ECE 5140
Electrical Energy Engineering
Syllabus/Schedule

Semester: Fall 2016	**Section:** 001	**CRN:** 42501	**Credits:** 3

Catalog Description: Introduction to electrical energy and power sources, distribution and consumption; economics, device, instrumentation, and systems analysis/design.

Prerequisites: Sophomore physics & mathematics; electromagnetics

Class Outcomes: Gaining factual knowledge, learning fundamental principles, learning to apply course material, developing specific skills and competencies, learning how to find and use engineering resources, learning to analyze and critically evaluate in the following areas: electric power generation and distribution from solar, chemical, mechanical, hydrocarbon, hydro, nuclear, wind, geothermal, and oceanic energy sources.

- Learn to model electrical energy system architectures
- Be able to use system models to analyze the performance of electrical energy systems
- Gain experience in the design of electrical energy systems
- Understand the operation of energy conversion subsystems & devices

Course Objectives:

- Beneficial productive careers
- Lifelong learning
- Commitment to IEEE professional code of ethics

Text: Baker, D. J. *Electrical Energy Engineering*, ECE Department, College of Engineering, 3rd edition, Utah State University, August 2012.
Guidelines and Standards for lab notebooks, Rose-Hulman Institute.

References: Abdullah, M.O., *Applied Energy: An Introduction*, CRC Press, 2012. **ISBN-13:** 978-1439871577
Nelson, V., *Introduction to Renewable Energy*, CRC Press, 2011. **ISBN-13:** 978-1439834497
Patel, M.R., *Wind and Solar Power Systems*, Taylor & Francis, 2006. **ISBN-13:** 978-0849315701
Wildi, T., *Electrical Machines*, Prentice Hall, 2005. **ISBN-13:** 978-0131776913

Tiwari, G.N., *Fundamentals of Renewable Energy Sources,* Alpha Science International, Ltd., 2007. **ISBN-13:** 978-1842653975		
Classroom: ENGR-307 **Lab:** EL-104 or EL-202 on a Friday	**Time:** MWF 9:30-10:20 a.m.	Homework Google
Field Trips: Solar plant, Hydroplant, and Gas-fired plant	**Time:** Scheduled during class time on Fridays	
TA: Qun (Claud) Wang wangqun_claud@126.com	Scientific Calculator	
Faculty Contact: doran.baker@usu.edu		

Date		Topic	Reading	Assignment Due Date
WEEK #1		ENERGY	Chapter 1	Problems
Aug 29	M	Introduction	Encyclopediaa Campus Weather Station Campbell Sci Solar Array	---
31	W	Electrical energy	DigitalDutch Energy Converter Index of energy animations	ONE: 1-1 & 1-2
Sep 2	F	Electromagnetic energy and power	Electromagnetic Waves, D.J. Baker Book Section	TWO: 1-4 &1-6

WEEK # 2		ELECTRICAL ENERGY	Chapter 2	
5	M	LABOR DAY NO CLASS		---
7	W	Electromagnetic power		THREE: 1-8 & 2-1
9	F	Field Trip #1 - Campbell Scientific Field Trip	Larry Shirk	FOUR: 3-2 & 3-3
WEEK # 3		SOLAR ENERGY	Chapter 3	
12	M	Solar irradiance	Solar Calculator	FIVE: 3-13
14	W	Solar spectrum	PVEducation IV Curve USC Solar Cell I-V Curves and Equivalent n-p Junction Solar Cell	SIX: 3-4 & 3-5
			Solar cell spectral response	
16	F	Lab #1: Solar Power Experiment	Measurement items	SEVEN: 3-6 & 3-8
WEEK # 4		SOLAR POWER	Solar power plant	
19	M	Solar power systems		EIGHT: 3-22 & 3-26

21	W	Thermal solar power	Nellis Solar Plant	NINE
			PN junction properties calculator	
23	F	Field Trip #2 -- USU First Dam Generating Station (Reid Olsen)	Review	TEN
WEEK # 5		CHEMICAL ENERGY	Chapter 4	
26	M	Quiz #1	Chapters 1-3	-NONE-
28	W	Chemical conversions Read Chapter 4	Electropaedia All about Batteries	ELEVEN
30	F	Chemical Cells and Batteries	Battery University Battery Table Energy densities GP Batteries Convert mAh to Wh All about batteries tables Table of Constants	TWELVE
WEEK #6		ELECTROMECHANICAL GENERATORS	Chapter 5	
Oct 3	M	AC Generators	Read Chapter 5	THIRTEEN
			Electric Motors and Generators	

			Electric Machines	
5	W	Three-phase generators and alternators	Review phasors Convert RPM to hertz	FOURTEEN
7	F	DC generators	 Forge blower & AC motor from forge in basement of USU Old Main	FIFTEEN
WEEK # 7		ELECTRICAL TRANSMISSION	Chapter 6	
10	M	Electrical grid Read Chapter Six	Logan City Grid	SIXTEEN
12	W	Distribution systems Complex Power		SEVENTEEN
			Equivalent Circuit of Transformer Electric Transformer Action	---
14	F			---
WEEK # 8		HYDROCARBON ENERGY	Chapter 7	

17	M	Fossil fuel	Heats of Formation	None
			Heat of Formation Table	
19	W	Natural Gas Fuel	Animated heat & power	Thirty-three & thirty-four
20	Th	Field trip #3 - USU Central Energy Plant	Central Energy Plant Map	EIGHTEEN
21	F	FALL BREAK		
WEEK # 9				
24	M	Finish reading Chapter 7	Standard Enthalpy Table	NINETEEN
26	W	Natural gas fuel	Carnot Cycle Heat of Combustion Calculator	TWENTY
38	F	Hydrocarbon sources		TWENTY ONE
WEEK # 10		HYDROELECTRIC ENERGY	Chapter 8	
31	M	Hydrocarbon systems Distribute take-home Quiz #2		TWENTY TWO

			Animated hydroelectric power plant	
Nov 2	W	Hydropower review & start nuclear	Hydroelectric Dam	TWENTY THREE
4	F	Nuclear systems Submit take-home Quiz #2		TWENTY FOUR
WEEK # 11		NUCLEAR ENERGY	Chapter 9	
7	M	Fission power	Periodic table of elements Animation of nuclear fission	TWENTY FIVE
			Neutron cross-section Neutron spectra	
9	W	Reactors & Fusion power	Fission reactor Moderators	TWENTY SIX
			Nuclear chain reaction First reactor Nuclear stability Nuclear fusion animation	
11	F	Dr. Edwards presentation	Radiometry & Detectors Class, Spring 2016	TWENTY SEVEN

WEEK # 12		WIND ENERGY	Chapter 10	
14	M	Wind power	Wind Turbine	NONE
16	W	Wind turbine	U.S. Wind Resources	TWENTY EIGHT
18	F	Lab #2 Wind Energy	Air Density	TWENTY NINE
WEEK # 13		GEOTHERMAL ENERGY	Chapter 11	
21	M	Geothermal power Demo steam engine	Geothermal Uses Geothermal Energy Blundell Geothermal Plant Animation of Geothermal Plant	THIRTY
23	W	THANKSGIVING HOLIDAY		---
25	F	THANKSGIVING HOLIDAY		---
WEEK # 14		OCEANIC ENERGY	Chapter 12	
28	M	Oceanic power	OTEC Tidal Energy Barrage	THIRTY ONE

30	W	Systems Engineering	Pelamis Ocean Currents	THIRTY TWO
Dec 2	F	Energy Sources		THIRTY THREE
WEEK # 15				
5	M	Overview	Total cost of electricity production The Systems Engineering Process	THIRTY FOUR
7	W	Overview	Bring lab books	
9	F	Dr. Pantic presentation	Last Day of Classes	
WEEK # 16		**Finals Week**		
		Final Exam	EN-307 9:30 - 11:20 am	
Final Exam ***, December 9:30-11:20 a.m. ENGR-307***			**Tentative Component Grade Weighting** Participation = 15% Lab Experiments = 10% Lab Book Quality = 5% Homework = 25% Quizzes = 25% Final Exam = 20%	