

# Arch Discovery Week

## ECSE

Electrical, Computer, and Systems Engineering (ECSE)

8/27/20



Rensselaer

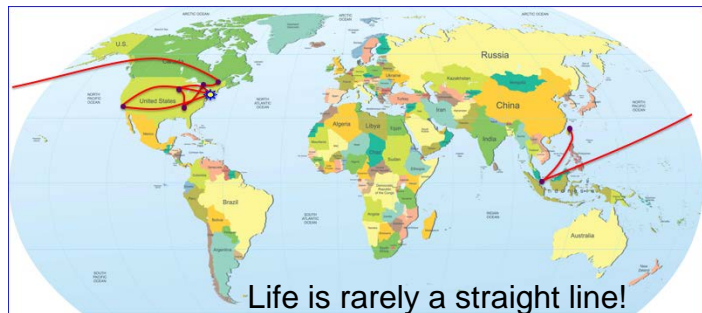
why not change the world?®

# Agenda

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- ECSE Welcome and Introduction
  - Quick refresh of curriculum, Arch
  - Resources available to you
    - Advising – moving to your faculty adviser/ECSE staff adviser
    - ECSE Industry Adviser Program
- ECSE Student Experiences
- Q&A

# A Bit about Me



**B.S. McGill University**

**M.S. University of Illinois**

**Ph.D. Rensselaer Polytechnic Inst.**

Fisher Control, Iowa, 1981-1982

Jet Propulsion Lab, Pasadena, 1985-1988

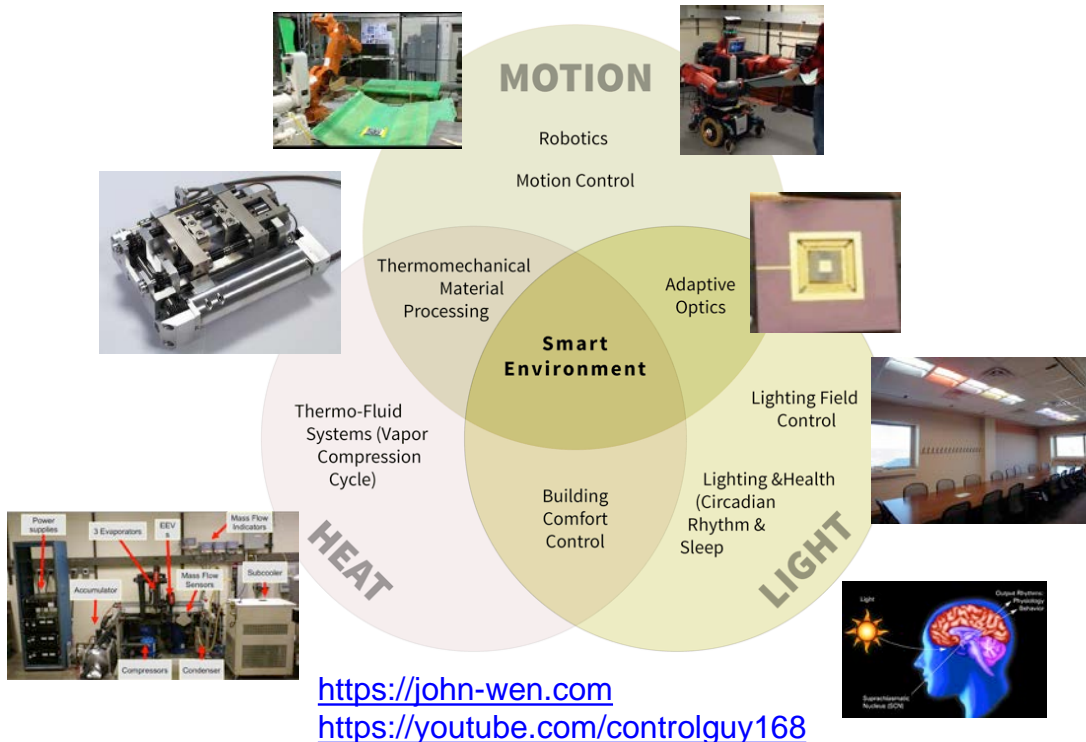
RPI faculty: 1988 - present

CATS Director: 2005 - 2013

ISE Dept Head: 2013 - 2018

ECSE Dept Head: 2018 - now

## Research: Control Theory & Application, Robotics

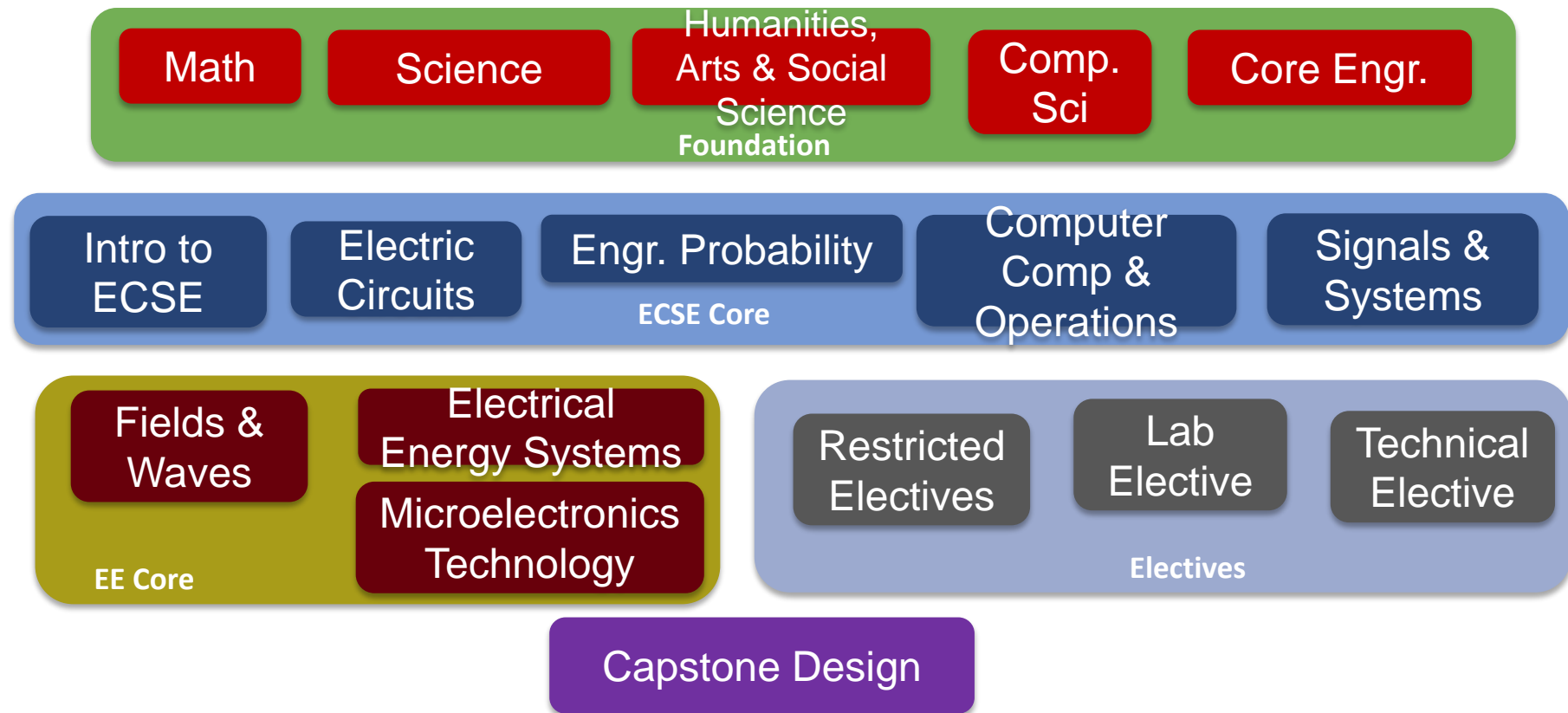


# Arch

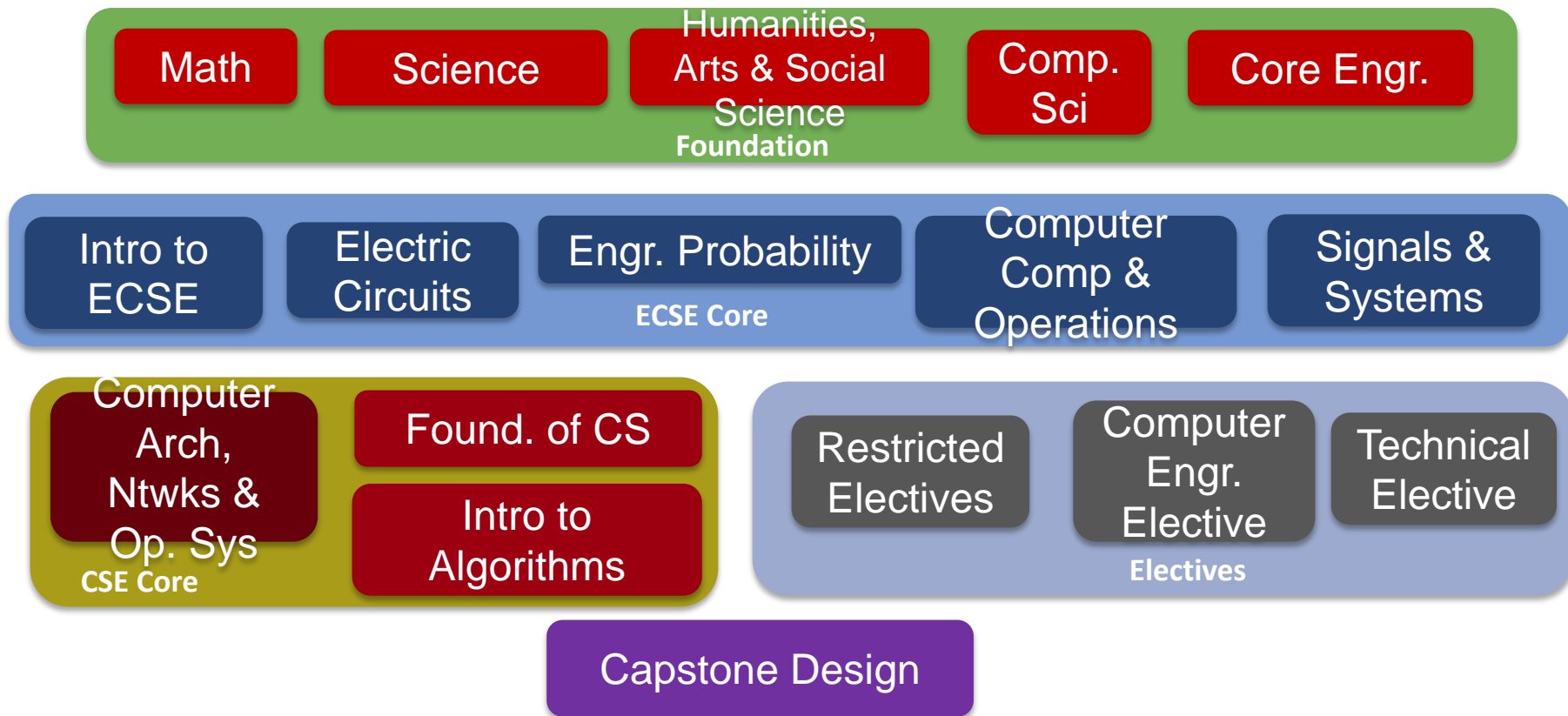
- <https://info.rpi.edu/the-arch>



# Electrical Engineering Curriculum



# Computer & Systems Engineering Curriculum



Electrical Engineering Curriculum Checklist  
Class of 2023 (REVISED)

First Year									
ECSE-1010	Intro. to ECSE *	4		ENGR-2350	Embedded Control	4			
MATH-1010	Calculus I	4		MATH-1020	Calculus II	4			
CSCI-1100	Computer Science I	4		PHYS-1100	Physics I	4			
	Hum., Arts or Soc. Sci. Elective	4			Science Elective	4			
				ENGR-1200 OR ENGR-1400	Eng. Graphics & CAD <sup>1</sup> OR Eng. Communications <sup>1</sup>	1			
Second Year									
ECSE-2610	Computer Comp. & Operations	4		ECSE-2010	Electric Circuits <sup>8</sup>	4			
PHYS-1200	Physics II	4		ECSE-2500	Engineering Probability <sup>8</sup>	3			
MATH-2400	Intro. to Differential Eqns.	4		MATH-2010	Multivariable Calc & Matrix Algebra	4			
	Hum., Arts or Soc. Sci. El.	4			Hum., Arts or Soc. Sci. El.	4			
ARCH SEMESTER			Third Year			Fall or Spring			
ECSE-2110	Electrical Energy Systems	3		ECSE-2050	Intro. to Electronics <sup>8</sup>	4			
ENGR-2050	Intro. to Eng. Design	4		ECSE-2100	Fields & Waves I <sup>8</sup>	4			
STSS-4100	Professional Development II <sup>1,3</sup>	2		ECSE-2410	Signals & Systems <sup>8</sup>	3			
	Hum., Arts or Soc. Sci. El.	4		ECSE-2900	ECSE Enrichment Seminar	1			
	Free Elective <sup>2</sup>	3-4			Math/Science Elective <sup>7</sup>	4			
Fourth Year									
ECSE-4900	Multidisc. Capstone Design <sup>1</sup>	3			Restricted Elective <sup>1,4,5</sup>	3			
ENGR-4010	Professional Development III <sup>1</sup>	1			Free Elective <sup>1,2</sup>	3-4			
ECSE-2210	Microelectronics Tech. <sup>8</sup>	3			Free Elective <sup>1,2</sup>	3-4			
	Lab Elective <sup>1,4</sup>	3			Free Elective (if needed) <sup>2</sup>	3-4			
	Restricted Elective <sup>1,4,5</sup>	3			Hum., Arts or Soc. Sci. Elective	4			
	Technical Elective <sup>1,4,5</sup>	3-4							

- May be taken either term.
- The free electives must total to at least 12 credits.
- For a list of courses that satisfy the Professional Development – Technical Issues & Solution res Development Courses" on the Registrar's "Academic Planning" web page. It should be complete
- It is recommended that students use electives to form a concentration. See the ECSE Web page
- No more than one Independent Study course may be used when satisfying the combined Techn
- May be replaced with ENGR-1100 Introduction to Engineering Analysis.
- Students who wish to take ENGR-1600 Materials Science as their Math/Science Elective must:
- Offered in Fall and Spring terms annually. Students should take the courses once the prerequisite

128 credits minimum

**RESTRICTED ELECTIVE**

Any 3 or 4 credit hour course with the designation ECSE-4xxx or ECSE-6xxx.

**TECHNICAL ELECTIVE**

Any 3- or 4-credit-hour course in engineering, mathematics, or science at the 4000 level or higher.

**LAB ELECTIVES**

ECSE-4090 Mechatronics  
ECSE-4130 Electric Power Eng. Lab  
ECSE-4220 VLSI Design  
ECSE-4760 Real-Time Ctrl & Comm.  
ECSE-4770 Cptr H/ware Design  
ECSE-4790 Microprocessor Systems  
ENGR-4710 Manufacturing Proc & Sys Lab 1

**SCIENCE ELECTIVE**

CHEM-1100 Chemistry  
BIOL-1010/1015 Introduct  
BIOL-2120 Cell and Me

**MATH/SCIENCE EL**

A 4-credit-hour course (hour laboratory) in Scie Mathematics (MATH), 3 cannot be used to sat

# Electrical Engineering Template and Arch Classes

Second Year									
ECSE-2610	Computer Comp. & Operations	4		ECSE-2010	Electric Circuits <sup>8</sup>	4			
PHYS-1200	Physics II	4		ECSE-2500	Engineering Probability <sup>8</sup>	3			
MATH-2400	Intro. to Differential Eqns.	4		MATH-2010	Multivariable Calc & Matrix Algebra	4			
	Hum., Arts or Soc. Sci. El.	4			Hum., Arts or Soc. Sci. El.	4			
ARCH SEMESTER			Third Year			Fall or Spring			
ECSE-2110	Electrical Energy Systems	3		ECSE-2050	Intro. to Electronics <sup>8</sup>	4			
ENGR-2050	Intro. to Eng. Design	4		ECSE-2100	Fields & Waves I <sup>8</sup>	4			
STSS-4100	Professional Development II <sup>1,3</sup>	2		ECSE-2410	Signals & Systems <sup>8</sup>	3			
	Hum., Arts or Soc. Sci. El.	4		ECSE-2900	ECSE Enrichment Seminar	1			
	Free Elective <sup>2</sup>	3-4			Math/Science Elective <sup>7</sup>	4			

Computer and Systems Engineering Curriculum Checklist  
Class of 2023 (REVISED)

First Year						
ECSE-1010	Intro. to ECSE <sup>7</sup>	4		ECSE-2610	Computer Comp. & Operations	4
CSCI-1100	Computer Science I	4		CSCI-1200	Data Structures	4
MATH-1010	Calculus I	4		MATH-1020	Calculus II	4
ENGR-1200 OR ENGR-1400	Eng. Graphics & CAD <sup>1</sup> OR Eng. Communications <sup>1</sup>	1		PHYS-1100	Physics I	4
	Hum., Arts or Soc. Sci. Elective	4				
Second Year						
ENGR-2350	Embedded Control	4		ECSE-2010	Electric Circuits <sup>8</sup>	4
CSCI-2200	Foundations of Comp. Sci.	4		CSCI-2300	Intro to Algorithms	4
MATH-2400	Intro. to Differential Equations	4			Science Elective	4
PHYS-1200	Physics II	4			Hum., Arts or Soc. Sci. Elective	4
Arch Semester		Third Year		Fall or Spring		
ECSE-2660	Cptr Arch, Nets, & Op Sys	4		ECSE-2050	Intro. to Electronics <sup>8</sup>	4
ENGR-2050	Intro. to Eng. Design	4		ECSE-2410	Signals & Systems <sup>8</sup>	3
MATH-2010	Multivar Calc & Matrix Alg.	4		ECSE-2500	Engineering Probability <sup>8</sup>	3
	Hum., Arts or Soc. Sci. Elective	4		ECSE-2900	Enrichment Seminar	1
				STSS-4100	Professional Development III <sup>1,3,4</sup>	2
					Hum., Arts or Soc. Sci. Elective	4
Fourth Year						
ENGR-4010	Professional Development III <sup>1</sup>	1		ECSE-4900	Multidisc. Capstone Design <sup>1</sup>	3
	Computer Eng Elective <sup>1,4</sup>	3-4			Free Elective <sup>2</sup>	3-4
	Restricted Elective <sup>1,5,6</sup>					
	Restricted Elective <sup>1,5,6</sup>					
	Technical Elective <sup>1,5,6</sup>					
	Free Elective <sup>3</sup>					

- 1 May be taken either term.
- 2 The free electives must total at least 12 cr
- 3 For a list of courses that satisfy the Profen Development Courses" on the Registrar's
- 4 May be taken in the third year.
- 5 It is recommended that students use electi
- 6 No more than one Independent Study cou
- 7 May be replaced with ENGR 1100 Introd
- 8 Offered in Fall and Spring terms annually

130 credits minimum

**RESTRICTED ELECTIVE**

Any 3 or 4 credit hour course with the designat  
ECSE-6000 or CSCI-4000 or CSCI-6000.

**TECHNICAL ELECTIVE**

Any 3- or 4-credit-hour course in engineering,  
science at the 4000 level or higher.

**COMPUTER ENGINEERING ELECTIVE**

ECSE-4670 Computer Comm. Networks  
ECSE-4740 Parallel Computing  
ECSE-4750 Computer Graphics  
ECSE-4770 Computer Hardware Design  
ECSE-4790 Microprocessor Systems  
CSCI-4380 Database Systems  
CSCI-4440 Software Design & Doc

# Computer and Systems Engineering Template and Arch Classes

Second Year							
ENGR-2350	Embedded Control	4			ECSE-2010	Electric Circuits <sup>8</sup>	4
CSCI-2200	Foundations of Comp. Sci.	4			CSCI-2300	Intro to Algorithms	4
MATH-2400	Intro. to Differential Equations	4				Science Elective	4
PHYS-1200	Physics II	4				Hum., Arts or Soc. Sci. Elective	4
Arch Semester		Third Year			Fall or Spring		
ECSE-2660	Cptr Arch, Nets, & Op Sys	4			ECSE-2050	Intro. to Electronics <sup>8</sup>	4
ENGR-2050	Intro. to Eng. Design	4			ECSE-2410	Signals & Systems <sup>8</sup>	3
MATH-2010	Multivar Calc & Matrix Alg.	4			ECSE-2500	Engineering Probability <sup>8</sup>	3
	Hum., Arts or Soc. Sci. Elective	4			ECSE-2900	Enrichment Seminar	1
					STSS-4100	Professional Development II <sup>1,3,4</sup>	2
						Hum., Arts or Soc. Sci. Elective	4

Templates, as well as more details about the curriculum can be found on our website:



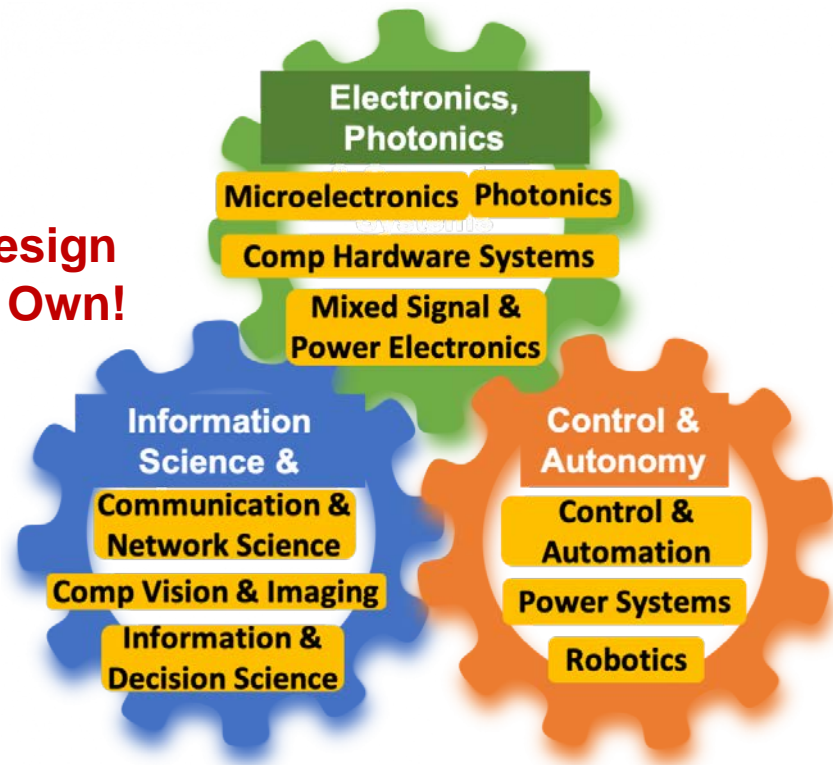
<https://ecse.rpi.edu/academics/undergraduate-programs/program-templates>

# ECSE Concentrations – Depth vs. Breadth

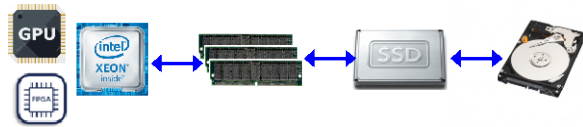
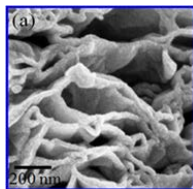
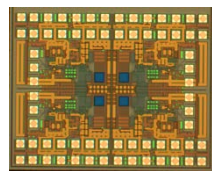
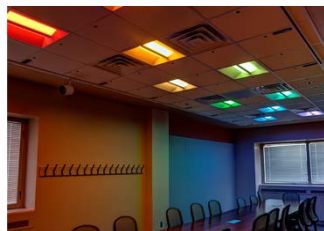
For restricted and technical electives:

- Microelectronics
- Photonics
- Power Electronics
- Computer Hardware Systems
- Communication & Networking
- Computer Vision & Imaging
- AI and Machine Learning
- Power Systems
- Control Systems
- Robotics & Automation

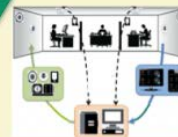
**Or Design  
Your Own!**



# ECSE Research



**Control and  
Autonomy**



**Communication and  
Networking**

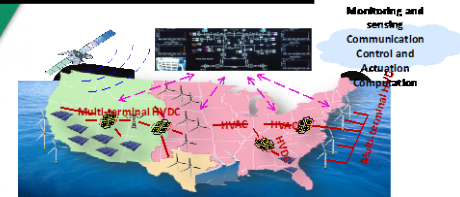
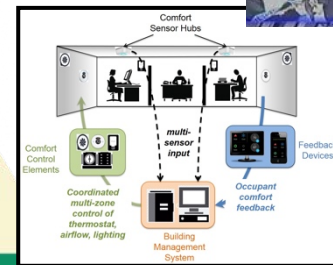
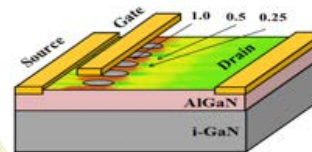
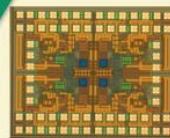
**Computer System  
Design**



**Energy and Power  
Systems**



**Electronics and  
Photonics**



# Where Do ECSE Students Go?



## **FACULTY ADVISERS**

Alhussein Abouzeid (abouzeid@ecse.rpi.edu)

Paul Chow (chowt@rpi.edu)

Rena Huang ([huangz3@rpi.edu](mailto:huangz3@rpi.edu))

Koushik Kar (koushik@ecse.rpi.edu)

Russ Kraft (krafr2@rpi.edu)

Fred Schubert efschubert@rpi.edu)

## **Undergraduate Student Coordinator - Rama Hamarneh**

[hamarr@rpi.edu](mailto:hamarr@rpi.edu)

518-276-8557 or 518-629-5616 (remote)

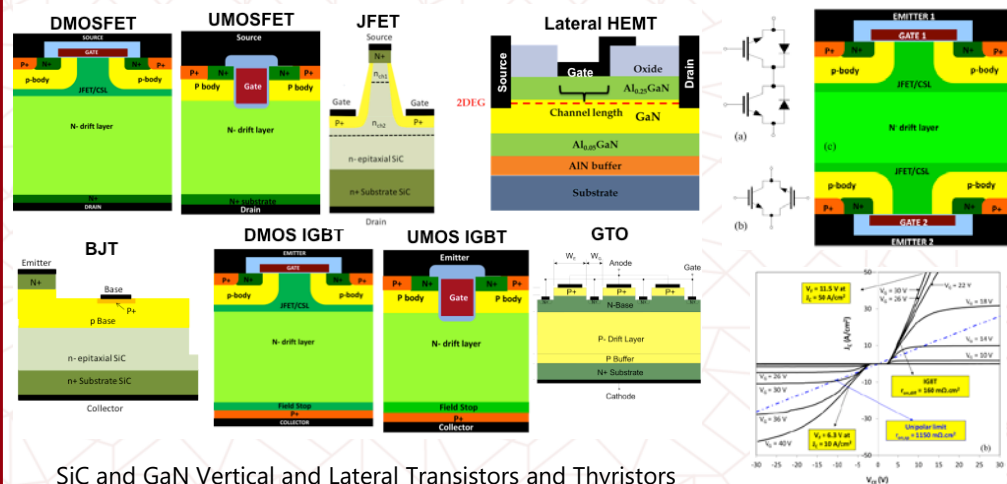
<https://calendly.com/hamarr>



Ph.D., Electrical Engineering,  
RPI, 1982

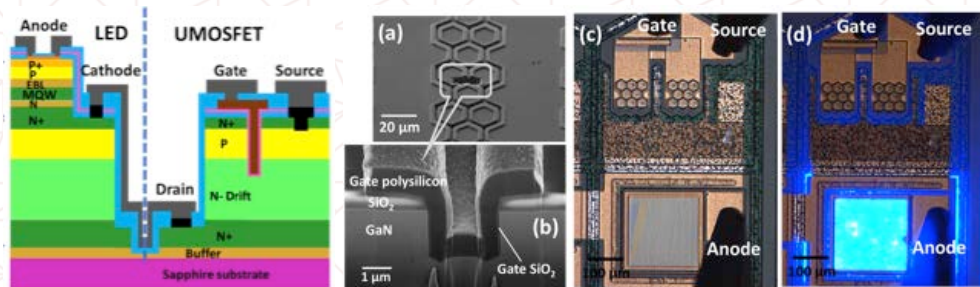
Research Interests: Smart power  
semiconductor devices and ICs

Sample Courses:  
ECSE-2010, Field and Waves  
ECSE-4900, Multidisciplinary  
Capstone Design  
ECSE-6230, Semiconductor Devices  
and Models I



SiC and GaN Vertical and Lateral Transistors and Thyristors

SiC Bidirectional IGBT



Monolithically Integrated GaN LED/UMOSFET



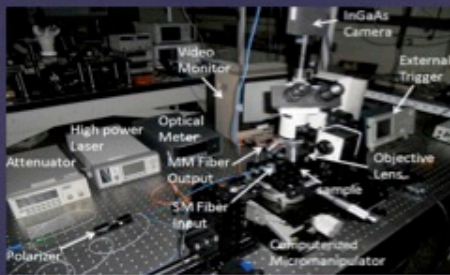
# Rena Huang

## Dept. of Elec., Comp., & Sys. Eng. @ RPI

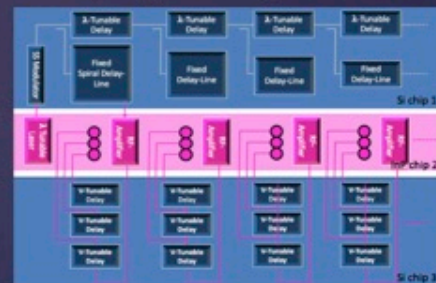
**Integrated Photonic Research: Si Photonics Devices and Systems for applications in Optical Interconnects, RF Photonics, Reservoir Computing and Quantum Computing**



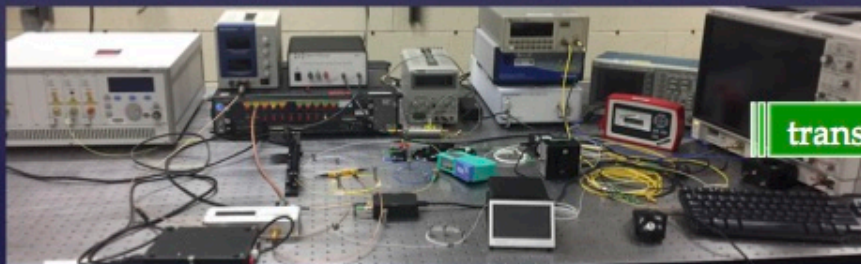
Si Photonic Device: Slow-Light Waveguide, on-Chip Optical Delay Lines, Light Modulators, MZI, Photodetectors



Device Characterization



Photonic Beamforming Chip for Phased Array Antenna



Benchtop Optical Reservoir Computing



Integrated Si Photonic Chip

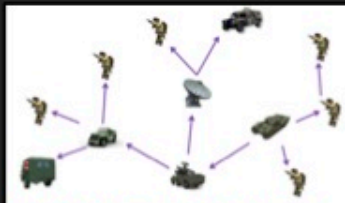


**Prof. Koushik Kar, ECSE Department, RPI**

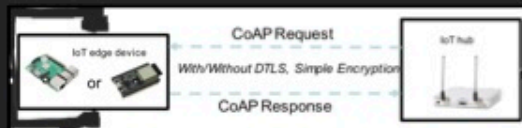
**Computer Networking and the Internet of Things, and their applications in Power and thermal grids, Smart buildings, and Military communication**



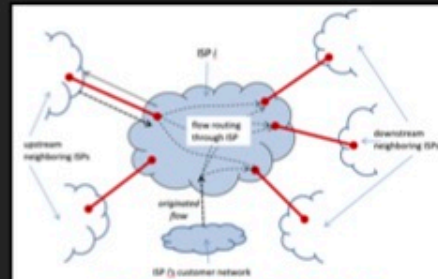
**Network control algorithms and protocols for Internet and wireless:**



*Battlefield communication networks*

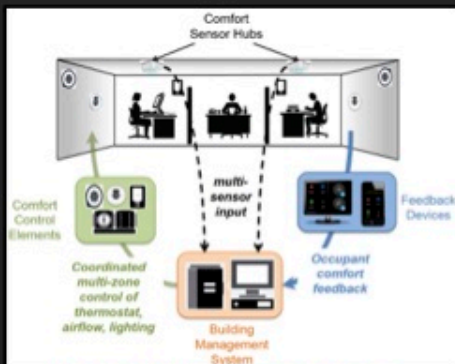


*Communication protocols for the Internet of Things (IoT)*

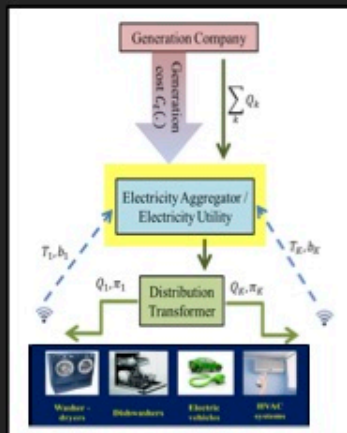


*Internet traffic routing and pricing*

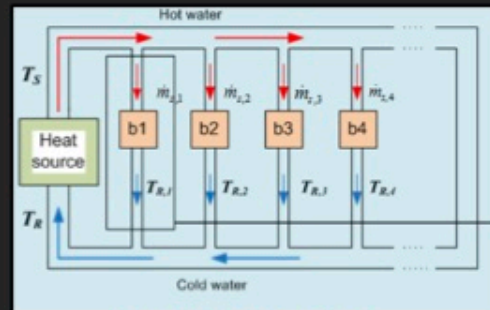
**... and applications of networked communication to smart grid and smart buildings:**



*IoT based indoor environment control*



*Distributed control of the smart grid*



*Thermal distribution networks*

**Web: [www.ecse.rpi.edu/~koushik](http://www.ecse.rpi.edu/~koushik)**

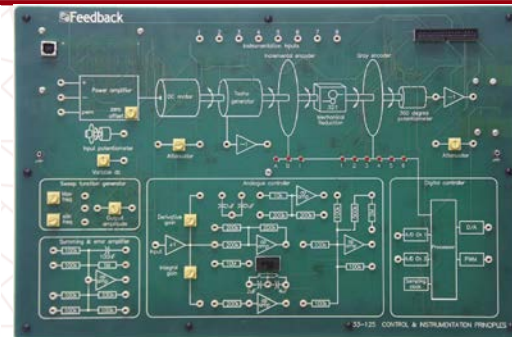
**Email: [koushik@ecse.rpi.edu](mailto:koushik@ecse.rpi.edu)**



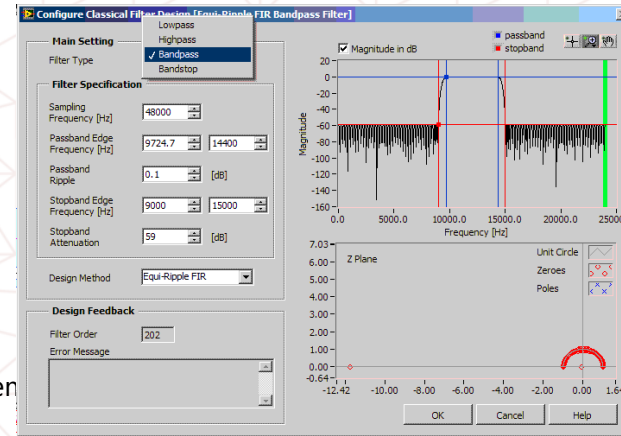
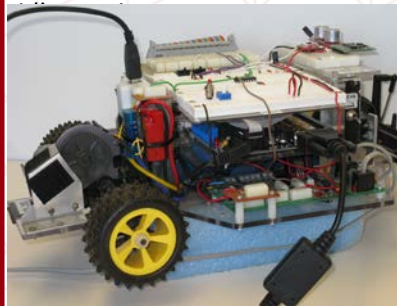
Ph.D., Electrical Engineering,  
Rensselaer Polytechnic Institute, 1983

Research Interests: Embedded  
Systems,  
Feedback Systems and Digital  
Control, IC Layout Research Support

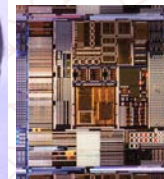
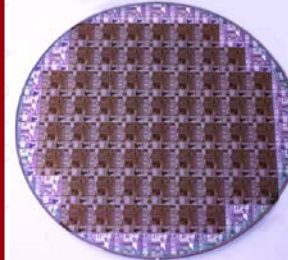
Sample Courses:  
ENGR-2350, Embedded Control  
ECSE-4760, Real-Time Applications in  
Control & Communications



Education: Feedback control, both analog (continuous) and digital



Microcontroller embedded system



Digital filter design and DSP

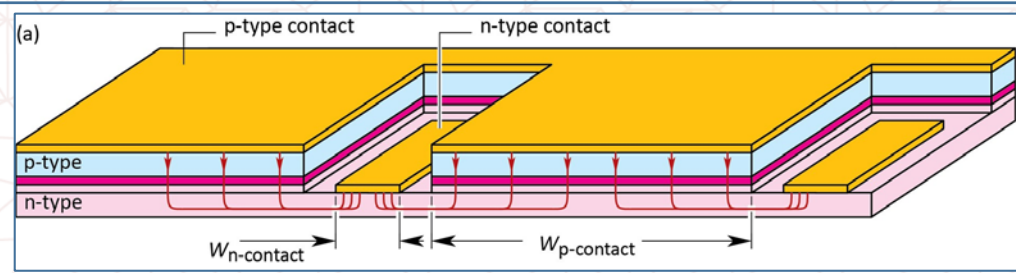
IC Layout tools & Fabrication



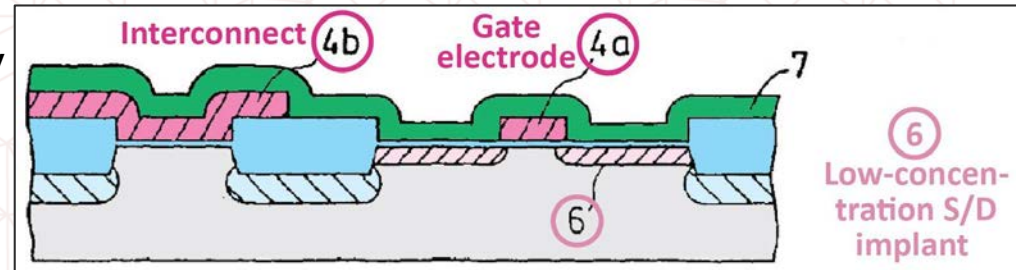
Ph.D., Electrical Engineering, University of Stuttgart, 1986.

Light emitting diode (LED) technology.  
Micro and optoelectronic technology.  
Si integrated circuit (IC) technology.

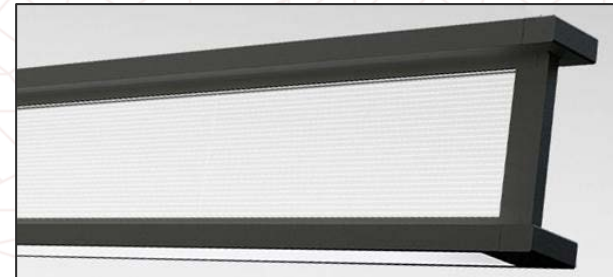
Sample Courses:  
ECSE-2100 Fields and Waves  
ECSE-6220 Physical Foundations  
ECSE-6280 Light Emitting Diodes



Light-emitting diode (LED) technology



Si integrated circuits particularly processing technologies such as atomic layer deposition



LED lighting systems

# Advising Sophomore – Senior Year

## Faculty Adviser

- Major and Degree requirements
- Class schedule
- Major elective questions
- Future plans
- Undergraduate research
- Graduate school
- Questions about the field
- Research
- Advisor signatures
- Jobs and internships

## ECSE UG Student Support

- Major and Degree requirements
- Graduation progress
- Class schedule
- Help with forms
- Declaring a minor
- Undergraduate research
- Registration
- Transfer credit
- Study abroad
- Opportunities and events
- General questions!

# Arch Preparation

**Semester Away:** In the fall or spring semester of their junior year, students are required to gain individual learning experience off campus, e.g., international travel, internships, co-ops, research opportunities, pursuit of an entrepreneurial idea, and engagement in community service projects.

<https://info.rpi.edu/arch/semester-away>

## TIPS:

- Join Handshake
- Join CCPD Discord Channel
- See Opportunities Posted in ECSE Weekly Newsletter
- Attend CCPD Workshops
- Join ECSE Industry Adviser Program

# Industry Adviser Program

- Connects current students with alumni for one on one industry advising
- Panels with alumni
- Other engagement with alumni to show you the many possibilities with an ECSE degree!

Sign Up Link: [https://rpi.qualtrics.com/jfe/form/SV\\_dhbKWEzDkLqLK1T](https://rpi.qualtrics.com/jfe/form/SV_dhbKWEzDkLqLK1T) (By 8/31)

# ECSE Student Away Experiences

Name: Thomas Su

Year: Class of 2021 (December 2020 Graduate)

Major: Computer and Systems Engineering (CSE)

Minor: Economics

Away Experience: Firmware Engineering Intern at Western Digital in Irvine, California

Name: Alejandro Naranjo

Year: Class of 2022

Major: CSE

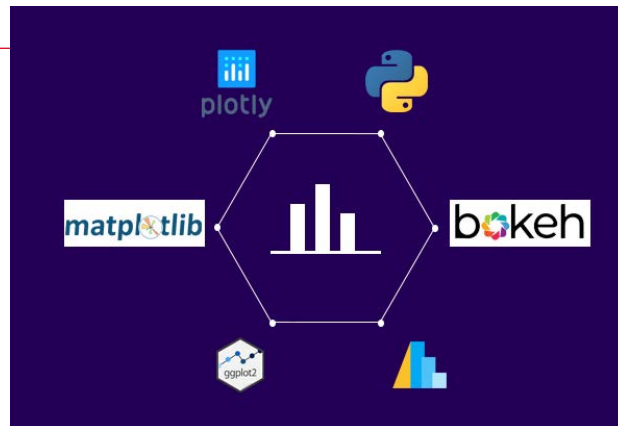
Away Experience: Firmware Engineering Internship with Western Digital

Name: Aiden Chen

Year: Senior

Major: Electrical Engineering

Away Experience: Georgia Tech  
Research Institute in Atlanta,  
Georgia



Name: Yashna Bansal

Year: Class of 2021, graduating December 2020

Major: Mechanical and Electrical Engineering

Away Experience: Internships for Collins Aerospace (spring) and SpaceX (summer)

Name: Avani Saggi

Year: 2021 (Senior)

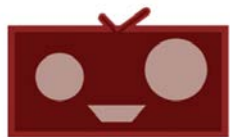
Major/Minor: Electrical Engineering

Away Experience: Worked with IBM on the HMC/SE  
Product Engineering team

# Additional Information

- Covid-19 <https://covid19.rpi.edu/students>
- URP: <http://info.rpi.edu/undergraduate-research>
- Co-op, internship: <https://www.rpi.edu/dept/cdc>
- Study Abroad: <http://info.rpi.edu/international-programs/study-abroad-and-exchange-opportunities>
- Co-term: <http://admissions.rpi.edu/graduate/admission/co-terminal.html>
- Emergency: 911, RPI Public Safety x6611
- Counseling center x6476 4100 Academy Hall  
<http://studenthealth.rpi.edu/counseling>
- Stay healthy! <http://studenthealth.rpi.edu/health>  
(exercise, Vitamins (B!), avoid caffeine and blue light at night!)

# Beyond the Classroom



## HKN

Eta Kappa Nu (HKN), the international honor society for electrical and computer engineers, is home to some of the best and brightest students in the field. Rensselaer Polytechnic Institute's Beta Nu chapter of Eta Kappa Nu is among over 200 other chapters across the United States, Europe, and Asia.

## IEEE

The RPI Student Branch of the IEEE is an organization dedicated to connecting students, researchers, and industry professionals in order to support the engineering community.

## Rensselaer Formula Hybrid

Through participation in the annual SAE Formula Hybrid competition, members build invaluable skills in product-design, team collaboration, and project management, helping to properly prepare them for professional careers in the world of engineering and management.

## Embedded Hardware Club

We are a group of students at Rensselaer Polytechnic Institute who share a passion for microcontrollers, electronics, tinkering and programming. As a club, we organize workshops and hands-on projects for both RPI students and EHC members. Whether you're an experienced pro, an amateur electronics enthusiast or just starting out, the Embedded Hardware Club serves as an avenue for electronics development and project collaboration.

## W2SZ: the Amateur Radio Club

Since 1911, W2SZ has been a place where students enjoy the challenges and satisfaction of Amateur Radio. Whether you would like to build radios, climb towers, send data over the air, bounce signals off the moon, send Morse code overseas, participate in contests, hike up mountains and look for radio signals, or just "hang out" on the repeater in the evenings, this is the club for you.





# IEEE

## Institute of Electrical and Electronics Engineers



- You DON'T need to be majoring in Electrical Engineering to join!
- Great way to meet students, faculty and professionals!
- Opportunities to develop projects.
- Attend different events and workshops.



Rensselaer

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# HKN (Eta-Kappa-Nu)

## Membership

Membership in HKN is by invitation only. Eligible students are drawn from the top 1/4 of juniors and the top 1/3 of seniors in the [ECSE Department](#). Membership is for life.

The benefits of membership in HKN are many and include recognition of exceptional academic achievement, opportunities to develop organizational and leadership skills, and access to an industry-wide network of HKN members and those who recognize membership as a mark of accomplishment. For more information, feel free to contact any of the [Officers](#)

# Eta Kappa Nu

BETA NU CHAPTER  
AT RENSSELAER


[Home](#)[News](#)[About](#)[Membership](#)[Officers](#)[Events](#)


### Welcome!

Eta Kappa Nu (HKN), the international honor society for electrical and computer engineers, is home to some of the best and brightest students in the field.

Rensselaer Polytechnic Institute's Beta Nu chapter of Eta Kappa Nu is among over 200 other chapters across the United States, Europe, and Asia.

>> [More about HKN!](#)





# Connect with ECSE



@EcseRpi



ECSE RPI Students Graduates and Friends



@ECSEDeptRPI



[ecse.rpi.edu](http://ecse.rpi.edu)

# Questions?

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Questions for ECSE Students about their Arch Experiences?

Further questions?

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Dr. Rama Hamarneh, Undergraduate Student Coordinator

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