ELIZADE UNIVERSITY ILARA MOKIN, ONDO STATE

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND SEMESTER EXAMINATION, 2018/2019 ACADEMIC SESSION

COURSE TITLE: ELECTROMAGNETIC WAVES

COURSE CODE: EEE 314

EXAMINATION DATE: 12TH JULY, 2019

COURSE LECTURER: PROF. SOLOMON ADENIRAN

HOD's Signature

TIME ALLOWED: 2 HOURS 40MINUTES

INSTRUCTION

1. ANSWER ANY **FIVE** QUESTIONS
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE NOT ALLOWED TO BORROW ANY WRITING MATERIALS AND CALCULATORS DURING THE EXAMINATION.
4. SMART WATCHES ARE NOT ALLOWED IN THE EXAMINATION HALL

1 (a) State Maxwell equations.

(b) What amendment did Maxwell do to Ampere's circuital law?

(c) What is the Maxwell's equation for a material media?

2 (a) Define Poynting vector, explaining things that will make it clear to a first timer.

(b) Given $E_x = 11e^{-j(15\pi z - 90t)}$, what is H_y assuming there are no other components of the wave? Obtain the following:

(i) velocity of propagation,

(ii) propagation constant, and

(iii) the Poynting vector.

3 (c) Derive the Three Maxwell's equations from the two Gauss equations and the Faraday's law of induction.

(b) A magnetic wave component in y direction is given as $H_y = 16\cos(k_1 x)\, e^{j\omega t - \gamma y}$, compute the components E_x, E_z, E_y, H_x, and H_Z

4 (a) A ray of electric field is incident on the boundary between two dielectrics. The ray enters the boundary at an angle of 30° to the vertical through the first dielectric with constant $3\varepsilon_0$ and emerges inside the second dielectric of $17\varepsilon_0$. Compute the angle at which the ray emerges in the second dielectric.

(b) Assume the ray is magnetic in nature and no charge flows over the boundary, compute the angle by which the ray emerges in the second dielectric.

5 (a) Derive the two wave equations for an empty space.

(b) Assume a plane wave in an open region, solve the equation $\nabla^2 \vec{E} - \mu\varepsilon\frac{\partial^2 \vec{E}}{\partial t^2} = 0$ for the electric field.

6 (a) Calculate the charge density giving rise to the following electric field densities:

(i) $\vec{D} = 6y\hat{y}$ (ii) $\vec{D} = 201x\hat{x}$ and (iii) $\vec{D} = 29\hat{y} + 101z\hat{z}$

(b) $\nabla X \vec{H} = \vec{J}_{cond} + \vec{J}_{conv} + \frac{\partial \vec{D}}{\partial t}$. Define all the symbols and explain the equation.

(c) Derive the Maxwell's fifth equation or continuity equation $\nabla . J = -\frac{\partial \rho}{\partial t}$.

7 (a) Discuss the reason(s) why a man standing in a clear water sees his feet in the water as shortened and bent.

(b) Derive the boundary conditions at the interface between a dielectric and a conductor for a magnetic field. Assume there is no current sheet at the interface.