POWER SYSTEM ANALYSIS

VI Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEB22	Core	2	1	-	3	30	70	100
Contact Classes: 30	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Power System Analysis course enables students to study the performance of interconnected power system under steady state and transient stability conditions. The course deals with formation of impedance and admittance matrices for various configurations, finding unknown electrical quantities at various buses, symmetrical and unsymmetrical fault analysis, power system using per unit repre- sentation. The course helps in selecting the protective devices to gain back normal operation of powersystem.

II. OBJECTIVES:

The course should enable the students to:

I	The methods to build the bus impedance and bus admittance matrices for primitive and non-primitive networks.
II	The numerical methods for load flow analysis of n bus interconnected powersystem.
III	The theorems and techniques involved in the fault level calculations duringbalanced and unbalanced faults.
IV	The performance of power system under steady and transient state stabilityconditions.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Build** the mathematical models and matrices of interconnected power system network for analyzing power flows and fault conditions	Apply
CO 2	**Develop** a network's power flow problem and solve it using multiple iterative strategies in obtaining optimal solution	Apply
CO 3	**Experiment** with power system fault analysis for balanced and unbalanced faults in order to determine fault levels and protectivedevice ratings, as well as to grasp the ideas of per-unit system.	Apply
CO 4	**Classify** the different types of stability, including the elements that influence the steady state stability limitations and how to improve it	Understand
CO 5	**Demonstrate** the different numerical integration and graphical approaches to understand the transient stability and the factors affecting as well as the methods of enhancing it	Understand

IV. SYLLABUS:

MODULE-I	POWER SYSTEM NETWORK MATRICES	Classes: 09

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 of element from a new bus to reference bus, addition of element from a new bus to an old bus, addition of element between an old bus to reference bus and addition of element between two old busses (Derivations and Numerical Problems), modification of Z bus for the changes in network Numerical Problems.

MODULE-II	LOAD FLOWS STUDIES	Classes: 09

Load flows studies: 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 PV 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; Newton Raphson method in rectangular and polar coordinates form: Load flow solution with or without PV busses derivation of Jacobian elements, algorithm and flowchart, decoupled and fast decoupled methods, comparison of different methods, DC load flow study.

MODULE-III	PER UNIT SYSTEM OF REPRESENTATION AND SHORT CIRCUIT ANALYSIS	Classes: 10

Per unit system: 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.

MODULE-IV	STEADY STATE STABILITY ANALYSIS	Classes: 08

Steady state stability: 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.

MODULE-V	TRANSIENT STATE STABILITY ANALYSIS	Classes: 09

Swing equation: 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.

Text Books:

1. I J Nagrath & D P Kothari, "Modern Power system Analysis", Tata McGraw-Hill Publishing Company, 2nd Edition, 2001.
2. M A Pai, "Computer Techniques in Power System Analysis", TMH Publications, 2nd Edition, 2004.

Reference Books:

1. K Umarao, "Computer techniques and models in power systems", I K International Pvt. Ltd, 1st Edition, 2000.
2. C L Wadhwa, "Electrical Power Systems", New age International, 3rd Edition, 2002.
3. HadiSaadat, "Power System Analysis", TMH, 2nd Edition, 2003.
4. Grainger and Stevenson, "Power System Analysis", Tata McGraw-Hill, 3rd Edition, 2011.
5. J Duncan Glover and M S Sarma., THOMPSON, "Power System Analysis and Design", 3rd Edition 2006.
6. Abhijit Chakrabarthi and Sunita Haldar, "Power system Analysis Operation and control", PHI 3rd Edition, 2010.

Web References:

1. https://www.worldcat.org/title/computer-methods-in-power-system-analysis/.../600788826
2. https://www.sjbit.edu.in/.../COMPUTER%20%20TECHNIQUES%20IN%20POWER%20%20SYS..
3. https://www.books.google.com › Technology & Engineering › Electrical
4. https://www.nptel.ac.in/courses/108105067/
5. https://www.jntusyllabus.blogspot.com/2012/01/computer-methods-power-systems-syllabus.html

E-Text Books:

1. https://www.scribd.com/.../Computer-Methods-in-Power-System-Analysis-by-G-W-St...
2. https://www.academia.edu/8352160/Computer_Methods_and_Power_System_Analysis_Stagg
3. https://www.uploady.com/#!/download/ddC9obmVTiv/NwO1AnQrlmogeJjS
4. https://www.materialdownload.in/article/Computer-Methods-in-Power-System-Analysis_159/ 5.
5. https://www.ee.iitm.ac.in/2015/07/ee5253/