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

FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
Examination 2021_2

Course Code: **MTH 417**
Course Title: **Electromagnetic Theory**
Credit Unit: **3**
Time Allowed: **3 Hours**
Instruction: **Attempt Number One (1) and Any Other (4) Questions**

1. (a) What forms the basis of classical electrodynamics, classical optics and electric circuits? **(3 marks)**

   (b) Describe the combined force law known as Lorentz force **(4 marks)**

   (c) State the four fundamental constitutive relationships to describe the response of a medium to a variety of electromagnetic input. **(4 marks)**
   (d) Define each of the following:
   (i) Gauss's law **(4 marks)**
   (ii) Ampere's law **(3 marks)**
   (iii) Faraday's law **(4 marks)**

2. (a) Define Maxwell's macroscopic equations **(3 marks)**
   (b)In the mid -1800's, the theories of electricity and magnetism were united by James Clerk Maxwell in four equations. State them! **(6 marks)**
   (c) Differentiate between Source and Sink in relation to net change inside a surface. **(3 marks)**

3. (a) Differentiate between the dielectric constant and magnetic permeability **(4 marks)**
   (b) State the Gauss's divergence theorem and Stokes **(8 marks)**

4. (a) State the kinetic energy of a particle. **(4 marks)**

   (b) How are Maxwell's equations used to show wave motion? **(8 marks)**

5. (a) Describe briefly the reflection and refraction at a boundary between dielectrics. **(10 marks)**

   (b) Using a simple equation, describe the energy theorem in Maxwell's theory **(2 marks)**

6. (a) Define each of the following:

   (i) Electric field energy **(2 marks)**

   (ii) Magnetic field energy **(2 marks)**

   (iii) Power flux **(2 marks)**

   (b) State the momentum theorem in Maxwell's theory in a vacuum. **(3 marks)**

   (b) Briefly describe the refractive index in a medium. **(3 marks)**