INSTRUCTOR: G. Kumar Venayagamoorthy, PhD, MBA, FiET, FSAIEE
Duke Energy Distinguished Professor of Electrical and Computer Engineering
Director of the Real-Time Power and Intelligent Systems Laboratory
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SEMESTER: Spring 2018

CLASS TIME: Tuesdays and Thursdays: 9.30 am to 10.45 am

CLASSROOM: Watt Innovation Center 310

OFFICE HOURS: Mondays: 8:30 am to 9:30 am or by appointment (However, the best way to reach me is via email)

EMAIL COMMUNICATIONS: When you send me an e-mail message, use a descriptive subject line that starts with the course identifier ("ECE4160/6160"). This can significantly reduce the response time of the reply. If you do not receive a response with 48 hours, resend the message. It may have been caught in a spam filter.


REFERENCES:
3. Papers from IEEExplore and Sciencedirect databases.
4. Guest Lectures
5. Additional material may be provided by the instructor.

COURSE OBJECTIVES:

The objectives of the ECE 4930 course are to enable undergraduate students to:

- Apply the interdisciplinary concepts and smart grid technologies learned from this course to design a modern power system, the next generation intelligent grid which is a system of systems.
- Differentiate a traditional power system from an intelligent power grid.
- Be able to contribute to the transformation of a traditional power system into an intelligent power grid.
- Demonstrate the concepts of smart grid technologies via a semester-long team (4 students) project.

The objectives of the ECE 6930 course are to enable graduate students to:
• Apply the interdisciplinary concepts and smart grid technologies learned from this course to design a modern power system, the next generation intelligent grid which is a system of systems.
• Differentiate a traditional power system from an intelligent power grid.
• Be able to think through the A to Z process needed to transform a traditional power system into an intelligent power grid.
• Implement an intelligent power grid.
• Demonstrate the breadth and some depth of smart grid technologies via a working laboratory prototype semester-long team (2 students) project.

COURSE DESCRIPTION: This introductory course on smart grid covers the concepts and technologies that transform the traditional power system into an intelligent power system (which is referred to as the smart grid today). The technologies needed for this transformation are of interdisciplinary nature and are introduced in this course.

The course specifically will cover the following topics:

Week #1: Introduction and the traditional power system
Week #2: Smart grid architectures
Week #3 & 4: Intelligent measurements
Week #5: Intelligent communication systems
Week #6: Renewable energy sources
Week #7: Electric vehicles
Week #8: Intelligent power electronics
Week #9 & 10: Computational technologies
Week #11: Cyber security
Week #12: Demand response management
Week #13 &14: Data and Visual Analytics
Week #15: Performance and Economic Analysis

Guest lectures will be offered as available during course of the semester and will be announced via Canvas.

Jan. 16, 2018 – Solar PV Systems - Dr. Raj Singh
Jan. 25, 2018 – Cybersecurity – Dr. Richard Brooks

PRE-REQUISITES: The basic requirement is a senior undergraduate standing with MATLAB and other programming language capabilities, Microsoft Office skills (word, presentation and spreadsheet) and creation of PDF documents.

GRADING: The grading requirements are different for the undergraduate (UG) and graduate students (G).

Assignments: a minimum of 6 assignments and no more than 8
• UG 20%
• G 10%

Discussions (in-class and offline): 5%

Project (Team based):
• UG: no more than 4 students 25%
• G: no more than 2 students 35%
Tests (include quizzes): 30%
- **UG** (two tests)
- **G** (three tests)

*An additional test for graduate students will be conducted.*

Final Exam (comprehensive coverage of course content): 20%

Grades:
- **UG**: A – 90% - 100%; B – 80 to < 90%; C – 70 to <80%; D – 60 to < 70%; & F – < 60%
- **G**: A – 90% - 100%; B – 80 to < 90%; C – 70 to <80%; & F – < 70%

All disputes about an evaluation of any graded work during the semester must be submitted in writing (typed, not handwritten) within one week after an assignment, test or project has been distributed to students in the class. Any grade challenges must provide specific justifications for why the grade would be changed.

**ATTENDANCE:**
Regular class attendance and participation in discussions is expected with attendance taken as IROAR requires entry of student’s last date of class attendance. Students are responsible for all material covered and assigned readings during the semester. If you anticipate not being able to attend a class for a particular reason, please e-mail me with the information (before the class to be missed). The optimal classroom learning experience depends on both a professional teaching environment and student participation.

**TESTS AND FINAL EXAM:**
Absence from the tests/final exam will be excused only for medical reasons or serious immediate family problems. A student who anticipates missing a test/exam for legitimate university or professional activities shall discuss with the instructor at least one week prior and set up an alternative arrangement to have test taken before the intended date.

**ASSIGNMENT/POST/HOMEWORK:**
It is anticipated that there will be at least five assignments and no more than ten.

All course submissions shall be submitted using Canvas no later than **11.55 pm of the posted due date**. No late submissions beyond a day will be accepted. Late submissions require approval of the instructor and may be subjected to a 50% loss of points.

Any homework assigned will not be required for submission but they are mandatory readings. Quizzes and class discussions may be based on homework (missed quizzes will have no make-ups).

**MEETING DEADLINES:** Plan ahead for the unexpected! You are accountable for staying on schedule should technological or other problems arise. You should immediately contact the instructor if an emergency may affect your ability to meet course deadlines. Do not fall behind. Playing catch-up causes stress, and stress hinders learning.

**PROJECT WORK:** This is team project. The projects will require written reports in IEEE PES paper format consisting of the following items:
- Title
- Abstract
- Introduction and motivation to the project topic with references (use the IEEE bibliography format)
- Concept/Methodology
- Description of concept in implementation (flowcharts, algorithms and/or programs)
- Discussions on the findings and/or results
- Summary (including future work).

Page length: Eight pages.

TEST/FINAL EXAM DATES (*tentative days):

*First Test: Thursday, February 8, 2018
*Second Test: Thursday, March 8, 2018
*Third Test (graduate students only, optional for undergraduates): Thursday, April 5, 2018
Final Examination: Wednesday, May 2, 2017, 8.00 am to 10.30 am

ACADEMIC INTEGRITY:
The following is Clemson’s official statement on academic integrity:

“As members of the Clemson University community, we have inherited Thomas Green Clemson’s vision of this institution as a ‘high seminary of learning.’ Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately and expeditiously to charges of violations of academic integrity.”

Please refer to the graduate academic integrity policy, approved March 26, 2007 by the Provost’s Advisory Council, at http://gradspace.editme.com/AcademicGrievancePolicyandProcedures#integritypolicy.

Each student should read this policy annually to be apprised of this critical information.

STUDENTS WITH DISABILITIES:
“It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students are encouraged to contact Student Disability Services to discuss their individual needs for accommodation.” Any student with an official Clemson University recognized learning disability must inform the instructor within the first week of class meetings so that arrangements can be made to meet the student’s needs. Details on policies and procedures are available at www.clemson.edu/sds.

CLEMSON UNIVERSITY TITLE IX STATEMENT (Undergraduate Students)
Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran’s status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at http://www.clemson.edu/campus-life/campus-services/access/title-ix/. Mr. Jerry Knighton is the Clemson University Title IX Coordinator. He also is the Director of Access and Equity. His office is located at 111 Holtzendorff Hall, 864.656.3181 (voice) or 864.565.0899 (TDD).
Clemson University Title IX Statement

The Clemson University Title IX (Sexual Harassment) statement: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The policy is located at http://www.clemson.edu/campus-life/campus-services/access/non-discrimination-policy.html. Jerry Knighton serves as Clemson’s Title IX coordinator and he may be reached at knightl@clemson.edu or 656-3181.

Copyright Statement:
Materials in some of the courses are copyrighted. They are intended for use only by students registered and enrolled in a particular course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Tech Act. Students should be reminded to refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy on the Clemson University website. Additional information is detailed at http://libguides.clemson.edu/copyright.

Preferred Name Policy:
Fostering an environment of inclusion is one of the major goals of Clemson University’s new strategic plan, ClemsonForward. Some of the most important elements of inclusion are the ways we interact with one another every day. To help foster interactions that support this goal, Clemson has approved a “Preferred Name Policy”. Simply put, it is now Clemson’s official policy that we all, as members of the Clemson Family, address one another using preferred names (i.e., the name an individual prefers to use even if different from his or her legal name). I therefore request you inform me of your preferred name if different than what I have in my records.

Final Considerations:

Learning:
At the end of the day it is how much you have learned from this course that matters. You are advised to be active course participant so that you will receive feedback to assist you with your learning and maximize your throughput.

Changes:
Any portion of this syllabus may be changed during the semester by the instructor as needed. You will be notified as soon as possible.

Agreement:
If you disagree with any of the policies or procedures stated above or cannot accommodate the time and work requirements of the course, you need to drop the course as soon as possible. By continuing, you agree to comply with all the policies and procedures described in the course syllabus.

Emergency Procedures:
Emergency procedures have been posted in all buildings and on all elevators. Students should review these procedures for their own safety on a regular basis and be aware of them at all times.

Last updated: January 11, 2018