NEW SCHEME

Reg. No. ☐☐☐☐☐☐☐☐☐☐

Seventh Semester B.E. Degree Examination, January/February 2006

Electrical & Electronics Engineering

High Voltage Engineering

Time: 3 hrs.)

(Max.Marks : 100

Note: *Answer any FIVE full questions.*

1. (a) List the advantages of very high voltages for transmission purposes. What is the highest value of AC transmission voltage in India ? What is the need for generating high voltages in laboratory ? **(10 Marks)**

   (b) Explain any three ionisation processes taking place in a gas. **(10 Marks)**

2. (a) Explain Townsend's theory of breakdown of gases. Derive the current growth equation. **(12 Marks)**

   (b) In an experiment in a certain gas it was found that the steady state current is 5.5×10^{-8} A at 8 KV at a distance of $0.4 cm$ between the plane electrodes. Keeping the field constant and reducing the distance to 0.1 cm results in a current of $5.5 \times 10^{-9} A$. Calculate Townsend's primary ionisation coefficient α. **(4 Marks)**

   (c) Derive Paschev's law. **(4 Marks)**

3. (a) Explain the suspended particle theory and the stressed oil volume theory of breakdown in liquids. **(10 Marks)**

   (b) Explain the electromechanical breakdown and thermal breakdown of solid dielectrics. **(10 Marks)**

4. (a) With a neat diagram explain the two stage cascade transformer connection to produce high voltages at 50 Hz. **(8 Marks)**

   (b) A $100 KVA$, $400V/250V$ testing transformer has 8% leakage reactance and 2% resistance on $100 kVA$ base. A cable has to be tested at $500 kV$ using the above transformer as a resonant transformer at $50 Hz$. If the charging current of the cable at $500 kV$ is $0.4A$, find the series inductance required. Assume 2% resistance for the inductor to be used and the connecting leads. Neglect the dielectric loss of the cable. What will be the input voltage to the transformer ? **(6 Marks)**

   (c) Three $500 kV$, $500 KVA$ transformers with a short circuit impedance of 12% are connected in cascade. Determine the rated full load current, impedance in ohms and the short circuit currents when the transformers are excited to 350 kV each. **(6 Marks)**

5. (a) With a neat diagram explain the working of 4 stage Cock roft - Walton DC generator. Derive expressions for ripple and output voltage. **(12 Marks)**

   (b) An impulse generator has eight stages with each condenser rated for $0.16 \mu F$ and $125 kV$. The load capacitance available is $1000 pF$. Find the series resistance and the damping resistance needed to produce $1.2/50 \mu s$ impulse wave. What is the maximum output voltage of the generator. If the charging voltage is 120 kV? **(8 Marks)**

6. (a) With a neat diagram explain the construction and working of an electrostatic voltmeter. What are its advantages and disadvantages ? (10 Marks)

   (b) List the chief sources of errors in potential dividers for impulse voltage measurements. (5 Marks)

   (c) The flashover voltage of an insulator at room temperature and pressure of 18^0C and $680mm$ of mercury pressure is $225kV$. Determine the flashover voltage at standard temperature and pressure of 26^0C and $760mm$ of Hg pressure. (5 Marks)

7. (a) Explain the method of measuring high voltages using sphere gaps. Also explain the factors affecting the measurements. (10 Marks)

   (b) Explain the method of measuring the capacitance and $tan\ \delta$ of a capacitor using a high voltage Schering Bridge. Derive the relevant equations. (10 Marks)

8. (a) Explain the method of measuring high voltages using an ammeter in series with a high impedance. (5 Marks)

   (b) Write a short note on magnetic links. (5 Marks)

   (c) With neat diagrams explain the impulse testing of transformers. How are the faults detected and located ? (10 Marks)

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