ECE 5332 Communications and Control in Smart Grid Syllabus

Instructor:

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Course Purpose:

Introduction to the new multi-disciplinary field of Smart Grid.

Catalog Description:

Smart grid communications and control, covering several special topics in the field of smart grid including advanced metering infrastructures, demand response, distributed storage, vehicle-to-grid systems, wide area measurement, smart grid cyber security, etc.

Course Topics:

- Basics of Power Systems:
  - Load and Generation
  - Power Flow Analysis
  - Economic Dispatch and Unit Commitment Problems

- Smart Grid:
  - Definition
  - Applications
  - Government and Industry
  - Standardization

- Smart Grid Communications:
  - Two-way Digital Communications Paradigm
  - Network Architectures
  - IP-based Systems
  - Power Line Communications
  - Advanced Metering Infrastructure

- Demand Response
  - Definition, Applications, and State-of-the Art
  - Pricing and Energy Consumption Scheduling
  - Controllable Load Models, Dynamics, and Challenges
  - Electric Vehicles and Vehicle-to-Grid Systems
  - Demand Side Ancillary Services

- Renewable Generation:
    - Carbon Footprint
    - Renewable Resources: Wind and Solar
    - Microgrid Architecture
    - Tackling Intermittency
    - Stochastic Models and Forecasting
    - Distributed Storage and Reserves

- Wide Area Measurement:
    - Sensor Networks
    - Phasor Measurement Units
    - Communications Infrastructure
    - Fault Detection and Self-Healing Systems
    - Applications and Challenges

- Security and Privacy:
    - Cyber Security Challenges in Smart Grid
    - Load Altering Attacks
    - False Data Injection Attacks
    - Defense Mechanisms
    - Privacy Challenges

- Economics and Market Operations

Prerequisites:

This is a graduate course and enrolment is restricted to **graduate students only**. There is no official pre-requisite for graduate students at the time of enrolment. However, basic knowledge of power systems, basic knowledge of computer and communications networks, and some background in probability and random variables, linear algebra, and convex optimization will be helpful.

Textbook:

This course does *not* have any official textbook. The main source of learning for the students is the set of handouts provided by the instructor. The students will also need to read several recent papers in the field of smart grid, e.g., in the IEEE Transactions on Smart Grid, the IEEE Innovative Smart Grid Technologies Conference, and the IEEE Conference on Smart Grid Communications.

Grading (Percentage):

Four Tests – 80%
Final Project Report and Presentation – 20%

Grading (Letter Grades):

$90 \leq A \leq 100$
$80 \leq B < 90$
$70 \leq C < 80$
$60 \leq D < 70$
$F < 60$

Class Policies:

Tests: There will be a **total of four** tests, each forming 20% of your final grade. Each test will be taken in the class during the class hours. There is no separate final exam for this course. The exact date for each test will be announced in class at least one week before the test.

Final Project and Report: Each student will have to complete an individual final project on a topic related to the broad area of smart grid based the student's personal choice and the instructor's approval. The students are free to pick a topic which may or may not be related to their graduate research. Students must choose their project topic and submit a **one page project plan** by Thursday March 21, 2011. The **final project report** will be due on May 8, 2011. Each student will give **10 minutes presentation** (less than 8 slides) on his/her final project during the last week of classes. Again, the final project must be done individually.

Academic integrity: It is the aim of the faculty of Texas Tech to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed is regarded by the faculty and administration as a serious offense and renders the offenders liable to suspension

ADA Compliance Statement:

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office in 335 West Hall or 806-742-2405.