M.E Semester: 1
Electrical Engineering (Electrical Power System)
Subject Name: Power System Modelling and Simulation

A. Course Objective:

- To review Deep concepts of Power System in the field of Power System.
- To address the underlying concepts and methods behind Advanced Power System
- To impart knowledge of advancement in the field of power system with insight experimental approach.

B. Teaching / Examination Scheme

SUBJECT		Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
		L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
CODE	NAME	Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
MEEPS104	Power System Modeling and Simulation	4	0	2	6	5	3	70	30	20	30	150

C. Syllabus

SR No.	Unit No	Topic	No. of Hours	Weightage In Exam.
1	**Unit:1**	**Network Formulation and Graph Theory:** Introduction, Network Equations,Graph Theory, Development of Network Matrices from Graph Theoretic Approach, Building Algorithm for the Bus Impedance Matrix, Modification of Z_{BUS} matrix due to changes in the primitive network, Transformer modeling for Y_{BUS}	08	15%
2	**Unit: 2**	**Load Flow Studies:** Introduction, Static Load Flow Equations and solution methods: Gauss Seidal 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	05	10%
		Three-phase load flow Mismatch equations, The power flow Jacobian, Performance of the power flow, Continuation power flow.	03	5%

3	**Unit: 3**	**Load forecasting:** Objectives of forecasting - Load growth patterns and their importance in planning – Load forecasting Based on discounted multiple regression technique-Weather sensitive load forecasting-Determination of annual forecasting-Use of AI in load forecasting.	08	10%
		Modelling of Power System Components: The need for modelling of power system, different areas of power system analysis. Simplified models of non-electrical components like boiler, steam & hydro-turbine &governor system. Transformer modelling such as auto-transformer, tap-changing & phase-shifting transformer.	08	10%
4	**Unit: 4**	**Introduction to State Estimation in Power Systems:** Introduction, Power system state estimation, Maximum Likelihood Weighted Least Squares Estimation, Introduction, , Maximum Likelihood Concepts, Matrix Formulation, State Estimation of an AC network ,Development of Method, An Introduction to Advanced topics in state estimation, Detection andIdentification of Bad measurements, Estimation of quantities not being measured, Network Observability and Pseudo measurements, Applicationof Power Systems State Estimation	16	30%
5	**Unit: 5**	**Power System Security:** Introduction, Factors Affecting Power System Security, Short Circuit Studies of a Large Power System Networks, Symmetrical Fault Analysis Using Bus Impedance Matrix, Algorithm for Formation of Bus ImpedanceMatrix, Contingency Analysis: Detection of Network Problems, Overview ofsecurity analysis, Linear Sensitivity Factors,Contingency Selection,Concentric Relaxation, Bounding	12	20%

D. Instructional Methods

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.

- Two internal exams may be conducted and average of the same may be converted to equivalent of 15 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of five marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

E. Students Learning Outcomes

- The student can identify different techniques of power system modeling, analysis and their comparison.
- Student should be able to implement different modeling techniques through simulation in power system.

F. Recommended Study Materials

- **Text & Reference Books:**

1. Power Generation Operation & Control, John Wiley & Sons, Inc, 1996- A. J.Wood and B. F. Wollenberg
2. Computational Methods for Electric Power Systems, Second Edition, Mariesa Crow, CRC Press, 2009
3. AC-DC Power System Analysis, IEE London UK, 1998- Jos Arrillaga and Bruce Smith
4. Advanced Power System Analysis and Dynamics, New Age International Ltd,New Delhi, 1992- L. P. Singh
5. Power System Analysis, Tata Mcgraw Hill, New Delhi, 1999- Hadi Sadat
6. Elements of Power System Analysis, W.D. Stevenson Jr., 4th Edition, Mcgraw hill,
7. Power System Analysis, A.R. Bergen, Vijay Vittal, 2nd edition, Pearson Publication.
8. Modern Power System Analysis, I.J. Nagarath, D.P.Kothari, 3rd edition, Tata Mcgraw Hill, New Delhi

