

# ENERGY SYSTEMS AND SUSTAINABILITY ENGINEERING

The MSE in Energy Systems and Sustainability Engineering (ESSE) program offered through the Electrical and Computer Engineering Department is designed to provide systems-based knowledge in energy systems and sustainability through five core courses and in-depth knowledge from two concentration areas (energy systems concentration and sustainability concentration). The core courses deal with sustainable energy sources, energy generation, energy storage, energy and environmental policies, and distributed power systems. The concentration courses can be selected from a range of courses offered in two concentration areas (1. energy systems, 2. sustainability). In addition, students need to fulfill the professional elective requirement (6 credit hours) in two ways: by selecting a thesis option or by taking two CECS graduate courses.

The degree requirement for this program consists of a minimum of 30 graduate-level semester credit hours (beyond an undergraduate degree from an accredited engineering program) with a minimum cumulative grade point average of 3.0 (on a 4-point scale). Courses in which grades of C- or below have been earned cannot be used to fulfill degree requirements. Students may be placed on probation if their cumulative GPA falls below 3.0. A minimum cumulative GPA of 3.0 is required to be eligible to receive the MSE (ESSE) degree.

This program can be completed fully online, in person, or a combination of both.

The proposed curriculum requires 30 credit hours of graduate studies to complete the program.

All ESSE students are required to take three core courses (9 credit hours):

## Requirements

Code	Title	Credit Hours
<b>I. Core Courses (9 credits)</b>		
Select three courses from the following:		
ESE 500	Sustainable Energy Systems	3
ESE 501	Energy Conversion	3
ESE 502	Energy Storage Systems	3
ESE 505	Ecosystem Engineering and Management	3
ESE 510	Sustainability Science and Engineering	3

## II Concentration Courses (15 credits)

The program has two concentration areas (Concentration 1: Energy Systems; Concentration 2: Sustainability). **Each student must declare a concentration based on his/her interests and background and students need to elect at least four courses from their selected concentration area.** If only four courses are elected from the selected concentration, the fifth can be any course in another concentration or a core course that is not elected for the core requirement.

## III Professional Electives (6 Credits)

Students may complete the professional elective requirements in two ways:

Code	Title	Credit Hours
<b>Option 1: Thesis - Work under the supervision of a faculty advisor; It will count for six (6) credit hours of graduate coursework and will extend for at least two terms.</b>		
ESE 699	Master's Thesis	6
<b>Option 2: Additional CECS Courses</b>		
Take two additional CECS graduate courses (any CECS graduate level courses excluding ENGR 500/ENGR 501, 6 credits).		

## Concentrations

Students must declare one on the following concentrations:

### Energy Systems Concentration

15 credit hours required

Code	Title	Credit Hours
<b>Concentration Courses</b>		
Energy Systems Courses - Select a minimum of four courses from the following:		
AENG 576	Battery Systems, Modeling, and Control	3
ECE 517	Adv Pwr Electrncs&Motor Drvs	3
ECE 519	Adv Topics in EMC	3
ECE 542	Intr to Pwr Mgmt & Reliability	3
ECE 615	Advanced Power Electronics	3
ECE 616	Advanced Topics in Power Sys	3
ECE 618	Advanced Grid Protection	3
ECE 5421	Grid Communication and System	3
ECE 5422	Grid Protection	3
ECE 5424	Data Analytics and Machine Learning for Power Systems	3
ME 592	Fundamentals of Fuel Cells	3
<b>If only four courses are elected from the above concentration list, the fifth can be any course from the following list or a core course that is not elected for the core requirement.</b>		
AENG/ME/ESE 578	Advanced Vehicle Energy Systems	3
BIOL 522	Conservation Biology	3
CHEM 548	Environmental Chemistry	3
ESCI 574	Watershed Analysis	3
ESE 503	Energy Policy, Econ & Environ	3
ESE 504	Energy Eval/Risk&Optimization	3
IMSE 5205	Eng Risk-Benefit Analysis	3
ME 598	Engine Emissions	3
Core Course List		
ESE 500	Sustainable Energy Systems	3
ESE 501	Energy Conversion	3
ESE 502	Energy Storage Systems	3

ESE 505	Ecosystem Engineering and Management	3
ESE 510	Sustainability Science and Engineering	3

## Sustainability Concentration

15 credit hours required

Code	Title	Credit Hours
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### Concentration Courses

Sustainability Courses - Select a minimum of four courses from the following:

AENG/ME 557	Sustainable Fuels for Transportation	3
AENG/ME/ESE 578	Advanced Vehicle Energy Systems	3
BIOL 522	Conservation Biology	3
CHEM 548	Environmental Chemistry	3
ESCI 574	Watershed Analysis	3
ESE 503	Energy Policy, Econ & Environ	3
ESE 504	Energy Eval/Risk&Optimization	3
IMSE 5205	Eng Risk-Benefit Analysis	3
ME 598	Engine Emissions	3

**If only four courses are elected from the above concentration list, the fifth can be any course from the following list or a core course that is not elected for the core requirement.**

AENG 576	Battery Systems, Modeling, and Control	3
ECE 517	Adv Pwr Electrncs&Motor Drvs	3
ECE 519	Adv Topics in EMC	3
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ECE 615	Advanced Power Electronics	3
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ECE 5421	Grid Communication and System	3
ECE 5422	Grid Protection	3
ECE 5424	Data Analytics and Machine Learning for Power Systems	3
ME 592	Fundamentals of Fuel Cells	3

### Core Course List

ESE 500	Sustainable Energy Systems	3
ESE 501	Energy Conversion	3
ESE 502	Energy Storage Systems	3
ESE 505	Ecosystem Engineering and Management	3
ESE 510	Sustainability Science and Engineering	3