POWER SYSTEM ANALYSIS
(Integrated)

Course Code: 19EE1119

L	T	P	C
2	0	2	3

Prerequisites:
Electric Circuit Analysis, Electrical Machines, Power System - I and Power systems - II.

Course Outcomes: At the end of the course, the student will be able to:

CO1: Solve load flow equations using Gauss-Seidel method.

CO2: Solve load flow equations using Newton-Raphson's method.

CO3: Analyze power system stability.

CO4: Analyze frequency control.

CO5: Analyze excitation control.

UNIT-I (8 Lectures)

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.

Learning Outcomes:

1. Formulate static load flow equation (L2)
2. Evaluate Load flow solution with and without P-V bus (L5)
3. Evaluate bus voltage and calculate lines losses for a given power system network (L5)

UNIT-II (7 Lectures)

POWER FLOW STUDIES - II

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

Learning Outcomes:

1. Apply power flow equation (L3)
2. Evaluate solution to load flow problem by different method (L5)
3. Analyze DC load flow (L4)

UNIT-III (7 Lectures)

POWER SYSTEM STABILITY - I

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.

Learning Outcomes:

1. Analyze power system stability concept (L4)
2. Analyze power angle characteristics (L4)
3. Analyze methods to improve steady state stability (L4)

UNIT-IV (7 Lectures)

POWER SYSTEM STABILITY - II

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 Runga-Kutta Method (up to 2 iterations) - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

Learning Outcomes:

1. Analyze equal area criterion to determine transient stability (L4)
2. Evaluate solution to swing equation (L5)
3. Analyze methods to improve stability (L4)

UNIT-V (7 Lectures)

EXCITATION VOLTAGE CONTROL

Excitation System Control in synchronous generators, Automatic Voltage Regulators. Series and Shunt Compensators.

Learning Outcomes:

1. Apply the concept of Excitation control in synchronous generation (L2)
2. Analyze voltage regulators (L4)
3. Analyze reactive power compensation (L4)

TEXT BOOKS:

1. John J Grainger, William D Stevenson Jr. "*Power system analysis*" Tata McGraw-Hill, 2th Edition, 2012.(Unit-I,II,III,IV)
2. Hadi Saadat, "*Power System Analysis*", TMH, 2nd Edition, 2007.(unit-I-V)

REFERENCE BOOKS:

1. M. A. Pai ”*Computer Techniques in Power System Analysis*”, Tata McGraw-Hill Publishing Company, 2nd Edition, 2006.
2. I.J. Nagrath & D.P. Kothari, “*Modern Power System Analysis*”, Tata McGraw-Hill Publishing Company, 3rd Edition, 2010.