

EEPC3002 POWER SYSTEM - I (3-0-0)

Course Objectives:

This course provides fundamental knowledge of power systems, covering transmission line parameters, performance analysis, corona effects, and mechanical design of overhead lines. Students will learn to calculate inductance, capacitance, and resistance, analyze distribution systems, and understand underground cables and earthing principles for efficient power system operation.

Module-I: (02 Hrs.)

Introduction to Power System and Generation of Electric Power: Evolution of Power Systems and Present-Day Scenario. Structure of power system. Conventional and non-conventional sources of Electrical Energy.

Module-II: (08 Hrs.)

Transmission Line Parameters: Types of Conductors, Resistance, Inductance of a Conductor due to Internal Flux, Flux Linkages between Two Points External to an Isolated Conductor, Inductance of a Single Phase Two Wire Line, Flux Linkages of one Conductor in a Group, Inductance of Composite-Conductors, Concept of GMD, Transposition of lines, Inductance of a Three Phase Line with symmetrical and Unsymmetrical Spacing, Inductance Calculations for Bundled Conductors, Skin effect and Proximity effect. Capacitance of a Two Wire Line, Capacitance of a Three Phase Line with symmetrical and Unsymmetrical Spacing, Effect of Earth on the Capacitance of a Three Phase Line, Capacitance Calculations for Bundled Conductors, Parallel- Circuit Three Phase Lines.

Module-III: (07 Hrs.)

Performance of Transmission Lines: Representation of Short, medium and long Transmission Line, Equivalent Circuit, Calculation and analysis of performance of transmission lines, Voltage Profile of transmission lines, Ferranti Effect, Power Flow Through Transmission Line, Power Flow capability and Surge Impedance Loading, Series and Shunt Compensation of Transmission Line.

Corona: Theory of corona formation, Electric Stress, Critical Disruptive Voltage, Visual Critical Voltage, Power Loss Due to Corona, Factor affecting corona loss, Methods for reducing corona loss, Advantages and Disadvantages of Corona.

Module-IV: (06 Hrs.)

Mechanical Design of Overhead Transmission Lines: Line Supports, the catenary curve, Sag and Tension Calculation, supports at different levels, stringing chart, Sag template, Conductor Spacing and Ground Clearance, Effects and Prevention of Vibrations (Vibrations and Dampers).

Overhead Line Insulators: Insulator Materials, Types of Insulators, Voltage distribution over a string of suspension insulators, String Efficiency, Methods of improving string efficiency, Testing of insulators.

Module-V: (07 Hrs.)

Distribution Systems: Classification of Distribution Systems, Primary and secondary distribution network, Voltage Drop in DC Distributors, Voltage Drop in AC Distributors, Kelvin's Law, Limitations of Kelvin's Law, Application of Capacitors to Distribution Systems.

Underground Cables: Type and construction, Classification of Cables, Parameters of Single Core Cables, Grading of Cables, Capacitance of Three Core Cable, Comparison of overhead lines with underground Cables.

Power System Earthing: Soil Resistivity, Earth Resistance, Tolerable Step and Touch Voltage, Actual Touch and Step Voltages. Design of Earthing Grid.

Course Outcomes:

On completion of this course, students are able to:

- CO1. Understand the structure and evolution of power systems and distinguish between conventional and non-conventional energy sources.
- CO2. Calculate the resistance, inductance, and capacitance of transmission lines using relevant formulas and techniques.
- CO3. Analyze the performance of different transmission line types (short, medium, and long) and assess voltage regulation and power flow.
- CO4. Evaluate the effects of corona in transmission lines and recommend methods to minimize power loss.
- CO5. Perform mechanical design calculations for overhead transmission lines, including sag, tension, and vibration prevention.

Text Book(s):

- 1. C. L. Wadhwa, Electrical Power Systems, India: New Age International Publishers, 2010.
- 2. A. Hussain, Power System, New Delhi, India: CBS Publishers & Distributors, 1998.
- 3. S. Sivanagaraju, S. Satyanarayana, Electrical Power Transmission and Distribution, Pearson Education, 2009.

Reference Book(s):

- 1. O. I. Elgerd, Electric Energy Systems Theory. New York, NY, USA: McGraw-Hill Education, 1995.
- 2. D. P. Kothari and I. J. Nagrath, Modern Power System Analysis, 4th ed. New Delhi, India: McGraw-Hill Education, 2011.
- 3. R.K. Rajput, Power System Engineering, Laxmi Publications (P) Ltd, 2007.