

LAIKIPIA



UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER 2023/2024 ACADEMIC YEAR

**SECOND YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE (GENERAL) AND BACHELOR
OF EDUCATION (SCIENCE)**

PHYS 222: INTRODUCTION TO MATERIAL SCIENCE

STREAM: R

TIME: 2 HRS

DAY: THURSDAY [11.30A.M – 1.30P.M] DATE: 11/04/2024

THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES

PLEASE DO NOT OPEN UNTIL THE INVIGILATOR SAYS SO.



INSTRUCTIONS TO CANDIDATE**SECTION A: (Compulsory) TOTAL MARKS FOR THIS SECTION IS (40 MARKS)****QUESTION ONE (40 MARKS)**

- a) Define what is meant by the term material science and explain its significance in various fields of engineering. **(4 Marks)**
- b) Describe the atomic structure of materials and explain how it influences their mechanical properties. **(6 Marks)**
- c) Discuss the relationship between microstructure and properties in materials. **(4 Marks)**
- d) Explain the concept of phase diagrams and their importance in material science. **(6 Marks)**
- e) State the role of material characterization techniques in material science and provide two examples of commonly used techniques. **(4 Marks)**
- f) Explain the concept of magnetism in materials. **(2 Marks)**
- g) Explain the three hardness testing methods. **(6 Marks)**
- h) Describe common four types of corrosion and methods for preventing corrosion in engineering materials. **(8 Marks)**

SECTION B. TOTAL MARKS FOR THIS SECTION IS (30 MARKS)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION. EACH QUESTION IN THIS SECTION CARRIES 15 MARKS.

QUESTION TWO (15 MARKS)

- a) Discuss four the role of material selection in engineering design and provide examples of materials suitable for specific applications. **(8 Marks)**
- b) Explain the concept of crystal structure in materials and its significance in determining material properties **(3 Marks)**
- c) Explain the factors influencing diffusion and provide examples of diffusion processes in different materials **(4 Marks)**

QUESTION THREE (15 MARKS)

- a) Define alloying as used in material science **(2 Marks)**
- b) Discuss two effects of alloying on material properties and provide examples of alloying elements used in engineering materials. **(4 Marks)**
- c) Discuss three factors influencing electrical conductivity. Provide examples of materials with high and low electrical conductivity and their applications. **(9 Marks)**



QUESTION FOUR (15 MARKS)

- a) Explain the concept of thermal conductivity and its importance in material selection for heat transfer applications. **(5 Marks)**

- b) Describe the five types of mechanical properties exhibited by materials and their significance in engineering applications **(10 Marks)**

QUESTION FIVE (15 MARKS)

- a) What is a polymer? **(1 Mark)**
- b) Explain the three classifications of polymers based on molecular structure. Provide examples of polymers for each classification. **(9 Marks)**
- c) State five advantages of composites in engineering applications. **(5 Marks)**

