



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST YEAR FIRST TERM EXAMINATION FOR

DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTRICAL ENGINEERING PRINCIPLES

DATE: 7/6/2021

TIME: 2.30-5.30 PM

INSTRUCTIONS

ATTEMPT ALL QUESTIONS

1. a) Describe the four component of an electrical system (8 marks)
- b) (i) A coil is wound from a 10 m length of copper wire having a diameter of 0.45 mm. If the resistivity of copper is 1.59×10^{-8} , determine the resistance of the coil.
- (ii) A conductor of 0.5mm diameter wire has a resistance of 500Ω . Determine the resistance of the same length of wire if its diameter were doubled. (9 marks)
- c) State three measures when handling a lead-acid battery. (3 marks)
2. a) i State Ohms law
- ii A current of 12 A flows in a resistor of resistance 6 ohms. Determine;
 - I. Rate of heat dissipation
 - II. Heat dissipated in 30 seconds in joules
 - III. Supply voltage
 - IV. Charge (9 marks)
- b) The effective resistance of two resistors connected in series 20Ω . The resistance of one of the resistors is 8Ω . Determine the;
 - i. resistance of the other resistor
 - ii. Resistance of the two resistors connected in parallel. (5 marks)

- c) The field winding of a d.c motor made of copper is connected directly across a 110V supply. When the winding is at the room temperature of 17°C , the current is 2A. 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 $0.00426/^{\circ}\text{C}$ at 0°C . Determine the average temperature throughout the winding.

(6 marks)

3. a) Figure 1 shows an electrical network. By applying Kirchhoff's laws determine the values of currents I_1 , I_2 and I_3 .

(9 marks)

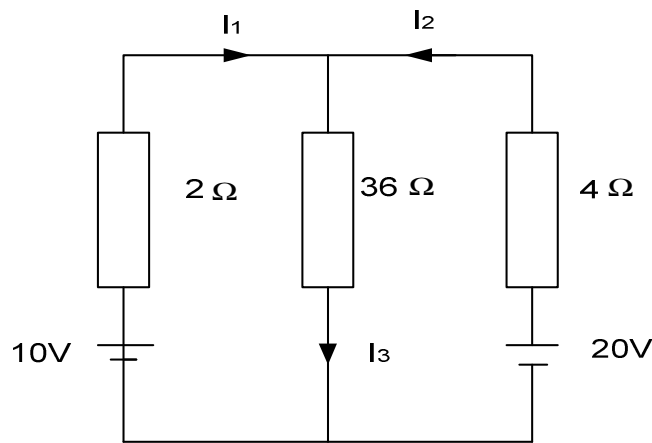


Figure 1

- b) An electrical network has three resistors of values 5 ohms, 8 ohms and 15 ohms connected in parallel across a 12 V DC source. Determine the;
- supply current in the network,
 - power dissipated in the 15Ω resistor,
 - energy supplied if the circuit is operated for 5 minutes.
- (11 marks)
4. a) Define each of the following terms with respect to electrical engineering
- current
 - resistance
 - electromotive force
 - potential difference
- (4 marks)
- b) 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)

- c) A coil of copper wire making an inductor has a resistance of 220 ohms when its mean temperature is 0°C . Determine the resistance of the coil when its temperature is raised to 60°C . Assume the temperature coefficient of resistance of copper to be $0.00426/^{\circ}\text{C}$ at 0°C . (4 marks)
5. a) State five areas of applications of batteries (5 marks)
- b) With an aid of a labelled diagram describe how the syringe hydrometer is used in electrolyte test. (6 marks)
- c) 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)