



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
University Village, Plot 91, Cadastral Zone, Nnamdi Azikwe Express Way, Jabi-Abuja

**FACULTY OF SCIENCES**  
**2021 Examinations**

**Course Code:** MTH417  
**Course Title:** Electromagnetic Theory  
**Credit Unit:** 3  
**Time Allowed:** 3 Hours  
**Total:** 70 Marks  
**Instruction:** Answer Question One (1) and Any Other 4 Questions

1. (a) State the free-space set (differential and integral forms) of Maxwell's equations  
(11 marks)  
(b) Given  $H = H_m e^{i(\omega t + \beta z)} a_x$  in free space, find  $E$ . (11 marks)
2. Given the equation  $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$  for electric field intensity, derive the wave equation for  $\vec{E}$ . (12 marks)
3. From the Maxwell's equations, derive the wave equation for the magnetic field  $\vec{B}$ . (12 marks)
4. Given  $E = E_m \sin(\omega t - \beta z) a_y$  in a free space, find D, B and H (12 marks)
5. Show that  $E = E_m \sin(\omega t - \beta z) a_y$  and  $H = -\frac{\beta E_m}{\omega \mu_0} \sin(\omega t - \beta z) a_x$  fields constitute a wave traveling in the z-direction. Verify that the wave speed and  $E/H$  depend only on the properties of free space. (12 marks)
6. State the general set (differential and integral forms) of Maxwell's equations (12 marks)