan.

(6 markah)

(e) Terangkan secara ringkas **Lima (5)** jenis kecacatan kayu.

(10 markah)

S5 (a) Senaraikan **Empat (4)** jenis bata boleh didapati di pasaran
(4 markah)

(b) Tuliskan prosedur kerja yang terlibat dalam menentukan kekuatan mampatan batu bata.
(6 markah)

(c) Data di bawah diprolehi daripada ujikaji bata dalam makmal.

Saiz bata A: 220 mm x 110 mm x 65 mm
Saiz bata B: 219 mm x 112 mm x 64 mm

Berat kering bata saiz A: 2.65 kg
Berat basah bata saiz A: 2.9 kg

Berat kering bata saiz B: 2.70 kg
Berat basah bata saiz B: 2.88 kg

Kirakan peratus purata penyerapan air dan purata ketumpatan
(4 markah)

(d) Terangkan proses yang terlibat dalam penghasilan batu-bata.
(8 markah)

(e) Tulis dan lakarkan **Tiga (3)** jenis ikatan dan susunan bata.
(3 markah)

S6 (a) Senaraikan **Lima (5)** kaedah ujian dan standard ASTM yang digunakan pada bitumen
(5 markah)

(b) Bincangkan **Lima (5)** Aplikasi penggunaan bitumen dalam kejuruteraan awam
(5 markah)

(c) Senaraikan **Lima (5)** sifat elastomer rubber.
(5 markah)

(d) Senaraikan **Lima (5)** sifat plastik
(5 markah)

(e) Bincangkan **Lima (5)** aplikasi utama komponent FRP dalam pembinaan
(5 markah)

APPENDIX: CIVIL ENGINEERING MATERIALS (BFC 10502)

NAME : _____

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

LECTURER NAME : _____

SECTION NO. : _____

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 4	..... Use the lower value [ ]
	1.8	*Maximum free-water/ cement ratio*	*Specified*	.....
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 5	..... 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 6	..... %
	5.3	Fine aggregate content	C5	..... × ..... = [ ] kg/m³
	5.4	Coarse aggregate content		..... − ..... = [ ] 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.

Table 2 Approximate compressive strengths (N/mm^2) of concrete mixes made with a free-water/cement ratio of 0.5

Cement strength class	Type of coarse aggregate	Compressive strengths (N/mm^2) Age (days) 3	7	28	91
42.5	Uncrushed	22	30	42	49
	Crushed	27	36	49	56
52.5	Uncrushed	29	37	48	54
	Crushed	34	43	55	61

Throughout this publication concrete strength is expressed in the units N/mm^2.
$1\ N/mm^2 = 1\ MN/m^2 = 1\ MPa$. (N = newton; Pa = pascal.)

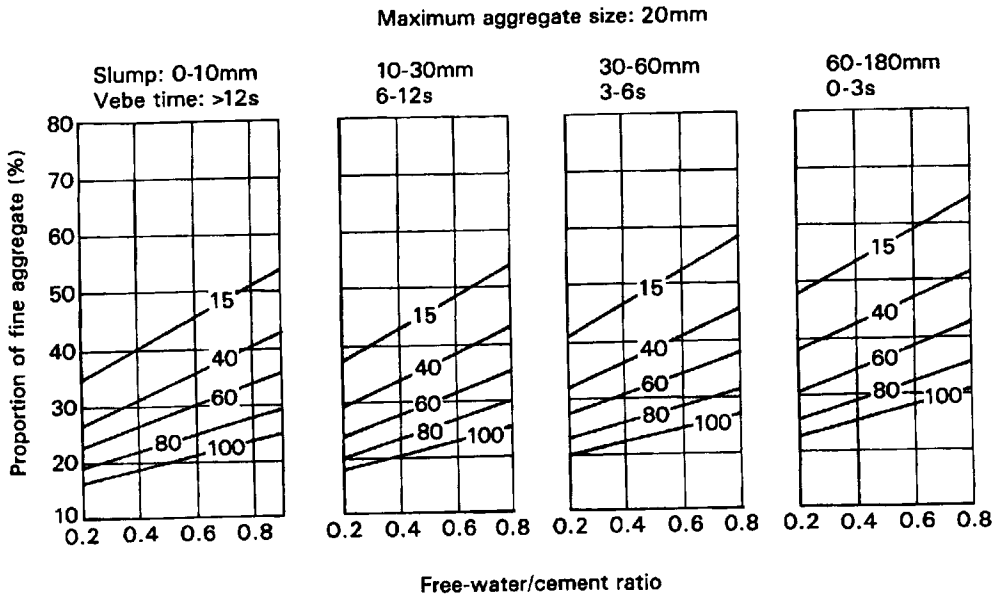

Table 3 Approximate free-water contents (kg/m^3) required to give various levels of workability

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:

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

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

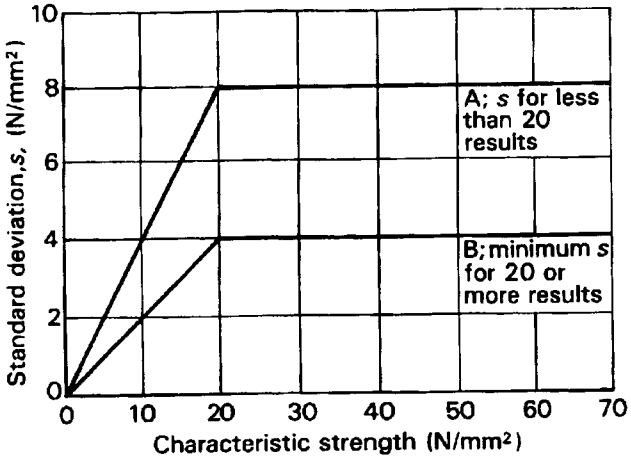

Figure 3
Relationship between standard deviation and characteristic strength

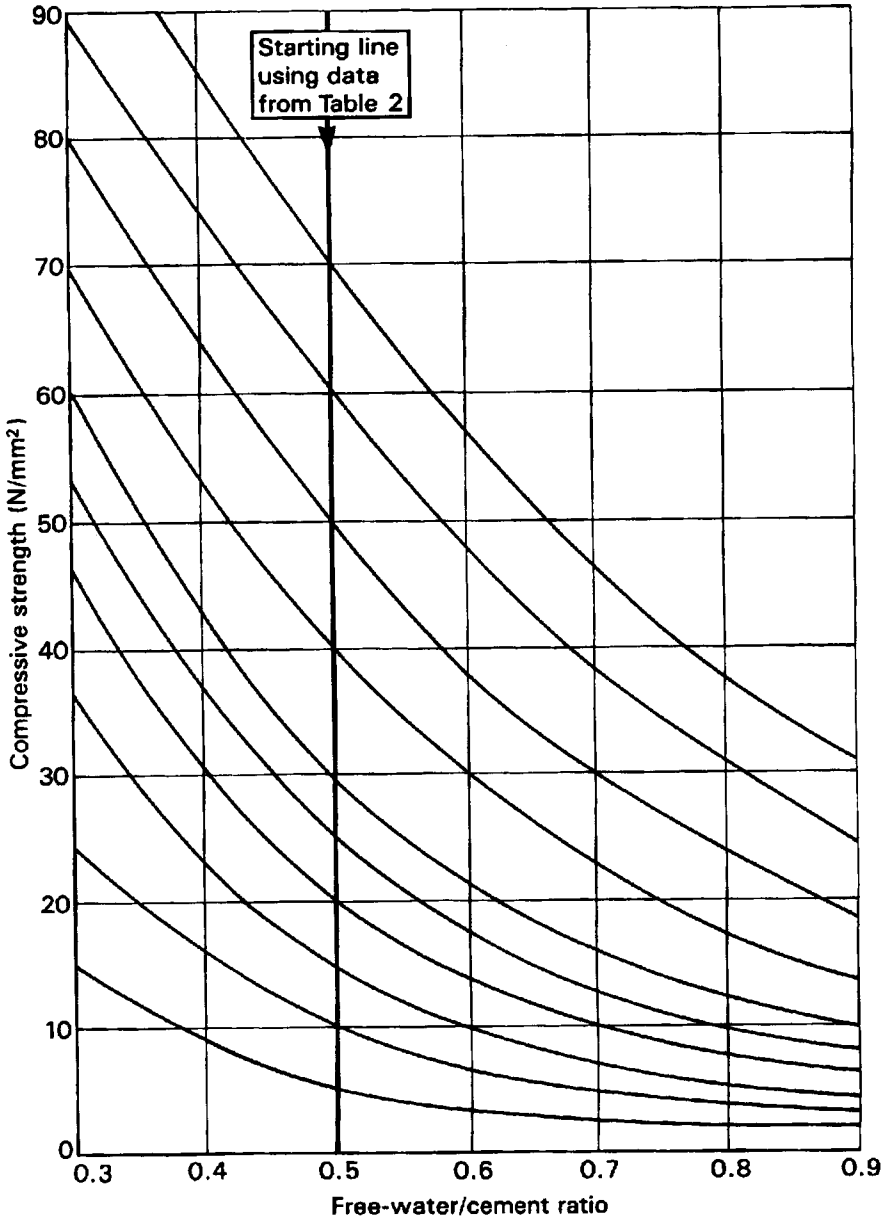

Figure 4
Relationship between compressive strength and free-water/cement ratio