MACHAKOS UNIVERSITY

University Examinations for 2020/2021

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA MODULE I (POWER &TELECOMMUNICATION)

ELECTRICAL ENGINEERING PRINCIPLES

DATE: 1/9/2021 **TIME: 2.30-5.30 PM**

INSTRUCTIONS TO CANDIDATES:

ATTEMPT ALL QUESTIONS

1. (a) State the Kirchhoff's Laws (4 marks)

   (b) 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 120V source. Determine;

   (i) The value of R so that apparatus A shall dissipate 500 Watts with a current of 10 amperes passing through it.

   (ii) Energy supplied if the circuit is operated for 2 minutes. (7 marks)

   (c) Three resistors of 6 Ω , 9 Ω and 15 Ω are connected in parallel to a 12 Vdc supply. Determine the:

   (i) Total effective resistance of the network;

   (ii) Supply current;

   (iii) Current in each branch of the circuit. (9 marks)

2. (a) State Superposition theorem (3 marks)

   (b) Figure 1 shows an electrical network. Determine the values of currents I_1, I_2 and I_3 by using each of the following methods

   (i) Kirchhoff's laws

   (ii) Superposition theorem

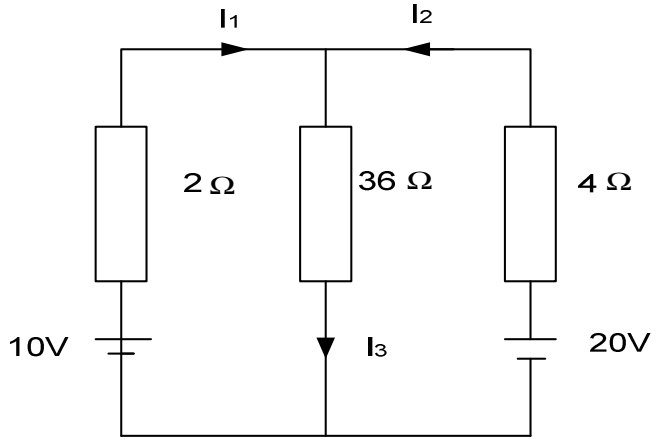

Fig 1 (17 marks)

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

(i) Capacitance

(ii) Dielectric (2 marks)

(b) A capacitor consists of two parallel metal plates, each of area 200 cm^2 and 5.0 mm apart. The space between the plates is filled with a layer of paper 2.0 mm thick and a sheet of glass 3.0 mm thick. The relative permittivities of the paper and glass are 2 and 8 respectively. A potential difference of 5 kV is applied between the plates. Calculate the:

(i) capacitance of the capacitor;

(ii) potential gradient in each dielectric in kV/mm;

(iii) total energy stored in the capacitor (14 marks)

(c) A 20 μF capacitor is charged at a constant current of 5 μA for 10 min. Calculate the:

(i) corresponding charge in coulombs ;

(ii) final p.d. across the capacitor. (4 marks)

4. (a) Three capacitors of values 12μF, 8μF 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) voltage across the 2μF capacitor.

(iv) energy stored in the 2μF capacitor. (10 marks)

(b) A capacitor consists of two parallel plates each of area 750 mm^2 and 5 mm apart. The space between the plates is filled with a sheet of glass with relative permittivity

8. A potential difference 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) charge

(iii) electric flux density

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

(v) total energy stored in the capacitor (10 marks)

5. (a) State five properties of lines of magnetic flux (5 marks)

(b) A conductor 2 meters long carrying a current of 0.5 amperes is placed in a magnetic field of 0.5 wb/m^2 . Determine the force exerted on the conductor. (4 marks)

(c) State the Faraday's electromagnetic laws (6 marks)

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