16EE302 POWER SYSTEM ANALYSIS

Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P
45	15	-

WA/RA	SSH/HSH	CS	SA	S	BS
5	40	5	8	5	5

Course Description and Objectives:

This course offers comprehensive knowledge on the basics of power system and its operation under steady state and transient state. The objective of the course is to model the power system and analyze power flow, different types of faults and stability using numerical techniques.

Course Outcomes:

The student will be able to:

- model different components in power system.
- obtain the system matrices used for various analysis.
- perform steady state load flow analysis.
- analyze symmetrical and unsymmetrical faults.
- analyze steady state and transient stability limits.

SKILLS:

- ✓ *Understand power system network model.*
- ✓ *Formulate basic power flow problem.*
- ✓ *Apply different numerical techniques to solve power flow problem.*
- ✓ *Perform contingency analysis in power system.*
- ✓ *Classify different short circuit faults in power systems.*
- ✓ *Understand the stability problem in power system subjected to disturbances.*

ACTIVITIES:

- *Building Y bus algorithm using MATLAB.*
- *Building Z bus algorithm using MATLAB.*
- *Solving non algebraic equations using Gauss Seidel's method.*
- *Solving non algebraic equations using newton's Raphson method.*
- *Solution of Swing equation for a given change in load.*

UNIT - 1 **L-10, T-3**

GRAPH THEORY AND NETWORK MATRICES: Review of graph theory, Network incident matrices, Formation of system Y-bus by inspection and by singular transformation, Z-bus building algorithm without mutual coupling, Formation of Y-bus and Z-bus matrices for simple power system.

UNIT - 2 **L-10, T-3**

POWER FLOW PROBLEM - I : Formulation of power flow problem - Types of buses, Classification of variables, Expressions for real and reactive power injections through Y-bus elements; Iterative solution using Gauss-Seidel method - Flow chart and algorithm incorporating Q-limit check for voltage-controlled buses; Solution of a set of non-linear algebraic equations by Newton's method - Convergence of solution, Algorithm and flow chart; Numerical solutions of systems upto 3-buses.

UNIT - 3 **L-8, T-3**

POWER FLOW PROBLEM - II : Decoupled Newton load flow - Assumptions, Derivation, Algorithm and flow chart; Fast decoupled load flow - Assumptions, Derivation, Algorithm and flow chart; Numerical solution of systems up to 3-buses; Comparison of all load flow methods.

UNIT - 4 **L9, T-3**

FAULT ANALYSIS: Single line diagram – Per phase and per unit representation, Change of base; Reactances of synchronous machine under steady and transient conditions, Symmetrical fault analysis - Fault level and circuit breaker capacity; Review of symmetrical components, Unsymmetrical fault analysis, Build Positive, Negative and Zero sequence networks for different faults, Numerical problems.

UNIT - 5 **L-8, T-3**

STABILITY ANALYSIS:

Steady state stability: Introduction to steady state, Dynamic and transient stability of synchronous machine connected to infinite bus, Power angle curve, Swing equation, Small signal oscillations, Synchronizing power coefficient.

Transient stability: Equal area criterion, Computation of swing curve by point-by-point solution, Case studies, Introduction to computation of swing curve by numerical methods.

TEXT BOOKS:

1. J. Grainger and WD Stevenson Jr, "Power System Analysis", 1st edition, Tata Mc-Graw Hill Publishing Company Ltd., New Delhi, 2005.
2. D.P. Kothari, I.J. Nagrath, "Modern Power System Analysis", 3rd edition, Tata Mc-Graw Hill Publishing Company Ltd., New Delhi, 2008.

REFERENCE BOOKS:

1. Hadi Saadat, "Power System Analysis", 1st edition, Tata Mc-Graw Hill Publishing Company Ltd., New Delhi, 1999.
2. O I Elgerd, "Electric Energy Systems Theory an introduction", 2nd edition, Tata Mc-Graw Hill Publishing Company Ltd., New Delhi, 2006.
3. P. Kundur, "Power System Stability and Control", 1st edition, Mc-Graw Hill, 2009.