TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

Electrical and Electronic Engineering

UNIVERSITY EXAMINATION FOR:

DEGREE OF BACHELOR OF ELECTRICAL AND ELECTRONIC ENGINEERING
(REGULAR/EVENING)

EEE2509: HIGH VOLTAGE TECHNOLOGY   PAPER 2

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

DATE: SEPTEMBER 2018

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **five** Questions; Question ONE is compulsory. In addition attempt any Other TWO Questions.
Do not write on the question paper.

Question ONE (Compulsory 30 marks)

a) An absolute electrostatic voltmeter has a movable circular plate 10cm in diameter. If the distance between the plates during measurement is 6 mm. Determine the potential difference when the force of attraction is 0.4gm.   **10Marks**

b) Using a labelled diagram explain the operation of the CHUBB –FORTESCUE method of measuring peak high a.c voltage.   **10Marks**

c) Rod gaps are no longer used for the measurement of high a.c.
   i.   Explain why?
   ii. Use a labelled diagram to explain why the rod gaps can be used for the measurement of d.c high voltage.   **10Marks**

Question TWO

(a) Using a labeled diagram, explain the operation of the Cockroft – Walton voltage multiple circuit when:

   (i) The circuit is unloaded.
   (ii) When loaded   **15Marks**

(b) Use labeled diagrams to explain the difference between chopped wares. –   **5 Marks**

Question THREE

a.) Using a labeled diagram explain the operation of the Goodlet impulse voltage generator and compare its performance with that of the Marx circuit.   **10 Marks**

b.) Briefly describe the factors that influence the design of the compensating reactors used in multistage transformers.   **2 Marks**

c.) A 100kVA, 250V/200kV feed transformer has a resistance and reactance of 2% and 6% respectively. This transformer is used to test a cable at 600kV at 50Hz. The cable takes a charging current of 0.6A at 600kV. Using a circuit diagram, determine;

   i.   The series inductance required under such conditions.
   ii.   Input voltage to the transformer

   Assume 1.5 % internal resistance of the inductor and neglect the dielectric loss of the cable.   **8Marks**

Question FOUR

(a) Treeing and tracking phenomenon in solid dielectrics; explain the two processes using diagrams.   **10 Marks**

(b) A steady current of 600µA flows through the plane electrode separated by a distance of 0.6cm. When a voltage of 12kV is applied. Determine the Townsends first ionization coefficient if a current of 65µA flows when the distance of separation is reduced to 0.12cm and the field is kept at the previous value.   **10 Marks**

Question FIVE

(a) Explain thermal breakdown in solid dielectrics. How is the mechanism more significant than the other mechanisms?   **5 Marks**

(b) Explain the application of oil in electrical power apparatus and discuss briefly its function with reference to circuit breakers.   **5 Marks**

(c) An electrostatic voltmeter has two parallel plates. The movable plate is 10cm in diameter with 15kV between the plates the pull is 6×10^{-3} Newtons. Determine the charge in capacitance for a movement of 1.2mm of the moveable plate. Indicate any constants used.   **5 Marks**

(d) Discuss the effects of;
      (i) Nearby earthed objects
      (ii) Humidity
        (iii) Dust particles

On measurement of high voltage using sphere gaps. **5 Marks**

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