



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**THIRD YEAR FIRST SEMESTER
SPECIAL/SUPPLEMENTARY EXAMINATIONS**

FOR THE DEGREE OF BSC (PHYSICS)

COURSE CODE: SPC 311

COURSE TITLE: SOLID STATE PHYSICS I

DURATION: 2 HOURS

DATE: 10/01/2022

TIME: 8-10AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the drawing paper.
- Answer each question on a separate drawing paper.



QUESTION ONE (30 MARKS)

- a) State two methods of determining crystal structure (2mks)
- b) Explain two applications of X-ray diffraction (3mks)
- c) Differentiate between intrinsic semi-conductors and metals (2mks)
- d) Explain the free electron model of metallic Solids (2mks)
- e) Explain five importance of miller Indices (5mks)
- f) State Wiedemann franz law (2mks)
- g) Explain five general characteristics of metals (5mks)
- h) Discuss five effects of impurities in the structure and properties of solids (4mks)
- i) Differentiate between interplanar distance and atomic radius (2mks)
- j) State three classes of solids (3mks)

QUESTION TWO (20 MARKS)

- a) Determine the inter atomic spacing when the glancing angle of 30° is observed during first order reflection in a crystal plane. Miller Indices as (111) given that the wavelength of X-ray is 2.0×10^{-10} M (6mks)
- b) In a single cubic Crystal. Find the ration of the intercept on the three axes by (1,2,3) plane (5mks)
- c) What is miller indices and outline steps involved in determining miller indices of a plane (9mks)

QUESTION THREE (20 MARKS)

- a) Discuss four types of crystal defect (8mks)
- b) Discuss three types of primary bonds found in different materials (6mks)
- c) Discuss four ways in which impurities affects structure and properties of solids (6mks)

QUESTION FOUR (20MARKS)

- a) Determine interatomic spacing when the glancing angle of 30° is observed forming first order reflection in a crystal lens Miller index as (111) given that the crystal length is 2.0×10^{-10} m (5mks)
- b) Discuss five mechanical properties of solids (10mks)
- c) Discuss five importance of miller indices (5mks)

QUESTION FIVE (20MKS)

- a) Show that atomic packing factor of HCP crystals is 0.74 (9mks)
- b) Magnesium has HCP structure, the radius of Magnesium atom is 0.1605nm. Calculate the volume change of unit cell of magnesium (6mks)
- c) Explain four behavior of a crystal that influences and determination of crystal plane (5mks)