

Fall 2013

BE 4989: SUSTAINABLE ENERGY ENGINEERING

BE 7909: ENERGY CONSERVATION AND RENEWABLE ENERGY ENGINEERING

2012-13 Catalog Description: Advanced Topics in Biological Engineering
One or more phases of advance biological engineering practice.

Credit: 3 hr Credit. 2 hrs. lecture, 3 hrs. lab.

Prerequisites: None. But please talk to the instructor if you do not have any thermo/transport/bio-reactor background (such as BE 4352 or BE 4341 or ME 3333 or CHE 3102 or equivalent classes). Instructor will cover the basics during the first 2 lab periods for student without thermo/transport/bioreactor background.

Required Textbook: None required. Partial notes will be passed out before each class. Some lecture and lab material may be posted on moodle (<http://moodle2.lsu.edu>).

References:

- Energy Systems Engineering, Evaluation & Implementation. Francis M. Vanek and Louis D, Albright. McGraw-Hill Companies, Inc., 2008, USA.
- Sustainable Energy, Choosing Among Options. Jefferson W. Tester, Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay, William A. Peters, The MIT Press, 2005.
- Energy Systems and Sustainability, Power for a Sustainable Future. Godfrey Boyle, Bob Everett, and Janet Ramage, Oxford University Press, 2004.
- Renewable Energy, Power for a Sustainable Future. Godfrey Boyle, Oxford University Press, 2004.
- The Renewable Energy Handbook, A Guide to Rural Energy Independence, Off-Grid and Sustainable Living. William H. Kemp., Aztext Press, Ontario, Canada. 2005.
- The Homeowner's Guide to Renewable Energy. Dan Chiras. New Society Publishers, Gabriola Island, Canada. 2007.
- Energy-Efficient Building. Kevin Ireton, The Taunton Press, Connecticut, USA, 1999.
- Biomass for Renewable Energy, Fuels, and Chemicals. Donald L Klass., Academic Press, California, 1998.
- Datta, A.K. 2002. Biological and Bioenvironmental Heat and Mass Transfer. Marcel Dekker, Inc., New York, NY. ISBN: 0-8247-0775-3*.
- Asenjo, J. and Merchuk, J. 1995. Bioreactor Systems Design. Marcel Dekker, Inc. NY. ISBN:0824790022
- Van Riet, K. and Tramper, J. 1991. Basic Bioreactor Design. Marcel Dekker, Inc. New York, NY. ISBN 0824784464.
- Catalysis for Renewables: From Feedstock to Energy Production. Wiley-VCH, 2007.

Class Schedule: **Lecture:** 4:40 – 6:30 PM Tuesday, Room 115 EB Doran
Laboratory: 4:40–7:30 P.M. Thursday, 115/118/142 BAE/Ag. Metal Bldg

Instructor: Chandra S. Theegala, Associate Professor
Biological and Agricultural Engineering
Office Location: Room 161, E.B. Doran Bldg., Office Phone: 225-578-1060
Office Hours: 10:30 AM – 11:30 PM Monday; 10:30 AM – 11:30 PM Tuesday
Other times are ok – Please schedule before you come.
E-mail: theegala@lsu.edu

Course Topics and Class Schedule*:

Week of	Lecture Topics	Laboratory
Week 1 Aug 26	Course Introduction Need for conservation and sustainability; Energy history, demand, demand projections; Environmental impacts; Measures of energy. Problems.	Optional - Thermo Review – For students without BE 4352 or appropriate heat transfer background (conduction, convection, radiation)
Week 2 Sep 2	Energy Conservation/Efficiency; Introduction to energy conservation/efficiency; Energy efficiency in buildings (air heating, insulation, lighting, water heating, air conditioning, window glazing, etc.). Problems.	Optional - Thermo Review Continuation. Optional - Biological Kinetics Review – For students without BE 4341 or bioreactor background.
Week 3 Sep 9	Project Planning. Energy efficiency in transportation and industry (IC gasoline engines, diesel engines, hybrid engines, electrical motors, distillation, heat exchangers, etc). Problems.	Lab1. DASYS Lab - Data Acquisition Lab & STELLA Modeling Lab. You will need these for projects.
Week 4 Sep 16	Alternative Energy Solar Thermal; Solar – Photovoltaic. Problems.	Lab2. Vehicle Drag Challenge in Wind Tunnel Lab (competition)
Week 5 Sep 23	Wind Energy Geothermal, Hydro, Wave, Hydrogen/Fuel Cell, Other Alternative Energy. Problems.	Lab3. Insulation Challenge Lab (compete with other groups in a fun-filled environment)
Week 6 Sep 30	Biomass Energy Technologies: Pyrolysis; gasification; liquefaction; biodiesel; ethanol; methane. Feedstocks: Traditional, non-traditional including Chinese tallow and microalgae	Lab4. Solar Water Heater Challenge Lab
Week 7 Oct 7	Biomass Energy ~ Continuation. Midterm Review Problems.	Lab5. Wind Power Generation Challenge Lab
Week 8 Oct 14	Midterm Exam (best of two)	Lab6. Evaporative Cooling Challenge Lab
Week 9 Oct 21	Advanced Bioreactor Kinetics and problems.	Lab7. Pyrolysis Lab Biomass Gasifier Lab
Week 10 Oct 28	Microalgal Cultivation, Potential and Challenges. Problems.	Lab8. Microalgal Photo-Bioreactors Lab
Week 11	Biofuels (ethanol, butanol, etc). Problems.	Nov 4 wk. Fall Holiday. No lab
Week 12 Nov 11	Catalysis for Renewables and Problems.	Lab9. Bio-ethanol Lab
Week 13 Nov 18	Advanced Renewable Energy Topics/Energy Storage/Reserve Class.	Lab10. Field trip – Reserve Lab.
Week 14	Project Presentations	Nov 25th week. Thanksgiving.
Week 15 Dec 2	Project Presentations. Final Exam Review Problems. Last day of class	Lab11. Bright Ideas – Lab??
Week 16 Dec 9	Final Exam (Optional, best of two)	

*Note: Instructor reserves the right to alter the schedule during the course of the semester. However, any alterations will be clarified in the class.

Purpose of the Course

This is a graduate level course designed to help the students learn about energy needs, energy conservation, and alternative energy options. The students will also gain relevant hands-on experience through laboratory experiments and class project.

Course Objectives:

1. To familiarize students with the needs, types, sources of energy.
2. To help students understand the concepts of energy conservation and related calculations through problems, lab experiments, and a term project.
3. To educate students on various renewable energy alternatives.

Important Dates to Remember:

Last day to drop w/o "W" grade. :

Last day to add courses and make section changes:

Last day for resigning from the University and/or dropping courses (with "W"):

Last Day of Class:

Grading Scale:

90 - 100%	A
80 - 89%	B
70 - 79 %	C
60 - 69 %	D
Below 60%	F

BE 4989 Grading Policy*:

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|----|---|-----|
| 1. | Homework Assignments (20%) and
Class Participation/Attendance (5%) | 25% |
| 2. | Midterm or Final Exam (best of two) | 25% |
| 3. | Lab Participation – 6 One Page Summary Sheets (Individual) | 25% |
| 4. | Project Report/Presentation (Groups of 3) | 25% |

**Instructor reserves the right to alter the grading policy. But you will be notified in class.*

Total	100%
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BE 7909 Grading Policy*:

- | | | |
|----|---|-----|
| 1. | Homework Assignments (20%) and
Class Participation/Attendance (5%) | 25% |
| 2. | Midterm or Final Exam (best of two) | 25% |
| 3. | Lab Participation – 6 One Page Summary Sheets (Individual) | 25% |
| 4. | Project Report/Presentation (Individual effort) | 25% |

**Instructor reserves the right to alter the grading policy. But you will be notified in class.*

Total	100%
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Course Policies:

Attendance Policy: Attendance is expected. Lateness beyond 5 minutes will be considered absent. Regular lateness will not be allowed, unless you have a valid excuse. Attendance and class participation will carry up to 5% of grade (at instructor's discretion). Attendance in lab will also be counted. Regular sleeping/napping in class period will be considered as absent (zero participation).

Submission Policy: Homework and lab summary sheets must be turned in regularly and will be due on the due date announced (usually before the beginning of a class period). The format/template for the one page lab summary sheet and semester project presentation/report will be discussed in class. Penalty for late submission will be 5% for each working day (valid until graded assignment is returned). You will be allowed one late HW per semester (late by up to 5 working days).

Make-up Exam: No make-up exam will be given for scheduled exam unless the student has a legitimate excuse documented properly (e.g. letter from court clerk that he/she must appear in a court, or a letter from a physician stating that he/she is/was sick). If you know that you will be missing a class, let me know in advance.

Academic Misconduct Policy: Cheating and plagiarism will not be tolerated. The Code of Student Conduct defines cheating and plagiarism. I suggest each of you obtain a copy of this document and be familiar with its contents (<http://www.lsu.edu/judicialaffairs/code.htm>). If you have any questions/concerns about plagiarism, feel free to ask me. It is my professional, ethical obligation, as a faculty member to uphold its standards. I take this responsibility seriously and will forward the case to respective officials at LSU. Keep in mind that as a faculty I can only report (cannot take things into my hands). On all homework assignments and lab summary sheets, I am expecting independent work.

Disruptive Behavior Policy: Absolutely no cell phones and pagers. I DO NOT BRING MY CELL PHONE TO CLASS OR LAB (UNLESS IT IS AN EMERGENCY) (I am giving my undivided attention – so I am expecting the same. Facebook, twitter, chatting, browsing.....etc. will distract the student's attention and lowers the instructor's enthusiasm/morale). Avoid going in and out during class. Any behavior that will disturb the attention of fellow students or instructor should be avoided.

Lab Safety: The laboratory is potentially dangerous. A concise set of safety rules is given below. Safety rules will be strictly enforced. Violations of safety rules can lead to dismissal from the laboratory. In case of an accident call Campus Safety or Emergency for help (contact numbers given below). All accidents (even minor ones) are to be reported to Dr. Theegala or department's front office staff immediately.

Contact Numbers: Emergency: 911

Campus Safety: 578-5640

LSU Emergency Help: 578-4357

Dr. Theegala: 578-1060

Lab Safety Rules (in no particular order)

1. Never lift anything more than 50 Lbs. No group lifting allowed without instructor approval.
2. Follow proper electrical safety. Also do not assume unless you know for sure. If you do know, ask.
3. Never add water to acid.
4. Wear safety glasses and hard hats when needed (instructor will notify you)
5. Wear lab coat or appropriate clothing in the lab (no sandals, no shorts).
6. Never mouth pipette.
7. All volatiles, explosives, strong acids or bases must be handled only in the fume hood. Wear gloves while handling these compounds.
8. Do not work alone in the lab.
9. Do not eat, drink, or smoke in the lab.
10. Keep working area clean.
11. No horseplay.