
UNIVERSITI SAINS MALAYSIA

KSCP EXAMINATION
Academic Session 2007/2008

June 2008

EAS 662/4 – Teknologi Pemulihan Struktur
[Structural Retrofitting Technology]

Duration: 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of **FOUR (4)** printed pages before you begin the examination.

*[Sila pastikan kertas peperiksaan ini mengandungi **EMPAT (4)** muka surat bercetak sebelum anda memulakan peperiksaan ini.]*

Instructions: This paper consists of **FIVE (5)** questions. Answer **FOUR (4)** questions only. All questions carry the same marks.

*[Arahan: Kertas ini mengandungi **LIMA (5)** soalan. Jawab **EMPAT (4)** soalan sahaja. Semua soalan membawa jumlah markah yang sama.]*

You may answer the question either in Bahasa Malaysia or English.

[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]

All questions **MUST BE** answered on a new page.

*[Semua soalan **MESTILAH** dijawab pada muka surat baru.]*

Write the answered question numbers on the cover sheet of the answer script.

[Tuliskan nombor soalan yang dijawab di luar kulit buku jawapan anda.]

1. (a) Discuss in detail the data required for initial appraisal pertaining to cracking of reinforced concrete structures.

[12 marks]

- (b) In normal circumstances, deterioration of concrete structures usually arises from a combination of causes such as cracks due to sulphate attack or chloride induced corrosion. As a result, it is important to gather all relevant information to interpret the phenomenon. Discuss the procedure in the interpretation of the data at the stage of investigation.

[13 marks]

2. A marine reinforced concrete jetty has suffered significant deterioration due to corrosion of reinforcement. The worst affected areas are the piers which have been exposed to tidal zone.

- (a) Explain **FIVE (5)** important properties that the repair material should have in order to ensure effective and lasting repair.

[15 marks]

- (b) Suggest a suitable repair technique that you would recommend to repair the affected structural members. Explain the steps involved in the repair process.

[10 marks]

3. (a) Cathodic protection is an electrochemical technique which can be used to arrest the progress of reinforcement corrosion. List two types of cathodic protection systems and explain the basic principle how each one works. Use appropriate sketches to aid your explanation.

[15 marks]

(b) Surface treatment is normally applied to newly built structures, to existing concrete structures or to newly repaired areas in existing structures. List **FOUR (4)** modes of protection, which surface treatment or protective coating works. Provide an appropriate sketch for each mode.

[6 marks]

(c) Suggest a suitable laboratory test that can be used to assess the efficiency of surface treatment against the penetration of chloride. Using the proposed test, describe how efficiency index could be determined.

[4 marks]

4. (a) Describe briefly the mechanism how plastic shrinkage crack occurs. Explain why the use of fly ash normally exacerbates the development of plastic shrinkage crack in concrete, in particular in hot and arid environment.

[6 marks]

(b) Explain how the combined use of superplasticiser and pozzolanic material could enhance the strength and durability performance of concrete.

[12 marks]

(c) Figure 1 shows the relative compressive strength development of concretes containing fly ash (FA) in comparison to a control Ordinary Portland Cement (OPC) concrete. The FA was used as a partial cement replacement material at replacement levels of 10, 20 and 30 %. Give the probable explanation to the different trends in relative strength development for the concretes containing FA.

[7 marks]

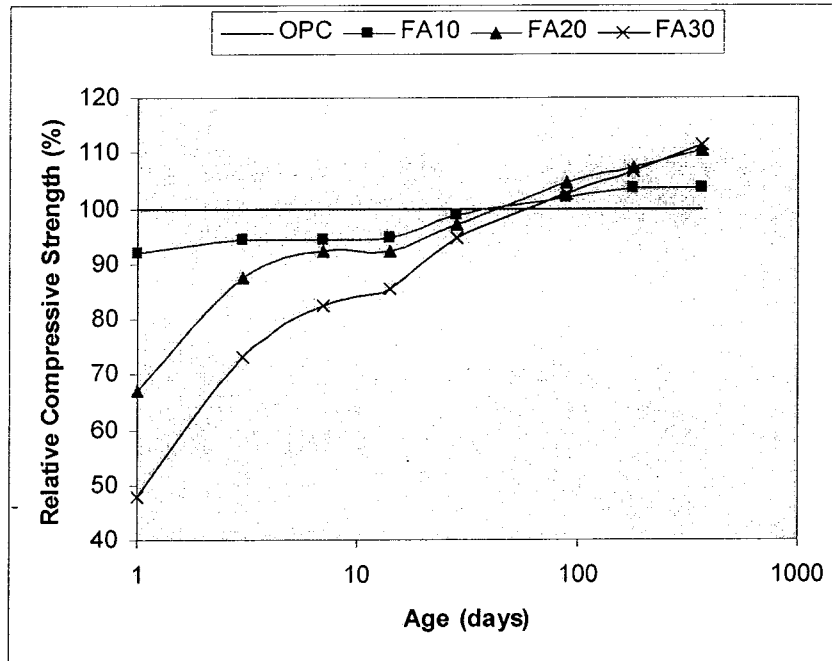


Figure 1: Relative compressive strength development of concretes containing FA.

5. (a) What is the purpose of using retarding admixtures. What are the active components in retarding admixtures. Under which circumstance, retarding admixtures are used. [5 Marks]
- (b) With appropriate sketch, explain the mechanism of wet mix process of sprayed concrete repair technique. [8 Marks]
- (c) A reinforced concrete column is deteriorated due to the increase of age and adverse environmental condition. It is necessary to improve the compressive strength of the column. To improve the compressive strength of column, identify and discuss a suitable strengthening procedure and highlight its advantages. [12 Marks]