

TECHNICAL UNIVERSITY OF MOMBASA  
FACULTY OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

EEE 2102 ELECTRICAL ENGINEERING SCIENCE

SERIES: MAY 2016

Instructions

- This paper consists of FIVE questions
- Answer any THREE questions
- All Questions carry equal marks

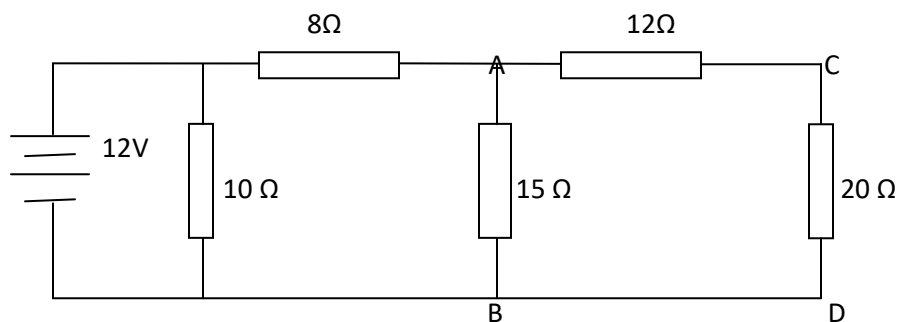
### QUESTION ONE

- (a) Define the following terms
- Ampere
  - Potential difference
  - Joule
  - Coulomb
- (8 marks)
- (b) (i) Explain THREE main sources of emf  
(ii) Explain the term electrochemical equivalent
- (8 marks)
- (c) State Kirchoff's laws
- (4 marks)

### QUESTION TWO

- (a) For the circuit of figure Q2a use Kirchoff's laws to determine:
- Total resistance
  - Circuit current
  - Power
  - Energy if the current flows for 2 minutes
  - Current in branch AB
  - Pd across CD
- (12 marks)

FIGURE Q2a

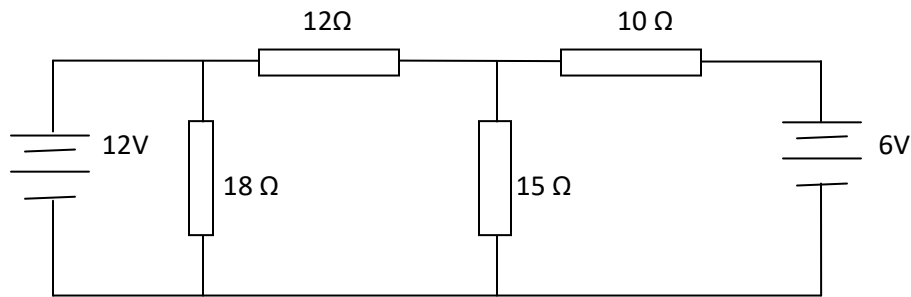


- (b) (i) Distinguish between resistivity and temperature coefficient of resistance  
(ii) A coil is wound from 28m length of copper wire having a cross-sectional area of  $2.5\text{mm}^2$ .  
Calculate:
- The resistance of the coil at  $0^\circ\text{C}$
  - The resistance of the coil at  $85^\circ\text{C}$
- (8 marks)
- (Temperature coefficient of copper =  $4.28 \times 10^{-8}$  and its resistivity =  $1.59 \times 10^{-8}$ )

**QUESTION THREE**

- (a) (i) State superposition theorem
- (ii) Use superposition theorem to calculate the current in each branch in the network of figure Q3a (10 marks)

FIGURE Q3a



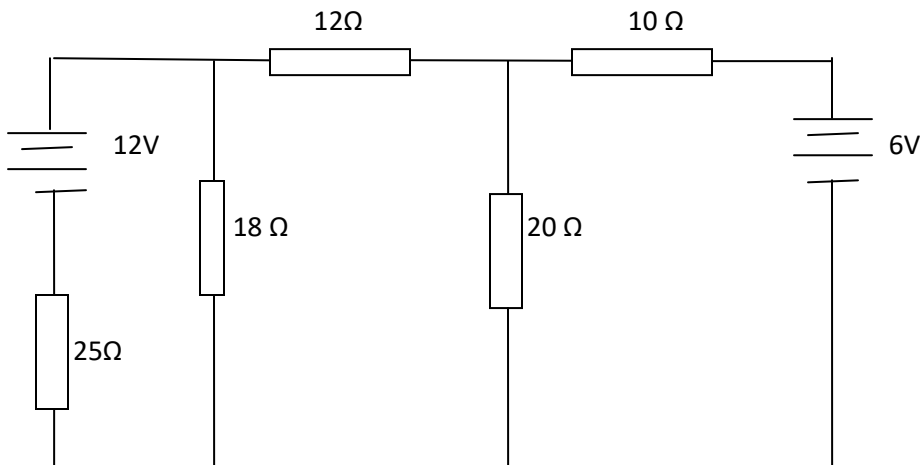
- (b) With the aid of a diagram explain the construction of a lead acid cell (6 marks)
  - (c) State any FOUR characteristics of lines of magnetic flux. (4 marks)
- (10 marks)

**QUESTION FOUR**

- (a) (i) State Thevenin's theorem
- (ii) For the circuit network of figure Q5a use Thevenin's theorem to determine the current the 20Ω

(10 marks)

FIGURE Q5a



Draw the delta and star connection of resistors and derive the basic equations for:

- i. Delta – star transformation
- ii. Star – delta transformation (10 marks)

#### QUESTION FIVE

(a) Explain the following terms in ac circuits

- i. Average value
- ii. RMS value (4 marks)

(b) Two instantaneous voltages  $V_1 = 50\sin\theta$  volts and  $V_2 = 40\sin(\theta - \frac{\pi}{6})$  volts act in the same circuit. Draw phasor diagrams and derive the expression for the sum of voltages. (8 marks)

(c) (i) Define the following terms

- I. Capacitance
- II. Farad

(ii) Two capacitors having capacitances  $8\mu\text{F}$  and  $15\mu\text{F}$  are connected in series across a 200V supply.

Calculate

- I. The pd across each capacitor
- II. The charge on each capacitor. (8 marks)