ELEG – 479X (Solar Energy and Solar Cell)
Instructor: *Fahim Uddin.*
Spring 2010
Saturday 10:00 AM to 12:30 PM (Tech 116)
UNIVERSITY OF BRIDGEPORT

Office hours: By appointment (Email: muddin@bridgeport.edu)

Introduction: 3 credit hours

This course provides very good introduction and understanding of Renewable Energies while focusing mainly on Solar energy and Solar Cell. Students often have different background and level of understanding of technical concepts; therefore we will develop necessary background in this course in first few weeks and gradually move from basic to advance topics as listed below in "Class Topics" section. This course will further help by developing approach to design devices and cells and address performance and cost issues. **Behind** every invention or law or device, there is always a need, a necessity. I take students from necessity to invention. At the end of the course, students will have strong and solid background in this field in order to continue research and career in this area.

Objectives:

- Prepare for taking advance courses in Sustainable/Renewable/Electrical Engineering program offered at UB or elsewhere.
- Introduce simulation tool(s) to develop background for future "Solar Lab" course (Being planned to be offered in Fall 2010)
- Develop Communication skills with "Teacher-Student" interaction and occasional presentations.
- Understand technology and science under this area through various problems, design case studies and theoretical concepts.
- Strengthen basic-advance concepts to be prepared for advance research in future and for Job interviews.
- Get information about various companies in this field for more in depth interest.
- Understand Electronics and Electricity concepts in Solar Energy and Solar Cell design areas.
- Explore current and latest technologies in this area and discuss various issues and concepts.
- Get introduced with various Renewable Energy Technologies with class discussion and Project work.
- Get updated with new researches in this field through IEEE and various publications.
- Get updated with new tech and work in this field through webinars and newsletters etc.
- **Update students with work being done currently in city of Bridgeport and state of Connecticut with my personal experience of working with B-2020 (Bridgeport Green building Movement) in order to prepare them to get internship and Jobs locally.**

Pre-requisite:

There is no Pre-requisite but students from Electrical Engineering, Computer Engineering, Computer science, Electronics, Mechanical Engineering, Physics and Bio-Medical engineering are good fit.

Class Activity/Lecture anatomy:

Class will be conducted with friendly lectures, discussions, assignments and projects that will help students learn as much as possible. Various Videos and presentations will be shown on Projector to further illustrate theory discussed in class, as applicable.
IEEE and various publications will be given in printed form to students to read occasionally for their interests. Related websites will be introduced for further studies. Webinar links will be provided from time to time for new technologies from various companies and manufacturers via emails for student further interest.

Refreshments:

Occasional Soda and Dinner will be served from my side. (You like this part, don't you?☺)

Class topics (more or less depending on available time and class progress):

1. Quick review of electricity and related concepts.
2. Energy, Work and Power concepts including Deep look into Kinetic and Potential energy.
3. Units of Energy as applied to solar energy areas.
4. Introduction to Renewable Energy area and where we are with it in today's world.
5. Quick introduction to Non-Renewable Energy areas.
6. Quick review of Bioenergy, Coal, Electric power, Fossil fuels, Fusion, Geothermal, Hydrogen, Hydropower, Natural Gas, Nuclear, Oil, Wind, etc.
7. Understanding Main source of all energy (SUN) and its Energy production plant.
8. Understanding Sunlight and its characteristics, Light spectrum, etc.
9. Solar System Design: Electrical Load Analysis, System Wiring, Inverter and Batteries consideration, Solar Cell Modules and Arrays – CASE Studies.
10. Introduction to Semiconductor and Photoelectric effect.
11. Photovoltaic cells (Solar Cell) and physics behind it.
12. PV cell efficiency limitations and ways to improve it.
13. Solar energy conversion with minimum losses and increased efficiencies.
14. Single Junction and Multi-Junction solar cells.
15. Thin film solar cell, Crystalline Silicon solar cells, and electrochemical PV cells.
16. Introduction to Plants: Si Crystal Growing or Casting Plants, Solar cell Plants, Module Assembly Plants, Systems Assembly.
17. Uses of Solar energy: Residential and Industrial applications.
18. Introduction to Research areas: PV, CSP and Solar Radiation.
19. Solar hybrid systems.
20. Solar Thermal and Concentrated Solar Power and its types (Trough, Dish, Tower, etc)
21. Introduction to "Solar Cell and Optical Fiber".
22. Solar Paint.
23. Solar Hydrogen.

Required Text:

- I don't require any particular text book but students are more than welcome to read related books as they feel. Some books will be suggested during class introduction.
- I provide sets of handouts to every student to cover today's work
- Students can use UB website to read books and try the website like www.scribd.com

Assignments, Project and Exam:

- Two exams will be conducted (1. Midterm, 2. Final)
- Group Project will be given (Group members need to be 2 or 3). Normally, I assign one Renewable Energy area to each group where they present Phase 1, 2 and 3 using PowerPoint presentations. I ask them set of questions for their research in books and web that provide them excellent opportunity to learn about their area and then I share each group work with every other group at the end of course for their future research and references.
- Home assignments are given occasionally and will be expected to be submitted on time unless if emergency or legitimate/valid reason is provided by student.

Communication:

- I usually send an email a day before the lecture to give reminders for home works and topics as applicable and an email after the lecture to summarize today's class activity.
- Students are **not** supposed to reply to above emails just to say "thank you" or so.
- Students can email me back with their questions if any. My response time is approximately 10-15 minutes during business hours and 30-60 minutes during evenings and before midnight.
- Students can ask questions during lecture and/or after it as time allows.

Grades and Class attendance:

- Students will earn good grades with their contribution to exam, Project and homework.
- Attendance is not required but highly recommended. Exam attendance is must.

Good Luck and remember Wise saying "***Quality is never an accident. It is always the result of an intelligent effort***" - John Ruskin