



**TECHNICAL UNIVERSITY OF MOMBASA**  

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**FACULTY OF APPLIED AND HEALTH SCIENCES**

DEPARTMENT OF MATHEMATICS & PHYSICS

**UNIVERSITY EXAMINATION FOR:  
DIPLOMA IN INFORMATON TECHNOLOGY**

APS 2103: FUNDAMENTALS OF PHYSICS  
END OF SEMESTER EXAMINATION

**SERIES: MAY 2016**

**TIME: 2 HOURS**

**Instructions to Candidates**

You should have the following for this examination

*Answer Booklet*

*examination pass*

*mathematical table or calculator*

*student ID*

This paper consists of **FIVE** questions.

Attempt question ONE (**Compulsory**) and any other TWO questions.

This paper consists of 4 printed pages

**Do not write on the question paper.**

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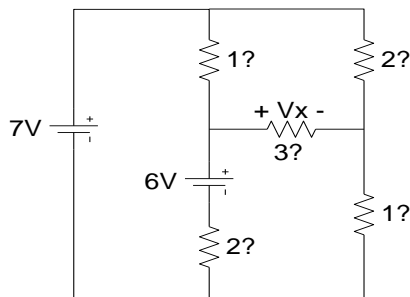
Coulomb's constant.  $F_e = 8.99 \times 10^9 \text{ Nm}^2/\text{C}^2$

**Question ONE (30mks)**

- a) Distinguish between intrinsic and extrinsic semiconductors. (2mks)
- b) Explain why a digital signal is superior to an analog signal (2mks)
- c) Define electric current and state SI unit (2mks)
- d) You are driving through town at 12 m/s when suddenly a ball rolls out in front of your car. You apply the brakes and begin decelerating at 3.5 m/s/s. How far do you travel before coming to a complete stop? (3mks)
- e) Define electromagnetic spectrum (1mk)
- f) Explain the application of transistors (2mks)
- g) Distinguish between forward bias and reverse bias connection of a diode with the aid of a diagram (4mks)
- h) Explain how doping produces an n- type semi conductors from a pure semi conductor material. (3mks)
- i) What is the electric potential 50 cm from a point charge  $q = 1 \times 10^{-6} \text{ C}$ ? (3mks)
- j) Define electric charge and give its SI unit (2mks)
- k) Define electric field and give its SI unit (2mks)
- l) Calculate the strength and the direction of the electric field  $E$  due to a point charge of 2.00nC at a distance of 5.00mm from the charge (4mks)

**Question TWO (15mks)**

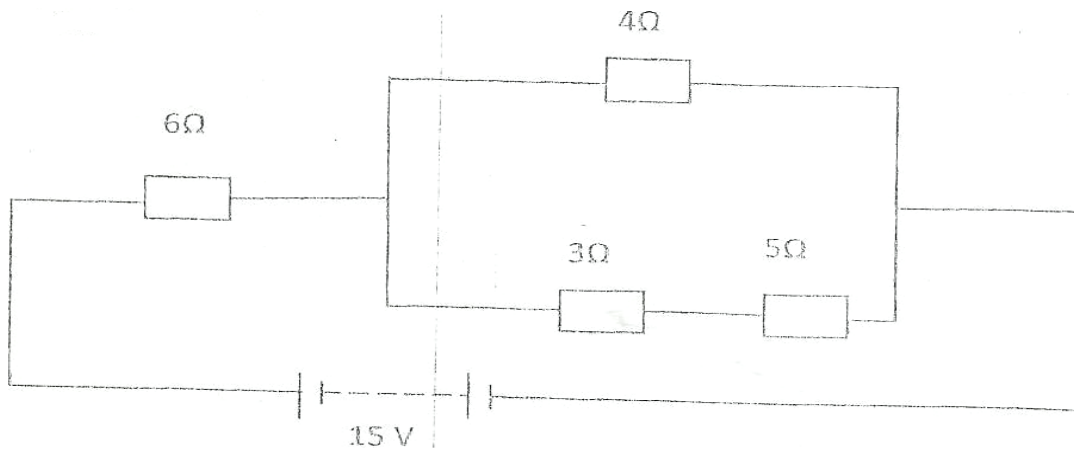
- a) Use Mesh analysis to find  $V_x$  (6mks)



- b) A 4.0, 8.0 and 12.0  $\Omega$  resistor are placed in a parallel circuit across a 24.0 V battery. What is the  $R_{eq}$  of the circuit and what is the current in each resistor? (4mks)
- c) Define impedance (1mk)
- d) A 60-W resistor, a 0.6 H inductor, and an 8-mF capacitor are connected in series with a 120-V, 60 Hz ac source. Calculate the impedance for this circuit. (4mks)

**Question THREE (15mks)**

a)The figure below shows a network of resistors connected to power supply of 15V.



Determine

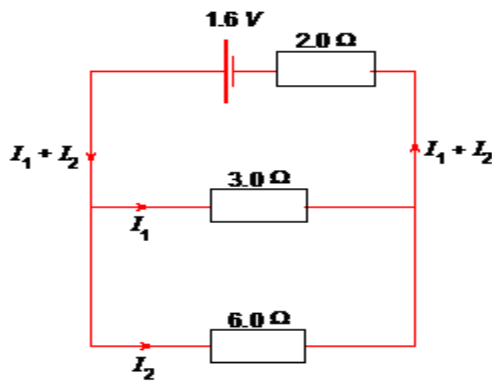
- (i) The effective resistance of the network (3mks)
- (ii) The voltage across the 3  $\Omega$  resistor (3mks)
- b) A transformer is used on a 240V a.c supply to deliver 12A at 12A to a heating coil. If 20% of energy taken from the supply is dissipated in the transformer. Calculate the current in the primary coil. (2mks)
- c) A transformer with 1200 turns in the primary circuit and 120 turns in the secondary circuit has its primary circuit connected to a 400V a.c source. It is found that when a heater is connected to the secondary circuit, it produces heat at the rate of 600w. Assuming 100% efficiency, determine the:
- (i) Voltage in the secondary circuit (2mks)
- (ii) Current in the primary circuit (2mks)
- (iii) The current in the secondary circuit (1mk)
- d) State two ways in which energy is lost from a transformer (2mks)

**Question FOUR (15mks)**

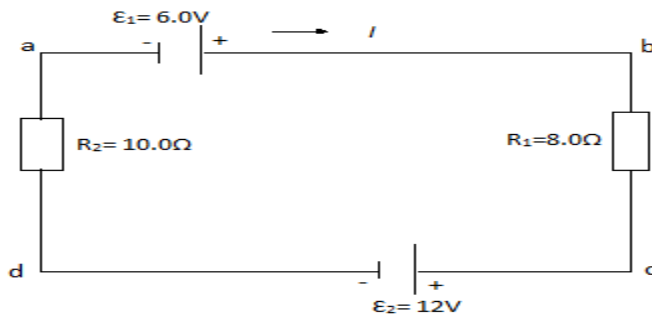
a) Two point charges are 5.0 m apart. If the charges are 0.020 C and 0.030 C, what is the force between them and is it attractive or repulsive? (3mks)

b) A particle of charge  $q_1 = +6.0\mu\text{C}$  is located on the  $x$ -axis at the point  $x_1 = 5.1\text{cm}$ . A second particle of charge  $q_2 = -5.0\mu\text{C}$  is placed on the  $x$ -axis at  $x_2 = -3.4\text{cm}$ . What is the absolute electric potential at the origin (4mks)

c) A circuit consists of a cell of emf 1.6 V in series with a resistance  $2.0\ \Omega$  connected to a resistor of resistance  $3.0\ \Omega$  in parallel with a resistor of resistance  $6.0\ \Omega$ . Determine the total current drawn from the cell and the potential difference across the  $3.0\ \Omega$  resistor. (4mks)



d) A single loop circuit contains two resistors and two batteries as shown in the figure below. (Neglect the internal resistance of the batteries). Find the current in the circuit. (4mks)



**Question FIVE (15mks)**

a) Explain any four uses of E.M Spectrum: (6mks)

b) Define the following terms as used in electronic signals (3mks)

c) Explain the factors the amount of heat produced by electrical device in unit time depends on: (3mks)

d) Give various application of heating effect of electric current (3mks)

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