ELECTRICAL ENGINEERING
http://www.uvm.edu/~cems/soe/

OVERVIEW
The Electrical Engineering (EE) program at the University of Vermont is at the forefront of research in the areas of digital signal processing, control systems, power and energy systems, wireless communications, and electronic circuit and system design and testing. This rigorous and focused program offers competitive funding and prepares graduate students for careers in research and technical leadership. Graduate students can contribute to interdisciplinary research within a broad range of applications, including power/energy, biomedical, aerospace, and transportation. In addition, the EE program partners with other academic units to offer M.S. and Ph.D. degrees in Materials Science and a Ph.D. degree in Biomedical Engineering.

DEGREES
- Electrical Engineering AMP (http://catalogue.uvm.edu/graduate/electricalengineering/electricalengineeringamp/)
- Electrical Engineering M.S. (http://catalogue.uvm.edu/graduate/electricalengineering/electricalengineeringms/)
- Electrical Engineering Ph.D. (http://catalogue.uvm.edu/graduate/electricalengineering/electricalengineeringphd/)

FACULTY
Almassalkhi, Mads; Associate Professor, Department of Electrical and Biomedical Engineering; PHD, University of Michigan
Bates, Jason H. T.; Professor, Department of Electrical and Biomedical Engineering; DSC, Canterbury University; PHD, University of Otago
Duffaut Espinosa, Luis; Assistant Professor, Department of Electrical and Biomedical Engineering; PHD, Old Dominion University
Frolik, Jeff L.; Professor, Department of Electrical and Biomedical Engineering; PHD, University of Michigan
Hines, Paul D.; Professor, Department of Electrical and Biomedical Engineering; PHD, Carnegie Mellon University
Jangraw, David; Assistant Professor, Department of Electrical and Biomedical Engineering, PhD, Columbia University
McGinnis, Ryan; Assistant Professor, Department of Electrical and Biomedical Engineering; PHD, University of Michigan
Ossareh, Hamid-Reza; Assistant Professor, Department of Electrical and Biomedical Engineering, PHD; University of Michigan
Wshah, Safwan; Assistant Professor, Department of Computer Science; PHD, State University of New York at Buffalo
Xia, Tian; Professor, Department of Electrical and Biomedical Engineering; PHD, University of Rhode Island

Courses
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. Credit not given for more than one of the courses EE 110, EE 210. Prerequisite: EE 171 or ME 111. Cross-listed with: ME 210.

EE 211. Real-Time Control Systems. 3 Credits.
Digital control systems analysis and design. Topics include: difference equations, the Z-transforms, discrete-time transfer functions, state-space models, sampled-data systems, discretization, and optimal control. Project-based final. Prerequisites: A grade of C- or better in either EE 110 or EE 210 or ME 210.

EE 215. Electric Energy Systems Analysis. 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 122 (preferred) or MATH 124.

EE 217. Smart Grid. 3 Credits.
Smart Grid: Using information/communication technology to modernize electric power/energy systems, including generation, transmission, distribution and consumption. Electricity physics/economics/policy; renewable energy; energy storage; demand response; energy efficiency; distributed generation; advanced metering infrastructure; distribution automation; microgrids; synchrophasors; HVDC and FACTS systems. Prerequisite: EE 113 or Graduate standing. Co-requisite: EE 215 recommended.

EE 218. Power Electronics. 3 Credits.
An introduction to the field of power conversion using power electronics devices. Topics include Energy and Power, AC-to-DC Converters, DC-to-DC Converters, DC-to-AC Converters, Elements of Control and Design of Power Converters, Applications of Power Electronics in Renewable Energy and Microgrids. Simulations and experiments illustrate concepts. Final project related to renewable energy. Prerequisites: EE 120 or Graduate student standing.

EE 221. Digital VLSI Circuit Design. 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. Prerequisites: EE 120. Pre/co-requisites: EE 131.

EE 222. Analog VLSI Circuit 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: Instructor permission.

EE 226. RF Circuit Design. 3 Credits.
An introduction to the design and analysis of active and passive radio frequency and microwave circuits. Topics include radio frequency and microwave circuit analysis, measurement methods, transmission line structures, matching networks, computer-aided analysis and design. Prerequisites: EE 120, EE 121.
EE 227. Biomedical Instrumentation. 3 Credits.
Measurement techniques for biomedical engineering research and industry, and health care institutions. Integrated biomedical monitoring, diagnostic, and therapeutic instrumentation. Prerequisite: EE 100 or EE 004 or EE 021 or EE 075. Co-requisites: EE 120, ANPS 020, or Instructor permission. Cross-listed with: BME 227.

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. Interface electronics, system grounding and shielding methods. Prerequisite: EE 101 or EE 120.

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; EE 134 or CS 121.

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. Prerequisite: EE 231.

EE 261. Semiconductor Materials/Device. 3 Credits.
Energy band theory, effective mass, band structure and electronic properties of semiconductors. Transport of electrons and holes in bulk materials and across interfaces. MOSFETs, BJTs, pn junctions, and Schottky barriers. Prerequisite: EE 120 or Graduate Student standing.

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. Prerequisite: Graduate student standing or STAT 151.

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

EE 279. Wireless Sensor Networks. 3 Credits.
Applications of and technologies behind wireless sensor networks. A systems-level perspective that integrates wireless networking, antennas, radio frequency circuitry, sensors, digital signal processing, embedded systems, and energy. Term project. Prerequisite: EE 171 or Instructor permission.

EE 301. System Theory. 3 Credits.

EE 302. Stochastic Processes. 3 Credits.
Probability theory, random variables and stochastic processes. Response of linear systems to random inputs. Applications in engineering. Prerequisites: EE 171 or ME 111; and STAT 151 or STAT 143.

EE 303. Convex Optimization. 3 Credits.
Provides advanced mathematical tools to recognize optimization problems from applications, presents rigorous theory of convex optimization with an emphasis on results that are helpful for implementation/computation/modeling, providing student with the experience and understanding necessary to use the tools in their own research work or applications. Prerequisites: Linear Algebra, Multi-variable calculus, Graduate student standing.

EE 314. Nonlinear System Theory. 3 Credits.
Basic nonlinear methods including computational and geometrical techniques for analysis of nonlinear systems. Describing function methods and bifurcation and catastrophe theory. Sensitivity and stability considerations. Prerequisite: MATH 230 or MATH 271. Pre/Co-requisites: EE 301 recommended.

EE 371. Estimation Theory. 3 Credits.

EE 391. Master's Thesis Research. 1-18 Credits.
EE 392. Master's Project. 1-3 Credits.
Master’s Project.

EE 393. Graduate Seminar. 1 Credit.
Presentation and discussion of advanced problems, research, and current topics in Electrical Engineering by faculty, graduate students, and outside guest speakers.

EE 395. Advanced Special Topics. 1-18 Credits.
Advanced topics of current interest in electrical engineering. Prerequisite: Instructor permission.

EE 491. Doctoral Dissertation Research. 1-18 Credits.
EE 496. Advanced Special Topics. 1-18 Credits.
See Schedule of Courses for specific titles.