



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2011/2012
OPEN DISTANCE AND e-LEARNING
FIRST SEMESTER EXAMINATION FOR THE DEGREE BACHELOR OF
EDUCATION
SPH 201: ELECTRICITY AND MAGNETISM II

DATE: Wednesday 14th December 2011

TIME: 4.30p.m – 6.30p.m

INSTRUCTIONS

1. Answer questions one and any other two questions.
2. Read the instructions on the answer booklet and strictly adhere to them.
3. You may find the following information and constants useful.
 - a). Permittivity of free space $\epsilon_0 = 8.854 \times 10^{-12} \text{ F/m}$
 - b). Permeability of free space $\mu_0 = 4\pi \times 10^{-7} \text{ T.A m}^{-1}$
 - c). Earth's magnetic field $H = 1.0 \times 10^{-4} \text{ Tesla}$

QUESTION ONE.

- A. State Gauss's law in electrostatics. [2]
- What is the significance of the boundary of the Gaussian surface in the application of Gauss's law? [5]
- B. Derive the equation for the capacitance of a cylindrical plate capacitor. [5]
- C. Explain fully three effects of inserting a dielectric medium between the plates of a capacitor. [6]
- D. Where do we use a galvanometer in the laboratory ? [2]
- Give a significant difference between a moving coil and a moving magnet galvanometers. [2]
- A capacitor charged to 2 V is discharged through a ballistic galvanometer. The corrected throw is 10 mm, the current sensitivity is $2.2 \times 10^3 \text{ A/cm}$ and the periodic time is 12 seconds. [4]
- Calculate the capacitance of the capacitor.

- E. Draw two **LRC** AC circuits, one in series and the other in parallel and elaborate on one significant differences of the two circuits. [4]

QUESTION TWO.

- A. Explain your understanding of the following terms;
i. A gaussian surface. [2]
ii. Electric flux. [2]
- B With the help of a diagram, show how the capacitance of a spherical capacitor is determined. [5]
- B.i. Give a statement of Amphere's law. [1]
ii. Describe a scientific device which uses Amphere's law for it's operation. [5]
- C Give a detailed analysis of an R-C. series circuit. [5]

QUESTION THREE.

- A i. Why is there need to rectify current in some electrical appliances? [2]
ii. With the help of diagrams, show the difference between a half-wave rectifier and a bridge rectifier. [8]
- B i. Under what conditions will we have an ampere current flowing in a circuit? [2]
ii. Calculate the force experienced by two straight conductors, placed 1cm apart and having currents of 500 A flowing in the same direction, if there is influence of resistance R. [5]
iii. Explain the role of a solenoid in an electric circuit.. [3]

QUESTION FOUR.

- A. With the help of a diagram, show how to determine the magnitude of the magnetic field **B** at the point P (outside the conductor), due to a current **I** flowing in a straight conductor of infinite length. [5]
How does this situation compare with Gauss's law of electrostatics? [2]
- B. Define a magnetic field and show that for a conductor of internal radius r and carrying a current of magnitude I , the relation below holds. [5]
$$B = \mu I / 2\pi r$$

- C. Explain fully the significance of Biot Savart law in a specific practical application of your choice. [4]
- D. Give expressions for calculating the;
i. work done in rotating a bar magnet through an angle Θ . [2]
ii. magnitude of the torque. [2]

QUESTION FIVE

- A. i. What practical roles do capacitors play in basic electronic circuits?
ii. When is the capacitance of a capacitor equal to 1 farad ? [2].
- B.. Calculate the charge on a capacitor consisting of two parallel plates each 400 cm^2 in area and 1 mm apart in air, the plates being at a potential of 200 volts. [5].
- C. State and explain any three effects resulting from the introduction of a dielectric medium between the plates of a capacitor. [9].
- D. Derive the relation for work done in rotating a bar magnet in a uniform magnetic field B. [3]