

Course Title: Power Systems I

Course Code: EPEG 315

Credit Hours: 3

Course Description:

This course imparts a broad overview of the design and implementation of modern power systems.

Course Contents:

Unit 1: Introduction to Power Systems

Historical developments, Basic structure, Power generation: Thermal, Hydro & nuclear power plants. Non-conventional futuristic energy sources, Energy storage and conservation facilities. Different types of supply systems, Comparison of conductor costs in various systems; Problems

Unit 2: Series Impedance of Transmission Lines

Line parameters, Resistance, Inductance, Definition of induction, Inductance of a conductor due to internal flux, Inductance due to external flux linkages, Inductance of a single phase two wire line, Flux linkages of one conductor in a group, Composite conductors, Inductance of 3- ϕ lines with equilateral spacing, Unsymmetrical spacing, Bundled conductors, Parallel circuit 3- ϕ lines, problems

Unit 3: Capacitance of Transmission Lines

Capacitance of a two wire line, System of conductors, Capacitance of a 3- ϕ line with equilateral spacing, Unsymmetrical spacing, Earth effects on line, Bundled conductors capacitance, Problems

Unit 4: Per Unit Representation

Introduction, advantages, one line diagram, impedance diagram, problems

Unit 5: Transmission Line

Short and medium transmission line, Phasor diagram, Pi and T equivalents, General constants, transmission efficiency, Long transmission line, Interpretation of the equations, The equivalent circuit of a long line, Power flow through a transmission line, Problems

Unit 6: Distribution System

Voltage level, Radial and loop system, AC & DC distribution systems, Comparison of different types of system and their advantages & disadvantages

Unit 7: Overhead Line Insulators

Types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing potentials, Problems

Unit 8: Mechanical Design of Transmission Lines

The catenary curve, Sag tension calculations, Support at different levels, Stringing chart, Sag template, Equivalent span, Stringing of conductors, Vibration and vibration dampers, Problems

Unit 9: Corona

Critical disruptive voltage, Corona loss, Line design based on corona, Disadvantages of corona, Radio interface, Inductive interfaces between power and communication lines

Unit 10: Insulated Cables

The insulation, EHV cables, Grading of cables, Insulation resistance of cables, Capacitance of single core cable, Current rating of cable, overhead lines vs underground cables, Types of cables

Unit 11: HVDC Transmission

Advantage of HVDC, Mono-bi-homo polar dc links, Reactive Var requirements of HVDC converters, Equivalent circuit of HVDC transmission line

Unit 12: Introduction of Different Types of Power Plants

MHD, Wind, Solar, Biomass, Schematic diagram of hydro power plant, Hydro power plant essentials, Advantages and disadvantages, Nuclear power plant, Gas turbine power plant, Generating plants, Plant installation, Combined working of different plants, Parallel operation, load duration curve, Load allocation, Control of plant, General economic problems, General terminology, Depreciation, Energy rates, Tariffs, Problems

Unit 13: Circuit Breakers

Types, Basic principle of operation

References:

1. William D. Stevenson, Jr., *Elements of Power System Analysis*, Mc Graw Hill
2. Ashfaq Husain, *Electrical Power System*, Dhanpat Rai & Co.
3. C.L. Wadhwa, *Electrical Power System*, New Age international