B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AEE52- ELECTRICAL POWER TRANSMISSION AND UTILIZATION

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Course Objectives:

- To calculation transmission line parameters and to find the performance of transmission line.
- To understand the mechanical design of transmission line.
- To study underground cables and power system transients.
- To understand different lighting design schemes for various applications and also about different types of heating and welding techniques.
- Learn basic principles of traction system & speed time curves for different traction system

UNIT – I: TRANSMISSION LINE PARAMETERS AND MODELING 10 Hrs

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 configurations with and without transposition. 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. Classification of Transmission Lines - Short, medium and long lines and their models - representations - Nominal-T, Nominal-π and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines. Long Transmission Line-Rigorous Solution, Interpretation of the Long Line Equations – Representation of Long lines – Exact T and π, Numerical Problems. Surge Impedance and surge Impedance loading - wavelengths and Velocity of propagation – Ferranti effect, Charging current.

Learning Outcomes:

At the end of this unit, the student will be able to

- Determine resistance , inductance and Capacitance of transmission line **L1**
- Learn about classification of transmission lines and their modeling. **L2**

UNIT – II: MECHANICAL DESIGN OF TRANSMISSION LINES 10 Hrs

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. 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.

Learning Outcomes:

At the end of this unit, the student will be able to

- Determine String Efficiency of Insulator and Corona Phenomenon **L1**
- To calculate Sag and Tension with Equal and Unequal Heights of Towers **L2**

UNIT – III: CABLES and POWER SYSTEM TRANSIENTS 10 Hrs

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. 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, TJunction, Lumped Reactive Junctions (Numerical Problems). Bewley's Lattice Diagrams (for all the cases mentioned with numerical examples).

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the Types, Construction of Underground Cables and find the Capacitance **L1**
- To Understand Types of System Transients and Bewley's Lattice Diagrams **L2**

UNIT – IV: ILLUMINATION and ELECTRIC HEATING **10 Hrs**

Definition –Laws of Illumination–Polar Curves – Calculation of MHCP and MSCP. Requirement of Good Lighting Scheme – Types, Design and Calculation of Illumination. Street Lighting and Factory Lighting – Numerical Problems. Electrical Heating: Advantages. Methods of Electric Heating – Resistance, Arc, Induction and Dielectric Heating. Electric Welding: Types – Resistance, Electric Arc, Gas Welding. Ultrasonic, Welding Electrodes of Various Metals, Defects in Welding.

Learning Outcomes:

At the end of this unit, the student will be able to

- Design lightning Scheme and Methods of Electric Heating **L1**
- Compare various types of Electric Welding **L2**

UNIT – V: ELECTRIC TRACTION **10 Hrs**

Introduction – Systems of Electric Traction. Comparison Between A. C and D. C Traction – Special Features of Traction Motors - Methods of Electric Braking – Plugging, Rheostatic and Regenerative Types. Mechanics of Train Movement. Speed-Time Curves of Different Services – Trapezoidal and Quadrilateral, Speed-Time Curves – Numerical Problems. Calculations of Tractive Effort, Power, Specific Energy Consumption - Effect of Varying Acceleration and Braking Retardation, Adhesive Weight and Coefficient of Adhesion – Problems

Learning Outcomes:

At the end of this unit, the student will be able to

- Understand the Features of Traction Motors and Methods of Electric Braking **L1**
- To Calculate Tractive Effort and Effect of Varying Acceleration and Braking **L2**

Text Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd. 2.
2. Electrical power systems - by C.L.Wadhwa, New Age International (P) Limited, Publishers,1998.
3. Utilization of Electric Energy – by E. Openshaw Taylor and V. V. L. Rao, Universities Press.
4. Art & Science of Utilization of electrical Energy – by Partab, Dhanpat Rai & Co

Reference Books:

1. Power system Analysis-by John J Grainger, William D Stevenson, TMC Companies, 4th edition
2. Modern Power System Analysis by I.J.Nagarath and D.P.Kothari, Tata McGraw Hill, 2nd Edition.
3. Utilization of Electrical Power including Electric drives and Electric traction – by N.V.Suryanarayana, New Age International (P) Limited, Publishers, 1996.
4. Utilization of Electrical Power – by R. K. Rajput, Laxmi Publications.

Course Outcomes:

At the end of this Course the student will be able to

- Analyze the transmission lines and obtain the transmission line parameters and constants. **L1**
- To determine String Efficiency of Insulator and calculate sag and tension. **L2**
- To determine Capacitance and Single and 3-Core Belted Cables **L3**
- Identify most appropriate heating & welding techniques for suitable applications and design the levels of illumination based on the applications **L4**
- To draw speed time curves and find the mechanics of Train Movement **L5**