AFE BABALOLA UNIVERSITY
ADO-EKITI (ABUAD)

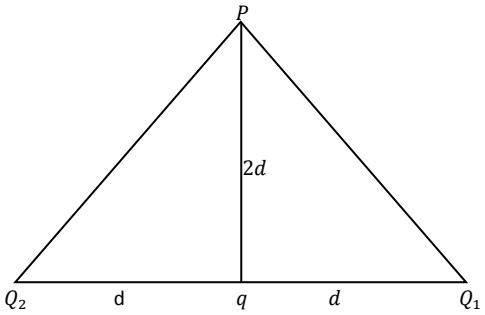
Department of Mathematical and Physical Sciences

Course Title: Electricity, Magnetism and Modern Physics
Course Code: PHY 102
Session: 2019/20

COVID-19 HOLIDAY ASSIGNMENT

Instruction: Answer Four (4) Questions in All - two from Section A and two from section B.

1. (a) Explain with the aid of a diagram how you can produce a negatively charged sphere by method of induction.
   (b) Each of two small spheres is charged positively, the combined charge being $5.0 \times 10^{-5}C$. If each sphere is repelled from the other by a force of 1.0N when the spheres are 2.0m apart, calculate the charge on each sphere.
   (c) Three charges were positioned as shown in the figure below. If $Q_1 = Q_2 = 8\mu C$ and $d = 0.5m$, determine q if the electric field at P is zero.



2. (a) Distinguish between the terms: electric field and electric field intensity.
   (b) A positive charge $Q_1 = 8nC$ is at the origin, and a second positive charge $Q_2 = 12nC$ is on the x −axis at $x = 4m$. Find
      (i) the net electric field at a point P on the x axis at $x = 7m$.
      (ii) the electric field at a point Q on the y axis at $y = 3m$ due to the charges.

3. (a) State the formulation of the following identities of charges:
   (i) Volume Charge density (ii) Surface Charge density (iii) Linear Charge density
   (b) Explain with appropriate equations, the electric potential difference
   (c) Two point charges Q_1 = 10μc and $Q_2 = -2$μc are arranged along the x-axis at x = 0 and x=4m respectively. Find the position along the x-axis where v = 0.

4 (a) What is Magnetic flux?
(b) An electron with a rest mass of 9.11 x 10^{-31}kg moves in a circular orbit of radius $1.4 \times 10^{-7}m$ in a uniform magnetic field of 3.5 x 10^{-1} Weber/meter square, perpendicular to the speed with which electron moves. Find the cyclotron frequency of the moving electron.

(c) Discuss your answer in 4b above.

5. (a) State the Biot-Savart Law.

(b) Using the Biot-Savart Law, show that the magnitude of the magnetic field of a straight current-carrying conductor is given as

$$B = \frac{\mu_o I}{2\pi r}$$

6. (a) Explain the practical application of Faraday's Law in the production of sound in an electric guitar.

(b) A coil consists of 300 turns of wire having a total resistance of 2.0Ω. Each turn is a square of side $10cm$, and a uniform magnetic field directed perpendicular to the plane of the coil is turned on. If the field changes linearly from 0 to $10T$ in $0.5\ sec$,

(i) What is the magnitude of the induced emf in the coil while the field is changing?

(ii) What is the magnitude of the induced current in the coil while the field is changing?

(c) The plane of a rectangular coil of dimensions $5cm$ by $8cm$ is perpendicular to the direction of a magnetic field B. If the coil has $75\ turns$ and a total resistance of 8Ω, at what rate must the magnitude of the B change in order to induce a current of $0.1A$ in the windings of the coil?