WPI

Department of Electrical and Computer Engineering

New ECE Graduate Student Orientation Meeting

Monday, August 31, 2020

2:00PM Zoom

Introductions….

- **ECE Department Head** – Professor Rick Brown

- **ECE Associate Department Head** – Professor Reinhold Ludwig

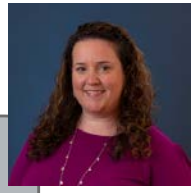
- **Graduate Program Committee Chair** – Professor Berk Sunar

- **ECE Shop Technicians** – Bill Appleyard and Daniel Hanson
- **ECE Lab and Office Manager** – James O'Rourke
- **ECE IT Support** – WPI Helpdesk (its@wpi.edu or go to the library)
- **ECE Department's Office (AK202) Staff**:

  - Colleen Sweeney – Main contact person for any graduate program questions *(i.e. forms, paperwork, letters, etc.)* *sweeney@wpi.edu*
  - Jessie Curley – Main contact for undergraduate program questions.
  - Deb Thompson – Main contact for questions about expense reports, reimbursements, etc.

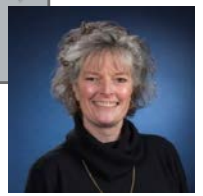
WPI Student Success Managers

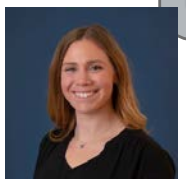
Greg Cesar
IUX, AE, ME, Matl Sci,
MPE, FPE



Jody Reis
Assoc. Director,
Program Delivery

Sarah LaFrance
IMGD, BBT, BME, BCB,
CH, CPM





Kara Crosson
Markt, IT, SCM, OAM,
Management,
LST, Development Eng

Kira Clary
CE, CS, ChE, ECE,
Appl MA, Fin Math, PHY
kclary@wpi.edu

Lori Kendall-Taylor
Data Science
Robotics

ECE Department Website and Social Media

WPI's Electrical and Computer Engineering (ECE) Department, located in the historical Atwater Kent Laboratories, is a community of world-class faculty and students conducting research on diverse subjects including machine learning, cryptography and information security, signal processing, autonomous vehicles, smart health, prosthetic control, analog and digital microelectronics, and wireless information networks. We have a strong tradition of making significant contributions to science and engineering, ranging from the invention of the negative feedback amplifier to laying the foundations of the first wireless local area networks.

Through our innovative Theory and Practice curriculum, hands-on laboratories, and project-based learning, the ECE Department continuously strives to develop the next generation of engineers who will develop new technologies and seek creative solutions to society's most pressing problems. We pride ourselves on our culture of creative scholarship; faculty, students, and staff work closely together and encourage each other through challenges both in the classroom and in life.

DEPARTMENTS & PROGRAMS

ELECTRICAL & COMPUTER ENGINEERING

- Faculty & Staff
- Research
- Major Qualifying Project
- Courses
- Resources
- PhD Students
- ABET Accreditation

@ECEWPI

@WPI_ECE

YouTube

ECE Department & Grad School Focus on Research

WPI

Philosophy behind ECE Department Research

- Theory ⟷ practice
- Intellectual merit
- Broad societal impact
- Application driven technology

Expectation as Member of Research Community

- MS: Master disciplinary area
- PhD: Independent contribution to knowledge
- You are always representing WPI!

Smart World: Cyberphysical Systems

Rick Brown
Professor

Xinming Huang
Professor

Kaveh Pahlavan
Professor

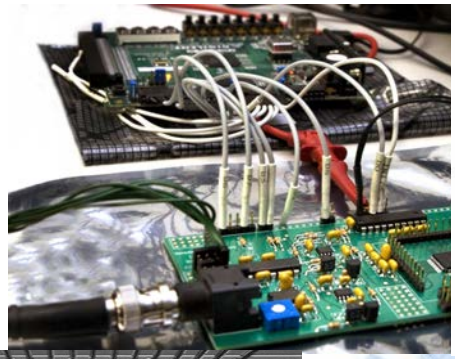
Randy Paffenroth
Asst. Professor
[MA/CS/DS]

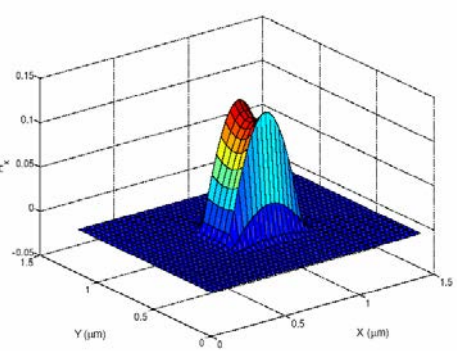
Alex Wyglinski
Professor

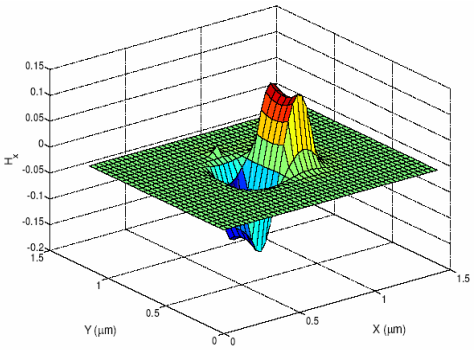
Zain Navabi
Adj. Teaching Prof.

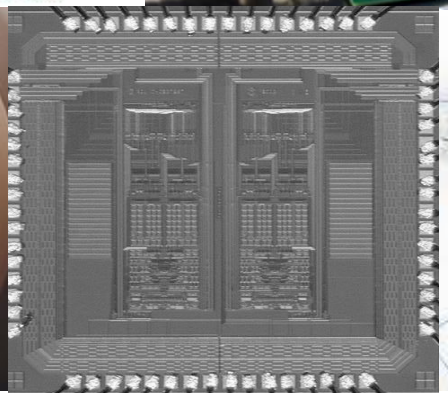
Ziming Zhang
Assistant Professor

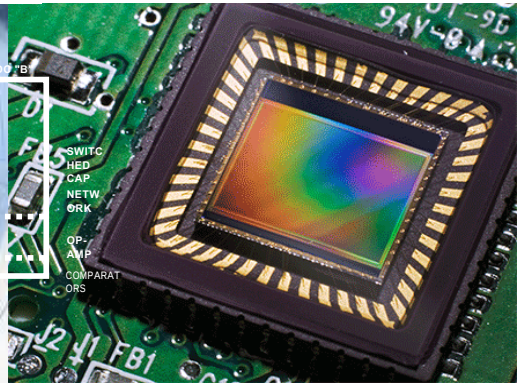
Autonomous Vehicles / Systems
Embedded Systems
Digital Signal Processing
AI / Machine Learning
Real-Time / High Performance Computing
Logic Synthesis / Testing Methodologies
RF / Mixed Signal / VLSI Circuits
Applied Electromagnetics • Digital Radar
Cognitive / Software-Defined Radio
Wireless Communications / Networking
WiFI / UWB / Indoor Localization











Smart World: Robotics

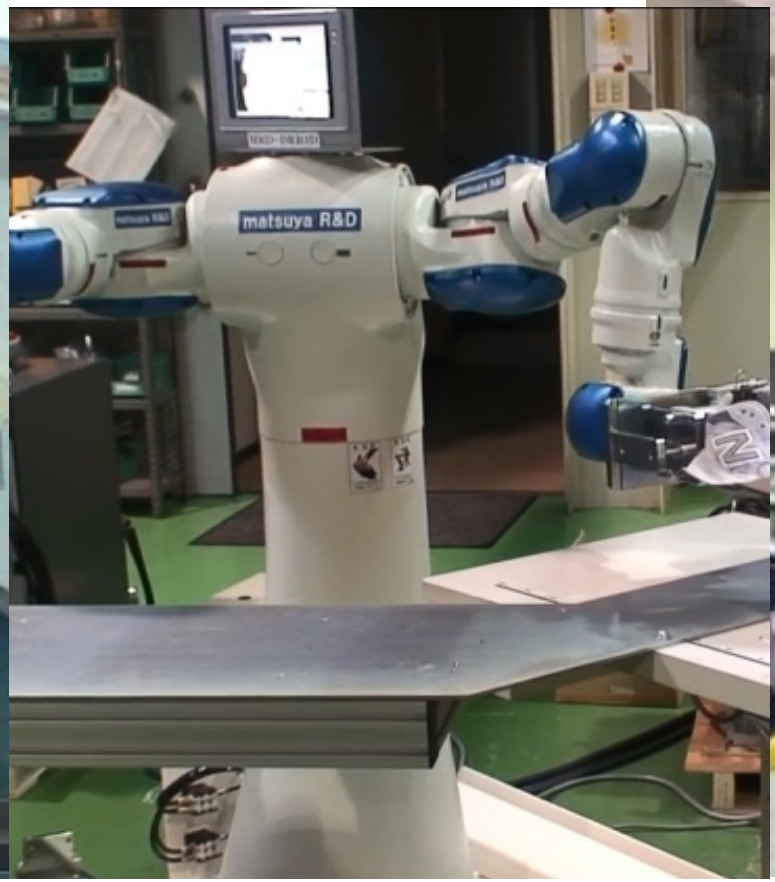
Bill Michalson
Professor [RBE]

Jie Fu
Asst. Professor [RBE]

Ziming Zhang
Assistant Professor

Cagdas Onal
Asst. Prof. [ME]

Machine Vision • Image Recognition
Assistive Robots • Soft Robotics
Cooperative “Swarm” Robotics
Control of Hybrid Dynamical Systems
Formal Methods • Automata Theory
Optimization Theory



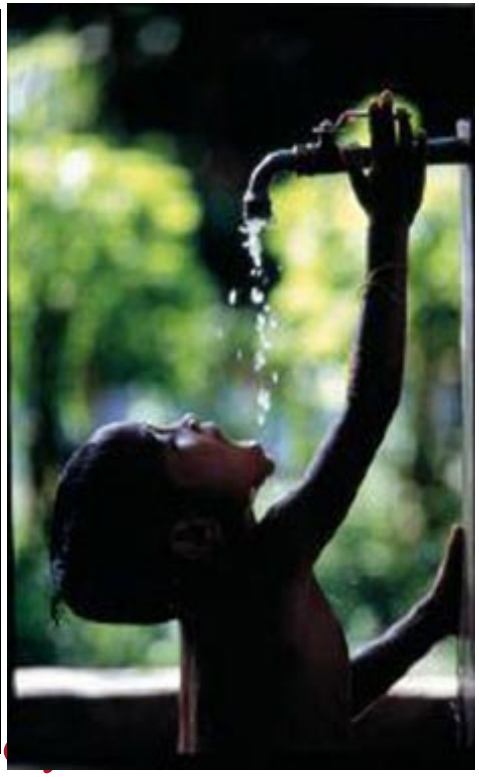
Smart World: Energy / Sustainability

Edvina Uzunovic
Asst. Teaching Prof.

Stephen Bitar
Instructor

Maqsood Mughal
Asst. Teaching Prof.

Solar / Wind / Renewable Energy
Power / Automotive Electronics
High-Voltage Technology
Energy Conversion
Smart Cities • Smart Grid
Sustainability Engineering
Power Systems • Power Quality



Health Care and Quality of Life

Ted Clancy
Professor

Xinming Huang
Professor

Reinhold Ludwig
Professor

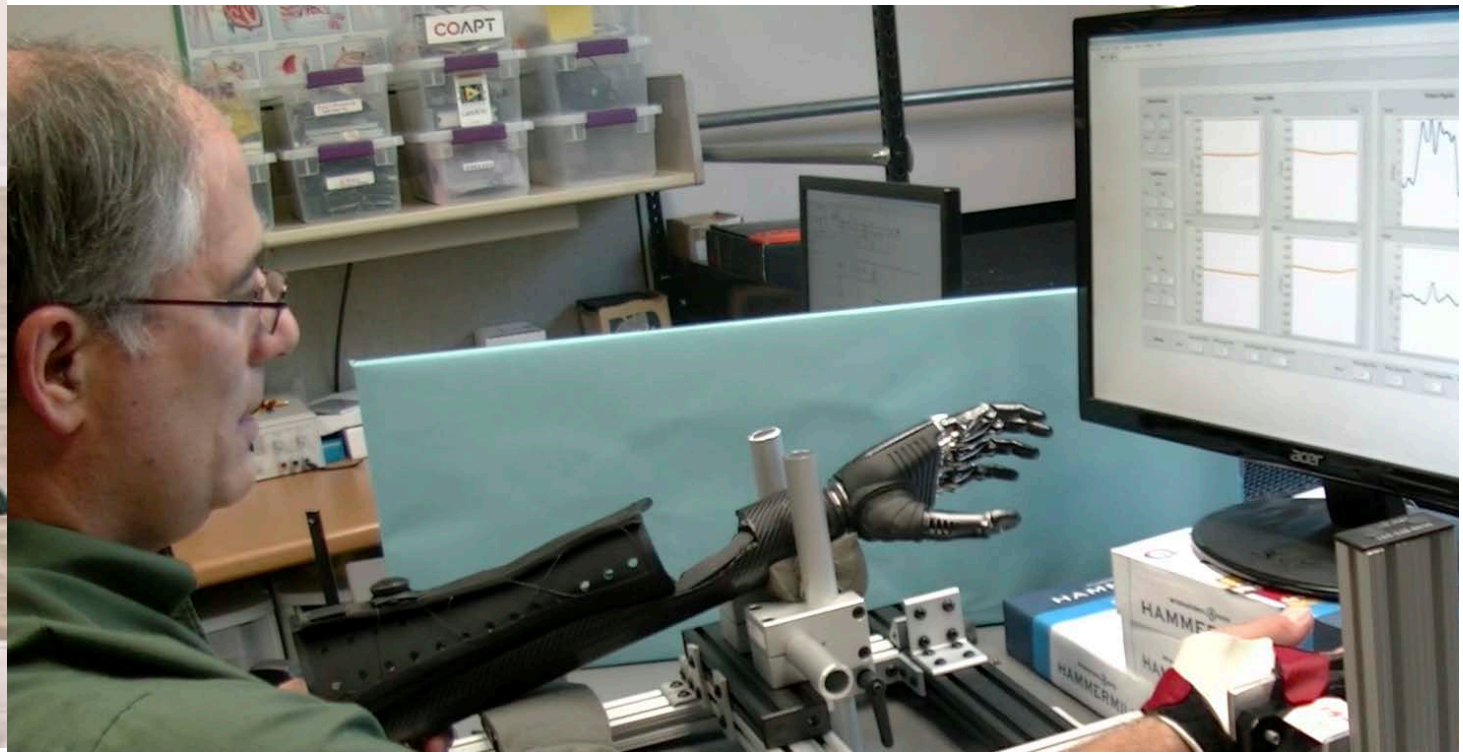
Sergey Makarov
Professor

Ulkuhan Guler
Asst. Professor

John McNeill
Professor

Kaveh Pahlavan
Professor

Biomedical Signal Processing / Modeling
Smart Prosthetics • Assistive Technology
Wearable Sensors • Medical Imaging
Biomedical Instrumentation
Optimization Methods for MRI
Nanotechnology for Biomedical Sensing
Body Area Networking
Computational “Virtual Human” Modeling
On-Body Antenna Prototyping



Security and Privacy

Berk Sunar
Professor

Andrew Clark
Asst. Professor

Patrick Schaumont
Professor

Bill Martin
Professor [MA]

Craig Shue
Assoc. Prof. [CS]

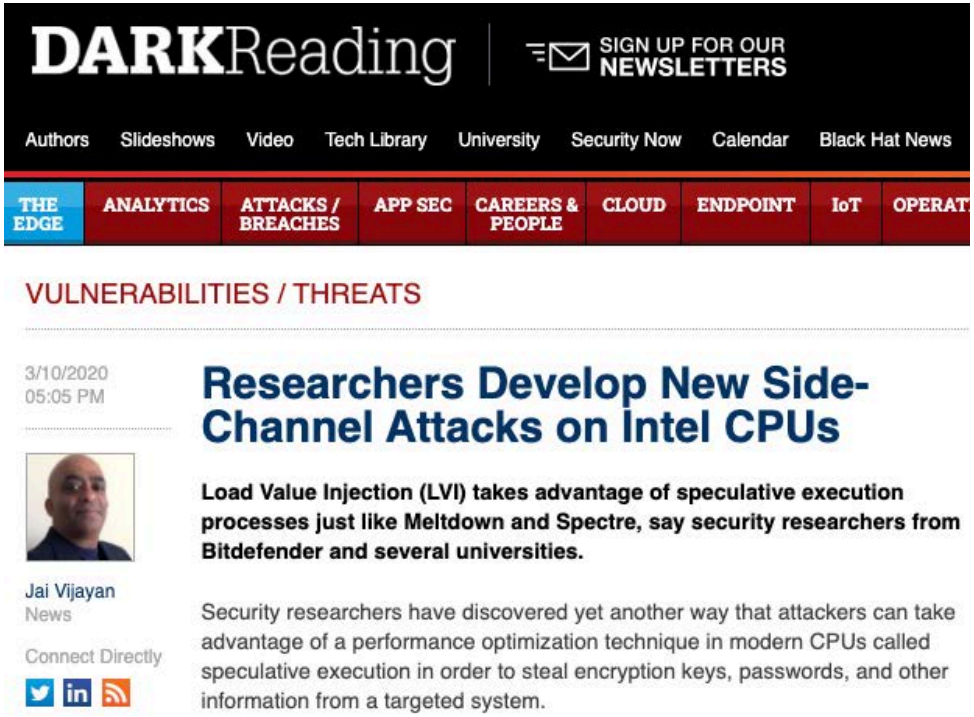
Fatemeh Ganji
Asst. Professor

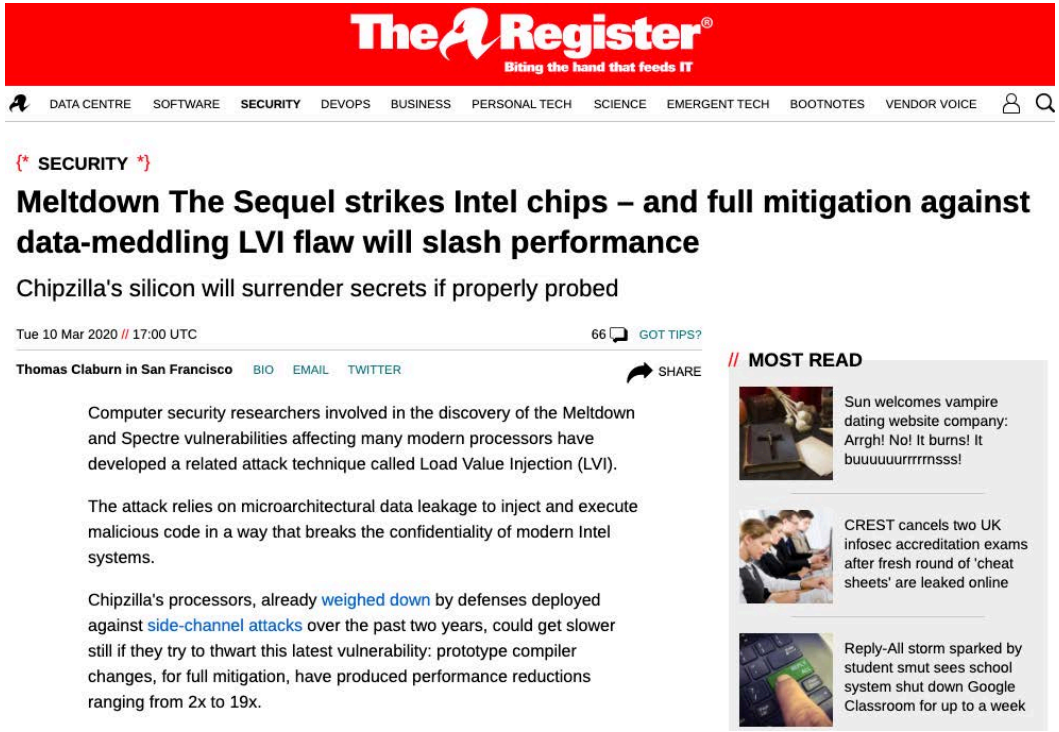
Shain Tajik
Asst. Research Professor

Koksal Mus
Asst. Teaching Prof.

Yarkin Doroz
Asst. Teaching Prof.

Secure Control of Cyberphysical Systems
Cryptographic Algorithm Implementation
Smart Grid Security • Network Security
Embedded Security Design
Physical Security / Side-Channel Cryptanalysis





Main ECE Graduate Degree Programs

- **Master of Science (MS)** - Students have the option of following two routes to this degree: (1) a **non-thesis option** requiring 30 graduate credits in course work, independent study or directed research, or (2) a **thesis option** also totaling 30 graduate credits and including a thesis of nine credits. Students completing a master's degree with thesis option will be required to do a presentation of their thesis as part of their degree requirements.

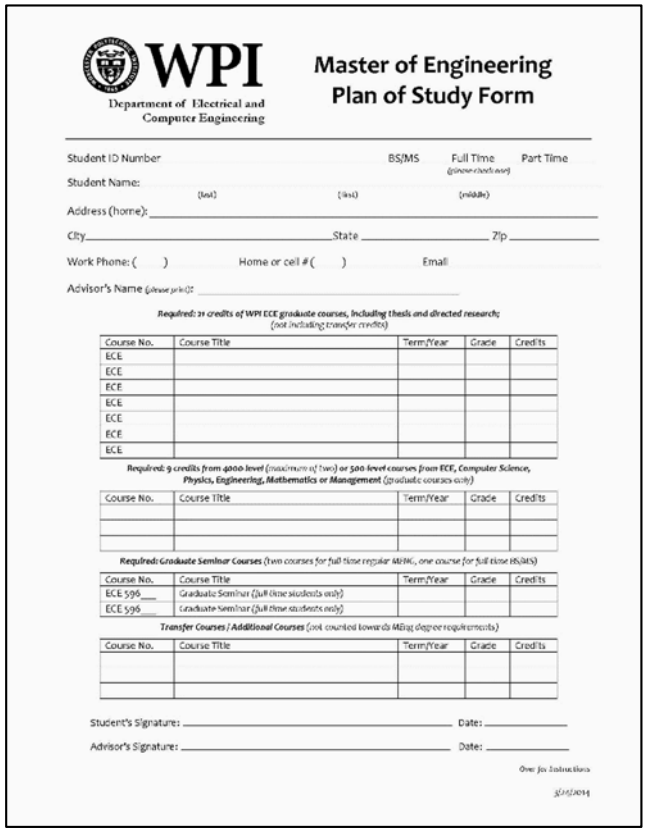
- **Doctor of Philosophy (PhD)** - Students with a M.S. degree in electrical and computer engineering may apply for the doctoral program; admission is contingent on a review of the application and associated references. Requirements: 30 credits of coursework, plus an additional 30 credits of dissertation research. Students will also need to pass the Diagnostic Qualifying Exam during their first year in the PhD program as well as an Area Exam at least 3 months prior to their Dissertation Defense.

Other ECE Graduate Degree Programs

- **Combined BS+MS** – WPI students can double count courses (*up to 12 credits*) taken as an undergrad towards their MS degree provided that they are accepted into this program. Students in the combined program continue to be registered as undergraduates until they have completed all requirements for the B.S. degree.
- **Master of Engineering (MEng)** - The MEng degree is tailored for individuals seeking an industrial career path. Similar to the M.S. degree, the MEng degree requires the successful completion of at least 21 credits of WPI ECE graduate courses. In contrast to the M.S. degree, the MEng degree allows up to 9 credits of non-ECE courses to be chosen as management courses and does not include a thesis option.
- **Graduate Certificate (GC)** – the graduate certificate program allows students to take five courses that are focused in a specific technical area (*SYS, PSE, or PSM*) which can be used towards a graduate degree program should the student decide to further their education.

ECE Program of Study Forms

All graduate students are required to submit their completed program of study forms to Colleen by email (PDF) by the end of their first semester in the graduate program.



WPI
Department of Electrical and Computer Engineering

Master of Engineering Plan of Study Form

Student ID Number BS/MS Full Time Part Time (please check one)

Student Name: (last) (first) (middle)

Address (home):

City State Zip

Work Phone: ( ) Home or cell # ( ) Email

Advisor's Name (please print):

Required: 21 credits of WPI ECE graduate courses, including thesis and directed research; (not including transfer credits)

Course No.	Course Title	Term/Year	Grade	Credits
ECE				
ECE				
ECE				
ECE				
ECE				
ECE				
ECE				

Required: 9 credits from 4000-level (maximum of two) or 500-level courses from ECE, Computer Science, Physics, Engineering, Mathematics or Management (graduate courses only)

Course No.	Course Title	Term/Year	Grade	Credits

Required: Graduate Seminar Courses (two courses for full time regular MENG, one course for full time BS/MS)

Course No.	Course Title	Term/Year	Grade	Credits
ECE 596___	Graduate Seminar (full time students only)			
ECE 596___	Graduate Seminar (full time students only)			

Transfer Courses / Additional Courses (not counted towards MEng degree requirements)

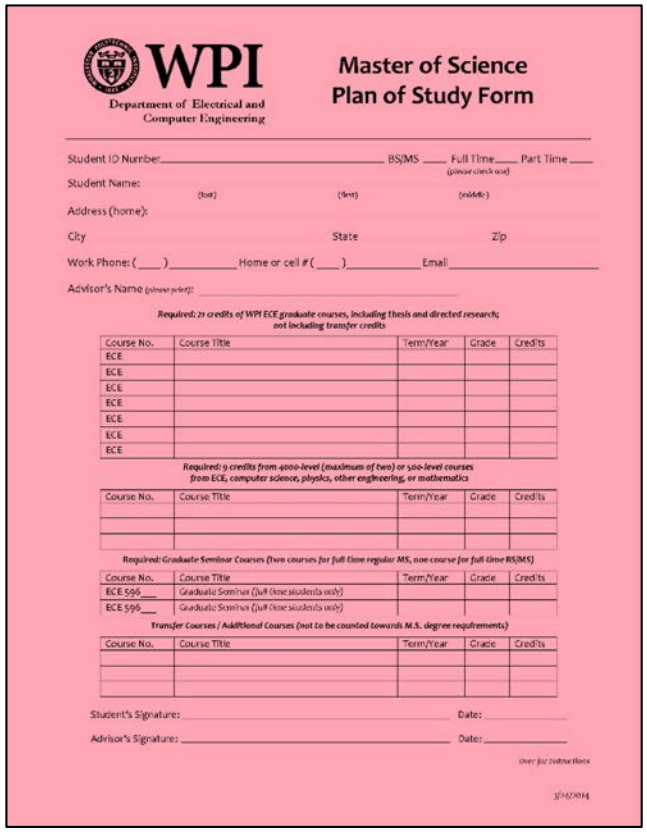
Course No.	Course Title	Term/Year	Grade	Credits

Student's Signature: Date:

Advisor's Signature: Date:

Over for Instructions

3/31/2014



WPI
Department of Electrical and Computer Engineering

Master of Science Plan of Study Form

Student ID Number: BS/MS ___ Full Time ___ Part Time ___ (please check one)

Student Name: (last) (first) (middle)

Address (home):

City State Zip

Work Phone: (___) Home or cell # (___) Email

Advisor's Name (please print):

Required: 21 credits of WPI ECE graduate courses, including thesis and directed research; not including transfer credits

Course No.	Course Title	Term/Year	Grade	Credits
ECE				
ECE				
ECE				
ECE				
ECE				
ECE				
ECE				

Required: 9 credits from 4000-level (maximum of two) or 500-level courses from ECE, computer science, physics, other engineering, or mathematics

Course No.	Course Title	Term/Year	Grade	Credits

Required: Graduate Seminar Courses (two courses for full time regular MS, one course for full time BS/MS)

Course No.	Course Title	Term/Year	Grade	Credits
ECE 596___	Graduate Seminar (full time students only)			
ECE 596___	Graduate Seminar (full time students only)			

Transfer Courses / Additional Courses (not to be counted towards M.S. degree requirements)

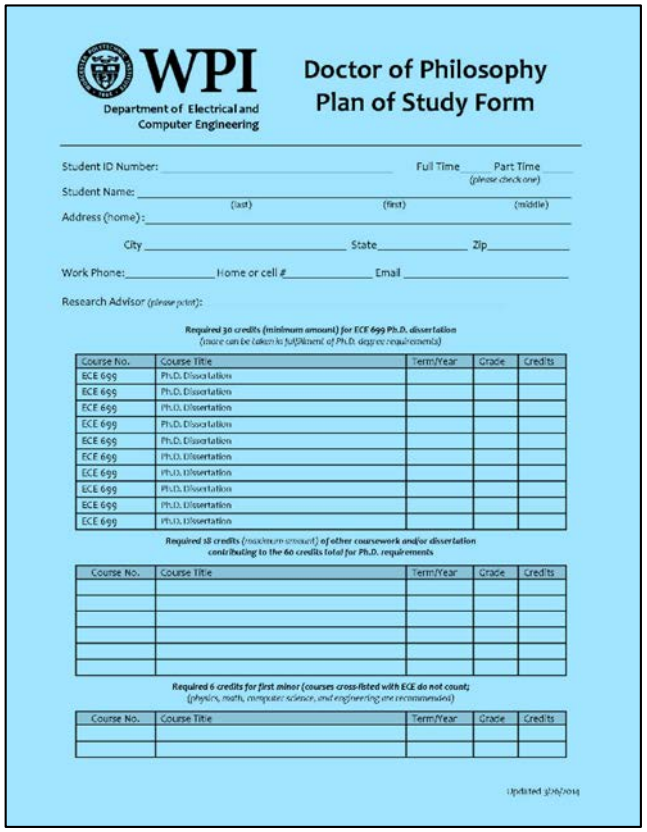
Course No.	Course Title	Term/Year	Grade	Credits

Student's Signature: Date:

Advisor's Signature: Date:

Over for Instructions

3/31/2014



WPI
Department of Electrical and Computer Engineering

Doctor of Philosophy Plan of Study Form

Student ID Number: Full Time ___ Part Time ___ (please check one)

Student Name: (last) (first) (middle)

Address (home):

City State Zip

Work Phone: Home or cell # Email

Research Advisor (please print):

Required 30 credits (minimum amount) for ECE 699 Ph.D. dissertation (more can be taken in fulfillment of Ph.D. degree requirements)

Course No.	Course Title	Term/Year	Grade	Credits
ECE 699	Ph.D. Dissertation			
ECE 699	Ph.D. Dissertation			
ECE 699	Ph.D. Dissertation			
ECE 699	Ph.D. Dissertation			
ECE 699	Ph.D. Dissertation			
ECE 699	Ph.D. Dissertation			
ECE 699	Ph.D. Dissertation			
ECE 699	Ph.D. Dissertation			
ECE 699	Ph.D. Dissertation			
ECE 699	Ph.D. Dissertation			

Required 18 credits (maximum amount) of other coursework and/or dissertation contributing to the 60 credits total for Ph.D. requirements

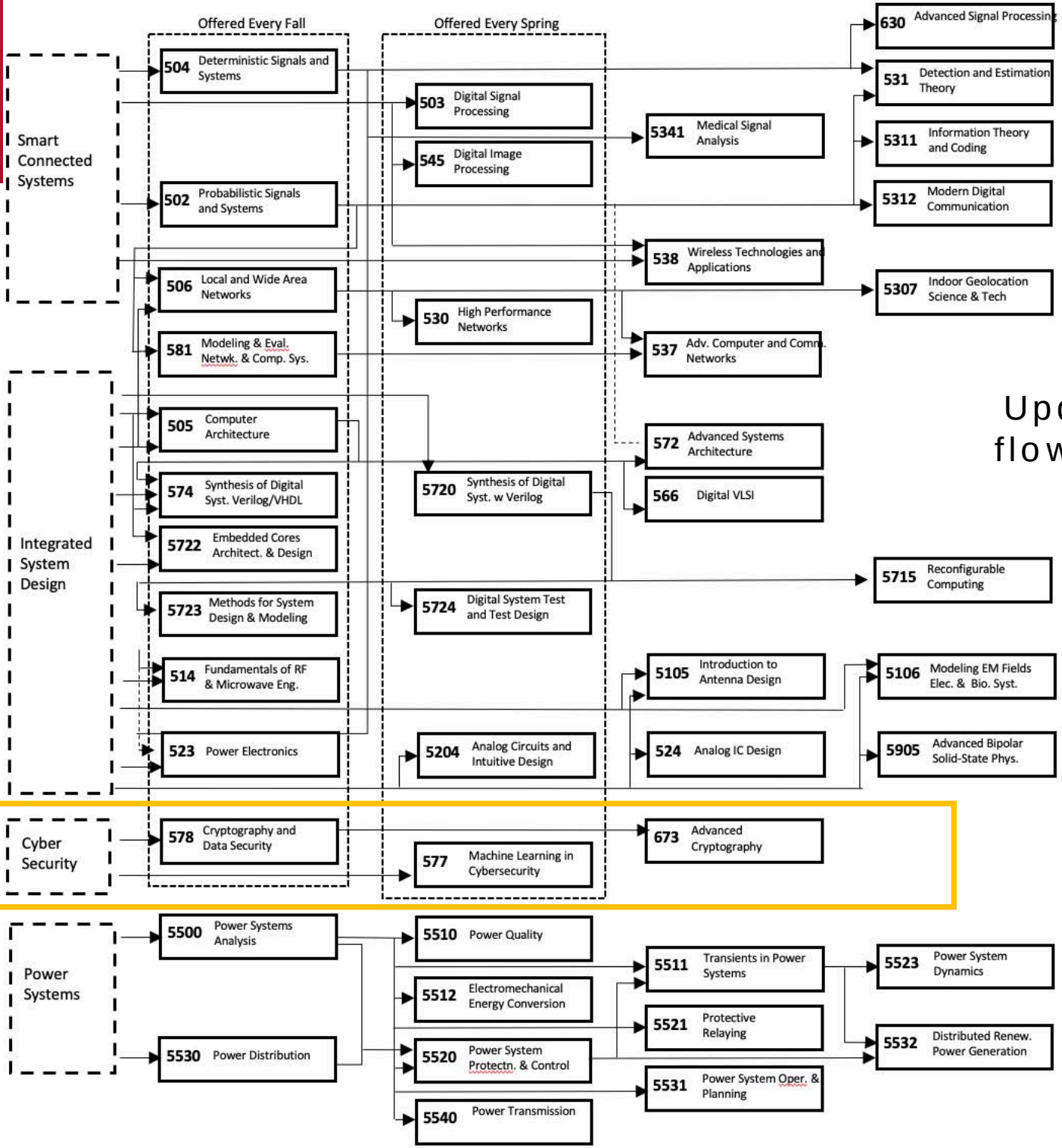
Course No.	Course Title	Term/Year	Grade	Credits

Required 6 credits for first minor (courses cross-listed with ECE do not count; (physics, math, computer science, and engineering are recommended)

Course No.	Course Title	Term/Year	Grade	Credits

Updated 3/31/2014

[Get these forms online: https://www.wpi.edu/academics/departments/electrical-computer-engineering/resources](https://www.wpi.edu/academics/departments/electrical-computer-engineering/resources)



Updated graduate course flow chart in the Fall 2020 Graduate Catalog

Introductory ECE Graduate Courses

The following are considered "*introductory*" ECE graduate courses that new students usually register for during their first or second semester:

- ECE 502. ANALYSIS OF PROBABILISTIC SIGNALS AND SYSTEMS

  Applications of probability theory and its engineering applications. Random variables, distribution and density functions. Functions of random variables, moments and characteristic functions. Sequences of random variables, stochastic convergence and the central limit theorem. Concept of a stochastic process, stationary processes and ergodicity. Correlation functions, spectral analysis and their application to linear systems. Mean square estimation. (Prerequisite: Undergraduate course in signals and systems.)

- ECE 503. DIGITAL SIGNAL PROCESSING

  Discrete-time signals and systems, frequency analysis, sampling of continuous time signals, the z-transform, implementation of discrete time systems, the discrete Fourier transform, fast Fourier transform algorithms, filter design techniques. (Prerequisites: Courses in complex variables, basic signals and systems.)

Introductory ECE Graduate Courses

- ECE 504. ANALYSIS OF DETERMINISTIC SIGNALS AND SYSTEMS

  Review of Fourier series and linear algebra. Fourier transforms, Laplace transforms, Z transforms and their interrelationship. State space modeling of continuous-time and discrete-time systems. Canonical forms, solution of state equations, controllability, observability and stability of linear systems. Pole placement via state feedback, observer design, Lyapunov stability analysis. (Prerequisite: Undergraduate course in signals and sys.)

- ECE 505. COMPUTER ARCHITECTURE

  This course introduces the fundamentals of computer system architecture and organization. Topics include CPU structure and function, addressing modes, instruction formats, memory system organization, memory mapping and hierarchies, concepts of cache and virtual memories, storage systems, standard local buses, high-performance I/O, computer communication, basic principles of operating systems, multiprogramming, multiprocessing, pipelining and memory management. The architecture principles underlying RISC and CISC processors are presented in detail. The course also includes a number of design projects, including simulating a target machine, architecture using a high-level language (HLL). (Prerequisites: Undergraduate course in logic circuits and microprocessor system design, as well as proficiency in assembly language and a structured high-level language such as C or Pascal.)

Introductory ECE Graduate Courses

ECE 506. INTRODUCTION TO LOCAL AND WIDE AREA NETWORKS

This course provides an introduction to the theory and practice of the design of computer communications networks according to IEEE 802 standard model for lower layers and IETF standard for TCP/IP higher layers. Analysis of network topologies and protocols, including performance analysis, is treated. Current network types including local area and wide area networks are introduced, as are evolving network technologies. The theory, design and performance of local area networks are emphasized. The course includes application of queueing analysis to performance analysis of medium access control (MAC) and application of communication theory in design of physical layer (PHY). (Prerequisites: familiarity to MATLAB programming is assumed. Background in undergraduate level courses in networking, probability, statistic, and signal processing.)

ECE 578. CRYPTOGRAPHY AND DATA SECURITY

This course gives a comprehensive introduction to the field of cryptography and data security. The course begins with the introduction of the concepts of data security, where classical algorithms serve as an example. Different attacks on cryptographic systems are classified. Some pseudo-random generators are introduced. The concepts of public and private key cryptography are developed. As important representatives for secret key schemes, DES and IDEA are described. The public key schemes RSA and ElGamal, and systems based on elliptic curves are then developed. Signature algorithms, hash functions, key distribution and identification schemes are treated as advanced topics. Some advanced mathematical algorithms for attacking cryptographic schemes are discussed. Application examples will include a protocol for security in a LAN and a secure smart card system for electronic banking. Special consideration will be given to schemes which are relevant for network environments. For all schemes, implementation aspects and up-to-date security estimations will be discussed. (Prerequisites: Working knowledge of C; an interest in discrete mathematics and algorithms is highly desirable. Students interested in a further study of the underlying mathematics may register for MA 4891 [B term], where topics in modern algebra relevant to cryptography will be treated.)

ECE Funding Opportunities

- **Research Assistants*** – *Please visit ECE's research pages (http://www.wpi.edu/academics/ece/research.html) for information on the department's research labs and to check for open RA positions.*

- **Teaching Assistants and Graduate Tutor Positions***

  - *TA positions are reserved for PhD students actively working on research projects with ECE faculty. Your research advisor can request an ECE TA position.*

  - *If you are interested in a tutoring position, you will need to respond to the tutoring survey sent out by Colleen a few weeks before each term. You must respond to this survey to be considered for a tutoring position.*

- **Graduate Internships** – *Students are responsible for obtaining their own internship positions and will need to fill out CPT forms (for international students only). Start and end dates must follow the academic calendar and are only allowed for paid positions. Students should speak to their advisors to determine what evaluation materials will need to be submitted at the end of their internship.*

ECE Academic Advisors

- **Why do I need an academic advisor?**

  Advisors can answer questions you may have regarding courses, course pre-requisites or research opportunities, as well as any questions you may have about your graduate program. They can also help with other problems that may require a graduate petition which would need their approval.

- **How do I know if I have been assigned an advisor?**

  Please see Colleen Sweeney in the ECE office if you haven't done so already, and she will let you know who your advisor is and how to contact them.

- **Am I allowed to change my advisor? What is the process?**

  If for any reason, you decide to change your academic advisor, please contact Colleen and she will assign you a different advisor and will update your file accordingly.

- **Is my academic advisor also my research advisor?**

  No, an academic advisor is only assigned to advise academic issues, e.g., course selection. If you end up working with a research advisor different from your academic advisor, it is common to make your research advisor also your academic advisor.

FAQ's

The answers to the ECE Department's most frequently asked questions can be found below and on the subsequent slides. If you don't see the question and answer you are looking for, please let us know! Always refer to the latest catalog for the full details.

How long will it take me to finish my degree program?

Length of the degree programs vary based on the type of degree and whether the student is full-time or part-time.

The total number of tuition credits needed for the MS program is 30 credits. On average, a full-time MS student, taking 9 credits (3 classes) per semester, will be able to complete the requirements for their degree program in about two years or less. Part-time students, taking one to two classes per semester, can complete their degree program in about 3 to 5 years.

The Ph.D. program requires students to complete 30 credits of coursework and an additional 30 credits of research. Full-time students pursuing a Ph.D. degree can usually complete their degree requirements in about 3 or 4 years depending on the number of credits the student has completed each semester.

FAQ's

What are the graduate seminar course requirements?

Full-time MS, MENG, and PhD ECE graduate students are required to register and pass two semesters of ECE Graduate Seminar. BSMS students are only required to pass one semester of graduate seminar. Number of seminars attended needed to pass vary by instructor. Students should attend the first seminar meeting of the semester to find out the specifics.

Where can I find a listing of ECE's course schedules for the upcoming academic year?

All course schedules, past and present and future, can be found on the registrar's web pages.

What are the graduation dates for the academic year?

WPI graduation dates are in October, February and May. Application for graduation forms must be filled out and submitted to Colleen in the ECE office for signatures so that the completed forms can be sent to the registrar's office by the deadlines listed on the application for graduation forms (September - July 1st, February - October 1st, May - February 1st).

FAQ's

Are grad students allowed to take undergraduate courses for graduate credit?

Graduate students can count up to three 4000-level ECE courses (6 credits) toward their graduate course requirements. The credit hours will then be adjusted/converted from 3.0 to 2.0 for the graduate credit. Note that graduate students cannot register for undergraduate courses and will need to contact the registrar's office in order to register for these courses.

How do I register for directed research, independent study or thesis & dissertation credits?

This is now handled by Workday. Please contact the registrar's office if you have any questions.

FAQ's

How many credits am I allowed to transfer for courses taken at another university?

Students can transfer up to 9 credits (3 courses) of coursework taken at another university provided that the courses are comparable to ones offered at WPI and the grades received were a B or better and providing that the courses being transferred were not used towards a previous degree. Transfer credit forms must be completed for any courses being transferred and must include the course description, syllabus, the book used and the homework assignments given. An updated program of study form with the transfer courses listed, must also be included.

FAQ's

What if I fail a course or end up on academic probation?

Academic Warning: *Students have one semester of course work to raise their cumulative overall GPA . Students who do not improve their GPA upon the next review will move down to the next level of standing. Students who do not have a cumulative overall GPA of at least 3.0 will remain in Academic Warning.*

Academic Probation: *Students have one semester of course work to raise their cumulative overall GPA. Students who improve their GPA but still remain below 3.0 will be moved up to Academic Warning. Students who do not improve their GPA upon the next review will move down to the next level of standing.*

Academic Dismissal: *Students are academically withdrawn from the University. Students may appeal dismissal by submitting a petition to the University Registrar.*

Academic standing appeal procedure: *Student petitions will be reviewed by the Committee on Graduate Studies and Research . A representative from the student's home department will be present during the appeal process. This petition must be submitted with any supporting documentation no later than the date specified in the dismissal letter, typically two weeks after semester end.*

If I retake a failed course and receive a better grade, which of these letter grades will be listed on my transcript?

The better of the two grades received for that course will be evaluated in the academic review process and the graduation requirements, however both grades will be counted in the overall GPA on your transcript. If the student decides to take a different course, the course with the higher grade will remain on the student's transcript and will count in their overall GPA.

WPI

Department of Electrical and Computer Engineering

*Thank you for attending!**

We look forward to helping you achieve your academic goals!

*(*Please Note: Today's presentation slides will be posted on our ECE web page under "Resources" then "ECE Presentations" for students to reference.)*