Instructor: S. Santoso (ssantoso@mail.utexas.edu)
Office Hours: MW 1-2P and by appointment at UTA 7.229
Laboratory Schedule: ECI 1.316, M 6:30-9:30P, T 3:30-6:30P, T 6:30-9:30P, W 5:00-8:00P
Teaching Assistant: Min Lwin (m.lwin@utexas.edu)
Assistants: David Orn Jonsson (davidorn@utexas.edu)

Course Objective: The objective of the course is to provide students with fundamental principles of electric power systems design and analysis emphasized through theory, simulation and modeling, as well as hands-on laboratory experiments. This course focuses on balanced three-phase power systems, their operation, and elements of power systems encompassing generation, transmission, and distribution systems. In addition, this course introduces wind power generation and its interconnection requirements. This course serves as the first course in the electric power systems and renewable energy sequence. It provides a foundation for a career in the power and energy industry.

Pre-requisites: EE 331 or EE 438 with a grade of at least C (minimum pre-requisite).


Course website: https://courses.utexas.edu/

Course structure: Two one-and-a-half hour classes and one three-hour lab per week, hands-on experiments (12 to 17 sets), four small exams, one final exam.

Planned Topics:
0. Overview of generation, transmission, and distribution systems.
1. Balanced three-phase power systems (Ch. 2): phasors, single-phase circuits, balanced three-phase circuits, real, reactive, and complex power, interpretation, power factor and reactive power compensation.
   Experiments:
   - Concepts of RMS values and Real and Reactive Power (part 1)
   - Real Power and Reactive Power (part 2)
   - Power Factor Correction

2. Transformers and per-unit systems (Ch. 3): ideal transformer, equivalent circuit, per-unit system, three-phase transformers, three-winding transformers, autotransformers.
   Experiments:
   - Single-Phase Transformers; Transformer Polarity
   - Transformer Regulation; Autotransformer

3. Synchronous machines (Sadaat Ch. 3, Grainger Ch. 3): internal voltage, equivalent circuit, phasor diagram, power and torque, operation as motors and generators.
   Experiments:
   - Phase Sequence
   - Synchronous Machines as Generators
   - Synchronization of Synchronous Generators and Active and Reactive Power Control
Planned Topics:
4. Transmission Line Parameters (Ch. 4): design consideration, resistance, conductance, inductance, capacitance, computation of line impedance.

5. Transmission Lines - Steady-state Operation (Ch. 5): Short, medium, and long transmission line models, equivalent pi and lossless models, maximum power flow, line loadability, reactive power compensation.

Experiments:
- Power Flow and Voltage Regulation of a Simple Transmission Line
- Phase Angle and Voltage Drop Between Sender and Receiver
- Parameters which Affect Real and Reactive Power Flow

6. Wind generators: technology (Types 1 – 4), squirrel cage induction machines, concept of rotor slip, equivalent circuit, power and torque characteristics, operation as motors and generators, wind power applications, reactive power requirements.

Experiments:
- Prime Mover and Torque Measurement
- Squirrel-Cage Induction Motor
- Wound Rotor Induction Motor
- Direct Connect Fixed Speed Wind Turbine
- Reactive Power Requirement for a Wind Turbine
- Islanded Operation of IG Wind Turbine

7. Power flows: Definition of the power flow problem, power flow solutions, Gauss-Seidel, Newton-Raphson, control of power flow

Experiments:
- Power flow using PowerWorld

8. Symmetrical faults (Ch. 7): three-phase short-circuit and circuit breaker and fuse selection

9. Short-circuit analysis (Ch. 8 and 9): symmetrical components, sequence networks of power apparatus, and single line-to-ground faults

10. System protection (Ch. 10): circuit breakers, reclosers, fuses, relays (overcurrent), zones of protection, relays (distance and differential)

Grading Policy: Numerical grades ($g$) are as follows, with a total of 100 points

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<th>Problem assignments: 0 points</th>
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<td>Midterm exams: 4 x 10 points</td>
<td>Final Exam: 20 points</td>
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The correspondence of letter to numerical grade ($g$)

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Computing Tools: Matlab and PowerWorld

Exam dates
- Exam 1 – Wed, Feb. 18, 2015
- Exam 2 – Wed, Mar. 11, 2015
- Exam 3 – Wed, Apr. 8, 2015
- Exam 4 – Wed, May 6, 2015
Classroom behavior: Class meets on MW between 9 and 10:15 am except during University designated holidays. Although I do not take class attendance, all students are encouraged to be present in all scheduled classes. Late arrivals are indicative of lack of commitment and disruptive to everyone in the class. Be sure to arrive at least 5 minutes before the start of class. I reserve the right to refuse entry to students arriving 10 or more minutes late. Repeat offenders will be subjected to a 25% total grade reduction. The use of all electronic devices unrelated to the learning process is strictly prohibited. Laptop computers may be used for taking notes and running simulation models.

Policies for submitting laboratory reports and other assignments: All assignments must be submitted on the due date. Missed exams may be made up due to illness or other emergencies; otherwise a zero is assigned. Grades for late reports or assignments without instructor or TA consent will be reduced by 25%/day. 

Academic Integrity: Any scholastic dishonesty will not be tolerated. Please review this link: http://deanofstudents.utexas.edu/sjs/acint_student.php

Accommodations for Student with Disabilities: The University of Texas at Austin provides, upon request, appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of Dean of Students at 471-6259 and visit this link: http://www.utexas.edu/diversity/ddce/ssd/for_cstudents.php

Q drop Policy: The State of Texas has enacted a law that limits the number of course drops for academic reasons to six (6). As stated in Senate Bill 1231: “Beginning with the fall 2007 academic term, an institution of higher education may not permit an undergraduate student a total of more than six dropped courses, including any course a transfer student has dropped at another institution of higher education, unless the student shows good cause for dropping more than that number.”

Emergency Evacuation Policy: Occupants of buildings on the UT Austin campus are required to evacuate and assemble outside when a fire alarm is activated or an announcement is made. Please be aware of the following policies regarding evacuation:

- Familiarize yourself with all exit doors of the classroom and the building. Remember that the nearest exit door may not be the one you used when you entered the building.
- If you require assistance to evacuate, inform me in writing during the first week of class.
- In the event of an evacuation, follow my instructions or those of class instructors.

Do not re-enter a building unless you are given instructions by the Austin Fire Department, the UT Austin Police Department, or the Fire Prevention Services office.

Religious Holy Days: By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, I will give you an opportunity to complete it within a reasonable time after the absence.