



KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER
SUPPLEMENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE) AND BSC (PHYSICS)

COURSE CODE: SPH 311

COURSE TITLE: SOLID STATE PHYSICS I

DURATION: 2 HOURS

DATE 05/10/2018

TIME: 3:00-5:00PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- 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 3 printed pages. Please Turn Over



KIBU observes ZERO tolerance to examination cheating

QUESTION ONE: [30 marks]

- a) Identify **three** classes of solids [1]
- b) Explain **two** applications of X-Ray Diffraction [4]
- c) Briefly explain the following terms:
 - i. Unit cell [2]
 - ii. Wigner-Seitz cell [2]
 - iii. Reciprocal lattice [2]
 - iv. Crystal constants [2]
- d) X-rays with wavelength 1.534 \AA are reflected from planes with $d=1.212 \text{ \AA}$. Calculate the Bragg angle θ for constructive interference. [2]
- e) Explain the term 'Bravais lattice' then state the 5 Bravais lattice types in two-dimension. [5]
- f) State the Wiedemann–Franz law and state **four** of its limitations [3]
- g) Calculate the atomic packing factor for a FCC structure. [4]
- h) Briefly describe the general characteristics of metals. [3]

QUESTION TWO: [20 marks]

- a) How do impurities affect the structure and properties of a solid? [10]
- b) Discuss the **four** types of crystal defects [10]

QUESTION THREE: [20 marks]

- a) What are Miller indices? Outline the steps involved in determining the Miller indices of a plane. [8]
- b) Explain **four** behaviours of the crystal that influences the determination of the crystal planes. [12]

QUESTION FOUR: [20 marks]

- a) What is a Wigner-Seitz cell? [2]
- b) Explain the Wigner-Seitz Method. [8]
- c) Construct a hexagonal shape. Use it to construct a Wigner-Seitz cell. [10]

QUESTION FIVE: [20 marks]

- a) Explain the free electron model of metallic solid [2]
- b) Identify **four** experimental phenomena that can be explained by the free electron model [8]
- c) Discuss the diamond structure. [10]

The End