MODERN POWER SYSTEM ANALYSIS

ISemester: EPS								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BPSC01	**Core**	3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

Modern Power system analysis deals with planning and operation of power system, short circuit analysis, power flow analysis, contingency analysis and state estimation techniques. First the bus impedance matrices are formulated by various methods and their power flow analysis is performed using Newton Raphson method and gauss Seidal methods. Short circuit analysis performed for balanced and unbalanced networks. Different techniques used for contingency analysis also discussed in this course. This course also covers state estimation for power system which includes and identification of bad measurements, estimation of quantities not being measured, network observability.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The basic components and restructuring of power systems.
II. The methods to rank the contingencies.
III. The need of state estimation and study simple algorithms for state estimation.
IV. Power flow analysis using various methods.
V. Fault analysis for balanced and unbalanced faults.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	**Utilize** the representation of basic components and single line diagram of power system for understanding there structuring of system	Understand
CO 2	**Examine** the optimal power flow solution using FACTS devices to solve power flow analysis problems using various methods.	Apply
CO 3	**Analyse** the new bus voltages contingency by adding/removal of lines for illustrating the various techniques for contingency evaluation and analysis.	Apply
CO 4	**Evaluate** the operating states and security monitoring of power systems to describe its contingency analysis.	Apply
CO 5	**Understand** the importance of power flow analysis in planning and operation of power systems.	Understand
CO 6	**Apply** the various algorithms for state estimation to estimate different components and states of power systems.	Apply

IV. SYLLABUS

MODULE –I: PLANNING AND OPERATIONAL STUDIES OF POWR SYSTEMS (09)

Need for system planning and operational studies, basic components of a power system, introduction to restructuring, single line diagram, per phase and per unit analysis, generator, transformer, transmission line and load representation for different power system studies, primitive network, construction of Y-bus using inspection and singular transformation methods, Z-bus.

MODULE -II: POWER FLOW ANALYSIS(10)

Importance of power flow analysis in planning and operation of power systems, statement of power

flow problem, classification of buses, development of power flow model in complex variables form, iterative solution using Gauss-Seidel method, Q-limit check for voltage controlled buses, power flow model in polar form, iterative solution using Newton-Raphson method, decoupled and fast decoupled power flow solutions, DC power flow solution, power flow solution using FACTS devices, optimal power flow solution.

MODULE -III: SHORT CIRCUIT ANALYSIS(09)

Balanced faults: Importance of short circuit analysis, assumptions in fault analysis, analysis using Thevenin's theorem, Z-bus building algorithm, fault analysis using Z-bus, computations of short circuit capacity, post fault voltage and currents.

Unbalanced faults: Introduction to symmetrical components, sequence impedances, sequence circuits of synchronous machine, transformer and transmission lines, sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin's theorem and Z-bus matrix.

MODULE -IV: CONTINGENCY ANALYSIS(09)

Contingency Evaluation: Operating states of a power system, concept of security monitoring, techniques for contingency evaluation, Importance of contingency analysis, addition / removal of one line, construction of a column of bus impedance matrix from the bus admittance matrix, calculation of new bus voltages due to addition / removal of one line, calculation of new bus voltages due to addition / removal of two lines.

MODULE -V: STATE ESTIMATION(09)

Power system state estimation, maximum likelihood weighted least squares estimation, matrix formulation, state estimation of AC network, state estimation by orthogonal decomposition, detection and identification of bad measurements, estimation of quantities not being measured, network observability and pseudo measurements.

V. Text Books:

1. J J Grainger, W D Stevenson, "Power system analysis", McGraw Hill, 1st Edition, 2003.
2. A R Bergen & Vijay Vittal, "Power System Analysis", Pearson,2nd Edition,2000.

VI. Reference Books:

1. K Umarao, "Computer techniques and models in power systems", I K International Pvt. Ltd.
2. HadiSaadat, "Power System Analysis", TMH. 2nd Edition, 2003.
3. Grainger and Stevenson, "Power System Analysis", Tata McGraw-Hill, 3rd Edition, 2011.
4. J Duncan Glover and M S Sarma., THOMPSON, "Power System Analysis and Design", 3rd Edition 2006

VII. Web References:

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

VIII. 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