III Year I Semester

15AEE18-ELECTRICAL POWER TRANSMISSION SYSTEMS

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Course Objectives:

This course enables the students to

- *Understand the theory of transmission lines modeling and their performance analysis.*
- *Study the mechanical design of transmission lines, cables and insulators.*
- *Study the performance of transients*
- *Understand the concepts of travelling waves in power transmission lines.*
- *Study the types of cables and grading of cables.*

UNIT- ICALCULATION OF TRANSMISSION LINE PARAMETERS

Transmission Line Parameters: Types of Conductors - Calculation of Resistance For Solid Conductors - Calculation of Inductance for Single Phase and Three Phase, Single and Double Circuit Lines, Concept of GMR & GMD, Symmetrical and Asymmetrical Conductor Configuration with and without Transposition, Numerical Problems. Calculation of Capacitance for 2 Wire and 3 Wire Systems, Effect of Ground on Capacitance, Capacitance Calculations for Symmetrical and Asymmetrical Single and Three Phase, Single and Double Circuit Lines, Numerical Problems.

UNIT- II PERFORMANCE OF TRANSMISSION LINES:

Performance of Short, Medium & Long Transmission Lines: Classification of Transmission Lines - Short, Medium and Long Line and Their Model - Representations - Nominal-T, Nominal-Π and A, B, C, D Constants. Numerical Problems.Mathematical Solutions to Estimate Regulation and Efficiency of all Types of Lines - Numerical Problems. Long Transmission Line-Rigorous Solution, Evaluation of A, B, C, D Constants, Interpretation of the Long Line Equations – Representation of Long Lines – Equivalent T and Equivalent Π – Surge Impedance and Surge Impedance Loading - Wavelengths and Velocity of Propagation – Ferranti Effect , Charging Current.

UNIT – III POWER SYSTEM TRANSIENTS & TRAVELLING WAVES

Power System Transients: Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of Lines with Different Types of Conditions - Open Circuited Line, Short Circuited Line, T-Junction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

UNIT- IV MECHANICAL DESIGN OF TRANSMISSION LINES

Overhead Line Insulators:Types of Insulators, String Efficiency and Methods for Improvement, Numerical Problems - Voltage Distribution, Calculation of String Efficiency, Capacitance Grading and Static Shielding.

Corona:Corona - Description of the Phenomenon, Factors Affecting Corona, Critical Voltages and Power Loss, Radio Interference.

BOS-Chairman

Sag and Tension Calculations: Sag and Tension Calculations with Equal and Unequal Heights of Towers, Effect of Wind and Ice on Weight of Conductor, Numerical Problems - Stringing Chart and Sag Template and Its applications.

UNIT-V CABLES

Underground Cables: Types of Cables, Construction, Types of Insulating Materials, Calculations of Insulation Resistance and Stress in Insulation, Numerical Problems. Capacitance of Single and 3-Core Belted Cables, Numerical Problems.Grading of Cables - Capacitance Grading, Numerical Problems, Description of Inter-Sheath Grading.

Course Outcomes:

The students will have knowledge on the following concepts

- *Types of conductors used for transmission lines and to know the concepts like single and double circuit lines, GMD, GMR concepts.*
- *Resistance, inductance and capacitance calculations of transmission line conductors.*
- *The performance of short, medium and long transmission lines and the concept of power system transients.*
- *Skin effect, proximity effect, corona and Ferranti effects.*
- *The types of underground cable basics and grading of cables.*
- *Types of insulators and calculation of string efficiency.*

TEXT BOOKS:

1.A Text Book on Power System Engineering by M. L. Soni, P. V. Gupta, U.S. Bhatnagar, A. Chakrabarthy, DhanpatRai& Co Pvt. Ltd.

2. Electrical power systems - by C.L. Wadhwa, New Age International (P) Limited, Publishers, 1998.

REFERENCE BOOKS:

1. Power system Analysis-by John J Grainger, William D Stevenson, TMC Companies, 4th edition
2. Power System Analysis and Design by B. R. Gupta, S. Chand & Co, 6th Revised Edition, 2010.
3. Modern Power System Analysis by I. J. Nagarath and D. P. Kothari, Tata McGraw Hill, 2nd Edition.
4. Electric Power Transmission System Engineering: Analysis and Design, by TuranGonen, 2nd Edition, CRC Press.
5. Electric Power Systems by S. A. Nasar, Schaum's Outline Series, Revised 1st Edition, TMH.

BOS- Chairman