DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY EXAMINATIONS 2015/2016

EXAMINATIONS FOR BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

EXAMINATIONS FOR FIRST YEAR SECOND SEMESTER

SPH 2172 PHYSICS

SUPPLEMEMTARY/ SPECIAL

Date   **Venue**

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Instructions:

1. Answer Question **one** and any other **two** questions

2. Use SI units and standard notation only

3. No free-hand diagrams allowed

Some useful constants

a) Charge of an electron $e = 1.6 \text{ X } 10^{-19}$C
b) Speed of light $c = 3.0 \text{X} 10^8$ m/s
c) Permittivity of free space $\varepsilon_0 = 8.85 \text{x} 10^{-12}$ F/m

   QUESTION ONE   **COMPULSORY**   **(30 marks)**

a)   Define the following terms

   i) Power

   ii) Inductance

   iii) Current density

   v) Vector .   **(4 marks)**

b)   State 3 characteristics of a conductor in an electric field.   **(3 marks)**

c)   An inductor of 33mH is connected across a 120V root means square 60 Hz AC supply .Calculate

   i.   The peak voltage   **(3 marks)**

   ii.   The inductive reactance   **(3 marks)**

d) Find the equivalent capacitance of 3 capacitor are connected in parallel   **(3 marks)**

e)   Determine the dimension of work.   **(3 marks)**

f)   Two charges $9\mu C$ and $-18\mu C$ are placed $180cm$ apart. Find the field strength at their

        mid-point.   **(4 marks)**

g)   A person has a12V DC supply and needs to supply a p.d of 4V to a small radio. Draw a circuit

        and explain how the person can achieve the desired potential.   **(4 marks)**

h)   State 3 factors that determine the capacitance of a capacitor   **(3 marks)**

QUESTION TWO   OPTIONAL   **(20 marks)**

a)   Give the expressions for power in a DC circuit   **(3 marks)**

b)   Determine the resistance of the following colour coded resistors.

    i) Gray –red-red-gold.   **(2 marks)**

    ii) Green – blue – orange-silver.   **(2 marks)**

c)   Three resistors 15Ω, 33 Ω, and 56 Ω are connected in series to a 60VDC supply. Calculate:

    i. The current in the circuit.   **(4 marks)**

    ii. The potential difference across each resistor.   **(3 marks)**

    iii. The power dissipated by the 33 Ω resistor   **(3 marks)**

d) A resistor has a resistance of 56 Ω at 20 degree Celsius. Determine its temperature if its resistance

    changes to 64 Ω given that its temperature coefficient of resistance is 0.0025/°C. **(3 marks)**

QUESTION THREE   OPTIONAL   **(20 marks)**

a) Write down

    i. Ampere's law.

    ii. Biot-Savart law.   **(4 marks)**

b)   An inductor of inductance of 300mH carries a current that decreases at a uniform rate of 80A/s .

        Determine the self induced e.m.f.   **(3 marks)**

c)   An R-L d.c circuit consists a 50mH inductor, a 15Ω resistor and 120V DC battery. If the

        switch is closed at $t = 0s$, determine

    i. The time constant of the circuit.   **(3 marks)**

    ii. The current at t=0.008 seconds.   **(4 marks)**

e) State and explain three factors that determine the amount force on a charge in a magnetic field.

(3 marks)

f) State and explain three factors that determine the magnitude of magnetic force on a conductor

carrying current in a magnetic field.   **(3 marks)**

QUESTION FOUR   OPTIONAL   **(20 marks)**

a)   State

(i)   Coulomb's law   **(1 mark)**

(ii)   Three uses of capacitor   **(3 marks)**

b) A capacitor system is made of 2 plates each of area of $1.5cm^2$. The dielectric is 5mm thick .The

capacitor is connected across 300V DC supply and its dielectric constant is 4 .Determine

i.   The capacitance of the capacitor   **(3 marks)**
ii.   Electric flux density of the dielectric.   **(3 marks)**
iii.   The electric field strength in the dielectric   **(3 marks)**
iv.   The energy stored by the capacitor.   **(3 marks)**

c) Four points particles with charges $0.6\mu C , 2.2\mu C , -3.6\mu C , +4.8\mu C$ are placed at the corners of an
square of side$10cm$. Determine the external work needed to bring a charge of $-0.5\mu C$ from infinity
to the centre of the square. Show that this work does not depend on which charge is at which corner.
(4marks)

QUESTION FIVE   OPTIONAL   **(20 marks)**

a)   Define the following terms

i.   Period of oscillation

ii.   Angular frequency   **(2 marks)**

b)   An AC signal which has a frequency f = 50Hz and peak value of 230 V is applied to a series R-C

circuit , where R= 40 Ω and $C = 0.033\mu F$

Calculate

i.   The capacitive reactance.   **(3 marks)**

ii.   The circuit impedance.   **(3 marks)**

iii.   Root mean square current   **(3 marks)**

iv.   The phase angle   **(3 marks)**

c)   Explain two ways how power loss is reduced in AC transmission   **(6 marks)**

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