THE COUNCIL OF COMMUNITY COLLEGES OF JAMAICA

ASSOCIATE OF SCIENCE EXAMINATION

SEMESTER I – 2014 DECEMBER

PROGRAMMES:	**COMPUTER SERVICING AND ELECTRONICS**
COURSE NAME:	**FUNDAMENTALS OF ELECTRONICS**
CODE :	**(ELEC1103)**
YEAR GROUP:	**ONE**
DATE:	**MONDAY, 2014 DECEMBER 15**
TIME:	**1:00 P.M. – 4:00 P.M.**
DURATION:	**3 HOURS**
EXAMINATION TYPE:	**FINAL**

*This Examination paper has **6** pages*

INSTRUCTIONS:

SECTION B: ANSWER ANY <u>THREE (3)</u> QUESTIONS FROM THIS SECTION.

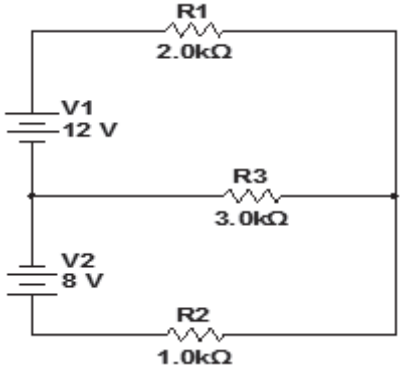
SECTION B

Instructions: Answer any <u>THREE (3)</u> questions from this section.

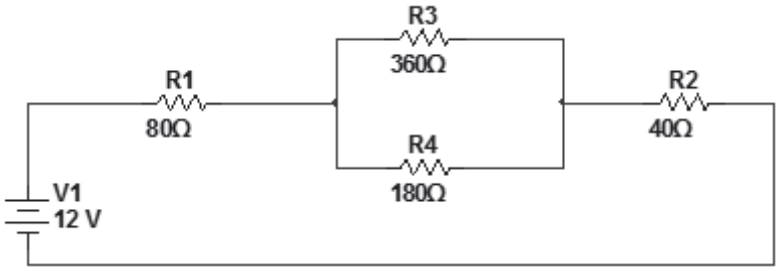
Question 1

a. Name and state Kirchhoff's **<u>two (2)</u>** laws. ***(2 marks)***

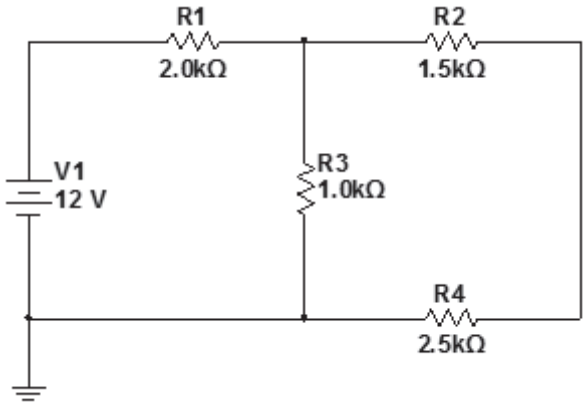
b. Using the laws stated in part (b) above, solve for the values of I_1 I_2 & I_3 in the circuit below. ***(8 marks)***



c. In the circuit below solve for the effective resistance and the current leaving the source. ***(5 marks)***



d. By applying the principle of mesh analysis to the circuit shown below



i. Determine the value of each mesh current. ***(8 marks)***

ii. The current following through R_3. ***(2 marks)***

(Total 25 marks)

Question 2

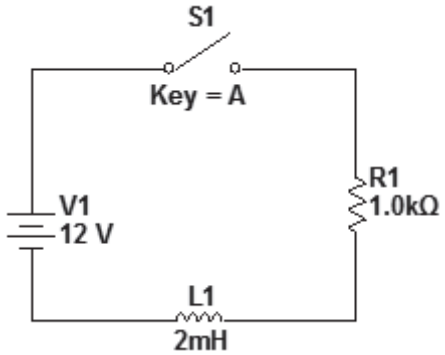
a. State and explain **two (2)** factors that affect the induce e.m.f of an inductor. ***(4 marks)***

b. State Faraday's laws. ***(2 marks)***

c. With the aid of a diagram **BRIEFLY** explain Fleming's right hand rule. ***(4 marks)***

d. Solve for effective inductance, if two (2) identical solenoid inductors each containing 200 turns, with length 0.05m and cross-sectional area $8x10^{-5}m^2$ are connected in series. ***(4 marks)***

e. The circuit below consists of an inductor and a resistor in series with a power source. Use the principle of circuit analysis and any other method to complete the following:



i. The current in circuit just after the switch is closed. ***(1 mark)***

ii. The current in circuit after a long period (t). ***(2 marks)***

iii. The energy stored by the inductor. ***(3 marks)***

iv. The inductor's time constant. ***(2 marks)***

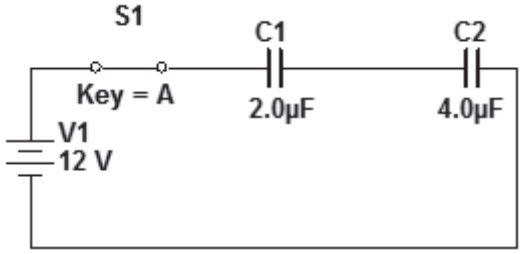
v. The voltage across resistor at t = time constant. ***(3 marks)***

(Total 25 marks)

Question 3

a. Define the farad. ***(2 marks)***

b. Two capacitors C_1 and C_2 are used to construct the circuit as shown below.



Assuming that the switch has been close for a long time solve for the following:

i. The effective capacitance of the circuit. ***(3 marks)***

ii. The total charge acquired by capacitor C_2. ***(2 marks)***

iii. The voltage across capacitor C_1. ***(2 marks)***

c. A typical air capacitor is designed using plates of area 100.0 cm^2 and a separation 1.0cm. If the capacitor is then connected to 9V battery, determine:

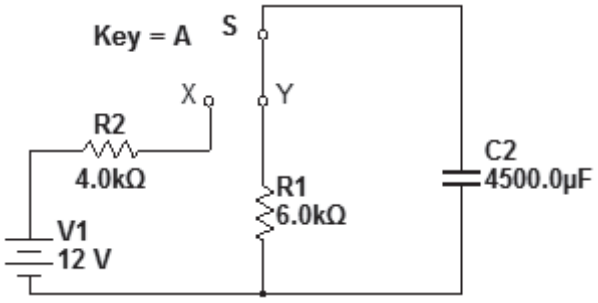
i. The capacitance of the capacitor. ***(3 marks)***

ii. The amount of charge stored on each plate. ***(2 marks)***

iii. The electric field across the plates of the capacitor. ***(2 marks)***

iv. The energy stored by the capacitor. ***(2 marks)***

d. A DC CR network is designed using a single resistor and capacitor as shown in the circuit below.



i. At what position must the switch be for the capacitor to be charged? ***(1 mark)***

ii. Solve for the time constant when the capacitor is being charged and complete the equation for the charging process. ***(2 marks)***

iii. In the discharging process how long does it take for the capacitor the reach 25% of its energy stored? ***(4 marks)***

(Total 25 marks)

Question 4

a. Differentiate between:

i. Magnetism and electromagnetism. ***(2 marks)***

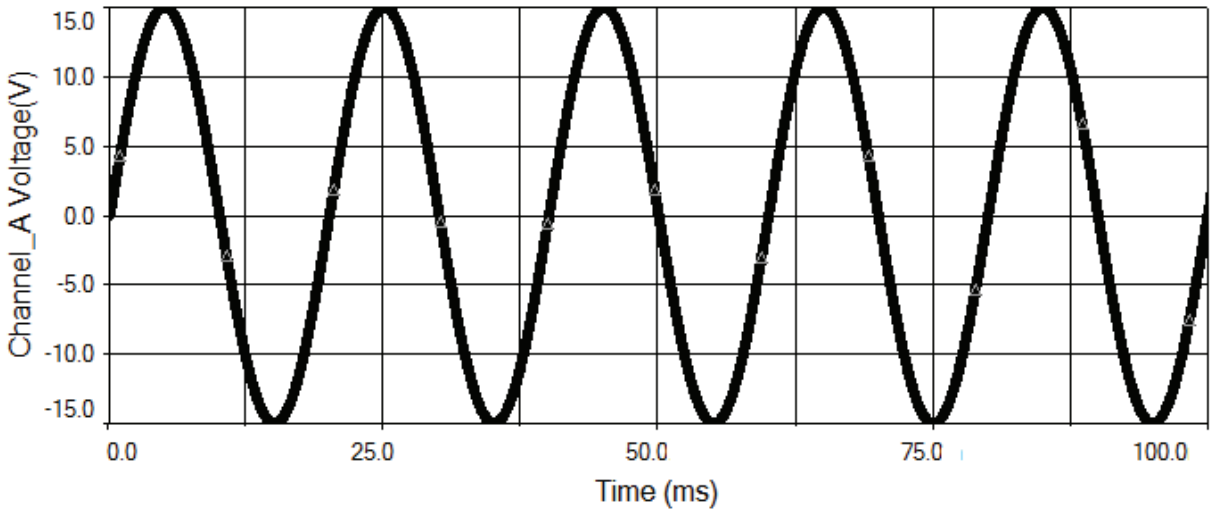
ii. Relative and absolute permeability. ***(2 marks)***

b. Calculate the magnetic flux density for each of the devices given below:

i. 5cm from a long straight wire carrying a current of 10 A. ***(3 marks)***

ii. A long solenoid of 500 turns and length 10cm carrying 5A. ***(3 marks)***

c. An AC source was analyzed by a group of students on a CRO and a snapshot of the wave form was obtained.



From the wave form given in the diagram above complete the following:

i. The period of the AC source in seconds. ***(2 marks)***

ii. The frequency of the wave. ***(2 marks)***

iii. The peak to peak value of the wave. ***(2 marks)***

iv. The wave's angular frequency. ***(3 marks)***

v. Derive an expression (equation) for the wave shown. ***(3 marks)***

vi. Determine the value of the voltage at t = 3ms. ***(3 marks)***

(Total 25 marks)

Question 5

a. In an AC circuit, what is meant by the term impedance? ***(2 marks)***

b. Distinguish between inductive reactance and capacitive reactance. ***(3 marks)***

c. Explain briefly the behaviour between the voltage and the current for both RC and RL circuits. ***(4 marks)***

d. In analyzing the behaviour of series RLC circuit a student was provided with a 12V AC 50Hz power supply, a 40 resistor, a 0.16H inductor and a 1.6×10^{-4}F capacitor. Using the information given complete the following:

i. Draw a diagram outlining the circuit to be designed. ***(3 marks)***

ii. Solve for the inductive reactance (X_L). ***(3 marks)***

iii. Solve for the capacitive reactance (X_C). ***(3 marks)***

iv. Calculate the impedance of the circuit. ***(4 marks)***

v. Determine the current that will flow in the circuit. ***(3 marks)***

(Total 25 marks)

END OF EXAMINATION