MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST YEAR FIRST SEMESTER EXAMINATION FOR DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

SUPPLEMENTARY EXAMINATION

EED 101: ELECTRICAL ENGINEERING PRINCIPLES I

DATE: 28/8/2017 **TIME:8:30 – 10:30 am**

INSTRUCTIONS:

Attempt Question One And Any Other Two Questions

1. (a) (i) State the potential-divider rule as applied to two resistors R1 and R2 connected in series.

(ii) The resultant resistance of two resistors connected in parallel is 10 Ω. The resistance of one of the resistors is 16 Ω . If the supply voltage is 24 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 Superposition theorem

(ii) Figure 1 shows an electrical network. By means of superposition theorem, calculate the currents I_1,I_2 and I_3.

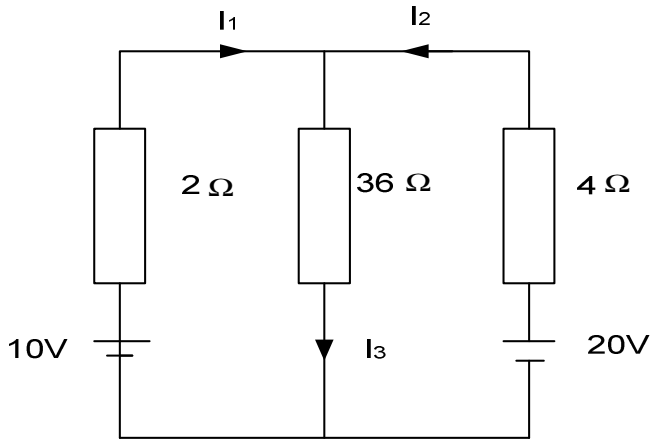

Fig 1 (8 marks)

(c) (i) With an aid of a schematic diagram describe the principle of operation of a lead-acid cell.

(ii) Distinguish between diamagnetic and paramagnetic with respect to magnetism. (9 marks)

(d) A capacitor consists of two metal plates, each 500mm x 400mm. The space between the metal plates is filled with glass 5mm thick. The relative permittivity of the glass is 7. Given that absolute permittivity as 8.85 X 10^{-12} F/m. Determine the capacitance of the capacitor. (4 marks)

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

I. Dielectric

II. Relative permittivity

(ii) A capacitor is made of five metal plates each with an area of 600cm^2 separated by a mica sheet 3mm thick. If mica has relative permittivity of 6 and absolute permittivity as 8.85 X 10^{-12} F/m. A p.d of 240 V is maintained across the terminals of the capacitor. Calculate

(i) capacitance

(ii) charge

(iii) electric field strength

(iv) energy stored (10 marks)

(b) (i) State Faraday's induction law

(ii) A conductor 220 mm long is carrying current of 50 A. The force on the conductor is 3N. Calculate the density of the field.

(iii) State four characteristics of lines of magnetic flux. (10 marks)

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

(ii) Explain the term 'negative 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 17 ºC, the current is 2.3 A. After the machine has been running for some hours, the current fell to 1.9A ,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 0.5mm diameter wire has a resistance of 300Ω. Determine the resistance of the same length of wire if its diameter were halfed.

(8 marks)

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

I. Local action

II. Secondary cell.

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

(b) A coil of 300 turns is wound uniformly over a wooden ring having a mean circumference of 400mm and a uniform cross-sectional area of 800 mm^2 . If the current through the coil is 5 A and permeability of free space is $4\pi \times 10^{-7}$ H/m. Calculate the;

(i) magnetic field strength

(ii) flux density

(iii) total flux (8 marks)

5 (a) (i) State the Kirchhoff's laws

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

I. Supply current, I

II. Supply voltage, E.

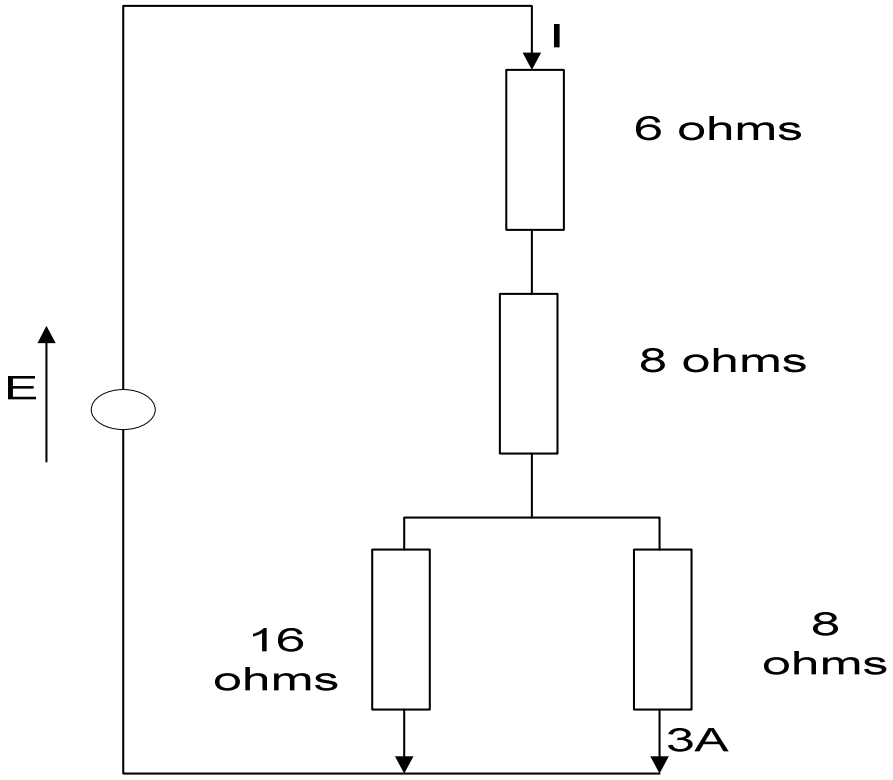

Fig 1 (8 marks)

(c) (i) describe the principle of operation of a the wireless battery charging

(ii) State four characteristics of lines of magnetic flux. (8 marks)