MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FIRST YEAR FIRST SEMESTER EXAMINATION CERTIFICATE IN ELECTRICAL ENGINEERING

EPC 106: ELECTRICAL ENGINEERING PRINCIPLES I

DATE: 19/12/2017 **TIME: 8.30-10.30 AM**

INSTRUCTIONS

ATTEMPT QUESTION 1 AND ANY OTHER TWO QUESTIONS

1. (a) (i) State the potential-divider rule as applied to three resistors connected in series.

(ii) The resultant resistance of two resistors connected in parallel is 12 Ω. The resistance of one of the resistors is 22 Ω . If the supply voltage is 12 V and the circuit is operated for 5 minutes. Determine ;

I. The resistance of the second resistor

II. Power developed in the circuit

III. Energy dissipated (9 marks)

(b) (i) State the Ohms law

(ii) Figure 1 shows an electrical network .By means of the Kirchhoff's laws calculate the

I. Supply current, I

II. Supply voltage, E.

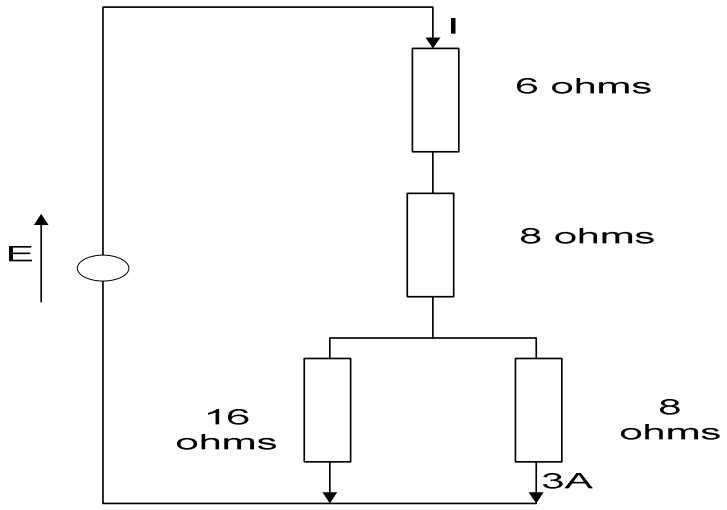

Fig 1 (9 marks)

(c) A capacitor is made of five metal plates each with an area of 900cm^2 separated by a mica sheet 2.5mm thick. If mica has relative permittivity of 7 and absolute permittivity as 8.85 X 10^{-12} F/m and a p.d of 200 V is maintained across the terminals of the capacitor. Calculate

(i) capacitance

(ii) charge

(iii) energy stored (8 marks)

(d) Distinguish between primary and secondary cells (4 marks)

2. (a) (i) Explain the effect of temperature on resistance on a conductor.

(ii) Explain the term 'positive temperature coefficient of resistance' (6 marks)

(b) The winding of a d.c motor is connected directly across a 240 V supply. When the winding is 20 ºC, the current is 2 A. After the machine has been running for some hours, the current fell to 1.8A ,the voltage remaining unaltered. Assuming the temperature coefficient of resistance of copper to be 0.00426/ºC .Determine the average temperature throughout the winding. (6 marks)

(c) (i) Describe resistivity with reference to materials

(ii) A conductor of 0.8mm diameter wire has a resistance of 300Ω. Determine the resistance of the same length of wire if its diameter were doubled.

(8 marks)

2. (a) (i) State the two Kirchhoff's laws

3. (ii) Figure 2 shows an electrical network. Calculate the currents I_1,I_2 and I_3.

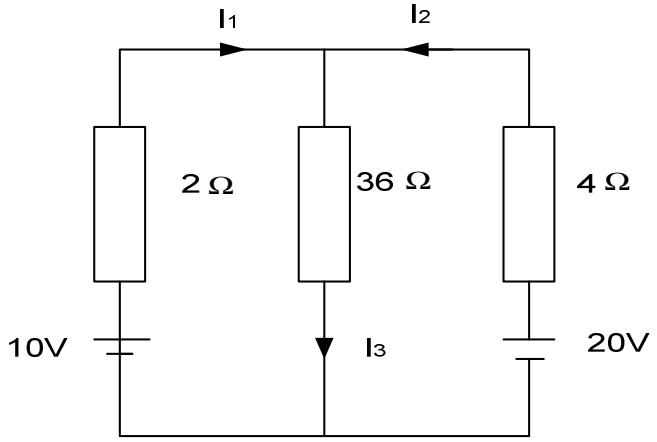

Fig 2 (12 marks)

(b) (i) With an aid of a labelled diagram describe how the syringe hydrometer is used in electrolyte test. (8 marks)

4. (a) (i) Define the following terms with respect to electrostatics;

I. Dielectric

II. Capacitance (4 marks)

(b) A capacitor consists of two metal plates, each measuring 500mm^2. The space between the metal plates is filled with glass 5mm thick. The relative permittivity of the glass is 6. Given that absolute permittivity as 8.85 X 10^{-12} F/m. Determine the capacitance of the capacitor. (7 marks)

(c) A circuit consisting of two capacitors 12 μF and 20 μF connected in series are supplied by a 12V dc source. Determine for the circuit;

I. total capacitance

II. voltage across each capacitor

II. energy in the 20 μF capacitor (9 marks)

5. (a) (i) Describe the following term with respect to batteries

I. Local action

II. electroplating.

(ii) With an aid of a labeled circuit diagram, describe the constant-voltage battery charging method (12 marks)

(b) (i) Describe the principle of operation of a the wireless battery charging

(ii) State four applications of batteries. (8 marks)