MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FIRST YEAR FIRST SEMESTER EXAMINATION

DIPLOMA IN ELECTRICAL ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

EED 101: ELECTRICAL ENGINEERING PRINCIPLES

DATE: 14/12/2017 **TIME: 8.30-10.30 AM**

INSTRUCTIONS

ATTEMPT QUESTION ONE AND ANY OTHER TWO QUESTIONS

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

(ii) A coil of 20 Ω resistance is joined in parallel with a coil of R Ω resistance. This combination is then joined is series with an apparatus A, and the whole circuit is connected to a 100V source. Determine;

(i) The value of R so that apparatus A shall dissipate 600 Watts with a current of 10 A passing through it.

(ii) Energy supplied if the circuit is operated for 2 minutes.

(iii) Three resistors of 6 Ω , 9 Ω and 15 Ω are connected in parallel to a 9 V supply. Determine the:

I. Current in each branch of the branch;

II. Supply current;

III. Total effective resistance of the network.

(18 marks)

(b) 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. (4 marks)

(c) State three four measures when handling a lead-acid battery. (3 marks)

(d) State five properties of lines of magnetic flux (5 marks)

2. (a) A coil is wound from a 20 m length of copper wire having cross-sectional diameter of 0.05 mm and resistivity of 1.59 X 10^{-8}. Determine the resistance of the coil. (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 shows an electrical network. By means of Superposition theorem determine the values of currents I_1, I_2 and I_3.

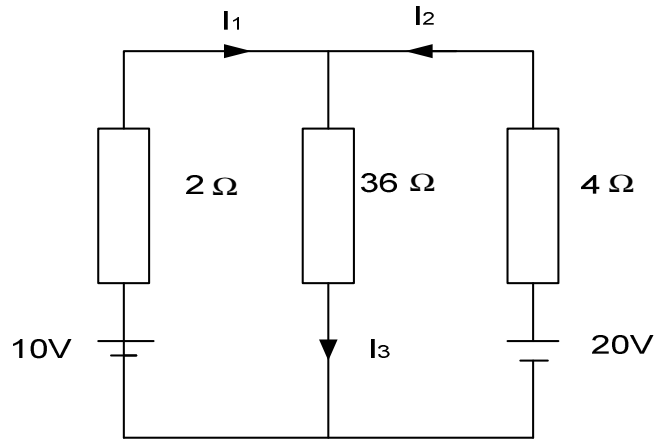

Fig 1

(9 marks

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

(i) Capacitance

(ii) Dielectric (2 marks)

(b) Three capacitors of values 12μF, 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 permittivity 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)

4. (a) 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.

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

(c) (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)

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 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)