NATIONAL OPEN UNIVERSITY OF NIGERIA
Plot 91, Cadastral Zone, Nnamdi Azikwe Expressway, Jabi, Abuja.

FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
October Examination 2019

Course Code: **MTH417**
Course Title: **Electromagnetic Theory**
Credit Unit: **3**
Time allowed: **3 Hours**
Instruction: **Answer Question Number One and Any Other Four Questions**

1. (a)State and briefly explain the four Maxwell's equations of electromagnetism. **(8 marks)**

(b) State the Stokes theorem for electromagnetic flux **(2 marks)**

(c) State the Gauss's divergence theorem **(2 marks)**

(d) Derive the laws of reflection and refraction **(10 marks)**

2. (a) Describe a brief experiment to demonstrate Lorentz force law. **(7 marks)**

(b) Explain the term "relaxation time" of a conducting medium with relevant equations **(5 marks)**

3 (a) Apply the boundary conditions on electric and magnetic fields to derive the laws of reflection and refraction. **(4 marks)**

(b) Show that the direction of the transmitted wave in a good conductor must be (close to the) normal to the surface. **(5 marks)**

(c) Write down the four Maxwell's equations in their differential forms **(3 marks)**

4. (a) Explain the term constitutive relations in electromagnetic theory with an analogy from continuous medium mechanics. **(8 marks)**

(b) Why do we consider light waves are transverse waves*?* **(4 marks)**

5. (a) By considering the continuity equation, state the condition of the currents if the change density is time independent **(4 marks)**

(b) Relate Gauss's divergence theorem to Maxwell's equations. **(8 marks)**

6 (a) Describe the phenomenon of reflection and refraction of plane waves at boundaries. **(6 marks)**

(b) Derive the properties of a reflected and transmitted waves, for a given incident wave. **(6 marks)**