ELIZADE UNIVERSITY
ILARA-MOKIN
ONDO STATE

FACULTY: Basic and Applied Sciences
DEPARTMENT: Physical and Chemical Sciences
SECOND SEMESTER EXAMINATIONS
2015/2016 ACADEMIC SESSION

COURSE CODE: PHY 301

COURSE TITLE: Electromagnetism

DURATION: 3 hours

HOD's SIGNATURE

TOTAL MARKS: 60

Matriculation Number: _____

INSTRUCTIONS:

1. Write your matriculation number in the space provided above and also on the cover page of the exam booklet.
2. This question paper consists of 1 page with printing on both sides.
3. Answer all questions in the exam booklet provided.
4. More marks are awarded for problem solving method used to solving problems than for the final numerical answer.
5. Box your final answers. Marks will be deducted for untidy work.
6. At the end of this examination, place the question paper inside the exam booklet.
7. Attempt any (6) of the eight (8) questions

PHY 301 Final Exam
Attempt any (6) of the eight (8) questions

1. A particle with positive charge $q = 3.20\times10^{-19}$ C moves with a velocity $\vec{v} = (2\hat{x} + 3\hat{y} - \hat{z})$ m/s through a region where both a uniform magnetic field $\vec{B} = (2\hat{x} + 4\hat{y} + \hat{z})$ T and uniform electric field $\vec{E} = (4\hat{x} - \hat{y} - 2\hat{z})$ V/m exist. Determine what angle the particle makes with the positive x axis. **[10]**

2. For a uniformly charged insulating sphere of radius r, uniform charge density ρ, and total positive charge q, calculate the electric field outside the sphere. **[10]**

3. A single-turn current loop, carrying a current of 4.00 A, is in the shape of a right triangle with sides 50.0, 120, and 130 cm. The loop is in a uniform magnetic field of magnitude 75.0 mT whose direction is parallel to the current in the 130 cm side of the loop. Find the total magnetic force on the loop. **[10]**

4. What is the flux through any closed surface surrounding a charged sphere of radius a_0 with volume charge density $\rho = \rho_0\left(\frac{r}{a_0}\right)$, where r is the distance from the center of the sphere. **[10]**

5. A wire bent into a semicircle of radius R forms a closed circuit and carries a current I. The wire lies in the xy plane, and a uniform magnetic field is directed along the positive y axis. Find the magnitude and direction of the magnetic force acting on the straight and curved portions of the wire. **[10]**

6. A closed cylinder of height h and radius R is placed in vector field given by $\vec{A} = A_0(\hat{x} + 2\hat{y} - 3\hat{z})$. The axis of the cylinder is aligned with the z-axis. (a) Determine if the vector field represents a magnetic field. (b) If a magnetic field exists, find the flux through the top, bottom, and curved surfaces of the cylinder. **[10]**

7. For the following function $\vec{v} = y^2\hat{x} + 2x(y+1)\hat{y}$ calculate (a) the divergence (b) the Laplacian (c) the curl, (d) divergence of the curl, and (e) the line integral from point $a = (1,1)$ to the point $b = (2,2)$. **[10]**

8. Explain (a) how electric and magnetic fields combine to make the magnetron work, (b) three applications of it other than the domestic microwave oven, (c) what plasmas are (d) two main ways they are generated, (e) two examples of natural plasmas and two examples of man-made plasmas. **[10]**