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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2017/2018**

COURSE NAME : CONCRETE TECHNOLOGY
COURSE CODE : BFS40603
PROGRAMME : BFF
EXAMINATION DATE : DECEMBER 2017/JANUARY 2018
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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- Q1**
- (a) Briefly explain about Sawdust Concrete, the properties and manufacturing in concrete. (5 marks)
 - (b) Explain in detail about the statistical quality control and acceptance criteria of concrete. (10 marks)
 - (c) Marine Shells are bio-composite materials that contain very high elements of calcium carbonate (CaCO_3) which is between 95-99%. The high content of the CaCO_3 is similar to lime stone powder to produce the Ordinary Portland Cement. Discuss the properties of concrete containing cockle shell ash as a cement replacement. (10 Marks)
- Q2**
- (a) Describe the mechanism of sulphate attack on concrete and the strategies that can be used to prevent sulphate attack. (6 marks)
 - (b) Discuss the special features of cold weather concreting and hot weather concreting. (9 marks)
 - (c) Discuss the characteristics of silica fume, fly ash and metakaolin which could exacerbate the risk and effect of plastic shrinkage cracking of concrete exposed to hot and dry environment. (10 marks)
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- Q3**
- (a) Explain in detail about the Mix Design and the various factors governing the selection of mix proportion. (5 marks)
 - (b) The following requirements are specified for concrete mix design Grade 35. Using the provided **Table 1** and **Figure Q1(a) – (f)**, calculate the concrete mix design for unrestricted design category.

Table 1: Concrete Mix Design Specification

Item	Value
Characteristic Strength at 28 days	35 N/mm ²
5 % Defective Rate	K = 1.96
Cement Type	Ordinary Portland cement (42.5)
Slump Required	10-30 mm
Maximum Aggregate Size	20 mm
Free-water/ Cement Ratio	0.45
Minimum Cement Content	290 kg/m ³

(20 marks)

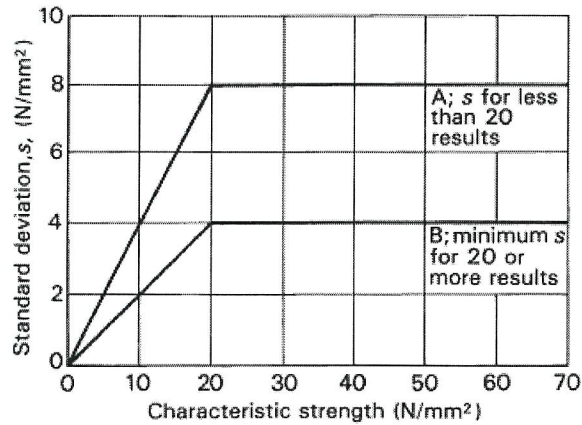
- Q4** (a) Define the meaning of pozzolanic material. (3 marks)
- (b) Describe the mechanisms of action of superplasticizer which enable reduction in water demand of concrete by up to 30%. (7 marks)
- (c) Durability of concrete particularly to chemical actions is very much dependent on the quality of concrete in particular the concrete cover. The quality is dependent on the transport or permeation characteristics of the concrete which are the permeability, diffusivity and porosity of the concrete. Explain in detail the influence of these factors, their inter-dependent and how they affect the durability performance of concrete. (15 marks)

- END OF QUESTIONS -

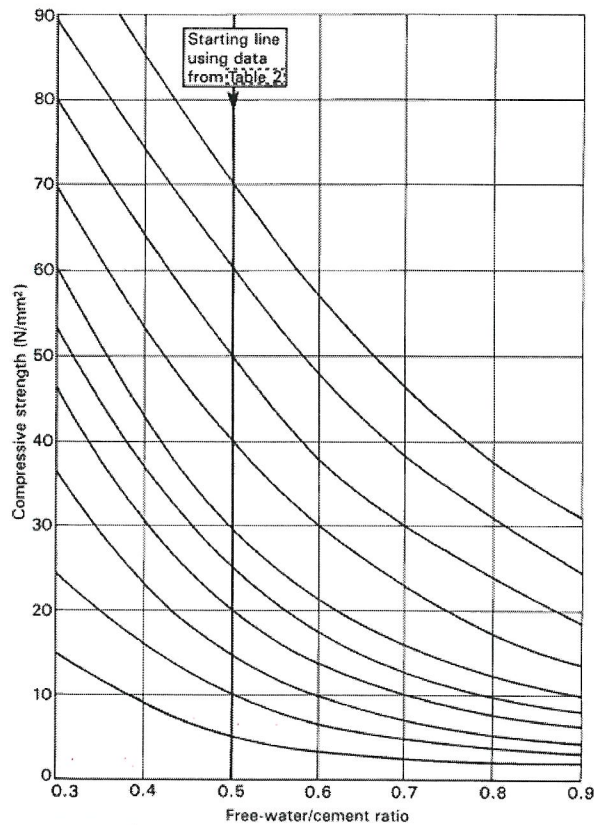
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a) Relationship between standard deviation and characteristic strength



b) Relationship between compressive strength and free-water/cement ratio

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Table 2 Approximate compressive strengths (N/mm²) 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/mm².
 1 N/mm² = 1 MN/m² = 1 MPa. (N = newton; Pa = pascal.)

c) Approximates compressive strength for cement strength Class

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

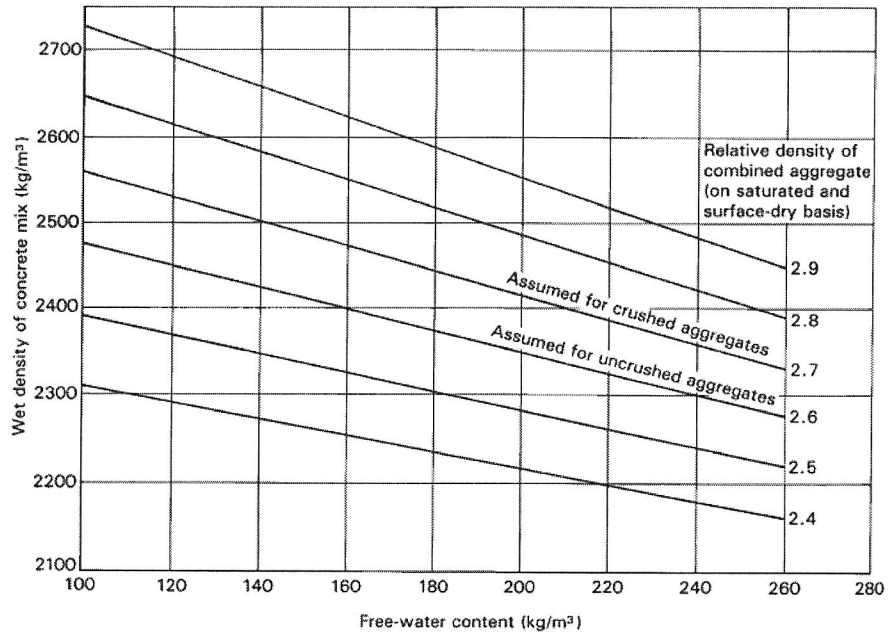
Note: When coarse and fine aggregates of different types are used, the free-water content is estimated by the expression:

d) Approximates free water contents

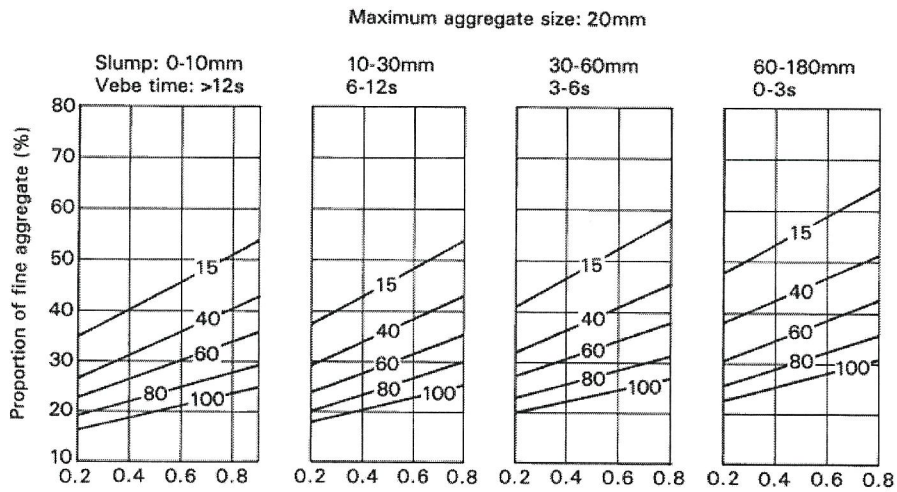


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e) Estimated wet density of fully compacted concrete



f) Free water / Cement Ratio

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FIGURE Q1