

IV Year II Semester
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HIGH VOLTAGE ENGINEERING
(Professional Elective-III)

Preamble:

The course is planned to give students regarding the growth of power, this is why HV power transmission has become an important subject. The performance of generating equipment requires knowledge of different phenomena occurring at higher voltage. Thus evaluations of various insulating materials are required for protection of HV equipment. Keeping this in view the course is designed to understand various phenomena related to breakdown study and withstand characteristics of insulating materials. The course also describes the generation and measurement of DC, AC and Impulse voltages as well various testing techniques.

Learning objectives:

1. Able to understand electric field distribution and computation in different configuration of electrode systems.
2. Able to understand HV breakdown phenomena in gases, liquids and solids dielectrics.
3. Able to acquaint with the generating principle of operation and design of HVDC, AC and Impulse voltages and currents.
4. Able to understand various techniques of AC, DC and Impulse measurement of high voltages and currents.
5. Able to understand the insulating characteristics of dielectric materials.
6. Able to understand the various testing techniques of HV equipment.

Unit – I

Introduction to High Voltage Technology

Electric Field Stresses – Uniform and non-uniform field configuration of electrodes – Estimation and control of electric Stress – Numerical methods for electric field computation.

Unit – II

Break down phenomenon in gaseous, liquid and solid insulation

Gases as insulating media – Collision process – Ionization process – Townsend's criteria of breakdown in gases – Paschen's law – Liquid as Insulator – Pure and commercial liquids – Breakdown in pure and commercial liquid – Intrinsic breakdown – Electromechanical breakdown – Thermal breakdown – Breakdown of solid dielectrics, composite dielectrics used in practice.

Unit – III

Generation of High voltages and High currents

Generation of high DC voltages – Generation of high alternating voltages – Generation of impulse voltages and currents – Tripping and control of impulse generators.

Unit – IV

Measurement of high voltages and High currents

Measurement of high AC, DC and Impulse voltages – Voltages and measurement of high currents – Direct, alternating and Impulse.

Unit – V

Non-destructive testing of material and electrical apparatus

Measurement of DC resistivity – Measurement of dielectric constant and loss factor – Partial discharge measurements.

Unit – VI

High voltage testing of electrical apparatus

Testing of insulators and bushings – Testing of isolators and circuit breakers – Testing of cables – Testing of transformers – Testing of surge arresters – Radio interference measurements.

Learning Outcomes:

1. Able to know and further deals with the performance of high voltages with regard to different configurations of electrode systems.
2. Able to understand theory of breakdown and withstand phenomena of all types of dielectric materials.
3. Able to deal with the techniques of generation of AC, DC and Impulse voltages.
4. Able to apply knowledge for measurement of high voltage and high current AC, DC and Impulse.
5. Able to be in a position to measure dielectric property of material used for HV equipment.
6. Able to know the techniques of testing various equipment's used in HV engineering.

Text books:

1. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition.
2. High Voltage Engineering and Technology by Ryan, IET Publishers.

Reference books:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition
2. High Voltage Engineering by C.L.Wadhwa, New Age International (P) Limited, 1997.
3. High Voltage Insulation Engineering by RavindraArora, Wolfgang Mosch, New Age International (P) Limited, 1995.