



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST YEAR FIRST SEMESTER CERTIFICATE IN ELECTRICAL AND
ELECTRONICS ENGINEERING

EPC 106: ELECTRICAL ENGINEERING PRINCIPLES I

DATE: 25/7/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

Attempt Question ONE and Any Other Two Questions

- 1 (a) (i) State the current-divider rule as applied to two resistors R_1 and R_2 connected in parallel.
- (ii) The resultant resistance of two resistors connected in parallel is $11\ \Omega$. The resistance of one of the resistors is $19\ \Omega$. 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 .

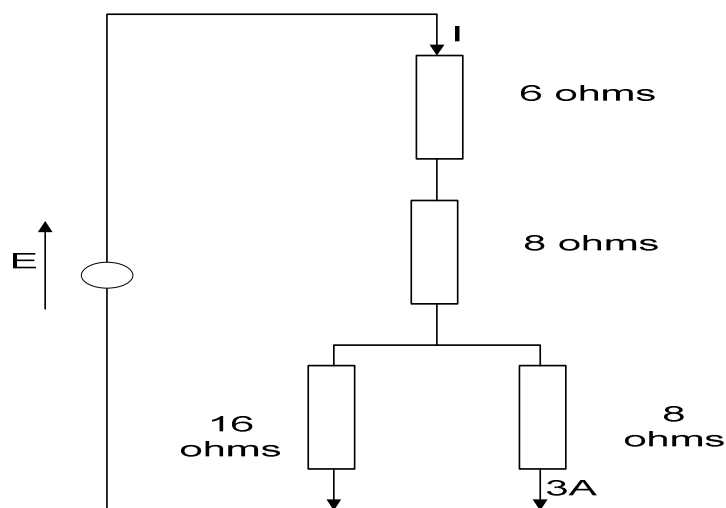


Fig 1

(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 $8.85 \times 10^{-12} \text{ F/m}$ and a p.d of 200 V is maintained across the terminals of the capacitor. Calculate
- capacitance
 - charge
 - 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 415 V supply. When the winding is 20°C , 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 $0.00426/^\circ\text{C}$. Determine the average temperature throughout the winding. (6 marks)
- (c) (i) Describe resistivity with reference to materials
- (ii) A conductor of 0.5mm diameter wire has a resistance of 300Ω . Determine the resistance of the same length of wire if its diameter were doubled. (8 marks)
3. (a) (i) State the Kirchhoff's laws
- (ii) Figure 2 shows an electrical network. Calculate the currents I_1, I_2 and I_3 .

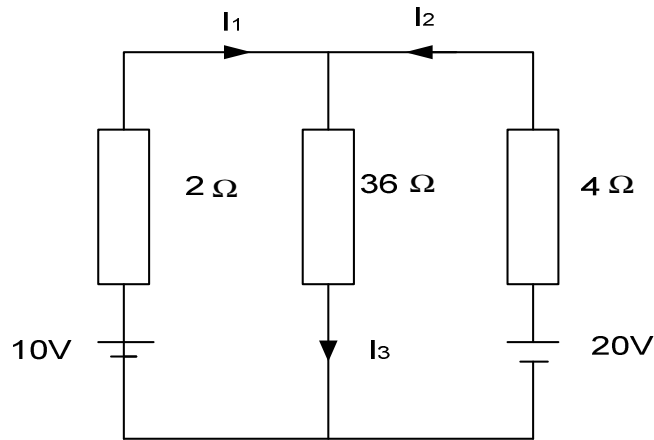


Fig 2

(12 marks)

- (b) With an aid of a labelled diagram describe how the syringe hydrometer is used in electrolyte test. (8 marks)
- 4 (a) (i) Describe the following term with respect to batteries
 I. polarisation
 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)
- 5 (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 $8.85 \times 10^{-12} \text{ F/m}$. Determine the capacitance of the capacitor. (7 marks)
- (c) A circuit consisting of two capacitors $12 \mu\text{F}$ and $20 \mu\text{F}$ connected in series are supplied by a 12V dc source. Determine for the circuit;
 I. total capacitance
 II. voltage across each capacitor
 III. energy in the $20 \mu\text{F}$ capacitor (9 marks)