TECHNICAL UNIVERSITY OF MOMBASA

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

<u>**Instructions to Candidates**</u>
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.

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
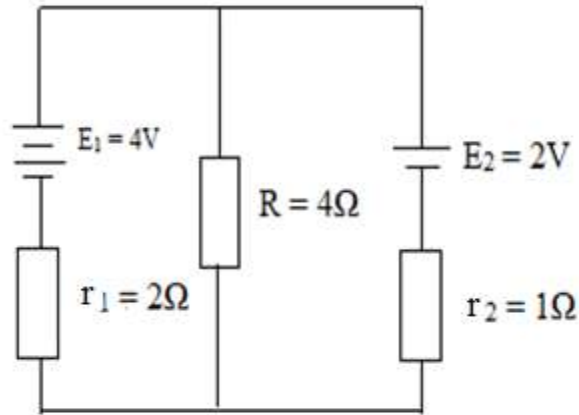   of the network given Figure Q1.

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)**

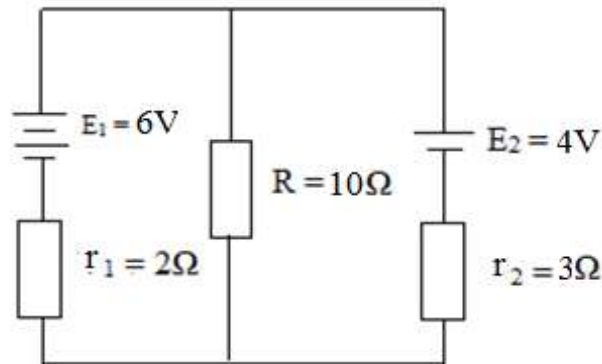(b) Applying superposition theorem determine the current in each branch of the network given Fig. Q2(a).

Fig. Q2(a)

(10 marks)

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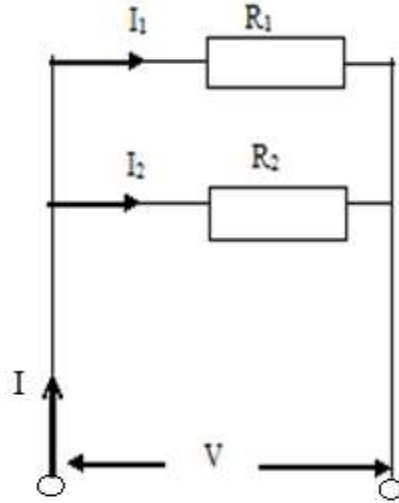   relationship between the supply current and the branch currents.

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 0.2µC. 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
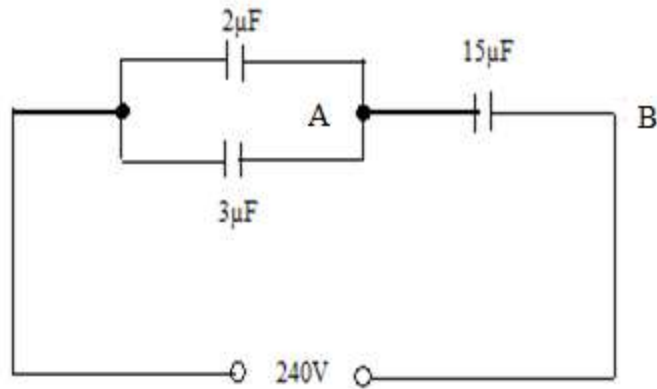   (III)   The charge on each capacitor

                                                                            (10 marks)

2μF

15μF

A

B

3μF

240V

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)