

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

Basic structure of power system, History of electrical power system, Integrated Nepalese Power System, Basics of power system supply, demand and failures

Unit 2: Series Impedance of Transmission Lines

Line parameters, Resistance, Inductance, 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, types of conductors

Unit 3: Capacitance of Transmission Lines

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

Unit 4: Per Unit Representation

Per unit (p.u.) representation and its advantages, p.u. of a transformer, p.u. quantities in 3 phase system, one line diagram, impedance diagram

Unit 5: Performance of 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, Ferranti effect, surge impedance loading

Unit 6: Overhead Line Insulators

Types of insulators, Voltage distribution string efficiency of suspension insulators, Methods of improving string efficiency

Unit 7: Mechanical Design of Transmission Lines

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

Unit 8: Corona

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

Unit 9: Insulated Cables

Cable construction, 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, skin effect, proximity effect

Unit 10: Transmission Line design

Selection of Voltage selection, calculation of surge impedance loading Selection of Conductor size and span, choice of number of circuits and configuration, estimation of corona loss, selection of insulators, calculation of line parameters, estimation of voltage regulation and efficiency, Choice of ground clearance and spacing

Unit 11: Distribution System

Structure of distribution system, types of distribution systems, DC distribution systems and types, voltage drop in DC distribution, AC distribution and types, Voltage drop in AC distribution, Comparison of conductor materials in ac and dc supply systems, economic choice of conductor and Kelvin's Law, Design consideration for distribution system

Unit 12: Power factor correction

Causes and consequences of low power factors, improvement of power factor using static capacitor and synchronous machine, economics of power factor improvement

References:

1. W. D. Stevenson, Jr., *Elements of Power System Analysis*, Mc Graw Hill
2. H. Saadat, *Power System Analysis*, McGraw-Hill
3. A. Husain, *Electrical Power System*, Dhanpat Rai & Co.
4. C.L. Wadhwa, *Electrical Power System*, New Age international

Evaluation:

In-Semester Evaluation: 50%

End-Semester Evaluation: 50%