



NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF PHYSICS
2025_1 EXAMINATION

COURSE CODE: PHY407
COURSE TITLE: SOLID STATE PHYSICS II
CREDIT UNIT: 3
TIME ALLOWED: (3 HRS)
INSTRUCTION: Answer question 1 and any other three questions
QUESTION 1

- (a) Explain what is meant by dielectric materials with examples **(8marks)**
- (b) Define electric susceptibility **(5marks)**
- (c) Describe the term diamagnetic substances with examples **(7marks)**
- (d) Define point defects **(5marks)**

QUESTION 2

- (a) State and explain the three parts of total polarisability of an atom **(5marks)**
- (b) Write the expression for electronic polarizability and define its terms **(4mark)**,
- (c) Calculate the electronic Polarization of argon atom. Giving at roentgen 1.0024 at NTP and $N = 2.7 \times 10^{25} \text{ molecule } m^{-3}$. **(6marks)**

QUESTION 3

- (a) Write the Langevin equation and define its terms **(5marks)**,
- (b) Write the Weiss field expression and define the terms **(4marks)**,
- (c) A paramagnetic sample shows a net magnetization of $0.8 A m^{-1}$, when placed in an external magnetic field of strength $0.8 T$ at a temperature $5 K$. When the same sample is placed in an external magnetic field of $0.4 T$ at a temperature of $20 K$, what is the magnetization? **(6marks)**,

QUESTION 4

- (a) (i) What is a diamagnetic material? Give one example **(2mark)**,
(ii) If water is boiled at 373 K, what is the change in diamagnetic susceptibility of water? **(3marks)**,
- (b) Write the expression for the magnetic susceptibility and define its terms **(4mark)**,
- (c) A magnetic material has a magnetization of $2200 A/m$ and flux density $0.0033 \text{ weber}/m^2$. Calculate the magnetization force and the relative permeability of the material **(6marks)**,

QUESTION 5

- (a) List the causes of defects in solids **(4mark)**,
- (b) (i) Explain how line defect is formed **(2mark)**,
(ii) State how grain size can be quantified **(3mark)**,
- (c) Explain the edge dislocation of a particle in a lattice **(6mark)**,