



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MEDICAL ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

DIPLOMA IN MEDICAL ENGINEERING (DME 315)

EEP 2152: ELECTRICAL ENGINEERING SCIENCE

END OF SEMESTER EXAMINATION

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

**DATE: 9 May 2016**

## Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FOUR** questions. Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

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## Question ONE (Compulsory)

(a) With reference to a simple cell, explain:

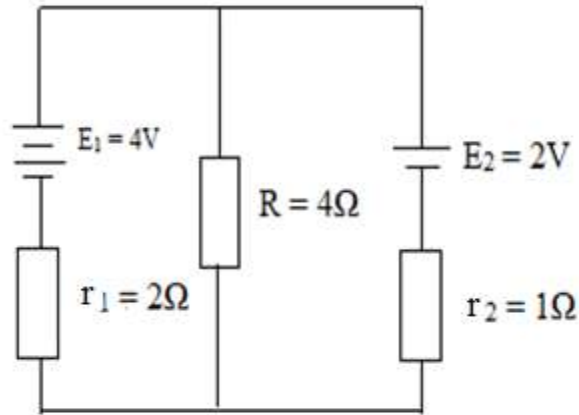
- (i). Polarisation
- (ii). Local action

**(4 marks)**

(b) (i) State Kirchhoff's laws.

**(4 marks)**

- (ii) Applying Kirchhoff's laws determine the currents flowing in each branch of the network given Figure Q1.



**Fig. Q1**

**(10 marks)**

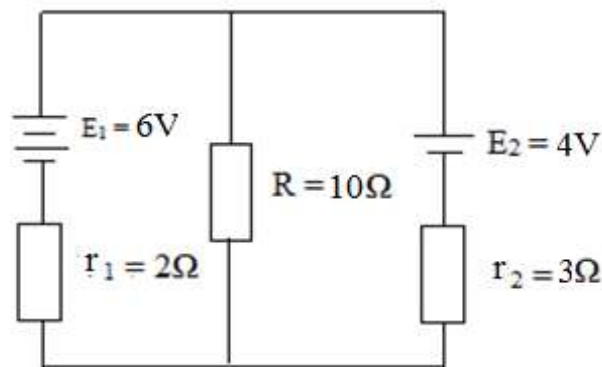
- (c) (i) State any **FOUR** characteristics of magnetic flux lines. **(4 marks)**
- (ii) Describe the processes that occur when the cell is:
- (I) Charging
  - (II) Discharging

**(8 marks)**

**Question TWO**

- (a) (i) Define the capacitance of a capacitor. **(2 marks)**
- (ii) State superposition theorem. **(2 marks)**

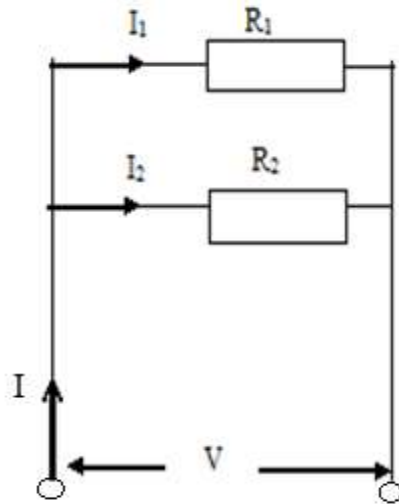
- (b) Applying superposition theorem determine the current in each branch of the network given Fig. Q2(a).



**Fig. Q2(a)**

**(10 marks)**

- (c) Applying current division principle for the circuit given Fig. Q2(b) show the relationship between the supply current and the branch currents.



**Fig. Q2(b)**

**(6 marks)**

### Question THREE

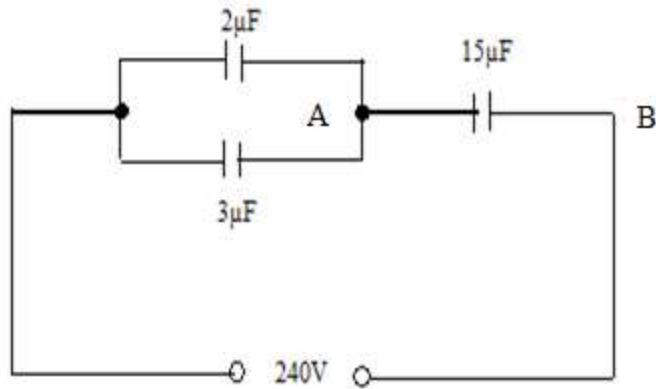
- (a) State the procedure followed to determine electrical quantities in active networks applying Thevenins theorem. **(4 marks)**
- (b) (i) With the aid of a diagram describe the construction of primary cell. **(8 marks)**  
(ii) State **THREE** applications of secondary cells. **(3 marks)**
- (c) Given that two parallel rectangular plates measuring 20cm by 40cm carrying an electric charge of  $0.2\mu\text{C}$ . Determine:
- (i) Electric flux density  
(ii) Electric field strength if the plates are spaced 5mm apart and the voltage between them is 0.25KV.

**(5 marks)**

### Question FOUR

- (a) (i) State the difference between ideal constant voltage generator to ideal constant current generator. **(4 marks)**  
(ii) Describe **THREE** types of magnetic materials giving an example in each. **(6 marks)**
- (b) For the given circuits network Fig. Q4(b), determine:
- (I) Equivalent capacitance  
(II) The voltage across AB  
(III) The charge on each capacitor

**(10 marks)**



**Fig. Q4(b)**

**Question FIVE**

(a) With aid of a diagram describe hysteresis loop as exhibited in a ferromagnetic material. **(10 marks)**

(b) (i) Given that a 250-KVA, 11000V/415V, 50Hz single phase transformer has 80 turns on the secondary winding. Determine:

- (I) Primary and secondary currents
- (II) Primary turns
- (III) Maximum value of the flux

**(5 marks)**

(ii) Given that 12V battery is connected in a circuit having three series-connected resistors of 4Ω, 9Ω and 11Ω. Determine:

- (I) Current flowing through the circuit
- (II) Voltage across 9Ω resistor
- (III) Power dissipated in the 11Ω resistor

**(5 marks)**