Welcome to Electrical and Computer Engineering

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• You are comparing several schools

• You are asking “What is different about WPI?”

• You are considering a number of different fields including ECE

• You would like to know “What is it like to be a student at WPI and in ECE?”

• What is ECE anyway?
NAE “Grand Challenges”

Health Care
Sustainability
Safety / Security
What is ECE Anyway?

Health Care
Sustainability
Safety / Security

Solving Important Problems
Being Creative
Making a Difference
What is ECE Anyway?

Health Care
Sustainability
Safety / Security

Solving Important Problems
Being Creative
Making a Difference

WPI: Challenge + Support
Health Care

- Diagnostic Sensing / Imaging
- Assistive Technologies
- Neurally Controlled Prosthetics
- Clean Air, Water
Sustainable Energy

- Energy Storage
- Optimizing Solar Panel Energy Collection
- Smart Grid Security

Holy Name High School Wind Turbine that resulted from an ECE Undergraduate Project
Safety and Security

- Data security
- Securing communication
- Smart grid security
- Technology for first responders
• 24 full-time faculty
• 350 undergraduates, 145 full-time grad students
• ~ 80 BSECE, 60 MS, 5 PhD annually
• Innovative, project-based undergraduate program with a focus on creativity and teamwork
• Student project & research activity with corporations, National Science Foundation, MIT Lincoln Laboratory, etc.
• Active graduate research program that integrates undergrads into many of the projects
A Sampling of ECE Areas

- **Bio/Medical:** monitoring, imaging, diagnostics, assistive technology, prosthetics, ...
- **Communications:** Internet, smartphones, video, satellite, fiber optics, wireless networking, ...
- **Computers:** Mobile devices, Mars Rover, iPhone apps, gaming systems, flight simulators, work stations, PC and console video games, CGI movies, ...
- **Energy:** Wind, solar, environmental sustainability, LED lighting, smart grid, power systems, ...
- **Security:** Hardware / software attacks, smart cards, cryptography, cybersecurity, ...
- **Robotics:** Sensors, actuators, controls, autonomous vehicles, DARPA challenge, ...
ECE Curriculum Focus Areas

- 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
In ECE what is the **first year** like?

- Math and science, CS intro courses
- Humanities and arts
- **ECE courses for first year students!**
  - ECE 1799
  - ECE 2010
- **INSIGHT** first year advising program
- Get involved - play sports, join a theater group, work with a service organization . . .
Two ways to get started (and, you can start in any term: A, B, C, or D)

ECE1799: *Frontiers and Current Issues of ECE*
- Seminar based course for first year students
- Breadth of activities, career choices and technologies across ECE
- Primarily for students who have not decided on a major or who are unsure of an ECE major

ECE 2010: *Introduction to ECE - An Application Oriented Approach*
- Laboratory-based introduction to the broad subject of ECE.
- Analyze, construct, test: iPod amplifier, RF transmitter, sensor systems, etc.
- Moderate depth treatment of a wide variety of fundamental topics.
- Typically followed by ECE2019, ECE 2029 or ECE2049 (Sensors, Digital Circuit Design, Embedded Computing)
Second year in ECE

- ECE major area foundation courses
  - Lab based courses - we believe in “hands-on” in our courses!

- ECE 2799 – Ideas in Action
  - Projects based foundation integration course and MQP prep
  - Work in teams to design a solution to an open ended problem
  - Named by most Seniors and by most alums as the single best and most important course they took in any department at WPI!!!!

- Prepare for third year projects – **attend global fair**!
What is the third year like?

• Participate in a Global Program opportunity (~600 students/year)

• Continue taking major, minor and/or dual-major courses

• Focus on an area within ECE, develop background needed for the capstone (MQP) project

• Plan for fourth year capstone project experience

• Plan seriously for graduate school, other post graduation education/work
Fourth year in ECE at WPI

- Complete capstone project – Intensive project with real results, the WPI MQP
- Advanced major area courses and complete minors/dual majors
- GRADUATE and then: Get a job, start a company, graduate school, medical school, law school, MBA, …
Example MQP Projects

Business
At WPI, a push to make smart wheelchairs
MQP project: Rescue Quadcopter

- Can fit through 22” x 6” opening
- Automatic collision avoidance
- Sensors: IR rangefinder, LIDAR and video camera
- Autonomous stable flight
- 1 kg payload capacity

- Semi-autonomous search and rescue quad-copter
- Indoor reconnaissance for first responders
Many ECE MQPs take place at an off-campus project center:

- **Lincoln Labs Project Center**
  - Lexington MA
- **MITRE Corp. Project Center,**
  - Bedford MA
- **Silicon Valley Project Center,**
  - SRI, NVIDIA, Silicon Valley, CA
- **General Dynamics Project Center,**
  - Groton CT
- **Wall Street/London Project Center,**
  - New York, NY
- **China Project Centers**

Worcester Polytechnic Institute
Faculty Research Areas

- Cryptography and Information Security (CRIS) Laboratory
- Analog and Mixed Signal Microelectronics Laboratory
- Signal Processing and Information Networking Laboratory (SPIN)
- Embedded Computing Laboratory
- RF-Electronics and Medical Imaging Laboratory
- Cyber Security Laboratory
- Center for Advanced, Integrated, Radio Navigation (CAIRN)
- Antenna Laboratory
- Wireless Innovation Laboratory (WI Lab)
- Laboratory for Sensory and Physiologic Signal Processing L(SP)2
- Center for First Responder Technology / Precision Personnel Location

Many MQPs are based on these areas of faculty research and done in these research labs
Very active student organizations:
- IEEE Student Chapter
- HKN Honor Society
- WECE (Women in ECE)
- Pizza Friday every week in the lounge
- IEEE Barbecues
- Senior Dinner
- Impromptu Pizza Gatherings
- The Spark Party......
Review: Why study ECE at WPI?

Year 1: Intro 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, ...
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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.
Goals for WPI Students

**Become an “Expert”**
Master the discipline
Get the answers right

**Solve Real Problems**
Very un-disciplined
Ask the right questions

**About Courses…**
**and the Discipline**

**About Persistence…**
**and Experience**
Goals for WPI Faculty

**Challenge**
- Provide structure
- Demonstrate knowledge

**Support**
- Unstructured problems
- Mentor through process

About Courses... and the Discipline

About Relationship ... and Experience
In ECE at WPI you will be ...

Welcomed
Valued
Challenged
Supported
Questions?
Thanks for visiting today

Feel free to contact me:
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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
Some more senior projects

- Develop a system that integrates wireless networking and RFID technology so that every store item (quantity, type, price) can be automatically inventoried.
- Develop microcomputer controlled sun tracker for increased efficiency solar energy collector.
- Develop a multi-camera vision based robot tracker that will provide location information for all robots on a FIRST Competition field for use during autonomous scoring periods.
- Develop a high efficiency solar power converter for use on a nanosat.
- Develop an autonomous fire-finding and extinguishing robot.