

Course Title	Electric Power Systems
Course Code	EE4403
No. of Credit Hrs (Lecture + Tutorial + Lab)	4 (3+0+1)
No. of Contact Hrs (Lecture + Tutorial + Lab)	5 (3+0+2)
Level-Year	7-4
Prerequisite (if any)	EE3300

1) Course Objectives:

This is an introductory course for the modern power system. It introduces the main structure of power system (generation, transmission, and distribution) including divisions and basic components. It discusses the concept of per-unit system and per-unit quantities representation on impedance and reactance diagrams. The course explains transmission line parameters calculations, lines modeling and performance evaluation. Finally, this course concludes all of the above by performing power flow analysis for an interconnected power system under normal operation.

Expected Learning Outcomes:

Upon completion of this course, the students will be able to:

1. **Explain** the structure, function, and main components of electric power systems, including their interactions. **PLO1 [1]**
2. **Design and model** transmission lines and evaluate their performance under practical operating conditions. **PLO2 [2]**
3. **Apply** the concept of the per-unit system to simplify and analyze power system calculations. **PLO1 [1]**
4. **Analyze and investigate** power systems using power flow analysis to assess system operation. **PLO3 [6]**
5. **Perform and simulate** studies on transmission line modeling, power flow, and fault analysis, and interpret results. **PLO3 [6]**
6. **Communicate** technical findings effectively by preparing structured reports on power system performance and fault analysis. **PLO8 [3]**

2) Course Contents:

1. Supply systems: Basic network of power system. Transmission and distribution voltage, effect of system voltage on size of conductor and losses
2. Distribution Systems: Primary and secondary distribution systems, feeder, distributor and service mains. Radial and ring- main distribution systems. Kelvin's law for conductor size.
3. Mechanical Features of Overhead Lines: Conductor material and types of conductor. Conductor arrangements and spacing
4. Parameters of Transmission Lines: Resistance inductance and capacitance of overhead lines, effect of earth, line transposition. Geometric mean radius and distance
5. Inductance and capacitance of line with symmetrical and unsymmetrical spacing Inductance and capacitance of double circuit lines. Skin and proximity effects. Equivalent circuits and performance of short and medium transmission lines.
6. Generalized ABCD Line Constants: equivalent circuit and performance of long transmission line. Ferranti effect. Interference with communication circuits. Power flow through a transmission line
7. Corona: Electric stress between parallel conductors. Disruptive critical voltage and visual critical voltage, Factors affecting corona. Corona power loss.

8. Insulators: Pin, shackle, suspension, post and strain insulators. Voltage distribution across an insulator string, grading and methods of improving string efficiency
9. Underground Cables: Conductor, insulator, sheathing and armoring materials. Types of cables. Insulator resistance and capacitance calculation. Electrostatic stresses and reduction of maximum stresses.
10. Causes of breakdown. Thermal rating of cable. Introduction to oil filled and gas filled cables

Course Contents lab:

Conduct experiments to cover the following topics

1. Introduction to MATLAB.
2. Introduction to Power World.
3. Medium Transmission Line Modeling: ABCD Parameters Determination (MATLAB).
4. Long Transmission Line Modeling: ABCD Parameters Determination (MATLAB).
5. Formation of Y-Bus and Z-Bus Matrices Using Inspection Method (MATLAB).
6. Power Flow Study Using Gauss-Seidel and Newton-Raphson Methods (Power World).
7. Computation of Inductance & Capacitance for a Single phase Line, Three Phase Symmetrical Line, Three phase unsymmetric transposed line

3) Teaching Methods:

- Lectures and Discussion
- Videos
- Self-learning
- Laboratory demonstrations

4) Mode of Evaluation:

Course Assessment Methods

- Quizzes , Assignment, Homeworks, Reports, Presentations etc.
- Lab Work
- Mid Exam
- Final Exam

Evaluation

No	Assessment Activities *	Percentage
1.	Assignments/Quizzes/HomeWorks/Mini-Projects/Presentations/Reports+Quizzes	15%
2.	Mid Exam	25%
3.	Lab/Tutorial (Lab Exam)	10%
4.	Lab/Tutorial (Lab Reports)	10%
5.	Final Exam	40%

5) Textbook(s):

- Hadi Saadat, "Power System Analysis" McGraw-Hill, 3rd Edition
- J. Duncan Glover, "Power system Analysis and Design" CENGAGE Learning, 5th Edition
- John J. Grainger, William D. Stevenson " Power System analysis" McGraw-Hill, 4th Edition.
- Lab Manual

6) References

- Alarainy, et..., " Fundamentals of electrical power engineering", King Saud Univ., academic press.
- Gross CA, "Power System analysis" John Wiley.

