MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST YEAR FIRST SEMESTER DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

EED 101: ELECTRICAL ENGINEERING PRINCIPLES 1

DATE: 28/7/2017 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS:

Attempt Question One and Any Other Two Questions

1. (a) (i) State the Kirchoff's Laws

(ii) An electrical network has two resistors of values 6 ohms and 15 ohms connected in parallel across a 12 V DC source. Determine the;

I. supply current in the network,

II. power dissipated in the 15Ω resistor,

III. energy supplied if the circuit is operated for 5 minutes.

(iii) Figure 1 shows an electric circuit, by use of Kirchoff's Laws determine the current I_3.

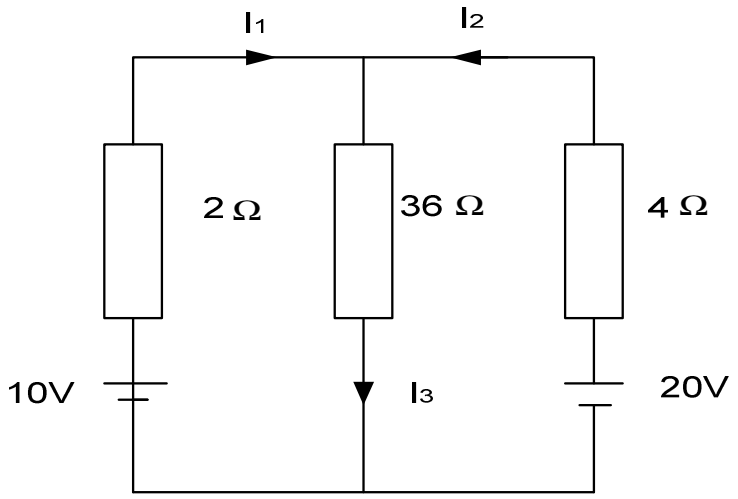

Fig 1 (15 marks)

(b) A coil is wound from a 10 m length of copper wire having cross-sectional diameter of 0.045 mm. If the resistivity of copper is 1.59 X 10^{-8}, determine the resistance of the coil.

(3 marks)

(c) A capacitor is made with five metal plates and separated by sheets of mica having a thickness of 0.5mm and a relative permittivity of 6. The area inside each metal plate is 600 cm^2. Given absolute permittivity as 8.85 X 10^{-12} F/m, calculate the capacitance.

(5 marks)

(d) (i) State four measures when handling a lead-acid battery.

(ii) State three properties of lines of magnetic flux (7 marks)

2. (a) The effective resistance of two resistors connected in parallel is 15Ω. The resistance of one of the resistors is 20Ω. Determine the;

(i) The resistance of the other resistor

(ii) The resistance of the two resistors connected in series. (5 marks)

(b) The field winding of a d.c motor is connected directly across a 240V supply. When the winding is at the room temperature of 17^0C, the current is 2.1A. After the machine has been running for some hours, the current fell to 1.9 A, the voltage remaining unaltered. Assuming the temperature coefficient of resistance of copper to be 0.00426/^{0}C at 0^0C. Determine the average temperature throughout the winding. (6 marks)

(c) (i) State Superposition theorem

(ii) Figure 1 in question 1 shows an electrical network. By means of Superposition theorem determine the values of currents I_1, I_2 and I_3. (9 marks)

3. (a) (i) Distinguish between primary and secondary cells.

(ii) With an aid of a labeled diagram, explain the construction of a lead-acid battery. (12 marks)

(b) (i) A conductor 3 meters long carrying a current of 0.4 amperes is placed in a magnetic field of 0.5 wb/m^2 . Determine the force exerted on the conductor.

(ii) State the Faraday's electromagnetic laws (8 marks)

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

(i) Capacitance

(ii) Dielectric (2 marks)

(b) Three capacitors of values 8μF, 6μF and 2μF are connected in series across a of 24V dc source. Determine the;

(i) Capacitance of the combination

(ii) Charge on the 8μF capacitor

(iii) Energy stored in the 2μF capacitor. (9 marks)

(c) A capacitor consists of two parallel plates each of area 800 cm^2 and 5 mm apart. The space between the plates is filled with a sheet of glass with relative permittivy 8. A p.d of 5kV is applied between the plates. Given absolute permittivity as 8.85 X 10^{-12} F/m, calculate the;

(i) capacitance of the capacitor

(ii) the potential gradient in kV/mm in the dielectric

(iii) total energy stored in the capacitor (9 marks)

5. (a) (i) With an aid of a labelled circuit diagram, describe the constant-current battery charging method.

(ii) A fully charged lead-acid cell has a rating of 50Ah, determine the

(iii) operation time if it is discharged at a steady current of 3 amperes (9 marks)

(b) State five applications of magnets. (5 marks)

(c) With an aid of a labelled diagram describe how the syringe hydrometer is used in electrolyte test. (6 marks)