



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PHYSICS**  
**2025\_2 EXAMINATIONS**

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**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) Define solid state physics **5marks**
- (b) State four types of polarizability **8marks**
- (c) Explain the term paramagnetic materials with two examples **7marks**
- (d) Define a crystalline defect **5marks**

**QUESTION 2**

- (a) State the four properties of dielectric properties of solids **(6marks)**
- (b) Write the relation for the capacitance of a capacitor and explain its terms **(4marks)**
- (c) If an ionic crystal material subjected toward an electric field by  $1000 \text{ Vm}^{-1}$  and the resulting polarization  $4.3 \times 10^{-8} \text{ cm}^2$ . Calculate of relative permittivity of NaCl. **(5marks)**

**QUESTION 3**

- (a) (i) Define the term magnetisation. **(3marks)**  
(ii) Write the mathematical expression for magnetisation and explain its terms. **(5marks)**
- (b) A paramagnetic sample shows a net magnetisation of  $8 \text{ Am}^{-1}$  when placed in an external magnetic field of  $0.6 \text{ T}$  at a temperature of  $4 \text{ k}$ . when the same sample is placed in an external magnetic field of  $0.2 \text{ T}$  at a temperature of  $16 \text{ k}$ , the magnetisation will be. **(7marks)**

**QUESTION 4**

- (a) Explain what is meant by Nuclear magnetic resonance (NMR) **(5marks)**
- (b) Write an expression for relative permeability and explain its terms **(4marks)**
- (c) A magnetic material has a magnetization of  $3300 \text{ A/m}$  and flux density  $0.0044 \text{ weber/m}^2$ . Calculate the magnetization force and the relative permeability of the material. **(6marks)**

**QUESTION 5**

- (a) List five major categories of crystalline defects. **(5marks)**
- (b) Explain the concept of grain boundaries **(6marks)**
- (c) List the categories of grain boundaries **(4marks)**