THE UNIVERSITY of TENNESSEE CHATTANOOGA

"Advanced Metering Infrastructure and Cyber Security — AMI & CS" Summer 2012

1. Course Name and Numbern

Course Title: "Advanced Metering Infrastructure and Cyber Security — AMI & CS"
Course No.: ENEE-4999, ENEE-5910

2. Instructor

Name: Dr. Raziq Yaqub
Contact: Raziq-yaqub@utc.edu, dr.raziq@gmail.com,
Phone: 423-425-4373 (office) 908-319-8422 (Mobile)
Hours: Available to reach out to students during office hours, before/after class, over phone, or through e-mail.

3. Class Schedule

Dates:- My 16th (Wednesday) to June 26th (Tuesday) 2012
Time:- 05:30 to 08:40 p.m., Classroom EMCS-301

4. Course Material

Text Book: Lecture Notes will be provided by the Instructor. Notes will be based on several books and technical standards documents (No. Book available on this topic)

5. Course Description (Detailed contents of the course):

Course would be divided into 8 Chapters in all.

Chapter 1: Fundamentals of Smart Grids will set the stage by explaining existing power grid and its evolution into a modern power grid, commonly known as a Smart Grid. It will also explain the features of 1st Generation, 2nd Generation, and 3rd Generation, specifically the Security Features as they relate to the Smart Grid Goals.

Chapter 2: Advanced Metering Infrastructure (AMI) — The First Challenge in Cyber Security: will elucidate the basic concept and components of AMI. It would also introduce the technologies and topologies of Automatic Meter Reading (AMR) and explain that smart meter is an impending entry point for Cyber Attacks.

Chapter 3: AMI and Security Aspects at Subscriber End: Smart Meter will be installed at subscribers' premises, rendering the grid more prone to cyber attacks. . It will also expose the students to US Federal Government, DOE, and FERC's efforts to Secure Smart Grids from attacks. Thus this chapter will place more focus on in-home security vulnerabilities of Smart Meter, and Energy Theft susceptibilities, and Smart Metering Programs based on enhanced cryptographies.

Chapter 4: Fundamentals of Cyber Security: will explain the Types of Security Attacks, and Threats, and the Model of Cyber Security and Security Protocols for Smart Grid. It will also highlight Information Assurance Fundamentals (such as Authentication, Authorization, Integrity, Confidentiality, and Non Repudiation, etc

Chapter 5: AMI and Security Aspects at Utility End: will touch upon Distribution System Architecture and its Security Challenges. It will also introduce the notion of Feeder Meters, Sensors and Meter Aggregators, Utility Demilitarized Zone, Data Center Access and Smart Meter Security Management, SCADA and Back-Office Computational Platforms.

Chapter 6: AMI and Security Aspects in Communication/Sensors Networks: will mainly spotlight Network Security Concepts and Protocols, Wide Area Network (WAN), Neighborhood Area Network, and Personal/Local Area Networks for In-home Displays and Energy Management Systems, and the Security concerns about these networks.

Chapter 7: AMI and Subscribers' Privacy Aspects: will be devoted for consumer privacy aspects, in-Home Consumer Privacy and Protections, and the Privacy Information Impacts on Smart Grid.

Chapter 8: AMI and Attack Detection and Recovery: will be optional and will be covered if time allows. It will add on students' knowledge on how Cyber-Attack can be Detected and Identified at Utility Network. It will also educate the students on how the Cyber Attack can be tackled and how the under attack Utility Network can be recovered.

The course is content extensive, but depending on the available time and students' grasping speed, the contents will be adjusted accordingly. The course will be delivered in a manner that both graduate students and industry managers will be able to comprehend the foundations of Advanced Metering Infrastructure and Cyber Security.

6. Course Objectives

6.1. Learning

Students are expected to learn fundamental concepts in AMI & CS. More specifically, understand in detail the Advanced Metering Infrastructure, Information Transport Methods, and Cyber Security aspects.

Introduction to Advanced Mobile Broadband is a graduate level course but may be offered to undergraduate students as well. Graduate students are expected to perform at a higher and produce a research paper dealing with a current problem(s) in context with AMI & CS. The paper should provide analysis of the current or envisioned future problem; and an innovative solution or recommendations for addressing the problem/issue. Continuous supervision through the research paper would be provided by the instructor. Students are required to submit a research paper and to give a presentation. The presentation would be evaluated by the instructor as well as the fellow students. (For Research Paper, format is defined below, however, no format necessary for power point presentation. At least 10 minutes presentation is mandatory).

6.2. Innovation (Research Paper):

A semester long innovative research project is expected from a group of two-three students. The project will require proposing an innovative idea. This will require (a) finding a problem, (b) prior art search (reading of journal and conference papers, etc), and (c) submission/presentation of research paper. The paper shall be written in professional engineering style as if submitting it to a professional IEEE conference or journal. The paper shall include an (a) abstract, (b) prior art, (c) description of student's new idea, (d) Analysis, (e) conclusions, and (f) references. The paper is **due by the last day of class**, no exceptions. An oral presentation is required.

If the research topic/idea and solution is provided by the Supervisor, the supervisor will be the first author/Primary Inventor of the paper/technology. Regarding length of the paper, there is no requirement. Quality would be evaluated, not the quantity. For prior art search, the IEEE Explorer data-base is an excellent search engine for finding papers (with downloadable pdf files). The database is accessible through the University library.

7. Course Format

The lecture portion of this class will present much of the foundation of the course. Several textbooks would be used to provide the basic concepts, vocabulary, and important details on which lecture material will be based. At the end of each class there will be CRQ (Chapter Review Questions). Grades on CRQ will manifest students' physical and mental presence in the class.

Assignments will be given at the end of some classes. To make the class interactive, during lecture periods, questions from the assignments and lectures will be addressed. Most of the lectures time will be spent examining the specific topics and or examples that provide a meaningful context with the concepts presented in the texts. Depending on time, a few topics covered in this syllabus may not be covered in the class.

8. Attendance/Makeup Exam:

The university's attendance policy will be applied. Attendance will carry points and more than **two** absences will result in loss of points. Make-up exams will be given in the cases of excusable absence or any extremely unusual circumstances.

9. My Teaching Philosophy

1. I think students learn the most when they are actively involved in learning process; therefore my philosophy is to engage with the students, go closer to them and interact with them. It prevails a friendly environment in the classroom, encourages students to ask questions, and establishes a two way communication.

2. I believe in Innovations and Research, therefore my philosophy is not only to teach accredited syllabus, but guide and mentor on an intellectual journey, opening and broadening curious minds by exposing them to new thoughts and ideas (Supervised 4 students in year Fall 2011, and 10 students in Spring 2012).

3. I believe that teaching material becomes exciting if it is related with the real life examples and applications. My goal is to create the excitement for learning by relating the textbook material with the real life examples and applications.

4. My objective is not to get my students "A grade" in the tests, but to walk out from the class room with the feeling of accomplishment and do well in professional life. With that feeling my objective is to work with the students even if I have to go extra mile, or invest my personal time.

5. I strongly believe in getting and honoring students' feedback .It not only enables me to meet their needs, but helps me learn how to become a good teacher. I deem constructive criticism fulfills the same function as pain in the human body. It calls attention to an unhealthy state of things. Thus getting and honoring students' opinion gives me the opportunity to think about and devise pedagogies to accommodate varying learning needs of students.

6. It is my strong believe that class attendance is a strong predictor of student success. The survey results indicate that the most important factor for a student in deciding whether to attend lectures is the lectures' quality and clarity; therefore it is my goal to deliver a quality lecture that encourages students not to miss even a single class.

7. I believe that above philosophy cannot be implemented unless a teacher has a passion for teaching, and ability to convince students of his knowledge and expertise. I am confident that I have that passion .

The best teachers teach from the heart, not from the book.

10. Teaching Milestones and Assessment Format

Teaching Milestones and Assessment Format

Teaching Milestones		**Assessment Format**	
Date	**Teaching Chapters**	**Assessments**	**Grading**
Week-1	Chapters 1-2	Home Assignment	
Week-2	Chapters 2-3	Home Assignment	
Week-3	Chapters 3-4	Home Assignment	
Week-4	Chapters 4-and Test	Home Assignment + MID TERM TEST	
Week-5	Chapters 5-6	Home Assignment	
Week-6	Chapters 6-7-8	Home Assignment	
(TBC)	**Final Test**	**Test Chap 8-13 (Closed Book)**	
		Midterm Test Grading	25%
		Final Test Grading	25%
		CRQ (Covered-material Review Questions) Grading	25%
		*Research Paper or Home Assignments	25%
		Total Points	**100%**

Grading Scale **Grading Scale**

A ≥ 90%

80 ≤ B ≤ 90 **70 ≤ C<80** **60 ≤ D ≤ 70**

F < 60

* Assessment of Research Paper and Home Assignments.

- Finding a Problem (6 %)
- Prior Art Search (6 %)
- Innovative Idea (6 %)
- Submission of Research paper and Presentation (6 %)

11. Submission Rules

- Please submit the soft copy ***utc.homeassignments@gmail.com***. NO hard copy submissions.
- Each Assignment due in the subsequent class day
- Please attach a Cover sheet with each submission. (Sample cover sheet will be provided)
- Missing Cover sheet ("— 6" Points)
- "— 1" point for Late Submission
- All submissions are to be an individual effort (except Research Paper)

NOTE

- If you think you did not get what you deserved, due to any reason, what so ever, please notify in two weeks from the date of grading. No action will be taken if you bring it up after this time period is elapsed.
- Honor Code violations are taken very seriously

12. ADA STATEMENT:

Attention: If you are a student with a disability (e.g. physical, learning, psychiatric, vision, hearing, etc.) and think that you might need special assistance or a special accommodation in this class or any other class, call the Office for Students with Disabilities at 425-4006, come by the office - 102 Frist Hall or see http://www.utc.edu/OSD/

If you find that personal problems, career indecision, study and time management difficulties, etc. are adversely affecting your successful progress at UTC, please contact the Counseling and Career Planning Center at 425-4438 or http://www.utc.edu/Administration/CounselingAndCareerPlanning/.