3/4 B.Tech. SECOND SEMESTER

EE6T4 HIGH VOLTAGE ENGINEERING Credits: 3

Lecture: 3 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Objective:

To get a fair knowledge about the generation of high voltages and currents. Understand the generation and measurement of high voltages and currents. Understand the concept of solid, liquid and gaseous dielectrics. Gain knowledge in testing of high voltage equipments.

Learning outcomes:

1. Describe the principles behind generating high DC – AC and impulse voltages
2. Develop equivalent circuit models of the different high voltage generators
3. Perform a dynamic response analysis of high voltage measurement systems
4. Compute the breakdown strength of gas, liquids and solids insulation systems
5. Transient voltages and their propagation characteristics
6. Insulation life and accelerated tests.

UNIT I Generation of High D.C and A.C Voltages

Principle of Voltage Doubler circuit, Cockcroft-Walton cascade arrangement and its Mathematical analysis, Van de Graff Generators; cascade connection of transformers, Rresonant transformers, Tesla coil.

UNIT II Generation of Impulse Voltages and Impulse Currents

Standard specifications, Sstandard wave shapes for testing, Circuits for producing Impulse waves, Multistage impulse generator-Marx Circuit, Standard specifications, analysis of impulse current generator, Tripping and control oh Impulse generator.

UNIT III Measurement of High Voltages

General concepts of High voltage measurements, Series resistance micro ammeter, Resistance potential divider, Generating Volt meters, Series impedance voltmeters, CVT, Electrostatic Voltmeters, Sphere gaps, Potential dividers for Impulse voltage measurements.

UNIT IV Measurement of High Currents

Measurement of High Direct-Currents, Measurement of High Alternating currents and Measurement of Impulse Currents.

UNIT V Break Down In Gaseous and Liquid Dielectrics

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 liquids.

UNIT VI Break Down In Solid Dielectrics

Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, solid dielectrics used in practice.

UNIT VII 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.

UNIT VIII Over Voltage Phenomenon and Insulation Co-Ordination

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

Learning Resources

Text Books:

1. High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 3rd Edition

Reference Books:

1. High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition.
2. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 1997.