RK UNIVERSITY

SYLLABUS

Course Title	Power System Analysis and Dynamics	
Course Code	EPS101	
Course Credit	Lecture	: 04
	Practical	: 00
	Tutorial	: 01
	Total	: 05

Course Objective

The objective of the course is to:
Enable the students to develop the understanding of power system components modelling and simulation of power system load flow problems. Understand the concept of power system studies in planning and analysis. Acquire the knowledge on optimal power flow problem formulation and its solution method. Understand about the power system security, Transient stability and various solution techniques.

Detailed Syllabus

Sr. No.	Name of chapter & Details	Hours Allotted
	Section – I	
1	**Network Formulation and Graph Theory:** Introduction, Network Equations ,Graph Theory, Development of Network, Matrices from Graph Theoretic Approach, Augment Cut set Incidence Matrix, Cut set and Circuit Equations, Building Algorithm for the Bus Impedance, Matrix Modification of ZBUS matrix due to changes in the primitive network	**10**
2	**Load Flow Studies:** Introduction, Different techniques such as Gauss Saidal method, Newton Raphson method, De-Coupled method, Fast Decoupled method, Modified Fast Decoupled, Concept of Optimal Power Flow, Solution of Optimal power flow by Gradient method, Solution of Optimal power flow by Newton's method Linear Programming Methods, DC load flow, Converter variables, DC per unit system, Derivation of equations, Incorporation of control equations, Control of converter AC terminal voltage, Inverter operation, Unified AC-DC solution Multi-converter Systems, Programming Considerations, Three-phase load flow Mismatch equations, The power flow, Jacobian, Newton's method, Performance of the power flow, Zero sequence blocking, Continuation power flow	**10**
3	**Power System Security:** Introduction, Factors Affecting Power System Security, Short Circuit Studies of a Large Power System Networks, Power system modeling, Fault analysis, Symmetrical Fault Analysis Using Bus Impedance Matrix, Algorithm for Formation of Bus Impedance Matrix, Contingency Analysis: Detection of Network Problems, Overview of security analysis, Linear Sensitivity Factors, Contingency Selection, Concentric	**10**

	Relaxation, Bounding	
	Section – II	
4	**Introduction to State Estimation in Power Systems:** Introduction, Power system state estimation Maximum Likelihood, Weighted Least Squares Estimation, Matrix Formulation, State Estimation of an AC network, Development of Method, State Estimation by Orthogonal Decomposition, An Introduction to Advanced topics in state estimation, Detection and Identification of Bad measurements, Estimation of quantities not being measured, Network Observability and Pseudo measurements, Application of Power Systems State Estimation	**12**
5	**Sparsity Techniques, Transients and Stability of Power System:** Introduction, Sparse System, Theorems of Sparse Matrix Method, Various application areas and sparsity, Direct solution of sparse network equations by optimally ordered triangular factorization, Electromagnetic Transient Simulation, Introduction, Traveling waves on transmission lines, Successive Reflections, Bewle Lattice Diagram, Multimachine Systems, Multimachine Transient Stability	**8**
6	**Numerical Integration Techniques:** Numerical integration techniques: One step methods, Taylor series based methods, Forward -Euler's method, Runge-Kutte methods, Trapezoidal method, Backward-Euler's method, Accuracy and error analysis, Numerical stability analysis, Stiff systems, Step-size selection Differential algebraic systems, Power system applications: Transient stability analysis	**10**

Instructional Method and Pedagogy:

- Lectures will be conducted with the aid of multi-media projector, black board, Transparencies etc.
- Assignments and Exercise will be given to the students for each unit/topic and will be evaluated at regular interval.
- Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
- Self study assignments, seminar from students can be conducted

Students Learning Outcomes:

At the end of the course students will be able

- To apply iterative methods of solve network power flow
- To use a power-flow simulation software package, model generation, transmission and distribution of electricity, model the integration of renewable energy into the electricity network.
- Theoretical understanding of principles of power system economics
- To apply economic constraint, optimize dispatch, location and power flow and understand scarcity techniques.

Reference Books/Text book:

1. Advanced Power System Analysis and Dynamics, New Age International Ltd, New Delhi, 1992- L. P. Singh.
2. Power Generation Operation & Control, John Wiley & Sons, Inc, 1996- A. J. Wood and B. F. Woollen berg.
3. Power System Analysis, Tata Mcgraw Hill, New Delhi, 1999- Hadi Sadat.
4. AC-DC Power System Analysis, IEE London UK, 1998- Jos Arrillaga and Bruce Smith.
5. Power System Analysis, John J. Grainger & Willam D. Stevenson; Jr., Mc-Graw Hill Inc.

Additional Resources:

www.sciencedirect.com
www.delnet.nic.in