

# DOCTOR OF PHILOSOPHY IN ELECTRICAL ENGINEERING WITH SPECIALIZATION IN ENERGY/ENVIRONMENT/ ECONOMICS (E3)

## Curriculum

Requirement	Credits
Minimum Credits Required	72
Minimum 500-level+ ECE Course Credits	15
Maximum Transfer Credit	32

Code	Title	Credit Hours
<b>E3 Courses</b>		<b>(18)</b>
CHE 543	Energy, Environment, and Economics	3
Select a minimum of five courses from Groups A and B		15
<b>Ph.D. Research</b>		<b>(24-36)</b>
ECE 691	Research and Thesis for Ph.D. <sup>1</sup>	24-36

<sup>1</sup> Dissertation research topic must be in an interdisciplinary E3 area.

Candidates must pass written qualifying and comprehensive examinations and must defend their thesis in an oral examination. The Ph.D. committee for E3 students must include at least one professor with specialization in an energy and sustainability area from outside the student's department.

## 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