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Syllabus

Course Overview

This course focuses on the basic functionality of electrical and computer engineering (ECE) systems and explores the technological and scientific principles on which they are based. The goal of the course is to provide you with an introductory understanding of the operation of these systems and connections to advanced topics in ECE.

During the course, we will consider several example systems from the broad range of applications of ECE technology, including wireless communication, power, digital cameras, data storage, medical imaging, audio signal processing, GPS, feedback control, and cybersecurity. Through a combination of lectures, demonstrations, computation and simulation (using MATLAB and Excel), and hands-on labs, you will learn about the fundamentals of the design and operation of these systems. The material learned in this course will serve you as a basis for more advanced courses in the ECE curriculum.

Course Goals

At the end of this course, you will be able to

1. Describe how electrical and computer engineering provides technological solution to address a wide range of societal challenges;
2. Explain the operation of specific systems in the electrical and computer engineering domain and their basic mathematical and scientific foundations;
3. Apply engineering tools and techniques to solve engineering problems;
4. Perform simple lab experiments with an embedded system; and
5. Identify and critique design choices in system deployed in practice.

Course Structure and Content

Lectures and Labs

This course is structured around content modules that are studied in lecture settings and hands-on experiences that are gained in a lab setting. Each content module consists of three lectures and one homework assignment. Each lab assignment consists of a 3-hour lab session.

Content Modules and Learning Outcomes

- Module 1: Digital Information and Computers
 - Big-picture system: computer / embedded systems
- Module 2: Sampling and Quantization
 - Big-picture system: MP3 player
- Module 3: Power
 - Big-picture system: electrical power grid
- Module 4: Electromagnetic Waves
 - Big-picture system: analog radio
- Module 5: Wireless Communication
 - Big-picture system: cell phone
- Module 6: Optical Sensor
 - Big-picture system: digital camera
- Module 7: Signals and Timing
 - Big-picture system: Global Positioning System
- Module 8: Cybersecurity
 - Big-picture system: Internet
- Module 9: Analog Circuits
 - Big-picture system: TBD
- Module 10: Imaging
 - Big-picture system: medical imaging
- Module 11: Data Storage
 - Big-picture system: memory stick, disk drive
- Module 12: Feedback Control
 - Big-picture system: thermostat, self-balancing robot

Grading

Your final grade will be derived from your performance in three areas:

- Attendance: You are expected to attend and actively participate in lectures. Attendance is taken using a sign-in sheet.
- Homework: Homework assignments consist of sets of theoretical problems and short coding assignments. Homework will be graded using a nonlinear "A/B" grading system that encourages both thoroughness and correctness. Each homework assignment will receive two separate scores:
 - A-Grade: The grade reflects the fraction of assigned problems for which complete solutions were submitted.
 - B-Grade: The grade is the score achieved on a subset of the assigned problems that are selected for full grading.

The total score assigned for a given homework assignment is $\text{Grade} = (A+B)/2$.
- Labs: The lab grade is based on lab assignment. Note that a passing grade in the lab assignment is required to receive a passing grade in the course.

- Two Exams: There is one midterm exam during the semester and one final exam. The exams are closed-book, closed-notes and evaluate how well you retained and understood the course content as well as how well you can apply the course concepts to new problems. For each exam, an in-class review session will be held to provide time for resolving issues regarding the content and procedure of the exam.

Homework are assigned according to the schedule posted on the course website. Late submissions will not be accepted. In case of a medical emergency, late submission or a make-up exam can be requested if a note from a medical professional is provided. Midterm and final exams are held according to the schedule on the course website. The final exam is scheduled by the university.

The final grade will be norm-referenced (i.e., graded "on a curve") with the following weighting:

- Attendance: 10%
- Homework: 15%
- Labs: 10% (passing grade required)
- Midterm 1 exam: 20%
- Midterm 2 exam: 20%
- Final Exam: 25%

You are encouraged to track your scores on Moodle to ensure that you have received the appropriate credit for each of your assignments and exams. No extra credit or "make-up" assignments will be given (with exception to the cases stated in the examination policy below).

Course Policies

The following course policies apply (in addition to all university, college, and department regulations):

- Attendance and Punctuality: You are expected to attend the all of the lectures and lab sessions for which you are enrolled. You are expected to come to lectures, labs, and examinations on time; arriving late and/or leaving early is disrespectful and disrupts the entire class.
- Late / Make-Up Policy: Assignments are due as posted. Late submissions will not be accepted except in medical emergencies or other extenuating circumstances. In such cases, late submission can be requested by contacting the instructors. Proof may be requested (e.g., note from a medical professional).
- Academic Integrity: Consultation with fellow students is encouraged. However, directly copying another student's work (past or present) defeats the purpose of the assignments and is a violation of the code of conduct. Unless otherwise noted, students are expected to complete all assignment individually. Violations will result in serious penalties including course failure and possible disciplinary action. If in doubt, please consult the instructor or the official UMass guidelines regarding academic honesty (<http://www.umass.edu/ombuds/honesty.php>).
- Inclusivity: The diversity of the participants of this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued or respected for any reason, please speak with me privately. If you wish to communicate anonymously, you may do so in writing, speak with Assistant Dean Dr. Paula Res (rees@umass.edu, 413.545.6324, or in person in 128B Marcus Hall, within the Engineering Community, Equity and Inclusion Hub across from the coffee shop). You may also submit your concern and comments through the College of Engineering Climate Concerns and Suggestions on-line form (<https://tinyurl.com/UMassEngineerClimate>) and/or the Positive and Negative Classroom Experience online form (<https://tinyurl.com/UMassEngineerClassroom>). 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.
- Pronouns and Names: Everyone has the right to be addressed by the name and pronouns that they use for themselves. You can indicate your preferred/chosen first name and pronouns on SPIRE, which appear on class rosters. Please let the instructors know what name and pronouns they should use for you if they are not on the roster. Anybody's chosen name and pronouns are to be respected at all times in the classroom. To learn more read: [Intro Handout on Pronouns](#).
- Disability Accommodation and Inclusive Learning Statement: If you have a disability and requires accommodations, please let the instructors know as soon as possible. You will need to register with Disability Services (161 Whitmore Administration building; phone 413-545- 0892). Information on services and materials for registering are also available on their website www.umass.edu/disability. Your success in this class is important to us. We all learn differently and bring different strengths and needs to the class. If there are aspects of the course that prevent you from learning or make you feel excluded, please let the instructors know as soon as possible. Together we will develop strategies to meet both your needs and the requirements of the course.