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NEW SCHEME

Seventh Semester B.E. Degree Examination, Dec. 06 / Jan. 07
Electrical and Electronics Engineering
High Voltage Engineering

Time: 3 hrs.]

[Max. Marks:100

Note : 1. Answer any FIVE full questions.
 2. Assume suitably any missing data.

1. a. Explain the process of ionization by collision and hence derive the "Townsend's Current Growth Equation". (07 Marks)
 b. Explain briefly formative time lag and statistical time lag. (05 Marks)
 c. In an experiment in a certain gas it was found that the steady state current is 5.5×10^{-5} 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 5.5×10^{-9} A. Calculate Townsend's primary ionization coefficient α . (08 Marks)

2. a. Briefly explain "Cavitation and Bubble Theory" in the context of liquid dielectric breakdown. (08 Marks)
 b. The following observations were made in an experiment for determination of dielectric strength of transformer oil. Determine the power law equation.

Gap spacing (mm)	4	6	8	10
Breakdown voltage (kV)	88	135	165	212

(12 Marks)

3. a. Explain how high direct voltages can be generated using a Cockroft Walton circuit. (08 Marks)
 b. A Cockroft Walton type voltage multiplier has eight stages with capacitances, all equal to $0.05 \mu\text{F}$. The supply transformer secondary voltage is 125 kV at a frequency of 150 Hz. If the load current to be supplied is 5 mA, find
 i) The percentage ripple
 ii) The regulation
 iii) The optimum number of stages for minimum voltage drop. (12Marks)

4. a. Explain how high alternating voltages can be generated by "Cascading of Transformers". (07 Marks)
 b. State the chief advantages of resonant transformers. (05 Marks)
 c. A 100 kVA, 400 V/250 kV 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 0.4 A, 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? (08 Marks)

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- 5 a. Explain the working principle of series capacitor peak voltmeter based on the Chubb-Frotschue method. (07 Marks)
- b. Briefly explain the four factors influencing the Sparkover voltage of sphere gaps. (08 Marks)
- c. A generating voltmeter has to be designed so that it can have a range from 20 to 200 kV d.c. If the indicating meter reads a minimum current of $2 \mu\text{A}$ and a maximum current of $25 \mu\text{A}$, what should the capacitance of the generating voltmeter be? (05 Marks)
- 6 a. Give the general equation of a standard impulse wave and explain the wave shape giving the percentage tolerances allowed for front, tail and the peak. (07 Marks)
- b. Which are the four main sources of errors in the measurement of impulse voltages with potential dividers. (08 Marks)
- c. A resistance divider of 1400 kV (impulse) has a high voltage arm of $16 \text{ k}\Omega$ and a low voltage arm consisting of 16 members of 250Ω , 2 W resistors in parallel. The divider is connected to a CRO through a cable of surge impedance 75Ω and is terminated at the other end through a 75Ω resistor. Calculate the exact divider ratio. (05 Marks)
- 7 a. Explain the method of measuring dielectric loss at power frequency using high voltage Schering Bridge. (08 Marks)
- b. Explain partial discharge detection using straight detectors. (07 Marks)
- c. A Schering bridge was used to measure the capacitance and loss angle of a high voltage bushing. At balance, the observations were : the value of the standard condenser = 100 pF , $R_3 = 3180 \Omega$, $C_3 = 0.00125 \mu\text{F}$ and $R_4 = 636 \Omega$. What are the values of the capacitance and loss angle of the bushing? (05 Marks)
- 8 Write short notes on any four of the following :
- Trigatron gap
 - Mixed R-C potential dividers
 - Rogowski coil
 - Treeing and tracking
 - Van De Graff generator
 - Penning effect.
- (20 Marks)