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University Examinations 2024/2025

FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE MASTER OF SCIENCE IN CHEMISTRY AND MASTER OF SCIENCE IN CEMENT AND CONCRETE

SCT 7121: CONCRETE DURABILITY

DATE: JANUARY 2024 **TIME: 3 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

1. Define the following terms

a) Permeability (2 marks)

b) Corrosion with respect to reinforced concrete (2 marks)

c) Define alkali-silica reaction (ASR) (2 marks)

d) Bio-deterioration in concrete (2marks)

2. What role do admixtures play in enhancing the durability of concrete? (4 marks)

3. Explain how the choice of aggregate impact concrete durability (4 marks)

4. What is the significance of proper curing in enhancing the durability of concrete? (4 marks)

5. Explain four main factors influencing the resistance of concrete to conventional sulphate attack (4 marks)

6. Distinguish between chloride diffusion and diffusivity in concrete (2 marks)

7. Explain why the pore solution in concrete should have high pH (typically in the range of 12 to 13) (4 marks)

QUESTION TWO (15 MARKS)

1. Explain the main factors that affect the durability of concrete (10 marks)

2. Discuss the significance of the (high and reduced) permeability of concrete in relation to its durability (5 marks)

QUESTION THREE (15 MARKS)

1. Describe the impact of alkali-silica reaction (ASR) on concrete durability (2 marks)

2. Discuss the factors that commonly trigger corrosion in reinforced concrete in relation to its durability (5 marks)

3. Using the porubate diagram, discuss corrosion of reinforced concrete (8 marks)

QUESTION FOUR (15 MARKS)

a) Explain the term 'delayed ettringite formation in concrete' (2 marks)

b) Explain the factors that contribute to the occurrence of Delayed ettringite Formation (8 marks)

c) Outline the main agents that can cause concrete deterioration as per BS 7543 (5 marks)

QUESTION FIVE (15 MARKS)

Discuss the influence of various concrete constituent characteristics on bleeding and plastic shrinkage cracking (15 marks)