

**ECE 597ED/697ED: Electricity Infrastructure and Delivery in the Developing World
Fall 2017**

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Office: 309C Knowles Engineering Building
Meetings: Tues/Thurs 10:00 - 11:15 in Engineering Laboratory 305
Office Hours: Tues 1-2, Wed 2:30-3:30, or by appointment
Enrollment: Open to Graduate Students and Undergraduate Seniors

Syllabus Version 0 (September 2017)

DESCRIPTION:

This course surveys the current state of the electricity infrastructure in developing countries as well as the challenges and technology trends that are shaping the evolution of these systems. Concepts include infrastructure components, electricity access initiatives, measurement of electricity reliability and power quality, and the relationship between electricity and international development. Students will gain insight into contemporary engineering challenges in improving the scope and quality of electricity service in developing contexts.

COURSE OBJECTIVES:

By the end of the course, students will be able to:

- Examine the past and current electricity situation of a country and synthesize important technology and industry trends to chart the future of electricity systems.
- Critically evaluate the different pathways for electricity access in low- and middle-income countries, understanding the current technology, strengths, weaknesses, and limitations of each method.
- Understand the key metrics used to evaluate electricity access, reliability, and quality globally.
- Evaluate engineering research studies on electricity in developing communities.

READINGS & ASSIGNMENTS:

(1) *Readings and homework questions:* All readings and discussion questions will be posted to moodle.umass.edu for you to download. These are an integral part of this class. I expect you to come to class having read the assignment listed for that day and be ready to participate in discussions throughout the class periods. If you do not understand something in the readings, please ask questions in class or in office hours.

Answers to homework will be due **through Moodle** by the start of class time (10am). Homeworks will consist of questions about previous class materials or will include questions covering the reading for the current and previous class sessions. Late assignments will accrue a penalty of a 10% deduction from the total score for each day

late. Paper assignments will not be accepted, and each student's lowest scored assignment will be dropped from their grade.

- (2) *Field Trip*: There will be one course field trip to the Independent System Operator – New England (ISO-NE) facility in Holyoke, MA. The schedule for this visit is to be decided. Each student will be responsible for a 2-page write-up describing the operations, responsibilities, and challenges present in ISO-NE's role. Attendance at the field trip is required.
- (3) *Midterm*: There will be one midterm exam during a class period consisting of short answer and essay questions based on lecture material and the readings.
- (4) *Country Presentation and Report*: Each student will choose a low- or middle-income country and provide a 10-minute presentation (in class) and 5-7 page report detailing the history, current status, challenges, and future directions of electricity delivery in that country. Professor Taneja will provide a sample report for Kenya in class, and student presentations will be distributed throughout the semester. After each session, each student besides the presenter will be responsible to provide a brief summary of the 3 most interesting and/or surprising findings from the country presentation. These summaries are due by the beginning of the next class session. Schedule for presentations is to be decided.
- (5) *Final project*: Students will work either by themselves or with a partner on the course final project. The project will (1) relate to electricity access, reliability, and/or quality; (2) be data-driven; (3) study one or more low- or middle-income countries; (4) and include a review of pertinent research literature relating to the topic. Professor Taneja will provide a set of sample project ideas, though students are welcome to propose other project ideas. Project deliverables include a project plan including literature review on the topic, a final report (details TBD), and a poster for presentation.

GRADING:

Country Presentation and Report	20%
Participation and Homework (readings, field trip report, etc.)	25%
Midterm	20%
Course Project (project plan, project report, and poster)	35%

COURSE SCHEDULE (SUBJECT TO CHANGE).

Readings should be completed before the class date they are listed on.

Week	Date	Topic	Assignments
1	Sep 5 (Tues)	Introduction, course background; energy units	
	Sep 7 (Thurs)	Primary energy vs. electricity, economic growth, SDGs	HW1 Assigned
2	Sep 12 (Tues)	History of electricity	
	Sep 14 (Thurs)	Electricity access – grids	HW1 Due
3	Sep 19 (Tues)	Electricity access – distributed	HW2 Assigned
	Sep 21 (Thurs)	Electricity generation (I)	
4	Sep 26 (Tues)	Electricity generation (II)	HW2 Due
	Sep 28 (Thurs)	Electricity demand (I)	HW3 Assigned
5	Oct 3 (Tues)	Electricity demand (II)	
	Oct 5 (Thurs)	Working session for final project	HW3 Due; HW4 Assigned
6	Oct 10 (Tues)	<i>No Class – Monday class scheduled followed</i>	
	Oct 12 (Thurs)	Electricity reliability and quality (I)	HW 4 Due
7	Oct 17 (Tues)	Electricity reliability and quality (II) + Midterm review	
	Oct 19 (Thurs)	Midterm Exam in class	
8	Oct 24 (Tues)	Electricity meters	
	Oct 26 (Thurs)	Losses – transmission, distribution, commercial	Project plan due
9	Oct 31 (Tues)	Energy efficiency and conservation	
	Nov 2 (Thurs)	Field trip to NE-ISO (TBD)	
10	Nov 7 (Tues)	Working session for final project	ISO write-up due
	Nov 9 (Thurs)	Technology trends in energy (I)	HW5 Assigned
11	Nov 14 (Tues)	Technology trends in energy (II) and research directions	
	Nov 16 (Thurs)	Guest lecture – TBD	HW5 Due
	Nov 20-24	<i>No Class - Thanksgiving Break</i>	
12	Nov 28 (Tues)	Working session for final project	
	Nov 30 (Thurs)	Guest lecture – TBD	
13	Dec 5 (Tues)	Working session for final project	
	Dec 7 (Thurs)	Poster session	Poster due
14	Dec 12 (Tues)	Last Class - Summary and synthesis	
	Dec 14 (Thurs)	No final exam - final project due by 5pm	Final project due

Academic Honesty Policy Statement

Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. The procedures outlined below are intended to provide an efficient and orderly process by which action may be taken if it appears that academic dishonesty has occurred and by which students may appeal such actions.

Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent.

For more information about what constitutes academic dishonesty, please see the Dean of Students' website: http://umass.edu/dean_students/codeofconduct/acadhonesty/

Disability Statement

The University of Massachusetts Amherst is committed to making reasonable, effective and appropriate accommodations to meet the needs of students with disabilities and help create a barrier-free campus. If you are in need of accommodation for a documented disability, register with Disability Services to have an accommodation letter sent Professor Kumpel. It is your responsibility to initiate these services and to communicate with faculty ahead of time to manage accommodations in a timely manner. For more information, consult the Disability Services website at: <http://www.umass.edu/disability/>

UMass Amherst Diversity Mission Statement

The University of Massachusetts Amherst, as a public land-grant institution, has a responsibility to provide access and opportunities for all people, while demonstrating our commitment to inclusion of historically underrepresented groups. We believe that a culturally diverse campus is integral to academic excellence and that our students, faculty, and staff should reflect the diverse world in which we live. The university recognizes and values the wide range of voices and perspectives in all spheres of the academic enterprise. UMass Amherst is committed to policies that promote inclusiveness, social justice, and respect for all, regardless of race, color, religion, creed, gender, sexual orientation, age, national or ethnic origin, physical or mental disability, political belief or affiliation, marital status, veteran status, immigration status, gender identity and expression, genetic information, or any other characteristic or status protected by state or federal laws.

Civility, Respect, and Inclusivity Statement

We are all members of an academic community with a shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect. The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued for any reason, please speak with me privately. If you wish to communicate anonymously, you may do so in writing or speak with Dr. Paula Rees, Director of Engineering Diversity Programs (rees@umass.edu, 413.545.6324, Marston 128).