

# ECE 6541: Advanced Topics in Sustainable Energy and Power Systems

## Course Description

Advanced topics in sustainable energy and power systems; basic issues and solutions to sustainable energy; the concept of smart grid; cyber control and security.

**Transcript Abbreviation:** Adv Sus En & Pwr

**Grading Plan:** Letter Grade

**Course Deliveries:** Classroom

**Course Levels:** Undergrad, Graduate

**Student Ranks:** Masters, Doctoral

**Course Offerings:** Spring

**Flex Scheduled Course:** Never

**Course Frequency:** Every Year

**Course Length:** 14 Week

**Credits:** 3.0

**Repeatable:** No

**Time Distribution:** 3.0 hr Lec

**Expected out-of-class hours per week:** 6.0

**Graded Component:** Lecture

**Credit by Examination:** No

**Admission Condition:** No

**Off Campus:** Never

**Campus Locations:** Columbus

**Prerequisites and Co-requisites:** 5025 (624) or 724

**Exclusions:** No open to students with credit for 5541.

**Cross-Listings:**

**Course Rationale:** Existing course wing renumbered to graduate-only level

**The course is required for this unit's degrees, majors, and/or minors:** No

**The course is a GEC:** No

**The course is an elective (for this or other units) or is a service course for other units:** Yes

**Subject/CIP Code:** 14.1001

**Subsidy Level:** Doctoral Course

## Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

## Course Goals

Be familiar with different means of integrating solar and wind energy into the electric power grid
Master different techniques to control the power converters in solar and wind based electricity generation
Be competent with the common issues for grid-tied inverters
Be competent with the basic principles of energy conversion by different types of electric machines for wind energy
Master Matlab/Simulink Power Systems Toolbox or other modern simulation tools for electric power

## Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Energy composition in historical prospective	3.0							
Discussion of energy consumption and environmental impact	3.0							
Solutions to energy sustainability: fossil and green energy	3.0							
Modeling of micro-grids and distributed generation system	3.0							
Energy source and energy yield of photovoltaic modules	3.0							
Modeling of PV power plants with smart grid connection	3.0							
Control and grid-connection of PV power plants in mega-watts	3.0							
Energy source and energy yield of wind turbine generators (WTG)	3.0							
Doubly-fed induction machine and direct-driven PM machine WTGs	3.0							
Modeling of WTG power plants with smart grid connection	3.0							
Control and grid-connection of WTG farms in mega-watts	3.0							
Interfacing issues of renewable energy system to conventional power grid	3.0							
Energy storage systems	3.0							
Case studies on energy storage system in smart grid system	3.0							
Cyber control and cyber security issues/solutions to energy systems	3.0							

## Representative Assignments

Homework
Term project in computer simulations

## Grades

Aspect	Percent
Exams - 1 during semester + final	50%
homework	15%
term project in computer simulation	30%
written paper(s) & possible in-class presentation	5%

## Representative Textbooks and Other Course Materials

Title	Author
<i>Renewable and Efficient Electric Power Systems</i>	Gilbert Masters

## ABET-EAC Criterion 3 Outcomes

Course Contribution	College Outcome
***	a An ability to apply knowledge of mathematics, science, and engineering.
*	b An ability to design and conduct experiments, as well as to analyze and interpret data.

Course Contribution		College Outcome
*	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
***	e	An ability to identify, formulate, and solve engineering problems.
*	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.
**	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
**	i	A recognition of the need for, and an ability to engage in life-long learning.
**	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

### Additional Notes or Comments

Corrected abbreviation, course description, prereqs, exclusions, CIP code. Broke up compound course topics to one topic per line

Delete exclusions an prior course numbers of 643, 743. 9/10/12

Add textbook 9/1/12

Renumber to 6541, expand course goals, and change prereq to 5025 per ABET review 5/14/14  
BLA

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