UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/14

COURSE NAME	:	CONSTRUCTION MATERIALS
COURSE CODE	:	BNP 10202
PROGRAMME	:	1 BNA/1BNB/1BNC
EXAMINATION DATE	:	JUNE 2014
DURATION	:	2 HOURS
INSTRUCTIONS	:	ANSWER **FOUR (4)** QUESTIONS ONLY ATTACH THE DOE FORM TOGETHER WITH YOUR ANSWER SCRIPT

THIS PAPER CONSISTS OF **ELEVEN (11)** PRINTED PAGES

ENGLISH

Q1 (a) Explain **THREE (3)** main purpose of concrete compaction.

(6 marks)

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

(5 marks)

(c) List **TWO (2)** methods of concrete mix design.

(2 marks)

(d) 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, 20 mm,
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%

*** Please attach this Design Form with your answer script (Figure 7)**

(12 marks)

Q2 (a) Steel is an important building material that used in construction industry in Malaysia. Briefly describe **FOUR (4)** the natures of related steel.

(8 marks)

(b) Describe **FOUR (4)** advantage and **FOUR (4)** disadvantage of usage of steel.

(8 marks)

(c) Manufacturing of steel can be done through various process. List **FOUR (4)** manufacturing process of steel.

(4 marks)

(d) As a technologist, you were assigned to design the steel based on material laboratory building. Before your design work is conducted, you have to choose the appropriate section to be used for major structural element of **beams, column and trusses**. State the appriopriate section for the **all** structural elements with aided sketches.

(5 marks)

Q3 (a) List **THREE (3)** example of the usage of timber in housing construction industry.

(3 marks)

(b) Wood drying process is to produce of moisture or liquids in the airway cells in the timber. Describe the purpose of the drying process carried out before the the wood can be used.

(3 marks)

(c) Given the data for sample X used in the wood drying process. Calculate the percentage of moisture content of wood after drying 24 hours in the oven.

Wood size	:	100 mm x 50 mm x 50 mm
Initial weight	:	350 g
Final weight	:	280.4 g

(3 marks)

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

(6 marks)

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

(10 marks)

Q4 (a) List **FOUR (4)** types of brick available in the market.

(4 marks)

(b) The percentage of water absorption is indicated the degree of burning and the strength of brick is indicated on compressive strength test.

(i) List the procedure involved in determining the compressive strength for brick.

(ii) 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: 3.56 kg
Mass of wet brick size A: 3.98 kg

Mass of dried brick size B: 3.80 kg
Mass of wet brick size B: 3.98 kg

Calculate the average percentage of water absorption and average density

(10 marks)

(c) Sketch and explain the process involved in manufacturing the brick.

(8 marks)

(d) List and sketch **THREE (3)** types of bricks bonding and arrangement

(3 marks)

Q5 (a) Briefly describe the **FIVE (5)** following matters:

i. The Application of bitumen in civil engineering
ii. The good reason of using Elastomer Rubber in civil engineering.
iii. The Outstanding characteristic of Plastic
iv. The Applications of Polymer.
v. Discuss the main application of FRP component in construction application.
vi. Application of Gypsum Board

(25 marks)

- END OF QUESTION -

BAHASA MELAYU

S1 (a) Terangkan dengan jelas **TIGA (3)** tujuan utama pemadatan konkrit.

(6 markah)

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

(4 markah)

(c) Senaraikan **DUA (2)** kaedah rekabentuk bancuhan konkrit.

(2 markah)

(d) 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, 20 mm,
v. Ketumpatan relatif agregat dihancurkan, 2700 kg/m^3
vi. Nisbah air simen maksimum 0.56
vii. Peratus melepasi 600μm ayakan ialah 40%

(12 markah)

S2 (a) Keluli merupakan bahan binaan yang penting dan sering digunakan di dalam industri pembinaan di Malaysia. Huraikan secara ringkas empat(4) sifat keluli berkenaan.

(8 markah)

(b) Terangkan **EMPAT (4)** kebaikan dan **EMPAT (4)** keburukan penggunaan keluli sebagai bahan binaan.

(8 markah)

(c) Pengeluaran keluli boleh dilakukan melalui beberapa proses. Nyatakan proses-proses pengeluaran berkenaan.

(4 markah)

(d) Sebagai seorang jurutera teknologi anda telah ditugaskan untuk merekabentuk sebuah bangunan makmal bahan yang berasaskan keluli sebagai bahan binaan utama. Sebelum melakukan kerja-kerja rekabentuk anda dikehendaki memilih keratan yang sesuai untuk digunakan bagi elemen struktur utama iaitu **rasuk, tiang dan kekuda**. Nyatakan pilihan keratan yang bersesuaian untuk **semua** elemen-elemen struktur berkenaan dan lakarkan bentuk keratan tersebut.

(5 markah)

S3 (a) Berikan **TIGA (3)** contoh kegunaan kayu dalam industri pembinaan perumahan.
(3 markah)

(b) Proses pengeringan kayu adalah untuk mengeluarkan lembapan atau cecair yang terdapat di dalam rongga sel kayu tersebut. Terangkan apakah tujuan proses pengeringan ini dijalankan sebelum kayu tersebut boleh digunakan.
(3 markah)

(c) Diberi data bagi sampel kayu jenis X yang digunakan dalam proses pengeringan. Kirakan peratus kandungan lembapan kayu tersebut selepas pengeringan oven selama 24 jam.

Saiz kayu	:	150 mm x 50 mm x 50 mm
Berat awal	:	350 g
Berat akhir	:	280.4 g

(3 markah)

(d) Senaraikan **TIGA (3)** kebaikan dan **TIGA (3)** keburukan kayu sebagai bahan binaan
(6 markah)

(e) Terangkan secara ringkas **LIMA (5)** jenis kecacatan kayu.
(10 markah)

S4 (a) Senaraikan **EMPAT (4)** jenis bata boleh didapati di pasaran
(4 markah)

(b) Peratusan penyerapan air ditentukan pada darjah pembakaran dan kekuatan bata ditentukan oleh ujian kekuatan mampatan.

(i) Senaraikan langkah kerja dalam menentukan kekuatan mampatan bata.

(ii) Data di bawah diperolehi 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: 3.56 kg
Berat basah bata saiz A: 3.98 kg

Berat kering bata saiz B: 3.80 kg
Berat basah bata saiz B: 3.98 kg

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

(c) Lakarkan dan terangkan proses yang terlibat dalam menghasilkan bata.

(8 markah)

(d) Senaraikan dan lakarkan **TIGA (3)** jenis ikatan dan susunan bata.

(3 markah)

S5 (a) Ringkaskan huraian **LIMA (5) sahaja** perkara di bawah:-

i. Aplikasi penggunaan bitumen dalam teknologi kejuruteraan.
ii. Sebab yang baik penggunaan *Elastomer Rubber* dalam teknologi kejuruteraan.
iii. Sifat plastik .
iv. Aplikasi polimer.
v. Bincangkan aplikasi utama komponent FRP dalam pembinaan.
vi. Aplikasi Gypsum Board .

(25 marks)

- SOALAN TAMAT -

FINAL EXAM

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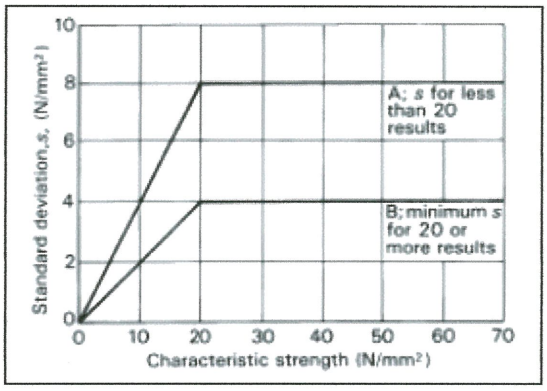

Figure . 1 Relationship between standard deviation and characteristic strength

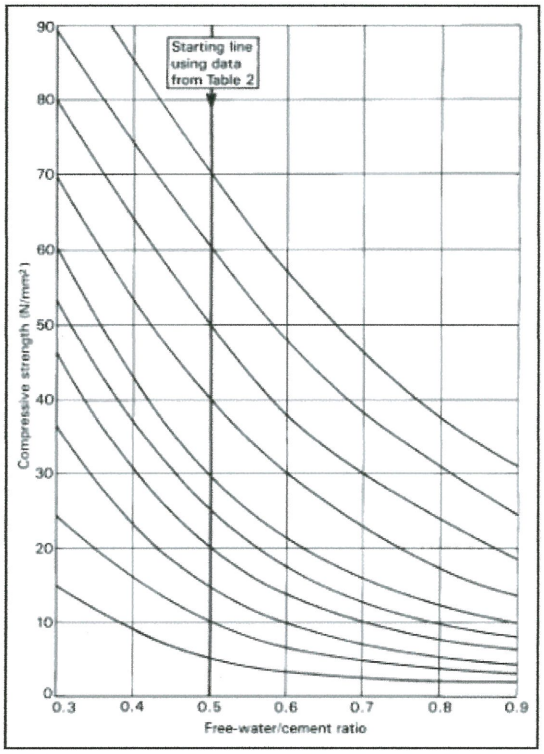

Figure 2. Relationship between compressive strength and free-water/cement ratio

FINAL EXAM

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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)

Figure 3 Approximate compressive strengths (N/mm2) of concrete mixes made with a free-water/cement ratio of 0.5

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:

$$\%W_f - \%W_c$$

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

Figure 4 Approximate free-water contents (kg/m3) required to give various levels of workability

FINAL EXAM

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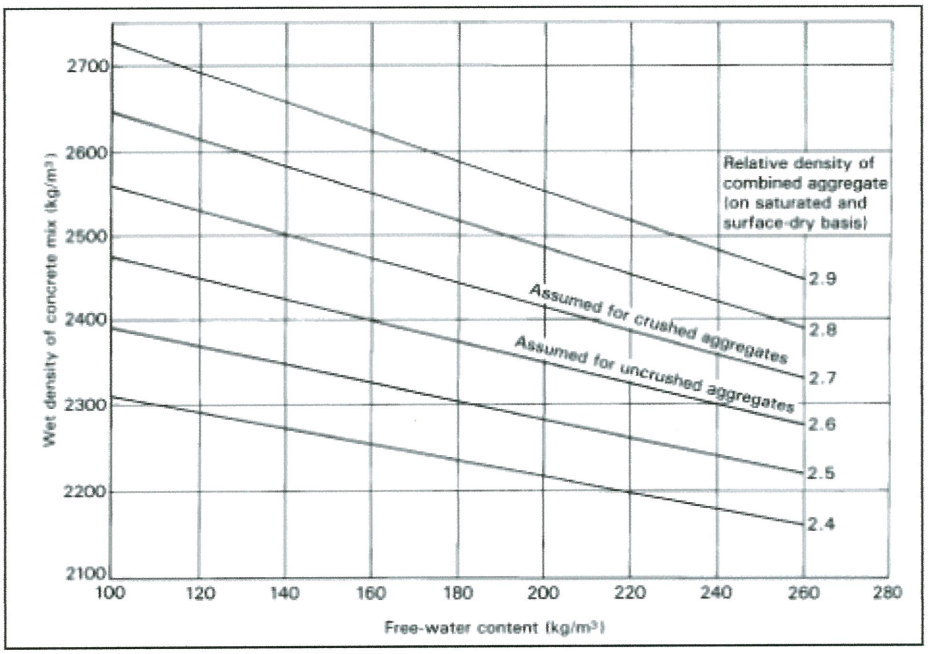

Figure 5 Estimated wet density of fully compacted concrete

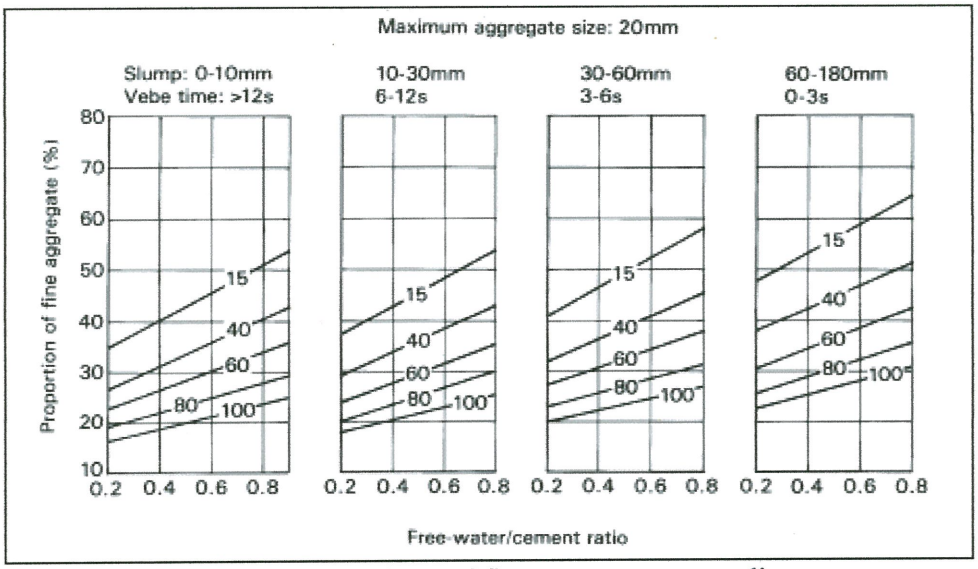

Figure 6 Recommended proportions of fine aggregate according to percentage passing a 600 μm sieve

Concrete mix design form

Job title .....

Stage	Item		Reference or calculation	Values
1	1.1	Characteristic strength	Specified	..... N/mm^2 at ..... days Proportion defective ..... %
	1.2	Standard deviation	Fig 3	..... N/mm^2 or no data ..... N/mm^2
	1.3	Margin	C1 or Specified	(k = ...) ..... × ..... = ... N/mm^2 ..... N/mm^2
	1.4	Target mean strength	C2	..... + ... = ... N/mm^2
	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	.....
	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/m^3
3	3.1	Cement content	C3	..... ÷ ..... = ... kg/m^3
	3.2	*Maximum cement content*	*Specified*	..... kg/m^3
	3.3	*Minimum cement content*	*Specified*	..... kg/m^3
				use 3.1 if ≤ 3.2 use 3.3 if > 3.1 [ ] kg/m^3
	3.4	Modified free-water/cement ratio		..... [ ]
4	4.1	Relative density of aggregate (SSD)		..... known/assumed
	4.2	Concrete density	Fig 5	..... kg/m^3
	4.3	Total aggregate content	C4	..... – ..... – ..... = ... kg/m^3
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/m^3
	5.4	Coarse aggregate content	C5	..... – ..... = [ ] kg/m^3

Quantities	Cement (kg)	Water (kg or litres)	Fine aggregate (kg)	Coarse aggregate (kg) 10 mm	20 mm	40 mm
per m^3 (to nearest 5 kg)	.....	.....	.....	.....	.....	.....
per trial mix of ..... m^3	.....	.....	.....	.....	.....	.....

Figure 7: Concrete mix design form