MURANG'A UNIVERSITY COLLEGE
(A constituent College of Jomo Kenyatta University of Agriculture and Technology)

SPH 2172 (PHYSICS) MAIN EXAM

DATE: 17 DECEMBER 213 **TIME: 2 HOURS**

Answer Question **One** And Any Other **Two** Questions

QUESTION 1

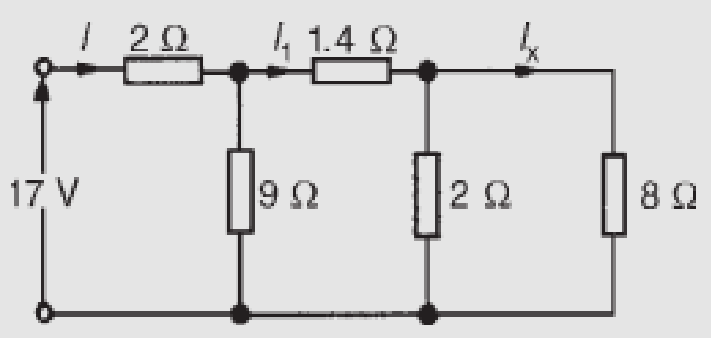
a) State Kirchhoff's laws. [2mks]

b) You are given three resistors R_1=10Ω, R_2=20Ω and R_3=30Ω. You are also given a 240V

c) source of emf. Draw a circuit diagram showing how you will connect these resistors so as

d) to obtain minimum effective resistance. Find also the supply current and the current flowing through the R_2. [5mks]

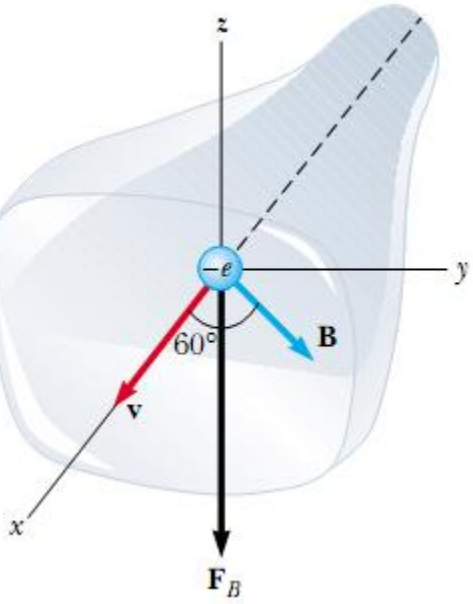
e) For the arrangement shown in the figure below, find the current I_x. [4mks]



f) Find the equivalent resistance of three resistors of resistance R_1, R_2 and R_3 when connected in series. [4mks]

g) A magnetizing force of 8000A/m is applied to a circular magnetic circuit of mean diameter 30 cm by passing a current through a coil wound on the circuit. If the coil is uniformly wound around the circuit and has 750 turns, find the current in the coil. [4mks]

h) An electron in a television picture tube moves toward the front of the tube with a speed of 8.0 % 106 m/s along the x axis as shown below. Surrounding the neck of the tube are coils of wire that create a magnetic field of magnitude 0.025 T, directed at an angle of 60° to the x axis and lying in the xy plane. Find the magnitude of the magnetic force. [4mks]



i) A cell has an internal resistance of 0.02Ω and an e.m.f. of 2.0V. Calculate its terminal p.d. if it delivers 5A.

[3mks]

j) The resistance of a coil of aluminium wire at 18°C is 200Ω. The temperature of the wire is increased and the resistance rises to 240Ω. If the temperature coefficient of resistance of aluminium is 0.0039/ °C at 18 ° C, determine the temperature to which the coil has risen. [4mks]

QUESTION 2

a) Determine the resistance of 1200m of copper cable having a diameter of 12mm if the resistivity of copper is 1.7×10^{-8} Ωm. [4mks]

b) Determine the colour coding for a 47 kΩ having a tolerance of ±5%. The table below can be used. [3mks]

Colour	Significant Figures	Multiplier	Tolerance
Silver	–	10^{-2}	±10%
Gold	–	10^{-1}	±5%
Black	0	1	–
Brown	1	10	±1%
Red	2	10^{2}	±2%
Orange	3	10^{3}	–
Yellow	4	10^{4}	–
Green	5	10^{5}	±0.5%
Blue	6	10^{6}	±0.25%
Violet	7	10^{7}	±0.1%
Grey	8	10^{8}	–
White	9	10^{9}	–
None	–	–	±20%

c) Determine the value of a resistor marked as 4M7M using the table below. Tolerance is indicated as follows: F =±1%, G=±2%, J =±5%, K =±10% and M =±20% 3mks

Resistance Value	Marked as:
0.47 Ω	R47
1 Ω	1R0
4.7 Ω	4R7
47 Ω	47R
100 Ω	100R
1 kΩ	1K0
10 kΩ	10 K
10 MΩ	10 M

d) A d.c. electric motor consumes 36MJ when connected to a 250V supply for 1 hour. Find the power rating of the motor and the current taken from the supply. [4mks]

e) Define conductance and state its units. [2mks]

f) A conductor has a conductance of 50μS.What is its resistance? Find the p.d across the conductor if a current of 0.5A is flowing through it. [4mks]

QUESTION 3

a) Calculate the resistance per unit length of a 22-gauge nichrome wire, which has a radius of 0.321 mm. The resistivity of nichrome is 1.5×10^{-6} Ωm. [4mks]

b) A resistance thermometer, which measures temperature by measuring the change in resistance of a conductor, is made from platinum and has a resistance of 50 Ω at 20°C. When immersed in a vessel containing melting indium, its resistance increases to 76.8 Ω. Calculate the melting point of the indium. Take the temperature coefficient of platinum $\alpha = 3.92 \times 10^{-3}\ ^{o}C^{-1}$. (5mks)

c) Define the emf of a battery. [1mk]

d) A battery has an emf of 12.0 V and an internal resistance of 0.05 Ω. Its terminals are connected to a load resistance of 3 Ω.

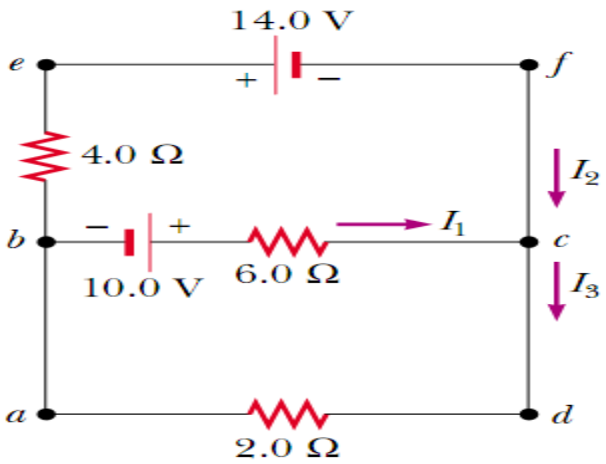
I. Find the current in the circuit and the terminal voltage of the battery. [4mks]

II. Calculate the power delivered to the load resistor, the power delivered to

III. the internal resistance of the battery, and the power delivered by the battery. [6mks]

QUESTION 4

a) Find the currents I_1, I_2, and I_3 in the circuit shown in the figure below. [10mks]



b) Two resistors connected in series have an equivalent resistance of 690 Ω. When they are connected in parallel, their equivalent resistance is 150 Ω. Find the resistance of each resistor. [5mks]

c) The current in a loop circuit that has a resistance of R_1 is 2 A. The current is reduced to 1.60 A when an additional resistor $R_2 = 3\ \Omega$ is added in series with R_1. What is the value of R_1? [5mks]

QUESTION 5

a) State three properties of the magnetic force on a charge moving in a magnetic field **B.** **[**3mks]

b) Describe an experiment that demonstrates the magnetic force acting on a current-carrying conductor. Use diagrams to demonstrate your description. [7mks]

c) Define magnetomotive force (m.m.f.), and state its units. [2mks]

d) Show that the equation $s = ut + \frac{1}{2}at^2$ is dimensionally correct. [3mks]

e) A pure inductance of 120mH is connected in parallel with a 25μF capacitor and the network is connected to a 100V, 50Hz supply. Determine the branch currents [5mks]