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UNIVERSITY EXAMINATIONS 2023/2024

FIRST YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN MATHEMATICS AND COMPUTER SCIENCE

SPS 3111: GENERAL PHYSICS

DATE: JANUARY 2025 **TIME: 2 HOURS**

INSTRUCTIONS: Answer Question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

a) Define electric current (1 Mark)

b) i. Describe Ohm's law (1 Mark)

ii. Calculate the current in a lamp given its resistance is 20Ω and a potential difference across its end is 5.0 V. (4 Marks)

c) Define the following;

i. Electromotive force (EMF) (1 Mark)

ii. Capacitance (1 Mark)

d) A 4 Ω, 8 Ω and 12Ω resistors are connected in series with a 240V battery;

Calculate;

i. The total resistance (2 Marks)

ii. Current following through the circuit. (2 Marks)

e) i. State the three law of magnetism (3 Marks)

ii. Differentiate between magnetic and non-magnetic materials. (4 Marks)

f) State the three Newton's law of motion. (3 Marks)

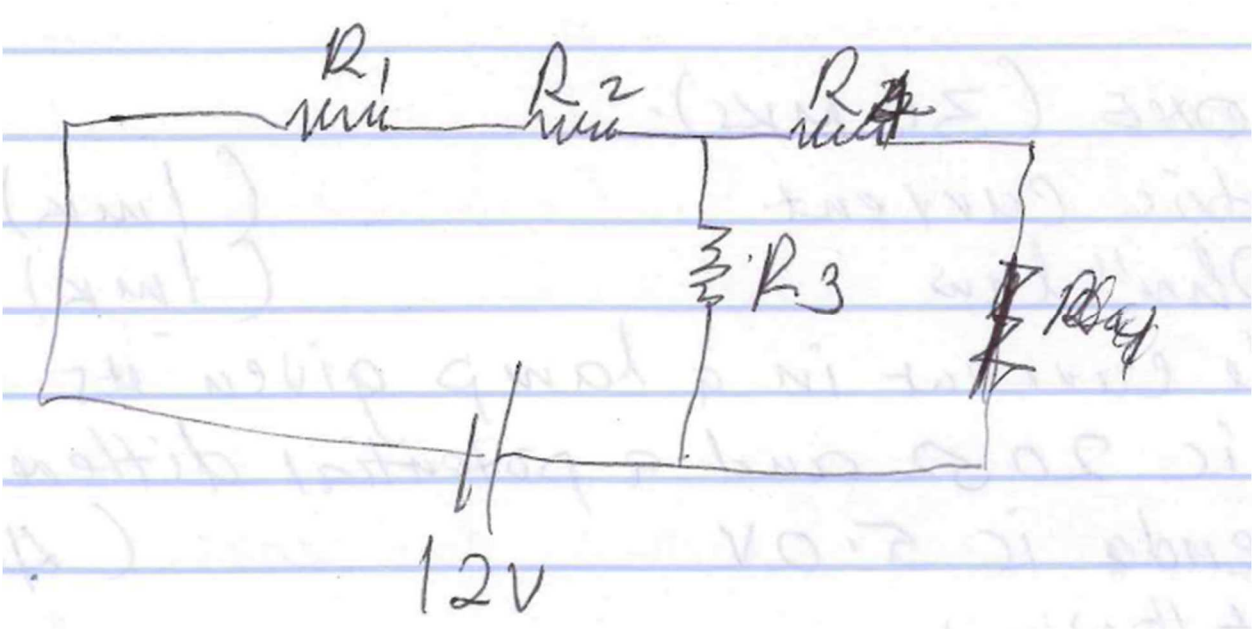
g) i. State Coulomb's law and write in mathematical form. (3 Marks)

ii. A point change $q, = 2\mu C$ located at the origin and another point charge $q_2 = -5\mu C$ is on the coordinate $(x = 3, y = 4)m$. Given that the constant $k = 9.0 \times 10^9 N.m^2/C^2$, find the electric force on charge q_1. (5 Marks)

QUESTION TWO (20 MARKS)

a) i. Define resistance (1 Mark)

ii. Calculate the total resistance and current in the following circuit given that $R_1 = 5\Omega, R_2 = 3\Omega, R_3 = 2\Omega$ and $R_4 = 10\Omega$. (4 Marks)



iii. Hence find the total current. (3 Marks)

b) i. State Kirchoff's law. (2 Marks)

ii. A long loop of area 200cm^2 is positioned perpendicular to a uniform magnetic field, without changing the direction of the magnetic field, its magnitude is reduced by 0.8 T in the time interval of 0.025 seconds. Find the average induced e.m.f of the loop. (6 Marks)

c) Give two difference between ferromagnetic materials and diamagnetic material.(4 Marks)

QUESTION THREE (20 MARKS)

a) distinguish between units and dimensions. (2 Marks)

b) Three capacitors $2mF, 4mF$ and $6mF$ respectively are connected in series to a 240 v a.c supply;

Find

i. The total capacitane (6 Marks)

ii. The charge on each capacitor (6 Marks)

iii. The p.d across each capacitor. (6 Marks)

QUESTION FOUR (20 MARKS)

a) Three resistors are connected in O series circuit. Suppose the output voltage of the battery is Rv and the resistances are $R_1 = 1.0\Omega, R_2 = 6.0\Omega$ and $R_3 = 13.0\Omega$.

i. What is the total resistance? (3 Marks)

ii. Find the current (3 Marks)

iii. Calculate the voltage drop in each resistor. (3 Marks)

iv. Calculate power dispatched by each resistor. (3 Marks)

b) Calculate the resistance of a piece of aluminum that is 10 cm long and has cross-sectional area of $10^{-4}m^2 (take\ p = 2.83 \times 10^{-8}\Omega m)$ (4 Marks)

c) A car headlight filament is made of tungsten and has Coh's resistance of 0.35Ω. if the filament is a cylinder 4.0 cm long, find the diameter. (4 Marks)