KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BSC (PHYSICS)

COURSE CODE: SPH 426E

COURSE TITLE: MATERIAL SCIENCE AND POLYMER PHYSICS

DURATION: 2 HOURS

DATE: TUESDAY 19TH DECEMBER 2017 **TIME:** 11.30 AM – 1.30 PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Question one has a total of **30 marks** whereas questions two to five is each **20 Marks**
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of 2 printed pages. Please Turn Over

QUESTION ONE (30 MARKS)

a) Differentiate between cement and concrete (2 marks)
b) Describe the two common structural composites the Laminar and sandwich (2 marks)
c) 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)
d) Discuss the structure of Portland cement (4 marks)
e) Describe polymers in terms of their molecular arrangement (2 marks)
f) Show that the minimum cation-to-anion ratio for the coordination number 3 is 0.155 for a given molecule (5 marks)
g) Describe the process of extraction of pure Copper from its ore (3 marks)
h) Describe the cystal structure of ceramic materials (4 marks)
i) Discuss the processes of Crushing and Pulverization as used in metallurgy (4 marks)

QUESTION TWO (20 MARKS)

a) Discuss three steps involved in extraction of metals from their ores (8 marks)
b) A continuous and aligned glass fibre-reinforced composite consists of 40 vol% of glass fibres having a modulus of elasticity of 69GPa and 60vol% of a polyester resin that, when hardened displays a modulus of 3.4GPa
   i) Compute the modulus of elasticity of this composite in the longitudinal direction
   ii) If the cross-sectional area is $250mm^2$ and a stress of 50MPa is applied in this longitudinal direction compute the magnitude of the load carried by each of the fiber and matrix phases
   iii) Determine the strain that is sustained by each phase when the stress in part (ii) is applied (12 marks)

QUESTION THREE (20 MARKS)

a) Discuss the structure of Portland cement (5 marks)
b) Discuss the chemistry of cement (15 marks)

QUESTION FOUR (20 MARKS)

a) Discuss the chemistry of polymer molecules which include polyethylene, PVC, PTFE, Polypropylene, polystyrene and PMMA (12 marks)
b) Discuss the molecular structure of polymers (8 marks)

QUESTION FIVE (20 MARKS)

Discuss the process of extraction of the following metals
(a) Iron (14 marks)
(b) Zinc (6 marks)