**Villanova University**
**Department of Electrical and Computer Engineering**
**Spring 2021**
**ECE 7810-DL1 – Power System Modeling**
**Thursday Evenings, 6:10-8:50 p.m.**
**Via Blackboard**


Instructor: R. Barnett Adler, Ph.D., P.E.
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Office Hours: After class until 10:00 p.m. and other times by appointment


## Course Objectives

ECE 7810 provides the basis for modeling and analyzing the steady-state behavior of electric power systems. Covered are the fundamentals of balanced three-phase systems, three-phase transformer banks, transmission lines, system power-flow analysis, and fault-current analysis of balanced and unbalanced faults. Professional PC software, *Power-World Simulator* (provided by text-book authors, Glover *et al*, free of charge), is used to explore the implications of material as it is introduced in this course. Issues related to stand-alone or interconnected micro-grids will be explored as they become relevant.

## Primary Text

J. D. Glover, T.J. Overbye & M.S. Sarma, *Power System Analysis and Design*, 6th Edition, CENGAGE Learning, 2017. (ISBN 978-1-305-63213-4) (now also available in paperback)

## Reference Texts

J. J. Grainger & W. D. Stevenson, Jr., *Power System Analysis*, McGraw-Hill, 1994. (ISBN 0-07-061293-5)

Arthur R. Bergen & Vijay Vittal, *Power Systems Analysis*, 2nd Edition, Prentice Hall, 2000. (ISBN 0-13-691990-1)

## Course Requirements

Attendance: Real-time participation in class is encouraged. Each quiz and exam will be released at the beginning of the class period in which it is scheduled. A specific postponed release time may be arranged by an individual student, as long as a proposed release time has been submitted via email no later than 1:00 p.m. on the day of the scheduled quiz or exam. Real-time participation in class discussion is highly recommended. The student is responsible for down-loading all e-mail distributions..

Grading:

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|---|---|
| Best 4 of 5 bi-weekly quizzes (30 minutes each) | 20% |
| Midterm Exam (75 minutes) | 25% |
| Weekly problem sets | 20% |
| Final Exam (Comprehensive). | 35% |

Homework submitted (via scan and email) within one week following its specified due-date will be accepted for full credit. Solutions will be distributed during that same week via BlackBoard. Later homework will be accepted for 95% credit up until 3/10 (before Midterm Exam), and 5/5 (before Final Exam).

## Tentative Schedule

| Topic | Chapter | Class Dates **(Evaluations)** |
|---|---|---|
| Fundamental principles, ac power calculations, three-phase network modeling. | 2 | 1/28, 2/4 |
| Transformer banks: modeling & connections, per-unit system for their incorporation. | 3 | 2/11(**Quiz 1)** |
| Transmission line parameters. Calculation of line resistance, inductance, capacitance. | 4 | 2/18, 2/25**(Quiz 2)** |
| Transmission-line modeling & calculations. | 5 | 3/4,3/11**(MidtermExam)** |
| Transmission-line modeling & calculations (continued) | 5 | 3/18 |
| Network nodal-voltage calculation. Power-flow analysis. | 6 | 3/25**(Quiz 3)**, 4/1 |
| Fault-current calculations following symmetrical (3-phase, balanced) faults. | 7 | 4/8**(Quiz 4)** |
| Modeling unbalanced conditions using Symmetrical Components. | 8 | 4/15 |
| Symmetrical components for analyzing impact of unbalanced-fault conditions. | 9 | 4/22**(Quiz 5)**, 4/29 |
| **Final Exam** | | 5/6**(Final Exam)** |

Students must make arrangements to submit their quiz and midterm exam solutions via scan-and-email within the allotted time period following downloading the quiz or exam. (Smartphone app **CamScan** has been found to work well for the purpose of timely quiz and exam submission.)