



EMBU UNIVERSITY COLLEGE

(A Constituent College of the University of Nairobi)

2015/2016 ACADEMIC YEAR

SECOND SEMESTER EXAMINATION

FOURTH YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SPH 403: SOLID STATE PHYSICS II

DATE: APRIL 13, 2016

TIME: 11:00-1:00PM

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions

QUESTION ONE

- a) What guides atomic motions in lattice vibrations? (2 Marks)
- b) How are sound waves propagated in crystals of solids? (4 Marks)
- c) What is the simplest structure of a crystal? (3 Marks)
- d) Differentiate between thermal conductivity and thermal expansion. (4 Marks)
- e) What is the basis of quantum free electron theory? (2 Marks)
- f) What are electrons? (2 Marks)
- g) Give one application of reciprocal lattice. (2 Marks)
- h) Briefly describe diffraction of x-rays in crystalline solids. (3 Marks)
- i) Calculate the longest wavelength that can be analyzed by a rock salt crystal of spacing $d = 2.82 \text{ \AA}$ in the first order. (4 Marks)
- j) What lattice vibration with respect to crystalline solids? (2 Marks)
- k) What is super conductivity in solids? (2 Marks)

- 1) The total area of a glass window pane is 0.5 m^2 . The temperature on the inside surface is $23 \text{ }^\circ\text{C}$ and on the outside surface is $2 \text{ }^\circ\text{C}$. Calculate how much heat is conducted per hour through the glass window pane if the thickness of the glass is 0.6 mm . (4 Marks)

QUESTION TWO

Explain a typical magnetization and hysteresis curves for a ferromagnetic material. (20 Marks)

QUESTION THREE

Show that for lattice vibrations of a one dimensional crystal consisting of a chain of identical atoms, the maximum frequency is given by: (20 Marks)

$$\omega_{max} = \sqrt{\frac{4k}{m}}$$

QUESTION FOUR

Briefly describe how crystallography by powder method can be used to determine the interplaner distance d in solids. (20 Marks)

QUESTION FIVE

Using one dimensional Schrodinger's equation for a free particle for $V = 0$, show that:

$$E_n(x) = \frac{h^2 n^2}{8mL^2}$$

--END--