ECE 2795 Microgrid Concepts and Distributed Generation Technologies

Meetings: Mondays from 17:00 to 19:30 ET at G36 Benedum Hall (Section 1010) or virtually (distant learning students – Section 1015)

Professor: Alexis Kwasinski (Benedum Hall 1229, akwasins@pitt.edu, Ph: 412-383-6744).

Course Home Page: http://www.pitt.edu/~akwasins/ECE2795uGridSpr17.html

Office Hours: Mondays from 3 pm to 5 pm and Tuesdays from 1:30 pm to 2:30 pm, or by appointment.

Prerequisites: Fundamentals of power electronics and power systems or consent from the instructor. Familiarity with at least one computer simulation software. Knowledge on how to browse through professional publications.

Reference Textbook(s): There is no required textbook. The reference textbook is:

G. Masters, *Renewable and Efficient Electric Power Systems*

Additional reference material, such as other books or papers, will be communicated during the class.

Course Description and objectives: This course describes fundamental concepts related with the development of microgrids and the integration of distributed generation. Technical topics are divided in three modules. The first module introduces microgrid components and discusses the main types of microsources. The second module focuses on energy storage technologies. The third module include system integration topics, such as power electronics interfaces; dc and ac architectures; economics, operation, stabilization, and control; reliability aspects; grid interconnection, and microgrids as part of "smart" grids. This course also aims at preparing students to conduct research or helping them to improve their research skills.

Grading:
Homework: 40%
Project preliminary evaluation: 20%
Project report: 30%
Class participation: 10%

Letter grades assignment: Grades will be assigned based on the following scale:
A+ (grade > 97%), A (97% ≥ grade ≥ 92%), A- (92% > grade ≥ 87%), B+ (87% > grade ≥ 82%), B (82% > grade ≥ 77%), B- (77% > grade ≥ 72%), C+ (72% > grade ≥ 67%), C (67% > grade ≥ 62%), C- (62% > grade ≥ 57%), D+ (57% > grade ≥ 52%), D (52% > grade ≥ 47%), D- (47% > grade ≥ 40%), F (40% > grade),

Homework:
This course does not have conventional tests. Instead, homework assignments tend to be somewhat more comprehensive than typical homework assignments you were used to have during your undergraduate studies. For this reason, homework will be assigned about every two weeks and you will have about that same time to work on the problems. In most cases homework problems will also require students to find solutions with minimal guidance from the instructor. The goal of this approach for homework assignment planning is for students to learn how to find paths for solutions to problems and to evaluate students academic maturity within the context of a graduate level course (i.e., based on the fact that students are already graduated professionals in engineering or science). That is, homework assignment scores will consider how well students demonstrate their skills in finding solutions independently and without guidance from the professor. Many times there could be many paths that will lead to solving a problem

and sometimes there will be many equally valid solutions for a given problem. Making mistakes is part of the learning process. For this reason the score of the assignment with the lowest score will not be considered to calculate the contribution of homework assignments to the course final grade. However, in order to have your lowest homework score discarded, you will need to attempt to solve all homework assignments which means that your lowest homework score will be discarded only if you submit all homework assignments showing a good-faith effort in solving all of the problems. Since some homework problems may have different valid solutions or different paths to a solution, the focus when I grade homework assignments is more on the process taken to address the problem and not necessarily on just a numerical answer. Hence, it is very important that homework problem solutions explain clearly but concisely the path taken to find the solution to a given problem and that students include some brief discussion explaining their answer to each homework question. Additionally, please, expect about couple of weeks grading cycle for homework assignments as both the content and the grading approach require extra time in order to perform a fair assessment of the completed work.

Project:

This course also includes a project that will require successful students to survey current literature and to analyze a problem. The project consists of carrying out limited research work throughout the course. For this project, students need to identify some topic related with microgrids and study it throughout the course. Examples of valid topics are the study of a microgrid power generation technology, integration of energy storage in microgrids, planning and design of microgrids, stability and control of microgrids, use of microgrids in a particular application, performance evaluation of microgrids, etc. Examples of topics that may likely be unsuitable for this course include the study of large wind or PV farms, technologies or operation of conventional power systems with a weak connection to microgrids, integration of microgrid technologies from the perspective of conventional power grids, smart grid or new power grid-related technologies (e.g. electric vehicles) with a weak connection to microgrids, etc. That is, this is a course about microgrids, not general power systems or conventional power grids, so the project needs to reflect this focus on microgrids. Thus, projects with a focus on electric power grids will likely receive a low score for being out of the scope of this course.

The project is divided in two phases:

1) Preliminary phase. Due date: February 6. Submission of references, description of the problem, and proposed approach to study it (1 to 2 pages long-single column document).
2) Second phase. Due date: April 10. Submission of a short paper (the report), at most 10 pages long, single column.

Participation:

Participation points are assigned at instructor's discretion based on the perceived attitude of individual students towards learning during the semester.

Communications

Very important: when sending me a message related with this course via email start your Subject line with "ECE-2795 S17:"

Class presentations and homework assignments will be posted in both CourseWeb/Blackboard and the course website. Announcements will be posted in the course website and in most cases in CourseWeb/Blackboard, too. So, please, check both CourseWeb/Blackboard and the class website regularly for information, class notes and homework assignments.

Disclaimers:

Although unlikely, this syllabus and the course schedule may change according to my judgment as to what is best for the class. Any changes will be declared in class. For example, due to the particular nature of my research I may need to travel to disaster areas on short notice. Although I will communicate these trips in advance along with any potential changes that these trips may cause, it is not possible to know at this time when those trips may occur. General course schedule and administrative deadlines follow the

University of Pittsburgh Academic Calendar 2016-2017 found at
http://www.provost.pitt.edu/documents/Academic%20Calendar%202016-2017_Final.pdf

University Policies:

Academic Integrity

University official statement: Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity (http://www.provost.pitt.edu/info/ai1.html). Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

My additional statements: Each student in this course is expected to abide by this Academic Integrity Policy. Any work submitted by a student in this course for academic credit will be the student's own work. A good explanation of what constitutes plagiarism can be found in the following IEEE's web page: http://www.ieee.org/publications_standards/publications/rights/ID_Plagiarism.html. Notice that paraphrasing could be considered a case of plagiarism. Finally, please be wise. Dishonesty is never worth it.

Disability Services

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS) (http://www.drs.pitt.edu/), 140 William Pitt Union, (412) 648-7890, drsrecep@pitt.edu, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

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Additional personal notice: I will post class presentations both in CourseWeb/Blackboard and the class website. The latter is open to the outside world but it is also a convenient way for students to access these class notes. Still, this material is copyrighted and protected according to the above notice. Other material, such as papers or class notes will only be shared in CourseWeb/Blackboard. In addition of being copyrighted, this material is only intended for students taking this course, so, please, do not distribute it or post it in the "outside world" as it is indicated in the above statement.

Statement on Classroom Recording

To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use.