1. What are the gases mainly used in insulating medium at high pressures? Which is more suitable? Why? What about its dielectric strength? Explain. [16]

2. (a) Define time lags of breakdown and show how the time lags of breakdown of various electrode gaps in gases can be used for protecting high voltage systems. [8]
   (b) Describe current growth phenomenon in gas subjected to electric fields. [8]

3. (a) Describe the mechanism of short-term breakdown of composite insulation
   (b) How do the temperature and moisture affect the breakdown strength of solid dielectrics? [6+10]

4. (a) Explain clearly the basic principle of operation of an electrostatic generator.
   (b) Discuss the advantages and limitations of Vande Graf generator. [8+8]

5. (a) Draw and explain high current generator equivalent circuit.
   (b) A 6 stage impulse generator has capacitors each rated for 0.2 $\mu$F, 150 kV. The capacitance of the test specimen is 400pF. Find the maximum output voltage if the charging voltage is 110kV. [8+8]

6. (a) Compare the relative advantages and disadvantages of using a series resistance micro ammeter and a potential divider with an electrostatic voltmeter for measuring high d.c. voltages.
   (b) What is capacitance voltage transformer? Explain the phasor diagram how a tuned capacitance voltage transformer can be used for high voltage measurements in power systems. [8+8]

7. (a) What is the force developed in electro static voltmeter? Explain.
   (b) A Ragowskii Coil is required to measure impulse current of 8 kA having rate of change of current of $10^{10}$ A/sec. The voltmeter is connected across the integrating circuit which reads 8 Volts for full scale deflection. The input to the integrating circuit is from the Ragowskii coil. Determine the mutual inductance of the coil, R and C of the integrating circuit. [8+8]

8. (a) A sample of insulation is placed in one arm CD of the Schering bridge. Under balanced conditions, the other three arms are as follows: AD = 109 pF, BC = 100 ohms and AB = 309 ohms in parallel with a loss free capacitance of 0.5 $\mu$F. Determine the capacitance equivalent series resistance and the power...
factor of the insulation in the arm CD. Derive the balanced conditions and also draw the phasor diagram.

(b) Explain the following terminologies often used in partial discharge detection
   i. electrical discharge
   ii. partial discharge
   iii. discharge inception voltage
   iv. discharge extinction voltage

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1. (a) What is mean free path? Explain its importance
   (b) Discuss the principle of
   i. Photoionisation
   ii. Secondary ionisation

2. (a) How is the condition for breakdown obtained in a Townsend’s discharge?
   (b) What is post breakdown phenomena in gases? Explain.

3. (a) How does the “internal discharge” phenomena lead to breakdown in solid dielectrics?
   (b) What is a composite dielectric and what are its properties?

4. (a) Discuss in detail about voltage multiplier circuits
   (b) Discuss ripple in cascaded voltage multiplier circuits.

5. (a) Derive an expression for voltage efficiency of single stage impulse generator.
   (b) An impulse current generator has a total capacitance of 15 \( \mu \text{F} \), the charging voltage of 125 kV, the circuit inductance is 2 mH and the dynamic resistance is 1 ohm. Find the peak current and wave shape of the wave.

6. What are the requirements of a sphere gap for measurement of high voltages?
   Discuss the advantages of sphere gap for measurements.


8. (a) A 33 kV 50 Hz schering bridge is used to test a sample of insulation. The various arms have the following parameters on balance. The standard capacitance of 500 \( \mu \text{F} \), resistive branch 800 ohms and branch parallel combination of resistance and capacitance has values of 180 ohms and 0.15 \( \mu \text{F} \). Determine the value of capacitance of the sample, its parallel equivalent loss resistance, power factor and the power loss under these test conditions.
   (b) Explain the terms withstand voltage, flashover voltage, 50% flashover voltage, wet and dry power frequency tests as referred to high voltage testing
1. (a) Define and explain mobility of gaseous ions.
   (b) What is de-ionisation by diffusion in gases? Explain. [8+8]

2. (a) What are the physical conditions that govern the ionization process?
   (b) What is an electrical avalanche? How do the avalanches give rise to an electrical breakdown in case of Townsend’s type of discharge? [4+12]

3. (a) What do you understand by “intrinsic strength” of a solid dielectric? How does breakdown occur due to electrons in a solid dielectric?
   (b) What are the special features of epoxy resin insulation? [8+8]

4. (a) Explain and compare the performance of half wave rectifier and voltage double circuits for generation of high d.c. voltages.
   (b) A 10 stage Cockroft – Walton circuit has all capacitors of 0.1 µF. The secondary voltage of supply transformer is 11 kV at a frequency of 50 Hz. If the load current is 2 mA find
      i. the voltage regulation
      ii. ripple voltage. [8+8]

5. (a) Give the Marx circuit arrangement for multi stage impulse generators.
   (b) An impulse current generator is rated for 50kW sec. The parameters of the circuit are C = 51 µF and L = 2 µH. Find the time to front, time to tail of the current wave form. [8+8]

6. (a) Compare the relative advantages and disadvantages of using a series resistance micro ammeter and a potential divider with an electrostatic voltmeter for measuring high d.c. voltages.
   (b) What is capacitance voltage transformer? Explain the phasor diagram how a tuned capacitance voltage transformer can be used for high voltage measurements in power systems. [8+8]

7. Discuss and compare the performance of:
   (a) resistance
   (b) capacitance potential dividers
   for measurement of impulse voltages. [16]
8. (a) How the dielectric constant and loss factor of an insulating material can be measured under high voltage condition at power frequency? Draw the necessary circuit diagram and explain the method.

(b) Explain the procedure for performing the partial discharge test. [10+6]
IV B.Tech I Semester Supplementary Examinations, February 2008
HIGH VOLTAGE ENGINEERING
(Electrical & Electronic Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) What is mean free path? Explain its importance
   (b) Discuss the principle of
       i. Photoionisation
       ii. Secondary Ionisation
       [8+8]

2. (a) What are the physical conditions that govern the ionization process?
   (b) What is an electrical avalanche? How do the avalanches give rise to an elec-
       trical breakdown in case of Townsend’s type of discharge?
       [4+12]

3. (a) What are the various breakdown mechanisms that occur in the solid di-
       elecctrics?
   (b) Explain in detail the intrinsic breakdown.
       [4+12]

4. (a) Why is a Cockroft - Walton circuit preferred for voltage multiplier?
   (b) Explain Cockroft - Walton circuit with a schematic diagram.
       [6+10]

5. (a) Discuss why three electrode gaps are required for impulse generator.
   (b) An eight stage impulse generator has 0.12 μF capacitors rated for 167kV. If
       it has to produce 1/50 μs waveform across load capacitor of 15000pF, find the
       values of wave front and wave tail resistances.
       [8+8]

6. Write short notes on:
   (a) Faraday Generator
   (b) Magnetic Links
   (c) Hall generator.
       [16]

7. (a) Draw a simplified equivalent circuit of a resistance potential divider and discuss
     its step response.
   (b) An absolute electrostatic voltmeter has a movable circular plate 8 c.m in di-
       ameter. If the distance between the plates during the measurement is 4 mm,
       determine the potential difference when the force of attraction is 0.2 gm. wt.
       [8+8]

8. (a) A schering bridge was used to measure the capacitance and loss angle of a high
     voltage bushing. At balance, the observations are as follows : the value of the
     standard condenser = 100 pF, \( R_3 = 3180 \) ohms, \( C_3 = 0.00125 \) μF and \( R_4 = 636 \) ohms. Calculate the values of the capacitance and tan d of the bushing

1 of 2
(b) Explain the partial discharge tests on high voltage cables. How is a fault in the insulation located in this test [8+8]