

**W1-2-60-1-6**

**JOMO KENYATTA UNIVERSITY**

**OF**

**AGRICULTURE AND TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2015/2016**

**FIRST YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE MATHEMATICS AND COMPUTER SCIENCE**

**SPH 2172: PHYSICS**

**DATE: DECEMBER 2015 TIME: 2 HOURS**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS**

**Useful Constants:**

Electronic charge = -1.6 x 10-19 coulombs

Proton charge = +1.6 x 10-19 coulombs

Permittivity of free space () = 8.85 x 10-12C2/N.m2

**QUESTION ONE**

1. What are Basic and derived physical quantities? Give examples. **(5 marks)**
2. What are the dimensions of momentum? **(2 marks)**
3. Centripetal force depends on mass of the object, velocity and the

radius of its circular path. Determine the expression for the centripetal

force using the method of Dimensions analysis. **(6 marks)**

1. State Ohms law. **(2 marks)**
2. Derive the expressions for equivalent resistance when resistors,

R1 and R2 are connected in:

1. Series **(5 marks)**
2. Parallel **(2 marks)**
3. Define electrochemical equivalent of a substance. **(2 marks)**
4. State Faraday’s laws of electrolysis
5. Derive an expression for maximum emf and maximum current in

an AC circuit containing a resistor, a capacitor and an Inductor

connected in series. **(6 marks)**

**QUESTION TWO**

1. State coulombs law of electrostatics. **(2 marks)**
2. Two equal charges of 3.0C are place on the y-axis, one at the

origin and the other at y = 6m. A third charge q3 = 2.0C s on

the x-axis at x = 8m. Find the magnitude and direction of the total

force on q3 **(5 marks)**

1. Define electric field at a point due to a point charge. **(2 marks)**
2. When a test charge of q0 = 2nC is placed at the origin, it

experiences a force of 8.0 x 10-4N in the positive y-direction;

1. What is the electric field at the origin?
2. What is the direction of the electric field?

**(4 marks)**

1. State Kirchoff’s laws for the distribution of current in a network of

conductors. **(2 marks)**

1. Two cells of emf 1.5 volts and 2.0 volts respectively and of internal

resistance 1.0 ohm and 2.0 ohms, are connected in parallel with an

external resistance of 5.0 ohms. Calculate the current in each branch

of the network and potential difference across the 5.0 ohm resistor. **(5 marks)**

**QUESTION THREE**

1. A 200 ohms resistor is connected in series with a 5F capacitor.

The voltage across the resistor is V=1.2 Sin (2500rad/s)t

1. Derive an expression for the circuit current
2. Determine the capacitive reactance of the capacitor
3. Derive an expression for the voltage across the capacitor

**(6 marks)**

1. What is a transformer? Explain its working. **(4 marks)**
2. Distinguish between peak value and root mean square value of an

alternating current and derive an expression that relates them. **(3 marks)**

1. Discuss the advantages of using alternating current for the

transmission of electrical power over large distances.  **(2 marks)**

1. In a series L-C-R circuit, suppose R = 300 ohms, L = 60mH,

C= 0.5F the source driving the circuit has voltage amplitude,

50V and  = 10,000rad/s. Find:

1. The inductive reactance
2. The impedance of the circuit
3. The current amplitude in the circuit
4. The voltage amplitude across each circuit element

**(5 marks)**

**QUESTION FOUR**

1. Deduce an expression for the magnetic force on a moving positive

charge, q, with velocity, v, in the vicinity of a magnetic field, B. **(2 marks)**

1. The magnetic field of the earth has a magnitude of 0.6 x 10-4T and

is directed downward at about 700 with the horizontal. A proton

moves horizontally in the northward direction with speed v = 107 m/sec.

What would be the magnitude and direction of the force on the proton?

Sketch a diagram showing the elements mentioned. **(5 marks)**

1. i) What are the factors on which the sensitivity of a moving coil

galvanometer depend on. **(3 marks)**

ii) What is the advantage inherent in using a moving coil

galvanometer?  **(4 marks)**

1. A sensitive galvanometer has resistance 100 ohms and requires

1.0A of current to produce full-scale deflection.

i) Find the shunt resistance needed to construct an ammeter

which reads 1mA full-scale deflection.

ii) What is the resistance of the ammeter?

iii) What resistance would be required to construct a voltmeter

reading 3.0 volts full-scale deflection?

**(6 marks)**