3/4 B.Tech. SECOND SEMESTER

POWER SYSTEM ANALYSIS

Credits: 4

EE6T5

Lecture: 4 periods/week **Internal assessment: 30 marks**

Tutorial: 1 period /week **Semester end examination: 70 marks**

Objective:

This course is designed to give students the required knowledge for the design and analysis of electrical power grids. Calculation of power flow in a power system network using various techniques, formation of Z_{bus} and its importance are covered in this course. It is also deals with short circuit analysis and analysis of steady state and transient stability.

Learning outcomes:

1. Upon completing this course student able to understands and can draw single line diagram of the power system.
2. Student able to analyse different types of fault in a power system
3. Student understands different load flow techniques.
4. Student able to understand stability analysis of power system

Unit I Per unit Representation

P.U. Representation: Single line diagram, Per unit quantities, , Per unit impedance diagram of a power system. Symmetrical Fault Analysis: Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors, Numerical Problems.

UNIT II Short Circuit Analysis

Symmetrical Component Theory: Symmetrical Component Transformation, Positive, Negative and Zero sequence components: Voltages, Currents and Impedances.
Sequence Networks: Positive, Negative and Zero sequence Networks, Numerical Problems.
Unsymmetrical Fault Analysis: LG, LL, LLG faults with and without fault impedance, Numerical Problems.

UNIT III Power System Network Matrices-1

Y bus formation by Direct inspection method, pie model of off-nominal tap changing transformer , Numerical Problems.
Necessity of Power Flow Studies – Data for Power Flow Studies – Derivation of Static load flow equations– Load flow solutions using Gauss Seidel Method: Acceleration Factor, Load flow solution with and without P-V buses, Algorithm and Flowchart. Numerical Load flow Solution for Simple Power Systems (Max. 3-Buses): Determination of Bus Voltages, Injected Active and Reactive Powers (Sample One Iteration only) and finding Line Flows/Losses for the given Bus Voltages.

UNIT IV Power flow Studies-2

Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution with or

With out PV Busses- Derivation of Jacobian Elements, Algorithm and Flow chart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods – DC load Flow.

UNIT V Power System Stability Analysis

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Description of: Steady State Stability Power Limit, Transfer Reactance, Synchronizing Power Coefficient, Power Angle Curve and Determination of Steady State Stability and Methods to improve steady state stability.

Derivation of Swing Equation and solution by point by point method. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Methods to improve Stability - Auto Reclosing and Fast Operating Circuit Breakers.

Learning Resources

Text Books:

1. Modern power system analysis by D.P.Kothari and I.J.Nagrath , TMG
2. Power system Analysis by J.J.Grainger & W.D.Stevenson. Jr, TMH,2007.

3.Power System Analysis by Hadi Saadat – TMH Edition.

Reference Books:

1. Power System Analysis by T.K.Nagsarkar M.S.Sukhija, OXFORD university press,2007

2 .Power System Analysis – by A.R.Bergen, Prentice Hall, Inc.
3. Power System Analysis by B.R.Gupta, Wheeler Publications
4. Electrical Power Systems by Ashfaq Hussain ,CBS Publishers & Distributors.