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

**UNIVERSITY EXAMINATIONS  
2021 / 2022 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER MAIN EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE IN PHYSICS WITH APPROPRIATE  
TECHNOLOGY**

**COURSE CODE:   SPH 323**

**COURSE TITLE:   GLASS CEMENT AND CONCRETE**

**DATE: TUESDAY 26<sup>TH</sup> APRIL, 2022   TIME: 12:00PM - 2:00 PM**

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**INSTRUCTIONS TO CANDIDATES**

TIME: 2 Hours

Answer question ONE and any TWO of the remaining.

Symbols used bear the usual meaning.

MMUST observes ZERO tolerance to examination cheating

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

**QUESTION ONE (30 MARKS)**

- a) Differentiate between Glass, Cement and Concrete (3 marks)
- b) Low tensile strength of cement paste is a result of low fracture toughness, describe four ways in which the flaws can be reduced (4 marks)
- c) A relatively large plate of a glass is subjected to a tensile stress of 40 MPa. If the specific surface energy and modulus of elasticity for this glass are 0.3 J/m<sup>2</sup> and 69 GPa, respectively, determine the maximum length of a surface flaw that is possible without fracture. (4 marks)
- d) Describe the procedures of working of glass (4 marks)
- d) Differentiate between glass production and forming processes (4 marks)
- e) Describe the compressive strength of cement measurement (3 marks)
- f) Illustrate the press and blow industrial production process of Coca cola glass bottle (4 marks)
- g) Discuss the procedure used to determine strength of hardened concrete (4 marks)

**QUESTION TWO (20 MARKS)**

- a) Discuss how thermal conductivity is improved in concrete structures a case study of Bridge structures (6 marks)
- b) A reinforced concrete column 200mm in diameter is designed to carry an axial compressive load of 300KN. Determine the required area of the reinforcing steel if the allowable stresses are 6MPa and 120MPa for concrete and steel respectively. Use  $E_{concrete} = 14GPa$  and  $E_{steel} = 200GPa$  (14 marks)

**QUESTION THREE (20 MARKS)**

Discuss the chemistry of cement (20 marks)

**QUESTION FOUR (20 MARKS)**

Discuss the effect of silica fumes admixture in a concrete mix in terms of mechanical properties of the structure (20marks)

**QUESTION FIVE (20 MARKS)**

The following data were obtained during a tension test of concrete member. The initial diameter of the test specimen was 0.505cm and the gauge length was 2.0cm

Load (Kg)	Elongation (cm)	Load (Kg)	Elongation (Kg)
0	0	14000	0.020
2310	0.0022	14400	0.025
4640	0.0044	14500	0.060
6950	0.0066	14600	0.080
9290	0.0088	14800	0.100
11600	0.0110	14600	0.120
12600	0.0150	13600	Fracture

Plot the stress-strain diagram and determine the following mechanical properties (a) Proportional limit (b) Modulus of elasticity (c) Yield point (d) Yield strength at 0.2% offset (e) Ultimate strength and (f) Rupture strength (20 marks)