NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**VII**
Course Code:	4EE204DE25
Course Title:	**Advanced Power System Analysis**
Course Type:	**Disciplinary Minor - (Elective Course-II)**
Year of Introduction:	**2025 – 26**

L	T	Practical Component				C
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Course Learning Outcomes (CLOs):

At the end of the course, students will be able to –

1. analyse probabilistic power flow and voltage stability for electrical network (BL4)
2. solve the UC and hydrothermal scheduling problem using various approaches (BL5)
3. apply fundamental principles to estimate power system security and reliability (BL3)
4. evaluate generation, transmission and generation planning in electrical power system (BL4)

Unit	Contents	Teaching hours (Total 45)
Unit -I	**Probabilistic load flow** Uncertainty in power networks, introduction to the probability theory, probabilistic load flow (PLF) techniques: Monte Carlo and point estimation method	08
Unit- II	**Unit commitment and Hydrothermal Scheduling** Introduction and concepts of unit commitment, spinning reserve, thermal unit constraints, must run and fuel constraints, priority-list and dynamic-programming methods for unit commitment solution, introduction and concepts of hydrothermal scheduling problems, long-term and short-term hydrothermal scheduling, gradient method for short-term hydrothermal scheduling problems	08
Unit- III	**Power system security and reliability assessment** Introduction to power system security, system state classification, security analysis, contingency analysis, sensitivity factor. Basic reliability concepts: general reliability function, Markov Chains and processes and their applications, simple series and parallel system models, static generating capacity, spinning generating capacity, transmission system and inter-connected systems generating capacity reliability evaluation	10
Unit- IV	**Voltage stability analysis** Basic concept, classification of voltage stability, modelling requirements, P-Q and Q-V curve, voltage stability limit, voltage stability indices, voltage stability analysis: static and dynamic,	11

sensitivity analysis, modal analysis, continuation power flow analysis, voltage collapse and prevention of voltage collapse

Unit -V **Power System Planning** 08

Time-horizon perspective of power system planning, power system planning issues, some economic principles, load forecasting: trend analysis, econometric modelling, end-use analysis, single-bus generation expansion planning, multi-bus generation expansion planning, substation expansion planning, network expansion and reactive power planning, power system planning under uncertainties, recent trends in power system planning.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

This shall consist of at least 10 practical / simulations based on the above syllabus.

Suggested Reading:

1. T. K. Nagsarkar & M. S. Sukhija, *Power system Analysis*, Oxford University Press, USA.
2. P. Kundur, *Power System Stability and Control*, McGraw Hill.
3. A. Chakrabarti, *A Textbook on Power System Engineering*, Dhanpath Rai Publishing Company Ltd.
4. Kirschen, Daniel S., and Goran Strbac, *Fundamentals of power system economics*, John Wiley & Sons.
5. Saadat, H., *Power system analysis*, McGraw hill.
6. T.V. Cutsem and C. Vournas, *Voltage Stability of Electric Power Systems*, Springer.
7. J.B. Gupta, *A Course in Electrical Power*, Katson books.
8. Sauer, Peter W. Pai, M. A., *Power System Dynamics and Stability*, Prentice Hall.
9. J. Duncan Glover, Thomas Overbye, *Mulukutla Sarma, Power System Analysis and Design*, Cengage Learning.
10. Edoy X. Wang and J. R. McDonald, *Modern Power Systems Planning*, McGraw Hill.
11. James Momoh, Lamine Mili, *Economic Market Design and Planning for Electric Power Systems*, John Wiley and Sons.
12. Hossein, Seifi, Mohammad Sadegh, Sepasian, *Electric Power System planning: Issues, Algorithms and Solutions*, Springer.
13. A. S. Pawla, *Electric Power Planning*, McGraw Hill Education.
14. Relevant recent literature, journal articles, standards and codes.

Suggested List of Experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1.	To perform probabilistic load flow using Monte Carlo techniques for power system network.	04
2.	To perform probabilistic load flow using point estimation techniques for power system network.	02
3.	To perform and analyse Unit Commitment using dynamic programming method.	02

4.	To perform short term hydro thermal scheduling of given power system	02
5.	To perform and analyse contingency analysis of given power system	02
6.	To perform security analysis on given power system.	02
7.	To perform reliability analysis on given power system.	02
8.	To analyse voltage change with load variation on sample power system network.	02
9.	To develop program for voltage stability analysis using CPF.	02
10.	To study power system generation, transmission and distribution expansion planning.	02