**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**14/16 AHMADU BELLO WAY, VICTORIA ISLAND, LAGOS**

**SCHOOL OF SCIENCE AND TECHNOLOGY**

**JUNE/JULY EXAMINATION**

**COURSE CODE: PHY407**

**COURSE TITLE: Solid State Physics II**

**TIME ALLOWED:3 Hours**

**INSTRUCTION: Answer any five questions.**

PHYSICAL CONSTANTS:

Speed of light $c=2.9979 ms^{-1}$; mass of electro $m\_{e}=0.9110×10^{-31}kg$; Electronic charge $e=1.6022×10^{-19}C$; Avogadro’s number $N\_{A}= 6.0221×10^{26}kmol^{-1};$ Boltzmann constant $k=1.3806×10^{-23}JK^{-1}$; Plank’s constant $h=6.6257×10^{-34}Js$; $μ\_{0}=4π×10^{-7}Henry/m$.

1. (a) (i)Write down the equation for the field of an electric dipole**4 marks**

(b) Two water molecules each having dipole moment $6.2×10^{-30}$Cm point in the same direction along the line joining the centres. Calculate the electric field due to dipole-dipole interaction when the centres are $3.1×10^{-10}m$ apart. **10 marks**

2. (a) what do you understand by polarization in dielectrics **6 marks**

(b) Obtain the Clausius-Mossotti formula relating microscopic dielectric constant with macroscopic polarization. **8 marks**

3. (a) What do you understand by depolarization field?**4 marks**

(b) Obtain the relation among polarization$\vec{P}$ in solid dielectric the electric field $\vec{E}$ and electric flux density or the electric displacement vector$\vec{D.}$**10 marks**

4. (a)What do you understand by dipole *relaxation time*?**4 marks**

(b) Find the frequency dependence of the electronic polarizability of an electron having the resonance frequency *ω*o, treating the system as a simple harmonic oscillator.**10 marks**

5. (a)Briefly explain what is meant by*paramagnetism*. Give two examples of

paramagnetic material.**4 marks**

(b) Obtain the Langevin function and define all the symbols used in it.**10 marks**

6. (a) What are *ferromagnetic materials?*Give two examples of

Ferromagnetic materials.**4 marks**

(b)Derive the relation of Curie-Weiss law.**10 marks**

7. (a) Mention four of the major defects in crystals.**4 marks**

(b) Write short notes on

(i) Twin boundaries**5 marks**

(ii) Interstcialcy.**5 marks**