NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCE

SEPTEMBER 2020_1 EXAMINATIONS

COURSE CODE: PHY 404
COURSE TITLE: ELECTRODYNAMICS III
CREDIT UNIT: 3
TIME ALLOWED: (2½ HRS)

INSTRUCTION: ***Answer question 1 and any other four questions***

QUESTION 1

a) Discuss the propagation of plane wave in unbounded isotropic media. **4 marks**

i) Mention any four (4) waves in nature **4 marks**

b) Distinguish between transverse and longitudinal wave **4 marks**

c) Write the differential form of Maxwell equation. **6 marks**

d) Differentiate between isotropic medium and unbounded isotropic medium **4 marks**

QUESTION 2

a) Show mathematical representation of the following:

(i) Magnetic field in y- direction **2 marks**
(ii) Electric field in z- direction **2 marks**
(iii) Circular polarization of plane wave **2 marks**

b) Give the mathematical expressions of the following laws:

i) Ampere's law of electromagnetism **2 marks**
ii) States Faraday's law of electromagnetism **2 marks**
iii) States Gauss's law of electromagnetism **2 marks**

QUESTION 3

a) Give the wave equations for magnetic and electric field for an insulating medium. **6 marks**

b) Give any four (4) parameters in conducting medium with their symbols. **4 marks**

c) Explain the term skin depth. **1 mark**

d) Explain the term Skin effect. **1 mark**

QUESTION 4

a) Show that work done in transferring a charge from one plate of the capacitor to the other plate is $W=\frac{1}{2}CV^2$ **5 marks**

b) Electrode-diaphragm pressure transducer has a plate whose area is $5X10^{-3}$ m and distance between plates is $1x10^{-3}$m. Calculate the capacitance if it is measures air pressure. The dielectric constant K=1. **5 marks**

c) What is energy density of electric field? **2 marks**

QUESTION 5

a) In electrodynamics terms, Show that $\mu_E = \frac{1}{2}DE$. **3 marks**

b) Given that the refractive index, n, of water for waves of frequency 100MHz is 9. Calculate the reflection and transmission coefficients of the medium. **3 marks**

c) Write reflection coefficient in terms of pointing vector. **3 marks**

d) Write transmission coefficient in terms of pointing vector. **3 marks**

QUESTION 6

a) List the components of electromagnetic waves spectrum. Give frequency range of each.

7 marks

b) Give examples of anisotropic medium. **5 marks**