DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY
UNIVERSITY EXAMINATIONS FOR 2015/2016
FIRST YEAR SPECIAL/ SUPPLEMENTARY EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

SPH 2172: PHYSICS
DATE: 5 ${ }^{\text {TH }}$ JULY 2016
TIME: 2.00-4.00 PM

## 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 $e=1.6 \times 10^{-19} \mathrm{C}$
b) Speed of light $c=3.0 \times 10^{8} \mathrm{~m} / \mathrm{s}$
c) Permittivity of free space $\varepsilon_{0}=8.85 \times 10^{-12} \mathrm{~F} / \mathrm{m}$

## QUESTION ONE COMPULSORY

a) Define the following terms
i) Power
ii) Inductance
iii) Current density
v) Vector .
b) State 3 characteristics of a conductor in an electric field.
c) An inductor of 33 mH is connected across a 120 V root means square 60 Hz AC supply .Calculate
i. The peak voltage
ii. The inductive reactance
d) Find the equivalent capacitance of 3 capacitor are connected in parallel
e) Determine the dimension of work.
f) Two charges $9 \mu \mathrm{C}$ and $-18 \mu \mathrm{C}$ are placed 180 cm apart. Find the field strength at their mid-point.
g) A person has a12V DC supply and needs to supply a p.d of 4 V to a small radio. Draw a circuit and explain how the person can achieve the desired potential.
h) State 3 factors that determine the capacitance of a capacitor

## QUESTION TWO OPTIONAL

a) Give the expressions for power in a DC circuit
b) Determine the resistance of the following colour coded resistors.
i) Gray-red-red-gold.
ii) Green - blue - orange-silver.
c) Three resistors $15 \Omega, 33 \Omega$, and $56 \Omega$ are connected in series to a 60 VDC supply. Calculate:
i. The current in the circuit.
ii. The potential difference across each resistor.
iii. The power dissipated by the $33 \Omega$ resistor
d) A resistor has a resistance of $56 \Omega$ at 20 degree Celsius. Determine its temperature if its resistance changes to $64 \Omega$ given that its temperature coefficient of resistance is $0.0025 /{ }^{\circ} \mathrm{C}$.

## QUESTION THREE

OPTIONAL
(20 marks)
a) Write down
i. Ampere's law.
ii. Biot-Savart law.
b) An inductor of inductance of 300 mH carries a current that decreases at a uniform rate of $80 \mathrm{~A} / \mathrm{s}$.

Determine the self induced e.m.f.
c) An R-L d.c circuit consists a 50 mH inductor, a $15 \Omega$ resistor and 120 V DC battery. If the switch is closed at $t=0 s$, determine
i. The time constant of the circuit.
ii. The current at $\mathrm{t}=0.008$ seconds.
(4 marks)
e) State and explain three factors that determine the amount force on a charge in a magnetic field.
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
b) A capacitor system is made of 2 plates each of area of $1.5 \mathrm{~cm}^{2}$. The dielectric is 5 mm thick .The capacitor is connected across 300 V DC supply and its dielectric constant is 4 .Determine
i. The capacitance of the capacitor
ii. Electric flux density of the dielectric.
iii. The electric field strength in the dielectric
iv. The energy stored by the capacitor.
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 10 cm . 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
a) Define the following terms
i. Period of oscillation
ii. Angular frequency
b) An AC signal which has a frequency $\mathrm{f}=50 \mathrm{~Hz}$ and peak value of 230 V is applied to a series $\mathrm{R}-\mathrm{C}$ circuit, where $\mathrm{R}=40 \Omega$ and $C=0.033 \mu F$
Calculate
i. The capacitive reactance.
ii. The circuit impedance.
iii. Root mean square current
iv. The phase angle
c) Explain two ways how power loss is reduced in AC transmission

