

III Year I Semester

Code: 20EE6319

L T P C

3 0 0 3

HIGH VOLTAGE ENGINEERING

Preamble: This course provides strong foundation in insulation technology and the ability to estimate and analyse over-voltages in power system. The course gives the ability to generate, measure and test the high voltages and currents.

Course Objectives

1. To understand the electric field distribution and computation in different configuration of electrode systems.
2. To study the HV breakdown phenomena in gases, liquids and solids dielectrics.
3. To provide adequate knowledge on the generation of high voltages and currents.
4. To understand the measurement of high voltages and currents and insulating characteristics of dielectric materials.
5. To study the various testing techniques of HV equipment.

Course Outcomes

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

CO – PO & CO – PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2	2										3	2	
CO 2	3	2		2									3	2	
CO 3	3	3			2	2							2	2	
CO 4	2	2	1	1									2	1	1
CO5	3	2			2								3	2	

1 – Weak, 2 – Moderate and 3 - Strong

Unit – I: High Voltage Terminology & Concepts

12 Hours

Introduction - Static dielectric constant – Polarization and dielectric constant - 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 Mechanism in gaseous, liquid and solid insulation 12 Hours

Behaviour of gaseous dielectrics in electric fields – gaseous discharges – different ionization processes – effect of electrodes on gaseous discharge – Townsend’s theory, Streamer theory – 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 12 Hours

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 12 Hours

Measurement of high AC, DC and Impulse voltages – Voltages and measurement of high currents – Direct, alternating and Impulse. Measurement of DC resistivity – Measurement of dielectric constant and loss factor – Partial discharge measurements.

Unit – V: High voltage testing of electrical apparatus 12 Hours

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

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.
3. Dieter Kind, Kurt Feser, “High Voltage Test Techniques”, SBA Electrical Engineering Series, New Delhi, 1999.
4. High Voltage Engineering by C.L. Wadhwa, New Age Internationals (P) Limited, 1997.

Reference Books:

1. High Voltage Engineering by M. S. Naidu and V. Kamaraju–TMH Publications, 3rd Edition
2. High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P)Limited,1995
3. Dieter Kind, Kurt Feser, “High Voltage Test Techniques”, SBA Electrical Engineering Series, New Delhi, 1999.