MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2013/2014

FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE & TECHNOLOGY, BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND BACHELOR OF SCIENCE IN INFORMATIO TECHNOLOGY

(MAIN CAMPUS)

SCS 108/CCS 103: ELECRICAL PRINCIPLES

Date: 26th November, 2013 *Time: 2.30 - 4.30 p.m.*

INSTRUCTIONS:

- **SECTION A: Question ONE is COMPULSORY.**
- **SECTION B: Questions 2-5: Answer ANY TWO questions.**

SECTION A **{30 MARKS)**

Q1. (a) State the primary energy source used in each of the following electrical devices:

(i) Battery

(ii) Generator

(iii) Thermocouple [3 marks]

(b) Give the definitions of the following terms:

(i) Watt [2 marks]

(ii) Joule [2 marks]

(c) (i) State the resistance value and percentage tolerance for the four-band colour-coded resistor shown in figure 1.1.

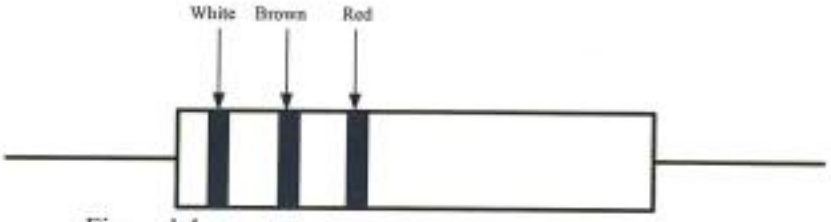

Figure 1.1.

[2 marks]

(ii) A separate fifth orange stripe is present on a colour-coded carbon-composition resistor. If 100 000 of such resistors were made, determine the number of these resistors likely to fail in the first 1000-hour period. [2 marks]

(d) Two resistors having resistances of 6 Ω and 9 Ω respectively are connected a cross a battery having an e.m.f. of 9 V and an internal resistance of 1.8 Ω. Calculate:

(i) the terminal voltage [4 marks]

(ii) the energy dissipated by the 9 Ω resistor if the current remains constant for 6 minutes. [2 marks]

(e) The field coil of a motor has a resistance of 220 Ω at 18 ° C. Determine the increase in resistance if the motor attains an average temperature of 50 ° C when running. Assume $\alpha = 0.00426 / ^\circ C$. [5 marks]

(f) A circuit consists of a resistor R in paralell with a capacitor C and connected across an ac source as shown in figure 1.2.

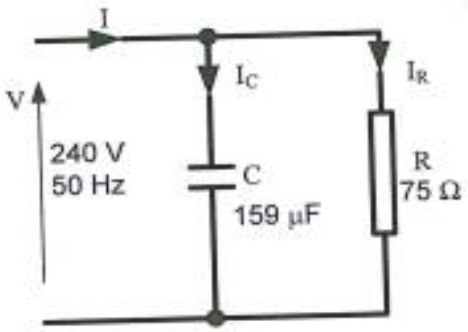

Figure 1.2.

Calculate the currents flowing in the circuit. [8 marks]

SECTION B **{20 MARKS EACH}**

Q2. (a) With the aid of diagrams, briefly explain the meaning of **temperature coefficient of resistance of a material** [6 marks]

(b) A load supplied by copper and aluminium cables connected in parallel draws a current of 250 A. Each cable has a conductor of total length of 150 m and cross-sectional area of 45 mm^2. Taking resistivity of copper and aluminium to be 0.018 μΩ m and 0.028 μΩ m respectively, determine the current carried by each cable. [8 marks]

(c) The field winding of a d.c. motor is connected directly across a 480 V supply. A current of 2.5 A flows when the winding is at a room temperature of 18 ° C. The current drops to 1.7 A and the voltage remains unaltered after some hours of machine operation. Assuming the temperature coefficient of resistance of copper to be 0.00426 / ° C at 0 ° C, calculate the average temperature throughout the winding. [6 marks]

Q3.

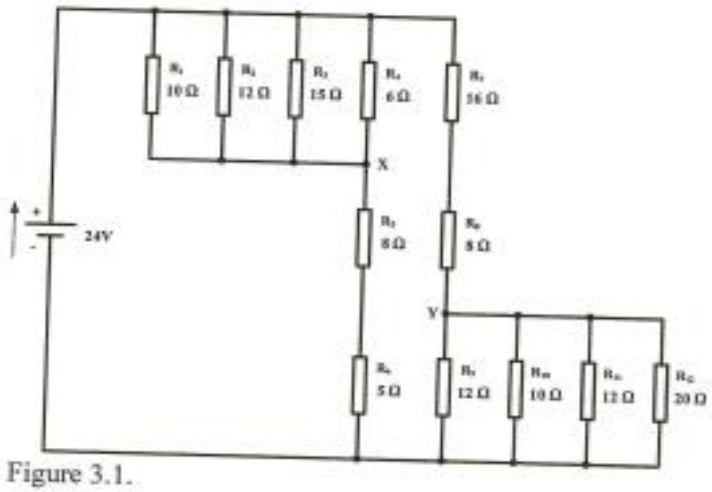

Figure 3.1.

Using the network shown in figure 3.1., determine:

(a) Curents through points X and Y [12 marks]

(b) Potential of point X with reference to point Y. [8 marks]

Q4. (a) With the aid of sketches show the dependence of reactance and current on frequency for a circuit that is purely:

(i) Capacitive [4 marks]

(ii) Inductive [4 marks]

(b)

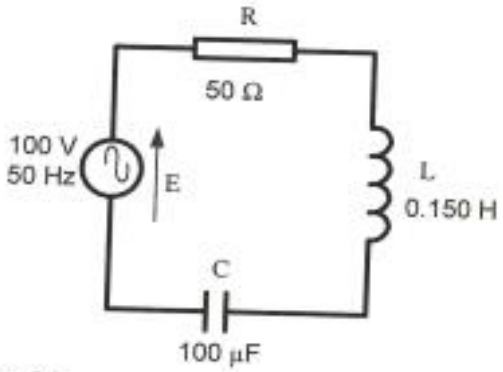

Figure 4.1.

From the circuit given in figure 4.1., calculate:

(i) the circuit impedance [4 marks]

(ii) the voltages across R, L and C [6 marks]

(iii) the phase difference between the supply current and the supply voltage [2 marks]

Q5. (a) State:

(i) Kirchoff's first law [2 marks]

(ii) Kirchoff's second law [2 marks]

(b) A certain circuit is arranged as shown in figure 5.1.

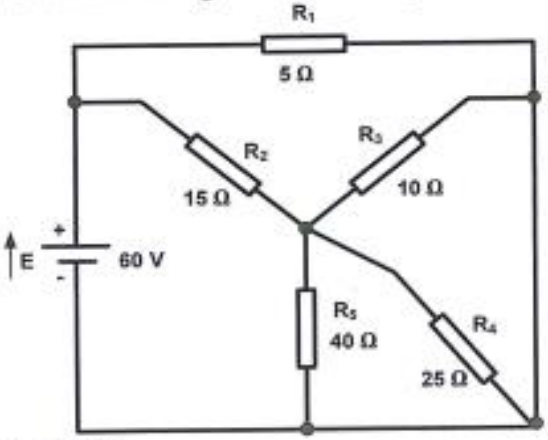

Figure 5.1.

Applying Maxwell's circulating current technique, calculate current in each of the network. [16 marks]