ECE 442- Power System Analysis

Tentative Course Outline — Fall 2024

Instructor: Dr. Walid Hubbi — **email: hubbi@njit.edu**

Office: ECE 329 — **Phone: (973) 596 3518**

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

Prerequisites: ECE 341 or ECE 342

Meeting time/location

TR	8:30 AM – 9:50 AM	CKB 226

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

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. According to the definition of a "credit hour" by the NJ government, 5 hours of study outside the class per week is required on the average for this course.

Software: The textbook (6th 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 6th 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.

Grading Policy: The maximum number of points is 150, divided as follows:

Tests1 and 2: 35 points each,
Homework, class participation, and short quizzes: 30 points,
Final test: 50 points.

The letter grading will be: A: 90-100%. B+ : 0-89.99%. B: 70-79.99%.
C+: 60-69.99%. C: 50-59.99% . F: <5

Weekly Schedule

Week1, 9/3 Introduction, Power Systems Operational Problems, Review of circuit theory, phasors, complex power. Ch. 2, excl sec 2.4

Assignment 1: HW1 : 2.6, 2.9, 2.12, 2.24

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 a Circuit Theory course. Therefore, students should solve as many problems as they feel they need to.

Week 2 and 3, 9/10 and 9/17: Balanced Three-Phase systems sections 2.5, 2.6, 2.7
Transformers, per unit system. Ch. 3

Ch. 3 is a reference, other books on energy conversion or electrical machines can be used to review the theory of transformers.
Assignment 2: HW 2: Problem 2.50 and 3.2, 3.4, and 3.16 due on 9/17
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.

Learning the PU system thoroughly is most important.

Assignment 2: HW 2: Problem 2.50 and 3.2, 3.4, and 3.16 due on 9/17
Assignment 3: HW3 : 3.22, 3.23, 3.25, and 3.28, due on 9/24

Week 4, 9/24 : R and L and C parameters of transmission lines. Ch. 4

Assignment 4: HW4: Chapter 4:- 1, 6, 8, 9, 10, 11, 16, 23, 25, 31, 32, 33, 39, 40 and 43

Problems 4.1 and 4.6 are relevant to section 4.2. 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.

Week 5, 10/1, Medium and short line representation, Network equations. Ch. 5 & sec. 2.4
Assignment 5: HW5: 2.35 and 2.37 from chapter 2; and 5.1, 5.2, and 5.11

Tuesday 10/8: Test 1

Thu. 10/10 and Week 7: **Po**wer flow techniques – solving by the Gauss-Seidel method Ch. 6: sections: 2, 4, and 5.
Assignment 6: from the end of chapter 6, solve: 6.6, 6.7, 6.9, 6.28, 6.30, 6.31 (use Matlab).

Week 8 and 9, 10/22 and 10/29 Power flow techniques – Solving by the Newton-Raphson method Ch. 6:sections 3, 6, 7, 8, 9.

Assignment 7: HW7: Problems 6.25, 6.43, and 6.55.

Week 10, 11/5 Economic Dispatch Ch. 7

Assignment 8: HW8: 7.1, 7.2, 7.3, and 7.4

Tue. 11/12 Test 2.

Week 11 and 12, 11/12, and 11/19 Symmetrical Faults Ch. 8

Sections: 8.1 (equations 8.1.11 and 8.1.12 will not be emphasized),

8.2 (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), 8.3, and 8.4

Assignment 9: HW9: 8.3, 8.12, 8.14, 8.23.

Week 13 and 14, 11/26 and 12/3 Power Systems Controls and review Ch. 13

Assignment 10: HW10: 13.5, 13.6, 13.7, and 13.14.

Course 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.

Students will:

- Acquire understanding of the importance of power systems to society and civilization.
- Learn how to calculate real power, reactive power, and understand phasor domain.
- Learn how to obtain a model of a power system and its components.
- Learn how to calculate system response to static boundary conditions—load flow.
- Learn how to schedule generation economically.
- Learn how to calculate the system response under faulty conditions.
- Learn some aspects of power systems control.

Grading Scale

Grade	GPA	Percentage
A	4.0	90-100%
B+	3.5	80-89.99%
B	3.0	70-79.99%
C+	2.5	60-69.99%
C	2.0	50-59.99%
F	N/A	0-49.99%

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

ECE 442 HW#

Name: _____ **Date Submitted:** _____

Roster# _____ **Problem Solved:** _____