3/4 B.Tech. SECOND SEMESTER

EE6T3 COMPUTER METHODS IN POWER SYSTEM **Credits: 4**

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 analysis of different type fault in a power system
2. Student able to understands different load flow techniques
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 of 3-winding transformer, 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

Graph Theory: Definitions, Bus Incidence Matrix, pie model of off-nominal tap changing transformer Ybus formation by Direct and Singular Transformation
Methods, Numerical Problems. Sparsity technique and it application in load flow studies .

UNIT IV Power flow Studies-1

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 V 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 VI Power System Network Matrices-2

Formation of Z Bus: Partial network, Algorithm for the Modification of Z Bus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems).- Modification of Z Bus for the changes in network (Problems).

UNIT VII

Short circuit studies using zbus.

UNIT VIII 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. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation.- Solution of Swing Equation: Point-by-Point Method. Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit

Breakers. Transient stability analysis of multi machine system.

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.