

## 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<sup>TH</sup> JULY 2016 TIME: 2.00-4.00 PM

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

### QUESTION ONE COMP

(**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)

**COMPULSORY** 

- 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)
<b>d</b> ) Fi	nd the equivalent capacitance of 3 capac	itor 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 pla	aced 180cm apart. Find the field strength a	at their
	mid-point.		(4 marks)
g)	A person has a12V DC supply and nee	eds to supply a p.d of 4V to a small radio.	Draw a circuit
	and explain how the person can achiev	e the desired potential.	(4 marks)
h)	State 3 factors that determine the capacitation	citance of a capacitor	(3 marks
QUE	STION TWO OPTIONAL		(20 marks
a)	Give the expressions for power in a Do	C circuit	(3 marks
b)	Determine the resistance of the follow	ring colour coded resistors.	
i)	Gray -red-red-gold.		(2 marks)
ii)	Green – blue – orange-silver.		(2 marks)
c)	Three resistors 15 $\Omega$ , 33 $\Omega$ , and 56 $\Omega$ are connected in series to a 60VDC supply. Calculate:		
i.	The current in the circuit.		(4 marks)
ii.	The potential difference across each re	sistor.	(3 marks)
iii.	The power dissipated by the 33 $\Omega$ resistance resistance of the 33 $\Omega$ resistance resistance of the same resistan	stor	(3 marks)
d) A	resistor has a resistance of 56 $\Omega$ at 20 de $$	egree Celsius. Determine its temperature i	f its resistance
ch	nanges to 64 $\Omega$ given that its temperature	coefficient of resistance is 0.0025/°C.	(3 marks)
<b>Q</b> U	ESTION THREE OF	PTIONAL	(20 marks)
a) W	Vrite down		
i.	Ampere's law.		
ii.	Biot-Savart law.		(4 marks)
b)	An inductor of inductance of 300mH c	arries a current that decreases at a uniform	m rate of 80A/s.
	Determine the self induced e.m.f.		(3 marks)
c)	An R-L d.c circuit consists a 50mH in	nductor, a $15\Omega$ resistor and $120V$ DC ba	ittery. 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) S	State and explain three factors that determine the amount force on a charge in a ma	gnetic field.		
		(3 marks)		
f) S	State and explain three factors that determine the magnitude of magnetic force on a	conductor		
	carrying current in a magnetic field.	(3 marks)		
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Q	UESTION 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 <sup>2</sup> . 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. iii.	Electric flux density of the dielectric.  The electric field strength in the dielectric	(3 marks) (3 marks)		
iv.	The energy stored by the capacitor.	(3 marks)		
	Four points particles with charges $0.6\mu C$ , $2.2\mu C$ , $-3.6\mu C$ , $+4.8\mu C$ are placed at square of side $10cm$ . Determine the external work needed to bring a charge of $-0$ to the centre of the square. Show that this work does not depend on which charge is	$.5\mu C$ from infinity		
QU	ESTION 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 $f = 50$ Hz and peak value of 230 V is appli	ied to a series R-C		
	circuit, where R= 40 $\Omega$ 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)		