COURSE CODE: PHY404
COURSE TITLE: ELECTRODYNAMICS III
CREDIT UNIT: 3
TIME ALLOWED: (3 HRS)
INSTRUCTION: *Answer question 1 and any other three questions*

QUESTION 1
(a) Write the expression for the (i) characteristic impedance (ii) speed of propagation of signals in transmission lines (10 marks)
(b) What is a plane-polarized wave? (5 marks)
(c) Calculate the cutoff frequency for the TE10 mode in a rectangular waveguide with dimensions $a = 5\ cm\ and\ b = 1\ cm$. Assume the waveguide is air-filled (6 marks)
(d) Define the term isotropic medium (4 marks).

QUESTION 2
(a) List two major characteristics of a plane wave (4 marks)
(b) Write the wave equations of electric and magnetic fields in an insulating medium and explain the terms involved (8 marks)
(c) Define a dipole (3 marks)

QUESTION 3
(a) Write the mathematical equation for the refractive index of an isotropic medium (3 marks)
(b) Write the waveguide equation for a parallel plate and two pairs of parallel plates(10 marks)
(c) What is a Poynting vector? (2 marks)

QUESTION 4
(a) What is cut-off frequency in the waveguides? (3 marks)
(b) Given that the refractive index of water for waves of frequency $100MH_z$ is 9 (n = $\sqrt{\varepsilon_r}$) varies with frequency. Calculate the reflection and transmission coefficients of the media. (9 marks)
(c) What is transmission lines (3 marks)

QUESTION 5
(a) Write the relationship between electric and magnetic fields in an electromagnetic wave (6 marks)

(b) With the aid of mathematically representation, explain the concept of group velocity and phase velocity in wave propagation. (9 marks)

QUESTION 6
(a) What is a wave? (3 marks)
(b) What is skin depth (2 marks)
(c) explain the concept of resonance (10 marks)