ELECTRICAL ENGINEERING

OVERVIEW
The Electrical Engineering program at the University of Vermont (UVM) offers programs of study leading to the M.S. and Ph.D. degrees in Electrical Engineering. In addition, the EE program partners with other academic units to offer M.S. and Ph.D. degrees in materials science and the Ph.D. degree in bioengineering. Areas of research expertise in electrical engineering include digital signal processing, control systems, electromagnetics and optics, electric energy systems, solid-state physical electronics, semiconductor materials and devices, wireless communications, VLSI design and testing, and biomedical engineering.

DEGREES
- Electrical Engineering AMP
- Electrical Engineering M.S.
- Electrical Engineering Ph.D.

FACULTY
- Frolik, Jeff L.; Associate Professor, School of Engineering; PHD, University of Michigan Ann Arbor
- Hines, Paul D.; Assistant Professor, School of Engineering; PHD, Carnegie Mellon University
- Mirchandani, Gagan S.; Professor, School of Engineering; PHD, Cornell University
- Oughstun, Kurt Edmund; Professor, School of Engineering; PHD, University of Rochester
- Titcomb, Stephen; Associate Professor, School of Engineering; PHD, Lehigh University
- Varhue, Walter John; Professor, School of Engineering; PHD, University of Virginia
- Xia, Tian; Associate Professor, School of Engineering; PHD, University of Rhode Island

Courses
- EE 209. Transient Phenomena. 3 Credits.
  Study of complex variable basis of Laplace and Fourier Transforms; applications to transient behavior of lumped and distributed parameter systems, root locus. Nyquist criterion and two-dimensional field problems. Prerequisite: MATH 271.
- EE 210. Control Systems. 3 Credits.
  Analysis and design of continuous and discrete-time control systems; stability, signal flow, performance criteria, classical and state variable methods, simulation design tools, computer-based realizations. Prerequisites: EE 171 or ME 111. Cross-listed with: ME 210.
- EE 212. Computer Vision. 3 Credits.
  Introduction to computer vision systems for interactive and industrial applications using both hard/software computational approaches. Pre/co-requisites: MATH 124 or MATH 271 and CS 026, or Instructor permission. Cross-listing: CS 212.
- EE 215. Electric Energy Systems Analys. 3 Credits.
  Transmission line, generator, transformer modeling and control, per-unit conversion, power flow calculations and software, symmetric components and fault analysis, protection/relaying, stability analysis, smart grid. Prerequisite: EE 113. Co-requisite: MATH 124.
- EE 221. Prin VLSI Digital Circuit Des. 0 or 3 Credits.
  Design of VLSI circuits using a modular approach with industrial grade software: schematic capture; circuit design languages (HDL); full-custom layouts; mixed signals; synthesis. Laboratory. Pre/co-requisites: EE 131, EE 163, EE 121.
- EE 222. Prin VLSI Analog Cir Design. 0 or 3 Credits.
  The design, layout, and simulation of VLSI analog circuits. Emphasis on small signal models and circuits used in operational amplifiers. Prerequisites: EE 163, EE 121, Instructor permission.
- EE 224. Principles VLSI System Design. 3 Credits.
- EE 227. Biomed Measmnts Instrum & Sys. 3 Credits.
  Biomedical and clinical engineering in research, industry, and health care institutions. Measurement techniques and instrumentation. Integrated biomedical monitoring, diagnostic, and therapeutic systems. Co-requisites: EE 121, ANPS 020; Instructor permission. Alternate years.
- EE 228. Sensors. 3 Credits.
  Sensor design, interrogation, and implementation. A wide variety of electrical, electronic, optical, mechanic, and cross-disciplinary devices. System designs, measurement techniques, and methodologies. Prerequisites: Senior standing in Engineering or Physics.
- EE 231. Digital Computer Design I. 3 Credits.
  Hardware organization and realization, hard-wired and microprogrammed control units, interrupt and I/O systems. Hardware design language introduced and used for computer design. Prerequisites: EE 131, either EE 134 or CS 101.
- EE 232. Digital Computer Design II. 3 Credits.
  Memory designs, error control, high-speed addition, multiplication, and division, floating-point arithmetic, cpu enhancements, testing and design for testability. Prerequisites: EE 231.
- EE 233. Microprocessor Systems & Appl. 0 or 4 Credits.
  Basic principles of mini/microcomputers; A/D; D/A; channels, magnetic devices, display devices, mechanical devices; interface designs of analog systems to mini/microcomputers; principles of microprogramming; bit-slice-based microcomputers. Prerequisites: Department permission; CS 101 desirable.
- EE 241. Electromagnetic Wave Theory. 3 Credits.
  Electromagnetic radiation and wave propagation in complex media and systems: angular spectrum of plane waves, dispersive pulse propagation, applications to communications, imaging and remote sensing. Prerequisite: EE 141 or equivalent.
EE 245. Quantum Electronics. 3 Credits.
A theoretical description of light-matter interactions in photon emitting resonant cavities. A practical understanding of laser design and operation. Prerequisite: EE 141.

EE 247. Physical Optics. 3 Credits.

EE 250. Test Engineering. 3 Credits.
Parametric, structural, functional, characterization and stress testing of components and subsystems. Test methods, strategies, planning, and economics. Test equipment hardware and software. Prerequisites: EE 121, EE 131.

EE 251. Digital Syst Testing & Design. 3 Credits.
Circuit failures, fault models, testing and test pattern generation, logic and fault simulation, design for testability, scan design, test interfaces, design for built-in self-test. Prerequisite: EE 131.

EE 256. Science & Tech Integrated Cir. 3 Credits.
Science and technology of integrated circuit fabrication. Interaction of processing with material properties, electrical performance, economy, and manufacturability. Prerequisites: EE 163 or EE 261; concurrent registration in EE 164 or EE 262.

EE 272. Information Theory. 3 Credits.
Introduction to probability concepts of information theory; entropy of probability models; theoretical derivations of channel capacity; coding methods and theorems, sampling theorems. Prerequisites: STAT 143/STAT 151/STAT 153.

EE 273. Digital Communications. 3 Credits.
Digital modulation/demodulation methods and BER performance; source entropy and channel capacity; optimal detection; convolutional codes and decoding algorithms. Pre/co-requisites: EE 174 and STAT 151.

EE 274. Intro Wavelets & Filter Banks. 3 Credits.

EE 275. Digital Signal Processing. 3 Credits.
Sampling and reconstruction of signals. DFT, FFT and the z-transform. FIR and IIR filter design. Speech coding. Accompanying lab: EE 289. Pre/co-requisites: EE 171; Instructor permission.

EE 276. Image Processing & Coding. 3 Credits.
Image enhancement techniques by point and spatial operations. Data compression techniques to include scalar quantization, entropy coding, transform and sub-band coding. Labs on PC hardware; PC and Unix-based software. Prerequisite: EE 275.

EE 277. Image Anly&P/Pattern Recognition. 3 Credits.

EE 278. Wireless Communication. 3 Credits.
Modern wireless systems, including cellular design, propagation modeling, multiple access and equalization techniques. Pre/co-requisites: EE 174 and STAT 151.

EE 281. Materials Science Seminar. 1 Credit.
Presentation and discussion of advanced electrical engineering problems and current developments. Prerequisite: Senior or Graduate Engineering enrollment.

EE 295. Special Topics. 1-18 Credits.
Special topics in developing areas of Electrical Engineering. Prerequisites: EE 174 and STAT 151.

EE 301. System Theory. 4 Credits.
Basic concepts in system theory; linear vector spaces; state variable representation; phase plane analysis of nonlinear dynamic systems; limit cycles; Lyapunov stability. Applications in engineering. Prerequisites: MATH 230 or MATH 271, MATH 124, EE 171.

EE 302. Stochastic Processes. 4 Credits.
Probability theory, random variables and stochastic processes. Response of linear systems to random inputs. Applications in engineering. Prerequisites: EE 171 and STAT 151.

EE 306. Digital Control Systems. 3 Credits.
Digital control system analysis and design using transform, algebraic, and state space methods. Sampled data systems, stability, quantization effects, sample rate selection, computer-based realization. Prerequisite: EE 210 or Instructor permission.

EE 310. Digital Control Systems. 3 Credits.
Analysis and application of computer models for semiconductor process and device simulation. Strategies for development of device models for circuit simulation. Prerequisite: EE 262; Instructor permission.
EE 341. ST: Electromagnetic Field Theory. 3 Credits.
For advanced students in the field of electromagnetism. Topics selected from special interests of staff with lectures and readings from current literature.

EE 352. Adv Semiconductor Device Physics & Design. 3 Credits.
MOSFET, bipolar, and CMOS device parameters, their characterization, and their relation to process technology. Description and use of computer-aided process and device models. Prerequisite: EE 262. Alternate years. Spring semester.

EE 354. MOS Analog Integrated Circuit Design. 3 Credits.
Analysis and design of MOS analog integrated circuits. Each student will design, layout, test, and document an analog integrated circuit using computer-aided-design techniques. Prerequisite: EE 338, EE 339.

EE 365. Optoelectronic Devices. 3 Credits.
Optical and electro optical properties of semiconductors. Applications to photodetectors, solar cells, light emitting diodes and lasers. Prerequisites: EE 142, EE 261.

EE 366. Solid State & Semiconductor Theory I. 3 Credits.

EE 371. Estimation Theory. 3 Credits.

EE 373. Advanced Topics in Communications. 3 Credits.
Advanced topics of current interest in communication systems. Topics may include channel coding/decoding, software radio, ad-hoc networks, wireless systems, etc. Prerequisites: EE 273 or Instructor permission.

EE 391. Master's Thesis Research. 1-18 Credits.

EE 392. Master's Project. 1-3 Credits.
Master’s Project.

EE 395. Advanced Special Topics. 1-6 Credits.
Advanced topics of current interest in electrical engineering. Prerequisite: Instructor permission.

EE 491. Doctoral Dissertation Research. 1-18 Credits.