Welcome to Electrical and Computer Engineering!

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Why Engineering?

It’s about ….

Being Creative

Making a Difference

Solving Important Problems
What is ECE Anyway?

Paradox: as ECE advances it becomes **less visible**

**But it is everywhere!**

- **Communications** devices (cell phones, internet, wireless)
- **Entertainment electronics** (cameras, music, TV, iPods, DVR, . . . )
- The vast majority of **transportation** systems (airplanes, cars, trains, spaceships, . . . )
- **Computers**, smart phones or computer applications
ECE is everywhere

- **Medical** devices, automated records, x-rays, MRI . . . ,
- **Home** electrical devices - lights, heating /cooling systems, Automated coffee pot, alarm clock radios, hair dryers . . . ,
- **Satellites**, advanced **weather** reporting, radar . . . ,
- **Environmental** controls, clean water . . .
• **Bio/Medical:** monitoring, imaging, diagnostics, insulin monitors/pumps

• **Communications:** Internet, cell phones, video, satellite, satellites, fiber optics, blue tooth . . .

• **Computers:** smart phones, Mars Rover, satellites, iTouch, gaming systems, flight simulators, work stations, PC and console video games, CGI movies, smart-anything

• **Energy:** Wind, solar, nuclear generation, environmental sustainability, LED lighting,

• **GPS:** navigation and landing systems, geo-caching, package tracking
• **Manufacturing**: robotics, sensors, measuring, testing, packaging, machine vision inspection

• **Solid State**: integrated circuits, chip fab lines, nano-electronics, photovoltaics, micro machines, lab analysis on a chip

• **Weather**: weather satellites, geospatial and ozone mapping

• **Transportation**: ~25% of the value of a car, hybrid and electric cars, pollution reduction, electronic flight systems, navigation, landing systems, collision avoidance systems, autonomous vehicles …
ECE at WPI

- 21 full-time faculty
- 350 undergraduates, 145 full-time grad students
- ~ 80 BS, 60 MS, 4 PhD degrees annually
- Innovative, project-based undergraduate program with a focus on creativity and teamwork
- Student project & research activity with corporations, National Science Foundation, Lincoln Labs, etc.
- Very active graduate research program that integrates undergrads into many of the projects

Holy Name High School Wind Turbine that resulted from an ECE Undergraduate Project
Focus Areas within WPI ECE

- Computers/microprocessor systems
- Microelectronics Circuits
- Wireless Networks, Antennas
- Satellite and Indoor Precision Personnel Positioning Systems
- Power Electronics and Generation
- Data Security, Cryptography
- Communications and Networking
- Software Defined Radios (SDRs)
- Biomedical Signal Processing, Advanced Prosthetics
- Robotic Systems and Sensors
Computer Engineering or Computer Science??

- Hardware + Software vs. Software
- Engineering vs. Science
  - Computer scientists *discover underlying principles* of computation: logic, language, knowledge organization…
  - Computer engineers use these principles to *solve problems* in hardware and software involving an enormous number of applications, products and devices using embedded processors and DSPs

Don’t worry too much about choosing your major yet!
Careers for ECE Graduates

• Design and build a voice controlled remote robotic surgery system with a virtual reality vision interface

• Enter law school and help build new companies with tomorrow’s innovations as a patent attorney

• Continue for MS degree and design the next generation electron microscopes

• Create a new artificial vision system to insure safe flight/driving in limited visibility conditions

• Continue for the PhD degree and develop the next generation wireless communication and navigation systems

NASA Engineer Elionex Rodriguez
WPI ECE Class of 2001
Why study ECE at WPI?

Year 1: Intro to ECE: Theory and Practice (hands on labs)
Year 2: ECE Design: Team Design Project
Year 3: Go Global: London, Venice, Bangkok, Melbourne, Washington, Cape Town, Hong Kong…
Year 4: Senior Design Project: Lincoln Labs, Silicon Valley, Analog Devices in Limerick, Ireland…
Why Else?

State of the Art, Student Centered

- Modern, well equipped and well maintained laboratories.
- Projects and laboratory experiences that are “real” and make a difference.
- A strong advising system.
- Focus on teamwork.
- Friendly, supportive community.
- Open 24:7 for student use.
- Cost effective BS/MS program.
…and community: Spark Party

• Early WPI ECE Tradition re-launched in 2006
Off-Campus Project Opportunities

- MIT Lincoln Laboratories
- Mitre Corporation
- Silicon Valley (SRI, NVIDIA)
- Ireland (Analog Devices, U Limerick)
- ... plus many on-campus sponsored projects
Some Typical Senior Projects

• Design and implement an intelligent network to collect climate and soil data in Alaska, and transmit the data in real time to project scientists wherever they are.

• Develop a system that integrates wireless networking and RFID technology so that every store item (quantity, type, price) can be automatically inventoried.

• Develop a modular, low cost, high capability robotic arm joint that can be fully computer controlled and has a 2-3kg lifting capability (ME+ECE +Robotics).

• Develop a high efficiency solar power converter for use on a nanosat.

• Develop a high lift capacity self-stabilizing quad-copter or automated marine rescue system.

SRI project group in Alaska
MQP project (May 2011): Semi-autonomous search and rescue

- Develop quad-copter with computer assisted smart flight controls and wireless video for indoor reconnaissance by firefighters, police and other first responders
- Can fit through any 22x6 inch wide opening
- Automatic collision avoidance assist

Status as of April 12, 2011:
- Completed, working!
- Sensors include: IR rangefinder, LIDAR and camera
- Achieved stable flight
- 1 kg excess lift capacity
MQP project (May 2011):
Autonomous marine search and rescue

- Develop self-navigating rescue boat which tracks GPS locations of over-board victim, mother ship and self to perform rendezvous with victim and return to ship
- Successfully first test in nearby lake (on windy day).
Employers, ECE Class of 2010

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Grad Schools, ECE Class of 2010

- Stanford
- MIT
- Carnegie Mellon
- Boston University
- U Connecticut
- WPI
Visit Atwater Kent Labs

Undergraduate and graduate student/faculty research projects
• Don’t worry too much about choosing your exact specialty
• Find a school that’s right for you
  – *Grow* personally and professionally by being challenged
  – Make friends and take advantage of opportunities
  – Learn about yourself
  – Learn about the world
Unigo: “21st Century Einsteins”

- Cal Tech
- Case Western
- Cornell
- Dartmouth
- Georgia Tech
- John Hopkins
- MIT
- Princeton
- Stanford
- WPI

- Unigo: web resource to assist high school students in the college search
- Student reviews exclusively
- “WPI has excellent name recognition as well as an excellent reputation in science and engineering industries. In other words, the people who matter (the ones who hire college grads) DO know about WPI and they hold it in very high esteem.”
Best wishes for this exciting time in your life!

Feel free to contact me:
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