ENERGY/ENVIRONMENT/ECONOMICS (E3)

Faculty Directors

Mechanical, Materials, and Aerospace Engineering

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The ongoing evolution of the energy system and related global, environmental, and economic issues make necessary a new interdisciplinary approach to the education of energy-industry engineers and management professionals, as well as to the planning and performance of energy research and development. The petroleum, coal, natural gas, nuclear, renewable, and electric utility industries and associated resource and raw material extraction, equipment design and manufacturing, and construction industries, are facing not only technological change and environmental constraints, but also drastic changes in the economic, institutional, and trade environments in which they operate.

The university's Energy/Environment/Economics (E^3) program was developed to respond to the rapidly changing needs of the energy industry by providing the interdisciplinary research and training required to produce a new breed of engineer—one who specializes in energy technologies and who understands the associated environmental issues and economic forces that drive technology choice.

The E^3 specialization requires an interdisciplinary thesis in an E^3 area of research for M.S. and Ph.D. degrees, and an interdisciplinary graduate project for professional master's degrees. Graduate students in E^3 should also be enrolled in fundamental courses related to the topics of energy, environment, and economics. E^3 is designed primarily for students majoring in chemical and environmental, mechanical and aerospace, or electrical engineering who are planning careers in energy-related fields. This interdisciplinary training prepares students to be not only creative and expert in a specialized area of energy extraction, conversion, or utilization, but also to possess a broad knowledge base of different energy sources, environmental issues related to energy extraction, conversion and utilization, and of the impact of industrial ecology principles on the design and operation of energy systems. Furthermore, students will gain sufficient knowledge of economic and regulatory issues to enable them to make more viable technology choices.

Research Centers, Facilities, and Areas

Students should consult descriptions in the respective departments:

- Electrical and Computer Engineering

General Degree Requirements

Students pursuing a master's degree are required to take 30-32 credit hours beyond the requirements of a B.S. degree program. The Ph.D. program requires 84 credit hours beyond the bachelor of science. The curriculum consists of two components: department core courses that provide a strong background in basic principles of the chosen engineering field and E^3 specialization courses. The following section details the E^3 course requirements for the professional master's, M.S., and Ph.D. degrees in environmental engineering, mechanical and aerospace engineering, and electrical engineering. Selected E^3 undergraduate courses may be substituted for graduate courses with the approval of the designated adviser, if the total undergraduate credit hours for the professional master's or M.S. degree do not exceed departmental constraints.

Students are also required to attend interdisciplinary seminars during their first and/or second semesters, which are offered as part of the regular graduate seminars by the Department of Mechanical, Materials, and Aerospace Engineering and the Department of Electrical and Computer Engineering. A student completing a M.S. or Ph.D. thesis or professional master's project will be a member of an interdisciplinary research team consisting of professors and students from environmental, electrical, and mechanical engineering backgrounds, working in a cross-disciplinary group project. Each interdisciplinary team must include professors from different departments.

Policies and procedures regarding admission, advising, financial aid, and comprehensive examinations are established by the individual departments offering this program.

Admission Requirements

Students should consult listings in the respective departments:

- Electrical and Computer Engineering
- Mechanical, Materials, and Aerospace Engineering

Degrees Offered

Professional Master's/Master of Engineering

- Master of Electrical and Computer Engineering with E3 Specialization
- Master of Engineering in Environmental Engineering with E3 Specialization

Master of Science

- Master of Science in Electrical Engineering with E3 Specialization

Doctor of Philosophy

- Doctor of Philosophy in Electrical Engineering with E3 Specialization

E3 Courses

See descriptions under the respective department's course listings.

Group A

CHE 536	Computational Techniques in Engineering	3
CHE 541	Renewable Energy Technologies	3
CHE 542	Fluidization and Gas-Solids Flow Systems	3
CHE 565	Fundamentals of Electrochemistry	3
ECE 550	Power Electronic Dynamics and Control	3
ECE 551	Advanced Power Electronics	3
ECE 552	Adjustable Speed Drives	3
ECE 553	Power System Planning	3
ECE 554	Power System Relaying	3
ECE 555	Power Market Operations	3
ECE 557	Fault-Tolerant Power Systems	3
ECE 558	Power System Reliability	3
ECE 559	High Voltage Power Transmission	3
ECE 560	Power Systems Dynamics and Stability	3
ECE 561	Deregulated Power Systems	3
ECE 562	Power System Transaction Management	3
ECE 563	Artificial Intelligence in Smart Grid	3
ECE 564	Control and Operation of Electric Power Systems	3
MMAE 517	Computational Fluid Dynamics	3
MMAE 520	Advanced Thermodynamics	3
MMAE 522	Nuclear, Fossil-Fuel, and Sustainable Energy Systems	3
MMAE 523	Fundamentals of Power Generation	3
MMAE 524	Fundamentals of Combustion	3
MMAE 525	Fundamentals of Heat Transfer	3
MMAE 526	Conduction and Diffusion	3
MMAE 527	Heat Transfer: Convection and Radiation	3

Group B

CHE 541	Renewable Energy Technologies	3
CHE 560	Statistical Quality and Process Control	3
ENVE 501	Environmental Chemistry	3
ENVE 506	Chemodynamics	3
ENVE 542	Physicochemical Processes in Environmental Engineering	3
ENVE 551	Industrial Waste Treatment	3
ENVE 561	Design of Environmental Engineering Processes	3
ENVE 570	Air Pollution Meteorology	3
ENVE 577	Design of Air Pollution Control Devices	3
ENVE 578	Physical and Chemical Processes for Industrial Gas Cleaning	3
ENVE 580	Hazardous Waste Engineering	3