

**SULIT**

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Second Semester Examination  
2021/2022 Academic Session

July/August 2022

**EAS357 – Sustainable Concrete Materials and Practices**

Duration : 1 hour

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Please ensure that this examination paper contains **THREE (3)** printed pages before you begin the examination.

**Instructions:** This paper contains **THREE (3)** questions. Answer **TWO (2)** questions.

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

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**SULIT**

1. As a civil engineer working for a renown ready-mixed and precast concrete producer, you are required to propose a suitable concrete mixture for the construction of a mass concrete foundation for a high-rise building. The exposure environment contains high concentration of sulphate. The concrete should be highly workable to facilitate placing and compaction of concrete in the heavily reinforced concrete foundation and should have adequate workability retention for concreting during hot weather condition. Strength requirement stipulates 28-day strength of 50 MPa.

Select the most suitable combination of admixtures that you would consider using as part of the concrete ingredients to be used in the construction of the mass concrete foundation from the listed materials to satisfy the stated conditions. Justify your selection with in-depth discussion.

- (a) Superplasticizer
- (b) Air entraining agent
- (c) Retarder
- (d) Accelerator
- (e) Metakaolin
- (f) Fly ash

[25 marks]

2. Several beams of a multistorey car park of a shopping mall in Ipoh, Perak have been reported to undergo cracking which focusses on the soffit of the beams and most of the cracks seem to appear underneath the steel reinforcements.

- (a) Suggest and explain appropriate non and/or semi-destructive tests that you would undertake in order to identify the most probable cause of the cracking and also the extent of the problem.

[10 marks]

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- (b) Explain the repair process if the deteriorated beams are to be repaired by preplaced aggregate grouting technique with the help of suitable sketches.

[15 marks]

3. (a) Method of concrete placing is important to place the concrete into position quickly and in a condition that allows it to be compacted and finished correctly with ease. Briefly describe **FIVE (5)** basic requirements in placing concrete.

[5 marks]

- (b) The American Concrete Institute (ACI) defines “Mass Concrete” as “any volume of concrete with dimensions large enough to require that measures be taken to cope with the generation of heat from the hydration of cement and the associated volume change to minimize cracking”. This phenomenon causes undesirable thermal stresses, cracking, and deleterious chemical reactions, consequently reducing the long-term performance of concrete structures. With these weaknesses, suggest **THREE (3)** appropriate strategies to reduce undesirable thermal stress in mass concrete.

[8 marks]

- (c) High-performance concrete must have several important criteria in its characteristics. Briefly describe **SIX (6)** characteristics of high-performance concrete as a construction material.

[12 marks]

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