III B.Tech II Semester

15AEE33-POWER SYSTEM ANALYSIS

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Course Objectives:

This course will enable the students

- Formation of Y-bus and Z- bus.
- Analysis of Symmetrical and Unsymmetrical faults.
- Analysis of Power flow studies using various methods.
- Concepts of Steady state, dynamic state and transient state stabilities and various methods to improve the stability.

UNIT -I POWER SYSTEM NETWORK MATRICES

Representation of Power System Elements, Graph Theory: Definitions, Bus Incidence Matrix, Y_{bus} Formation by Direct and Singular Transformation Methods, Numerical Problems. 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 – II SHORT CIRCUIT ANALYSIS

Per-Unit System of Representation.Per-Unit Equivalent Reactance Network of a Three Phase Power System, Numerical Problems. Symmetrical Fault Analysis: Short Circuit Current and MVA Calculations, Fault Levels, Application of Series Reactors, Numerical Problems. 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 FLOW STUDIES-I

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-II

Newton Raphson Method in Rectangular and Polar Co-Ordinates Form: Load Flow Solution with or without PV Buses- Derivation of Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods.

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

V. Seeta
BOS – chairman

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 by 4th Order Range – Kutta Method (up to 2 iterations) - Methods to improve Stability.

Course outcomes:

After completion of the course the students will have the knowledge on the following concepts

- *Formation of Y-bus and Z- buses and the problems related to them.*
- *Analysis of the problems related to Symmetrical and Unsymmetrical faults.*
- *Analysis of the problems of Power flow studies using various methods.*
- *Concepts of Steady state, dynamic state and transient state stabilities and various methods to improve the stability*

TEXT BOOKS:

1. Power Systems Analysis, by Grainger and Stevenson, Tata McGraw-hill Edition.
2. Modern Power system Analysis – by I.J.Nagrath&D.P.Kothari: Tata McGraw-Hill Publishing Company, 2nd edition.

REFERENCE BOOKS:

1. Computer Techniques in Power System Analysis by M A Pai, Second Edition, TMH.
2. Computer Techniques and Models in Power Systems by K. Uma Rao, I. K. International.
3. Electric Power Systems by S. A. Nasar, Schaum's Outline Series, Revised 1st Edition, TMH.

BOS-chairman