

EE423 HIGH VOLTAGE ENGINEERING (Dept. Elective - III)

Course Description & Objectives:

The course provides advanced knowledge associated with high voltage engineering methods, techniques and equipment. Learn fundamentals of the failure mechanisms of solid, liquid and gaseous insulation at high voltages. Learn consequent design principles for high voltage equipment; of the generation of high direct, alternating and impulse voltages for testing high-voltage equipment; and of methods for monitoring and assessing the condition of high-voltage equipment such as dissolved gas analysis for oil-filled transformers and partial discharge in cables. Learn the high-voltage equipment and in particular underground cables, overhead transmission lines, transformers, bushings and switchgear.

Course Outcomes:

- I Describe the principles behind generating high DC-, AC- and impulse voltages
- I Develop equivalent circuit models of the different high voltage generators
- I Perform a dynamic response analysis of high voltage measurement systems
- I Compute the breakdown strength of gas-filled insulation systems with simple geometries

UNIT I - Introduction To High Voltage Technology & Applications :

Electric Field Stresses, Gas / Vacuum as Insulator, Liquid Dielectrics, Solids and Composites, Surge voltages, their distribution and control, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushings.

UNIT II - Conduction and break down in gases, liquies & solid dielectrics:

Gases as insulating media, Townsend's criteria of breakdown in gases, Break down in Electro negative gases ,Time lags for Break down ,Streamer Theory of Break down in Gases Paschen's law, pure and commercial liquids, breakdown in pure and commercial liquids. Intrinsic breakdown, electromechanical breakdown, thermal breakdown, Breakdown in composite dielectrics.

UNIT III - Generation of high voltages & currents :

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Tripping and control of impulse generators.

UNIT IV - Measurement of High Voltages & Currents :

Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct , alternating and Impulse, Oscilloscope for impulse voltage and current measurements.

UNIT V - High Voltage Testing of Electrical Apparatus :

Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements, Testing of Insulators and bushings, Testing of cables, Testing of Transformers, Radio Interference measurements.

TEXT BOOKS:

1. M.S.Naidu and V. Kamaraju, "High Voltage Engineering" 3rd ed., Tata MC Graw Hill Publications, 2009.
2. E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, " High Voltage Engineering Fundamentals", 2nd ed., Elsevier, 2008.

REFERENCE BOOKS:

1. C.L.Wadhwa, "High Voltage Engineering" 3rd ed., New Age International (P) Limited, 2010.
2. Ravindra Arora, Wolfgang Mosch, "High Voltage Insulation Engineering" 1st ed., New Age International (P) Limited, 2005.