



**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**UNIVERSITY REGULAR EXAMINATIONS
2021/2022 ACADEMIC YEAR**

FIRST YEAR SECOND SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
MASTER OF SCIENCE IN STRUCTURAL ENGINEERING**

COURSE CODE: CSE 824

**COURSE TITLE: ADVANCED STRUCTURAL CONCRETE
AND PRESTRESSED DESIGN**

DATE: FRIDAY 29TH APRIL 2022 TIME: 8.00 – 11.00 AM

INSTRUCTIONS:

1. This paper contains **FIVE** questions.
2. Answer any **FOUR** Questions.
3. Marks for each question are indicated in the parenthesis.
4. State clearly any engineering assumption made.
5. Examination duration is **3 Hours**.

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over.

QUESTION ONE (25 MARKS)

Production of concrete using cement can be described as “unsustainable” due to the emission of embodied carbon dioxide. Based on BS 8500, the production of concrete considers sustainability. Discuss the major factors considered in the design of sustainable concrete according to BS 8500.

QUESTION TWO (25 MARKS)

A twenty-storey reinforced concrete building is to be constructed along the coastal region. The client requires that the project construction be accelerated and with limited formwork to save on time and money respectively. As the project engineer, design the high-performance concrete for the project under the prevailing circumstances.

QUESTION THREE (25 MARKS)

Concrete is susceptible to “aggressive environment” as its durability is reduced in such environments. Discuss the ‘aggressive factors’ for concrete structures in marine environment. Describe also the steps in designing concrete in aggressive chemical environment based on the BRE recommendations.

QUESTION FOUR (25 MARKS)

A 12m single-span, simply-supported prestressed post-tensioned concrete beam is to be designed to carry 50kN/m permanent load (excluding self-weight) and 75kN/m variable load. Due to prevailing circumstances, the total prestress losses should be 24%, permissible tensile stresses should be 2.5 N/mm² at transfer and 2.0 N/mm² in service and permissible compressive stresses should be 40 N/mm² at transfer and at service. Determine an appropriate rectangular section for the member taking the density of prestressed concrete to be 24 kN/m³.

QUESTION FIVE (25 MARKS)

In the design of prestressed prefabricated concrete, one needs to delineate the B-regions and the D-regions.

- a) With illustrations of a typical framed system, discuss the B-regions and D-regions. (13Mks)
- b) Describe the steps for the design of disturbed regions by strut and tie model. (12Mks)

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