

Area 4

Control, Communications, and Signal Processing

(Sensing, processing, coordination, and actuation)

Professor Stark Draper

From data to information & decision

Electrical Engineers (“EEs”) apply the laws of **physics** and of **information** to develop the electronic, electrical, and computational components, instruments & algorithms that lie at the heart of many engineered systems

Area 4: Control, communications and signal processing is concerned with:

- how to **sense & process** data to produce useful and actionable information,
- how to **store & transfer** such information reliably, and
- how to **understand & control** complicated systems.

Courses

Second year introduction to area

ECE 216: Signals and systems (required)

Probabilistic reasoning

ECE 302: Probability and applications

ECE 521: Inference algorithms

ECE 537: Random processes

├── ECE 302 pre-requisite

Communications

ECE 316 Comm. systems (area kernel)

ECE 417: Digital communications

ECE 464: Wireless communications

ECE 469: Optical comm. & networks

├── ECE 302 & ECE 316 pre-requisites

Signal processing

ECE 431: Digital signal processing

ECE 462: Multimedia systems

ECE 516 Intelligent image processing

Biomedical

ECE 445: Neural bioelectricity

ECE 446 Sensory communication

BME 595: Medical imaging

Courses

Second year introduction to area

ECE 216: Signals and systems (required)

Probabilistic reasoning

ECE 302: Probability and applications

ECE 521: Inference algorithms

ECE 537: Random processes

Communications

ECE 316 Comm. systems (area kernel)

ECE 417: Digital communications

ECE 464: Wireless communications

ECE 469: Optical comm. & networks

Analyze signals in time & frequency

Signal processing

ECE 431: Digital signal processing

ECE 462: Multimedia systems

ECE 516 Intelligent image processing

Biomedical

ECE 445: Neural bioelectricity

ECE 446 Sensory communication

BME 595: Medical imaging

Understanding structure of basic signal processing and communication systems

Courses

Second year introduction to area

ECE 216: Signals and systems (required)

Do better in poker

Probabilistic reasoning

ECE 302: Probability and applications

ECE 521: Inference algorithms

ECE 537: Random processes

Communications

ECE 316 Comm. systems (area kernel)

ECE 417: Digital communications

ECE 464: Wireless communications

ECE 469: Optical comm. & networks

Win the \$1m Netflix Prize

Signal processing

ECE 431: Digital signal processing

ECE 462: Multimedia systems

ECE 516 Intelligent image processing

Biomedical

ECE 445: Neural bioelectricity

ECE 446 Sensory communication

BME 595: Medical imaging

Find your favorite beer using BeerMapper

Courses

Second year introduction to area

ECE 216: Signals and systems (required)

Keep improving the Mars-Earth link: from
8.3 bps in 1965 to 12 Mbps in 2006 = 63dB

Probabilistic reasoning

ECE 302: Probability and applications

ECE 521: Inference algorithms

ECE 537: Random processes

Communications

ECE 316 Comm. systems (area kernel)

Reduce costs through improved
delay-sensitive factory automation

ECE 417: Digital communications

ECE 464: Wireless communications

ECE 469: Optical comm. & networks

Signal processing

Design next-generation cellular networks (1000x in 10 years)

ECE 431: Digital signal processing

ECE 462: Multimedia systems

ECE 516 Intelligent image processing

Biomedical

ECE 445: Neural bioelectricity

ECE 446 Sensory communication

BME 595: Medical imaging

Tackle the growth of heterogeneous data transmission

Courses

Second year introduction to area

ECE 216: Signals and systems (required)

Probabilistic reasoning

ECE 302: Probability and applications

ECE 521: Inference algorithms

ECE 537: Random processes

Understand how to digitize and store data

Communications

ECE 316 Comm. systems (area kernel)

ECE 417: Digital communications

ECE 464: Wireless communications

ECE 469: Optical comm. & networks

Signal processing

ECE 431: Digital signal processing

ECE 462: Multimedia systems

ECE 516 Intelligent image processing

Build distributed environmental monitoring systems

Develop specialized embedded information processors

Biomedical

ECE 445: Neural bioelectricity

ECE 446 Sensory communication

BME 595: Medical imaging

Make biometric recognition secure and reliable

Reduce the economic and environmental footprint of Google & Facebook's data centers

Courses

Second year introduction to area

ECE 216: Signals and systems (required)

Probabilistic reasoning

ECE 302: Probability and applications

ECE 521: Inference algorithms

ECE 537: Random processes

Enhance resolution and usability of medical images

Communications

ECE 316 Comm. systems (area kernel)

ECE 417: Digital communications

ECE 464: Wireless communications

ECE 469: Optical comm. & networks

Improve medical devices such as cochlea implants

Signal processing

ECE 431: Digital signal processing

ECE 462: Multimedia systems

ECE 516 Intelligent image processing

Biomedical

ECE 445: Neural bioelectricity

ECE 446 Sensory communication

BME 595: Medical imaging

Develop medical imaging devices

Understand the mechanisms behind seizures

Employment in Control, Comm. & SP

Wireless: Broadcomm, Qualcomm, Samsung,
Blackberry, Apple, Alcatel-Lucent, Huawei

Semiconductors: Intel, TI, Analog Devices, IBM

Government: CSA, CSE, DRDC

Automobile: Ford, GM, Honda, Toyota, Tesla

Aerospace: Bombardier, Boeing, Hughes, Airbus

Energy: Shell, Schlumberger

Medicine and devices: GE Healthcare,
TomoTherapy, Medtronic, EPIC

Manufacturing: 3M, GE, Mitsubishi, Caterpillar

Software & services: Google, Microsoft, Facebook

Finance: BMO, RBC, J.P.Morgan, D.E.Shaw

Entertainment: Disney, Pixar

Consulting: McKinsey, Bain, IBM