ECE 610- Power System Analysis

Tentative Course Outline — Fall 2024

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Office Hours: Office Hours: Mondays and Fridays 11:00 to 12:00 or by appointment.

Prerequisites: B.S. in EE or ME.

Course Description: Steady-state analysis of power system networks, particularly real and reactive power flows under normal conditions and current flows under faulty conditions. Symmetrical components and digital solutions are emphasized.

Course Learning Outcomes: Students will learn aspects of power system analysis, operation, and control. The course covers modeling of some power systems components, especially transmission lines. This is followed by Load-Flow analysis, study of symmetrical and unsymmetrical faults, and economic operations of power systems.

Textbook: "Power System Analysis and Design," by Glover, Sarma, and Overbye, 6th Edition, ISBN 978-1-1305-63213-4

Course Policy: The maximum number of points is 150, divided as follows:
Midterm test: 50 points
Final test: 50 points
50 points for homework, class participation, and short quizzes. Please use the cover page at the end of this outline and attach it to every homework you submit.

University Policy on Academic Integrity: Students should be familiar with NJIT Honor Code as presented in https://www.njit.edu/dos/academic-integrity . This code will be rigorously upheld, any violations will be brought to the immediate attention of the administration. It is the responsibility of the student also to report to the instructor any observed violation of the Policy on Academic Integrity.

Time Requirements: This course is a three credit-hours course. Assuming the average load of a full-time student is 15 credit-hours, and assuming a full-time student works 45 hours/week towards his/her studies, then this course requires 9 hours of study and class time per week on the average.

Software: The textbook (6^{th} edition) includes integrated PowerWorld Simulator examples and problems. This software performs Load-Flow analysis and Optimal Power-Flow for power systems. You are encouraged to download the software and cases (for the 6^{th} ed) directly from the PowerWorld website. This version of the software is available for free to all for educational use. http://www.powerworld.com/gloversarma.asp
We will also occasionally use Matlab to solve some problems especially the Load-Flow problem.

Weekly schedule:

9/3 Review of power system networks, complex power (in class) Ch. 2 excl sec 2.4

Bring your PC to class with Matlab installed to solve problems using Matlab in class .

HW: chapter 2: 6, 9, 12, 24, and 50.

End of chapter multiple choice questions should be done but will not be collected. This chapter is a review chapter and the material is supposed to have been covered in the undergraduate studies of most of the students. Therefore, students should solve as many problems as they feel they need to.

9/10 Transformers, per unit system (in class) Ch. 3

Ch. 3 is a reference but other books on energy conversion or electrical machines can be used to review the theory of transformers.

This week's material is a review of topics that are usually covered in textbooks on energy conversion with the exception of the per-unit system.

HW: 3.22, 3.23, 3.25, and 3.28

9/17 R and L parameters of single-phase transmission lines (asynchronous on line) Ch. 4

HW: Problems 4.1 and 4.6 are relevant to section 4.2

Problems 4.8 to 4.11

The T-Line described in problem 4.8 is the subject of problem 4.32 assigned later. You are encouraged to use Matlab to write a function that solves 4.8, 4.9 (a), and 4.9(b). With this function you can easily study the variation of the line inductance with the diameter of the conductor.

9/24 Inductance of 3-phase transmission lines (in class) Ch.4

HW: 4.16, 4.23, 4.25, and 4.31.

10/1 Capacitance of T-Lines and Medium and short line representation Ch. 4 & 5

(asynchronous on line) HW: Problems 4.32, 4.33, 4.39, 4.40 and 4.43.

10/8 Line representations, operation, and network equations (in class) Ch. 5 & sec. 2.4

HW: 2.35 and 2.37 from chapter 2; and 5.1, 5.2, and 5.11

10/15 Power flow techniques – solving by the Gauss-Seidel method (in class) Ch. 6

HW: 6.6 to 6.11

10/22 Test 1.

10/29 Power flow techniques – Solving by the Newton-Raphson method. Ch. 6
(asynchronous on line). HW: Problems 6.25, 6.28, 6.31, and 6.43.

11/5 Power flow techniques – The Fast-Decoupled method, Sparsity, Ch. 6
DC Load-Flow. (in class)
HW: Problems: 6.32, 6.49 and 6.50.

11/12 Economic dispatch (asynchronous on line) Sections 6.12 and 6.13

HW: 6.62, 6.63, 6.65, and 6.67

11/19 Symmetrical Faults (asynchronous on line) Ch. 7

Sections: 7.1 (equations 7.1.11 and 7.1.12 will not be emphasized), 7.2 (the various time constants in this section will not be emphasized, the purpose of the section is to impart understanding of the various synchronous machine reactances).

HW: 7.3, 7.4, 7.5, 7.12, 7.14, 7.23, 7.34

11/26: Follow Thursday Schedule

12/3: Power System Controls (asynchronous on line) Ch. 12

12/10: Symmetrical Components (in class) Ch. 8

HW: Problems: from end of chapter 8: 3, 4, 10, 25, 29, and 41.

12/17 Final Examination

Please use the following on a cover sheet and attach it to the front of your homework.

ECE 610 HW#

Name: **Date Submitted:**
Roster# **Problem Solved:**