



UNIVERSITY EXAMINATIONS

MAIN CAMPUS

SECOND SEMESTER 2018/2019 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION ARTS

PHYS 110 ELECTRICITY AND MAGNETISM

STREAM: Y2 S1 PART TIME

TIME: 1:00-3:00PM

EXAMINATION SESSION: APRIL

DATE: 9/04/2019

VENUE: SKILLS LAB

COPIES: 15

INSTRUCTIONS:

- Answer Question **ONE** and any other **TWO** Questions. Question One carries **30marks** while each of the other Two Questions carry **20marks**.
- **EXTRA** Questions Answered **WILL NOT** be marked
- **The following constants may be useful**
 - Permeability of free space $\mu_0 = 4\pi \times 10^{-7} \text{ Wb} / \text{A}$
 - Permittivity of free space $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 / \text{NM}^2$
 - Resistivity of Iron $\rho = 9.68 \times 10^{-8} \Omega \text{m}$
 - Acceleration due to gravity $g = 9.8 \text{m} / \text{s}^2$
 - Charge of electron $e = 1.6 \times 10^{-19} \text{C}$

QUESTION ONE

- a) State ohm's law in words and give its mathematical expression. (2mks)
- b) State Kirchoff's voltage and current laws (2mks)
- c) A toroid core has $N = 1200$ turns, length $L = 80\text{cm}$, cross-sectional area $A = 60\text{cm}^2$, current $I = 1.5\text{A}$. Compute B and H . Assume an empty core. (5mks)

As members of Kabarak University family, we purpose at all times and in all places, to set apart in one's heart, Jesus as Lord. (1 Peter 3:15)



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- d) Show that for two resistors arranged in parallel the effective resistance (R) is given by (5mks)

$$R = \frac{R_1 R_2}{R_1 + R_2}$$

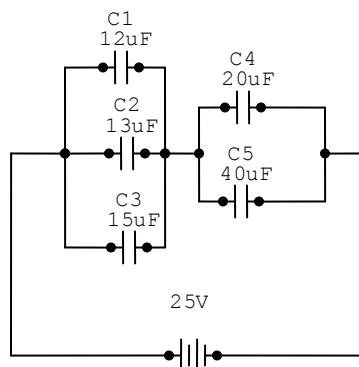
- e) A charge of 240C is moved when energy of 45J is applied between two points. Find the voltage between the two points. (4mks)
- f) An RL circuit with an inductor of inductance 16H and resistor of 10Ω is connected to the terminals of a battery of e.m.f. 12V and negligible internal resistance. Find
- The initial rate of increase of current in the circuit (3mks)
 - The current 0.75s after the circuit was switched on (4mks)
- g) State two similarities and two differences between electric force and magnetic force. (4mks)
- h) State two characteristics of magnetic flux (2mks)

QUESTION TWO

- What is meant by magnetic hysteresis? (2mks)
 - Sketch a typical hysteresis curve and explain. (12mks)
- What are the desirable magnetic properties for the material of (6mks)
 - the core of an electromagnet
 - a permanent magnet?

QUESTION THREE

- Define capacitance. (2mks)
- In the circuit below;



Calculate:

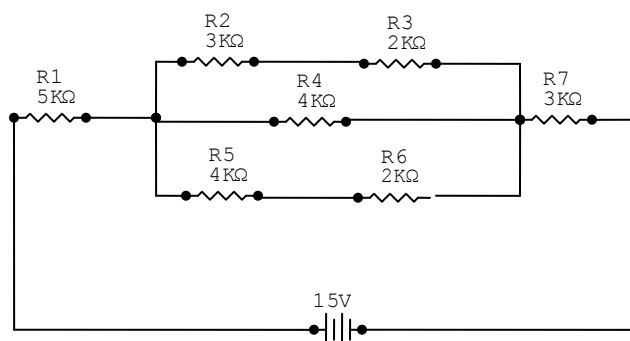
- i. Total capacitance (5mks)
- ii. Total charge (3mks)
- iii. Charge on capacitor C_3 (7mks)
- iv. Voltage across the two capacitors in parallel (3mks)

QUESTION FOUR

- a) What is magnetic flux? (1mk)
- b) i) Consider a segment of conductor of length (L), cross sectional area (A), carrying current (I) placed in a uniform magnetic field (\mathbf{B}), derive the expression of magnetic force F_B experienced by the wire segment. (8mks)
- ii) A straight horizontal segment of copper wire carries a current $I = 25A$. What are the magnitude and direction of magnetic field needed to balance its weight? Given that it's linear mass density is $0.05kg/m$. (4mks)
- c) Consider an electron of charge $1.6 \times 10^{-19}C$ being moved at a velocity of $2.5 \times 10^7 m/s$ in a uniform magnetic field of $4.2 \times 10^{-3}T$ at an angle of 30° .
 - i). Find the magnitude of magnetic force experienced by the proton (4mks)
 - ii). What will be the acceleration of the electron given that its mass is $9.11 \times 10^{-31} Kg$ (3mks)

QUESTION FIVE

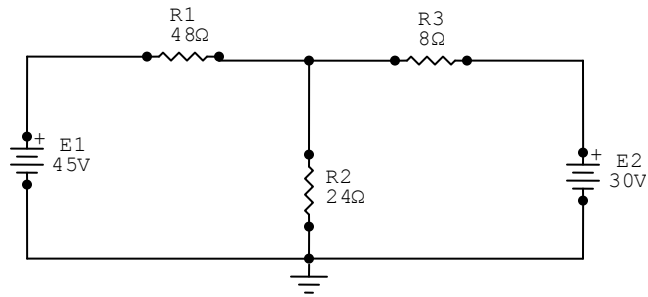
- i) Consider the given resistor network circuit.



Calculate;

- i. Total resistance (6mks)
- ii. the total current in the circuit (3mks)

- b) When a battery of e.m.f. 12V is connected to a load resistor of resistance 15Ω , the terminal voltage measured is 10V. Find the internal resistance of the battery. (6mks)
- c) Consider the given resistor circuit network



Calculate; Total resistance

(5mks)