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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016**

COURSE NAME : CONCRETE TECHNOLOGY
COURSE CODE : BFS 40603
PROGRAMME CODE : BFF
EXAMINATION DATE : JUNE / JULY 2016
DURATION : 3 HOURS
INSTRUCTION : ANSWER **FOUR (4)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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- Q1** (a) List **FOUR (4)** types of physical attack and **FOUR (4)** types of chemical attack in concrete durability. (4 marks)
- (b) Explain with sketches the mechanism on how reinforcement bars in concrete structures can be corroded. (8 marks)
- (c) The steel in a moist concrete is protected against corrosion by the high alkalinity of the pore solution in concrete.
- (i) Discuss how alkalinity is decreasing due to the carbonation and chloride ions. (10 marks)
- (ii) In your opinion, does porosity and capillary pores play a role in alkalinity reduction in concrete? (3 marks)
- Q2** (a) Why adding silica fume to concrete mix enhance concrete properties? (5 marks)
- (b) Explain how does silica fume react with ordinary Portland cement in concrete with the presence of water. (10 marks)
- (c) In your opinion, what will happen if silica fume is changed to fly ash in concrete mixture? Discuss in terms of early age mechanical properties aspects. (10 marks)
- Q3** (a) Describe the meaning of polymer concrete. Discuss factors affecting properties of polymer concrete. (12 marks)
- (b) Give **TWO (2)** differences between normal strength concrete and high strength concrete. (2 marks)
- (c) High strength/performance concrete durability is affected by several factors. Briefly explain admixture factor and mix proportion factors. (11 marks)

- Q4** (a) The first defense against corrosion of steel in concrete is by controlling the quality of the concrete and sufficient covers to the reinforcing bars. Briefly discuss this matter. (12 marks)
- (b) Discuss on how to modify concrete and corrosion protection system in concrete. (13 marks)
- Q5** (a) Define the term “Free water” in the context of concrete mix proportions. In your opinion, why free water is used instead of total water when designing a concrete mix? (8 marks)
- (b) **Table Q5** is a set of result from cube compressive strength tests on a construction site. Determine the mean, standard deviation and characteristic strength of the concrete at 2.5% defective level. (15 marks)
- (c) Based on the record in **Q5(a)**, if a specified characteristic of cube strength is 40N/mm^2 , calculate the target mean strength when designing a concrete mix. (2 marks)

- END OF QUESTIONS -

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FAKULTI KEJURUTERAAN AWAM DAN ALAM BUKUKAN
JABATAN KEJURUTERAAN STRUKTUR DAN BAHAN
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Table Q5 Compressive strength of 60 cubes from a construction site

24.1	20.8	21.1	14.6	20.6	22.0	28.1	17.1	22.1	26.4
19.6	28.8	23.5	19.1	28.9	31.5	24.4	28.3	32.6	17.2
26.7	35.7	21.6	26.0	31.6	15.4	26.9	22.8	27.0	15.1
30.0	38.4	18.5	31.1	22.3	23.8	18.6	25.5	17.5	12.8
23.2	19.7	26.1	12.7	27.4	25.0	27.4	39.2	34.0	17.0
32.4	22.9	20.9	31.8	21.6	14.2	25.9	22.3	19.8	23.3

Appendix

Specified value f_c	Proportion of results below f_c
$f_c = m - 1.28s$	10%
$f_c = m - 1.64s$	5%
$f_c = m - 1.96s$	2.5%
$f_c = m - 2.33s$	1%

(a) Normal distribution is expressed as follows.

$$P(m, s) = \frac{1}{s\sqrt{2\pi}} \cdot e^{-\frac{(x-m)^2}{2s^2}}$$

(b) Standard deviation

$$s = \sqrt{\frac{\sum(x - m)^2}{n - 1}}$$

where x = an individual test result
 n = the number of results
 m = the mean of the n results.

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