IV Year B. Tech EEE II – Semester

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EHV AC TRANSMISSION

(Professional Elective-VI)

Prerequisites: Power Systems-II, Electro Magnetic Field Theory

Course Objectives:

1. To understand in-depth inter related concepts of Extra High Voltage AC transmission.
2. To gain understanding of Lightning, Switching and Dynamic Overvoltage Studies.
3. To introduce the concept of Insulation Coordination in EHV Systems.

Unit 1: (~ 12 Lecture Hours)

INTRODUCTION TO EHVAC : Necessity of EHV AC transmission - advantages and numericals. Power handling capacity and line losses- Mechanical considerations - Resistance of Conductors - Bundled conductors – Bundle Spacing and Bundle Radius-Examples.

Review of Line Inductance and Capacitance Calculations - Sequence Inductances and Capacitances. Modes of propagation – Inclusion of Ground Return and Frequency Dependence in Line Parameters Calculations – Examples.

Unit 2: (~12 Lecture Hours)

VOLTAGE GRADIENTS OF CONDUCTORS : Electrostatics - Field of sphere gap - Field of line charges and properties - Charge - Potential relations for Multi-Conductors -Surface voltage gradient on conductors - Distribution of Voltage Gradient on Sub-conductors of a Bundle-Examples.

CORONA EFFECTS: Power loss and Audible Noise (AN) - Corona loss formulae- Charge voltage diagram -Generation, Characteristics - limits and Measurements of AN -Relation between 1-phase and 3-phase AN levels – Examples.

Unit 3: (~10 Lecture Hours)

RADIO INTERFERENCE : Corona pulses generation, properties, limits - frequency spectrum - modes of propagation - Excitation function - Measurement of RI, RIV and excitation functions-Examples.

ELECTROSTATIC FIELD: Calculation of electrostatic field of EHV/AC lines - effect on humans, animals and plants - Electrostatic induction in unenergised circuit of double-circuit line - Electromagnetic interference-Examples.

Unit 4:(~ 13 Lecture Hours)

LIGHTNING AND SWITCHING OVER-VOLTAGES : Lightning Stroke Mechanism, Probability Occurrence of Lightning Stroke Currents ,General principles of lightning protection problem, Lightning arrestors and protective characteristics ,dynamic voltage rise and arrestor rating, operating characteristics of lightning arrestors.

Calculation of switching surges- single phase equivalents, distributed parameter line energized by source, generalized equations for single phase representations ,generalized equations for three phase systems , inverse Fourier transform for the general case, reduction of switching surges on EHV systems.

Unit 5: (~13 Lecture Hours)

INSULATION CO-ORDINATION IN EHV SYSTEMS: Line and EHV Transformers Insulation design based on Transient Over-voltages, Flash-over and Withstand Voltages of EHV Line and Equipment Insulation, Lightning and Surge Arresters and their Protective Levels, Insulation co-ordination based on Lightning, Principle of insulation coordination on EHV power systems.

TEXTBOOKS :

1. R.D.Begamudre, "EHV AC Transmission Engineering", New Age International (P) Ltd ,3rd Edition 2006.

2.M.S.Naidu, V.Kamaraju, "High Voltage Engineering", Tata McGraw Hill Publication, 3rd Edition 2005.

3. S.Rao, "EHV-AC, HVDC Transmission & Distribution Engineering", Khanna Publishers, 2008.

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Reference Books:

1. Allan Greenwood, "Electrical Transients in Power Systems", 2nd Edition,Wiley Interscience, 1991.
2. Edison Electric Institute, "EHV Transmission Line Reference Book", New York, NY in EEI Publication.

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Course Outcomes:

1. To learn the relative applicational aspects of Bulk Power Transmission through EHV AC Transmission Lines.
2. Mathematically Model EHV AC Lines, the Physical phenomena & their Effects on Corona Formation, Audio ,Radio ,Television Interference caused by EHV Lines.
3. Learn the various Measuring Techniques & Testing Procedures applicable to EHV AC Transmission Lines & their Effects Assessment.
4. Analyze and Design EHV Systems, using the Travelling Wave Theory & Line Compensation Techniques.

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