MODERN POWER SYSTEM ANALYSIS

I Semester: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPSB01	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Explain the basic components and restructuring of power systems.
II. Understand power flow analysis using various methods.
III. Describe fault analysis for balanced and unbalanced faults.
IV. Describe power system security concepts and study the methods to rank the contingencies.
V. Explain the need of state estimation and study simple algorithms for state estimation.

COURSE OUTCOMES:

I. Describe the basic components, restructuring and formulation of bus matrices for power system networks.
II. Solve power flow analysis problems using various methods.
III. Discuss various methods for short circuit analysis of balanced and unbalanced networks
IV. Describe the operating states of power system and its contingency analysis
V. Implement the various algorithms for state estimation.

COURSE LEARNING OUTCOMES (CLOs):

1. Describe the basic components of power system and its restructuring.
2. Understand the single line diagram, per unit and per phase calculations of power system network.
3. Understand the representation of power system components.
4. Determine the bus impedance and admittance matrices for power system.
5. Understand the importance of power flow analysis in planning and operation of power systems.
6. Describe the power flow models in complex variable and polar forms.
7. Use different numerical methods to determine unknown parameters at various buses and to draw relevant algorithms.
8. Describe the optimal power flow solution using FACTS devices.
9. Use Thevenin's theorem and Z-bus building algorithm for balance short circuit fault analysis using Z-bus computations.
10. Calculate the electrical parameters under symmetrical fault conditions and understand symmetrical component theory.
11. Use Thevenin's theorem and Z-bus matrix for fault analysis of sequence networks.
12. Discuss the operating states and security monitoring of power systems.
13. Describe the various techniques for contingency evaluation and analysis.
14. Calculation of new bus voltages using contingency analysis by adding/removal of lines.
15. Understand the requirements of state estimation methods for power systems.
16. Use various methods for state estimation of power system networks.
17. Explain network observability pseudo measurements.

UNIT-I	PLANNING AND OPERATIONAL STUDIES OF POWER SYSTEMS	Classes: 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.

UNIT -II	POWER FLOW ANALYSIS	Classes: 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.		
UNIT -III	**SHORTCIRCUITANALYSIS**	**Classes: 08**
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.		
UNIT -IV	**CONTINGENCY ANALYSIS**	**Classes: 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		
UNIT -V	**STATE ESTIMATION**	**Classes: 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.		

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.

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.

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.nptel.ac.in/courses/108105067/

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