



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2010/2011
INSTITUTE OF OPEN LEARNING
EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION
SPH 201: ELECTRICITY AND MAGNETISM II

DATE: Saturday 5th February, 2011

TIME: 11.00 a.m. – 1.00 p.m.

INSTRUCTIONS

1. Answer questions one and any other two questions.

2. You may find the following information and constants useful.

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|--------------------------------|--------------|---|--|
| a). Permittivity of free space | ϵ_0 | = | $8.854 \times 10^{-12} \text{ F/m}$ |
| b). Permeability of free space | μ_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.** Mention two differences of the differential form of Gauss's law in electrostatics and the integral form. [2]
What is the role played by the shape of the enclosing surface Gauss's law? [6]
- B.** Derive the equation for the capacitance of a cylindrical plate capacitor. [5]
- C.** How is a dielectric medium inserted between the plates of a cylindrical capacitor. [6]
- D.** What is the role of a galvanometer in a wheatstone bridge circuit? [2]
Give three main similarities between a moving coil and a moving magnet galvanometers. [3]
- E.** Two parallel straight conductors 5 cm apart, have a current of 6.5A each in opposite directions.
Calculate the magnitude and direction of the force between the two conductors. [6]

QUESTION TWO.

- A. A circuit contains a 3.60 mH inductor. The rms voltage of a generator in the circuit is 30.0 V. Find the rms current in the circuit if the generator frequency is 250 Hz. [3]
- B. With the help of a well labelled graph, show how current, voltage and power are represented on a single graph. [7]
- C i. Give a mathematical expression of Ampere's law. [2]
ii. On which scientific principle does an ordinary loud speaker operate? [3]
- C Give a **detailed** analysis of an L-R. parallel circuit. [5]

QUESTION THREE.

- A i. What do you understand by the term current rectification? [2]
ii. With the help of diagrams, show the difference between a half wave rectifier and a full wave rectifier. [8]
- B i. Define one henry (1h) of inductance. [2]
ii. The core of a solenoid is air. What is the procedure to determine its self inductance? [4]
iii. Explain the role of a solenoid in an electric circuit.. [4]

QUESTION FOUR.

- A. Draw a diagram capable of being used to determine the magnitude of the magnetic field **B** at the point P, due to a current **I** flowing in a straight conductor of finite length. [5]
- B. A conductor of internal radius r is carrying a current of magnitude I . Derive a relation between the magnetic field B generated by this current and r . [5]
- C. Explain fully the significance of Ampere's law in a specific practical application of your choice. [5]

- D. Do electric monopoles exist? [1]
Outline a practical demonstration capable of proving your answer above. [2]
Differentiate between an electric and a magnetic dipole. [2]

QUESTION FIVE

- A. i. How does a permanent magnet differ from an electro magnet? [2].
ii. When is the capacitance of a capacitor equal to 1 farad ? [1].
- B.. Calculate the potential drop across the parallel plates of a capacitor of charge 57 C if each plate is 400 cm² in area and 1 mm apart in air. [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]