ECE 7860 Syllabus
Operation and Control of Modern Power Systems

Credit Hours:
4 Credit Hours (LCT 4).

Course Description:
Prereq: ECE 5430. Power system optimal dispatch, power system stability analysis and control. Smart grid technologies and applications, covering modeling and control of renewable energy systems, distributed generation, Microgrid architecture and control, demand response, energy storage for power grids, grid interface and integration of renewable sources, and electricity market fundamentals.

Instructor: Dr. Caisheng Wang,
Course Meeting Time: Tuesday and Thursday, 5:30 PM - 7:10 PM
Course Meeting Location: 0159  MAIN
Office Hours: Tuesday and Thursday, 2:00 PM - 3:30 PM
Office Location: 3146 Engineering Building
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Prerequisite(s): ECE 5430 Electric Energy Engineering Systems or equivalent.

Co-requisite(s): None.

Textbook(s) Required:

Computer Programs:
MATLAB/Simulink and PowerWorld Simulator

Goals:
Introduction to the multi-disciplinary field of smart grid and renewable energy systems. Understand the theory and methods for analysis and control of smart grid and integration of renewable systems.

Course Objectives:
Upon completion of this course the student will be able to:
1. Describe the structure of a power system and the concepts of smart grid.
2. Identify the contemporary challenges in implementing smart grids and increasing adoption of renewable sources.
3. Calculate optimal dispatch of power generation
4. Carry out stability analysis of a power system
5. Analyze and design controllers for power systems
6. Model the main components in typical renewable energy systems.
7. Describe the concepts of distributed generation and Microgrids
8. Describe typical methods of renewable energy integration
9. Identify the need and describe the function of energy storage and demand response
10. Describe the features and functions of the modern electricity market.

Topics:

1. Introduction: Concepts and motivations (1 week)
2. Fundamental of power systems (1 week)
   Components, power flow
3. Optimal dispatch of generation (1 week)
4. Power system stability (1 1/2 weeks)
5. Power system control (1 1/2 week)
6. Alternative/Renewable Energy Systems and System Integration (2 1/2 weeks)
7. Distributed generation and microgrids (1 1/2 weeks)
8. Energy storage systems (2 week)
9. Demand response (1 week)
10. Fundamentals of modern electricity market (1 week)

Contributions to the ECE Program Outcomes:

(a) Demonstrate mastery of advanced principles pertaining to the electrical engineering research path of the Ph.D. candidate. The homework assignments, project, and exams require direct applications of mathematical, scientific, and engineering knowledge to successfully complete the course. Students are required to perform analysis, design, control, and optimization of power systems and smart grids to complete the tasks.
(b) Plan and conduct independent research which leads to the development of new knowledge, approaches and solutions for electrical engineering problems. The course project requires students (either in individual or team) to independently study the analysis, modeling and control methods of power system and smart grid given in the textbook, to carry out literature survey on the related advanced topics in the field, and to present solutions to an identified problem related smart grid challenges.
(d) Effectively communicate, both verbally and in writing, scientific and engineering concepts to audiences with a broad range of technical knowledge. Students are required to write a comprehensive project report according to IEEE format and give presentations to show their results before the class and answer questions from the audience.
Grading Policy:

Homework 25%
Project 25%
Mid-term Exam 25%
Final 25%

Grading Scale:

A = 95-100, A- = 90-94, B+ = 85-89, B = 80-84, B- = 75-79,
C+ = 70-74, C = 65-69, C- = 60-64, F = 0-59

Schedules:

- Homework due: one week after completing the corresponding chapters/topics
- Project due: Dec 14
- Final Exam: Dec 14

Attendance:

Students are expected to attend all lectures. The most common reasons for failing this course are (1) not attending all lectures and (2) not having sufficient time spent on the course.

WITHDRAWAL POLICY:

Last day to drop with a tuition refund: End of 2nd Week of Semester
Last day to drop without a notation of W on the transcript: End of 4th Week

Depending on the situation of withdrawal, one of the following grades will be assigned:
WP: Withdrawal with Passing
WF: Withdrawal with Failing
WN: Withdrawal Never Attended

All drop/add activity during the first four weeks should be done by the student through Pipeline. Withdrawal after the fourth week requires the instructor’s permission and must be submitted on a Drop/Add form to the Registrar’s Office. Withdrawal after the ‘final drop’ date will only be permitted under exceptional circumstances and requires the permission of the Chair of the ECE department. A failing grade is not an acceptable reason for withdrawal after the ‘final drop’ date.

POLICY ON CHEATING:
Cheating is defined by the University as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment/exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure Academic Integrity, will also result in downgrading for the course. Students who cheat on any assignment or during any examination will be assigned a failing grade for the course and may be subject to additional penalties. See http://www.otl.wayne.edu/wsu_integrity.php for more details.

Code of Ethics for Engineers:

WSU library has a tutorial that talks about transmitting ideas, plagiarism, copyright, and citing sources. At the end, there is a quiz. You are encouraged to visit this site then take the quiz at the end.
http://www.lib.wayne.edu/services/instruction_tutorials/searchpath/mod6/contents.html

The following list gives additional sites:
http://onlineethics.org/codes/
http://www.iit.edu/departments/csep/codes/coe/abet-a.html

AVAILABILITY TO STUDENTS WITH DISABILITIES
If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, the instructor will meet with you privately to discuss your special needs. Student Disability Services’ mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University. Please be aware that a delay in getting SDS accommodation letters for the current semester may hinder the availability or facilitation of those accommodations in a timely manner. Therefore, it is in your best interest to get your accommodation letters as early in the semester as possible.

Last Updated:
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Prepared by: Dr. Caisheng Wang