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UNIVERSITI SAINS MALAYSIA

Peperiksaan Semester Kedua  
Sidang Akademik 2006/2007

April 2007

**EAS 355/2 – TEKNOLOGI KONKRIT LANJUTAN**

Masa : 2 jam

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

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

**Instructions:** Answer **FOUR (4)** questions only. All questions carry the same marks.

*[**Arahan:** Jawab **EMPAT (4)** soalan sahaja. Semua soalan membawa jumlah markah yang sama.]*

You may answer the question in English except one question should be answered in Bahasa Malaysia.

*[Anda dibenarkan menjawab soalan dalam Bahasa Inggeris kecuali satu soalan mestilah dijawab dalam Bahasa Malaysia.]*

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. Several piers of a highway bridge crossing a man made lake have been reported to undergo deterioration. The diagnosis of the investigation performed on the affected piers indicates that the concrete has cracked and spalled particularly at the bottom parts of the piers which have been exposed to lake water. Strength tests on some concrete core samples and further tests using scanning electron microscope and chemical analysis exhibit that strength of the concrete has reduced by a certain degree and hydrated magnesium silicate compound has appeared in the concrete cover zone of the affected areas.

*Beberapa tiang sambut bagi sebuah jambatan yang merentasi sebuah tasik buatan telah dilaporkan mengalami kemerosotan. Diagnosa daripada penyiasatan yang telah dijalankan menunjukkan konkrit telah mengalami keretakan dan pemisahan terutamanya di bahagian bawah tiang-tiang sambut yang terdedah kepada air tasik. Ujian kekuatan ke atas beberapa teras konkrit dan ujian lanjutan menggunakan mikroskop imbasan elektron serta analisis kimia menunjukkan konkrit telah mengalami pengurangan kekuatan dan sebatian magnesium silikat terhidrat dikesan pada penutup konkrit di kawasan yang terlibat.*

- a) By giving due justifications, state the most probable deterioration process at work.

(5 marks)

*Dengan memberikan justifikasi yang sesuai, nyatakan kemungkinan proses kemerosotan yang berlaku.*

- b) Explain the mechanism of the deterioration process in (a), which has led to cracking and spalling of concrete as well as reduction in concrete strength.

(12 marks)

*Terangkan mekanisma kemerosotan di (a), yang telah menyebabkan retakan dan pemisahan konkrit serta pengurangan kekuatan konkrit.*

- c) Describe the preventive measures that could be taken in the planning and construction stages to reduce the likelihood of the above deterioration process occurring.

(8 marks)

*Jelaskan langkah-langkah pencegahan yang boleh diambil di peringkat perancangan dan pembinaan untuk mengurangkan kemungkinan berlakunya proses kemerosotan seperti yang dinyatakan di atas.*

2. [a] State the **THREE (3)** key requirements of self-compacting concrete mixes.

(3 marks)

*Nyatakan **TIGA (3)** keperluan utama campuran konkrit terpadat sendiri.*

- [b] Briefly describe the **THREE (3)** classifications of concrete containing polymer.

(6 marks)

*Jelaskan secara ringkas **TIGA (3)** klasifikasi konkrit yang mengandungi polimer.*

- [c] Using appropriate sketches, explain the **FOUR (4)** stages of structure formation in concrete containing polymer.

(16 marks)

*Dengan menggunakan lakaran-lakaran yang sesuai, terangkan **EMPAT (4)** peringkat formasi struktur bagi konkrit yang mengandungi polimer.*

3. [a] Describe **FOUR (4)** objectives of performing non and/or semi destructive tests.

(6 marks)

*Jelaskan **EMPAT (4)** tujuan menjalankan ujian-ujian tanpa dan/atau separa musnah.*

- [b] Explain how the cause and the extent of corrosion of reinforcement could be assessed. You should suggest some suitable tests in your explanation.

(13 marks)

*Terangkan bagaimana punca dan tahap pengurangan tetulang boleh ditaksir. Anda perlu mencadangkan beberapa ujian dalam penerangan anda.*

- [c] Suggest **THREE (3)** tests that you may want to perform on concrete structure which has been exposed to fire. For each test suggested, give your justification why it is required.

(6 marks)

*Cadangkan **TIGA (3)** ujian yang anda mungkin jalankan ke atas struktur konkrit yang telah mengalami kebakaran. Bagi tiap-tiap ujian yang dicadangkan, berikan justifikasi kenapa ia diperlukan.*

4. Several piers of a marine jetty have undergone corrosion of reinforcement and in need of urgent repair. From the investigation that has been performed, it has been suggested that the concrete up to the depth of the reinforcement needs to be removed and replaced by suitable repair material. In several places, new reinforcement has to be fixed to supplement the existing reinforcement which has been badly corroded.

*Beberapa tiang sambut bagi sebuah jeti marin telah mengalami pengurangan tetulang dan perlukan pembaikan segera. Daripada penyiasatan yang telah dijalankan, dicadangkan supaya konkrit sehingga kepada kedalaman tetulang dibuang dan digantikan dengan bahan baik pulih yang sesuai. Di beberapa lokasi, tetulang baru perlu dipasang untuk menampung tetulang sedia ada yang telah berkarat dengan teruk.*

- a) Discuss **FIVE (5)** important properties that the repair material should have to ensure effective and durable repair work.

(20 marks)

*Bincangkan LIMA (5) sifat utama yang perlu ada pada bahan baik pulih untuk memastikan kerja baik pulih yang berkesan dan tahan lasak.*

- b) Describe a suitable repair system that you may want to propose to repair the affected piers.

(5 marks)

*Jelaskan satu system baik pulih yang anda akan cadangkan untuk membaiki kawasan tiang-tiang sambut yang terjejas.*

5. [a] Discuss **FIVE (5)** major factors which could influence the strength and durability performance of concrete.

(15 marks)

*Bincangkan LIMA (5) faktor utama yang boleh mempengaruhi kekuatan dan prestasi ketahanan lasakan konkrit.*

- [b] The use of silica fume has always been associated with significant improvement in concrete strength including the early age strength. Explain the mechanisms which lead to enhancement in strength as a result of silica fume inclusion.

(10 marks)

*Penggunaan wasap silika selalunya dikaitkan dengan peningkatan yang ketara ke atas kekuatan konkrit termasuk kekuatan awal. Terangkan mekanisma-mekanisma yang menyumbang kepada peningkatan kekuatan konkrit hasil daripada penggunaan wasap silika.*