IE 4395/5390; MECH 4395/5390

Special Topic: Green Energy Materials and Manufacturing

Course Syllabus

Summer, 2014

Instructors: Drs. Bill Tseng, Norman Love, and Yirong Lin
Locations: CCSB G.0208
Time: MTWRF 9:30 am – 10:35 am
Offices: Engineering Annex A215 (Dr. Tseng), A110 (Dr. Love), and A 111 (Dr. Lin)
Email/Phone: btseng@utep.edu; ndlove@utep.edu; and ylin3@utep.edu
Office Hours: MW 12:00 pm to 1:00 pm
TA: Aditya Akundi (Module -1), Rashedul Sarker (Module-2), Ricardo Martinez (Module-3)
Email: sakundi@miners.utep.edu, mhsarker@miners.utep.edu, rmartinez38@miners.utep.edu,
TA Office Hours: MW 12:00 pm to 1:00 pm

Text: Background material and Power Point slides available on the course website (Blackboard).

Prerequisite: Permission of instructors

Course Objective:
This course focuses on several themes that combine renewable energy design and manufacturing with cyber-infrastructure issues, and provides diverse and rich content to the students about how research in the area of nano-material, manufacturing, and building systems can be transformed into educational rich content via adoption of a cyber-infrastructure-based paradigm.

Course Contents:

- Course Introduction and Overview
- Green Energy Manufacturing and Life Cycle Analysis
- Overview of Green Energy Materials and Manufacturing
- Evaluation of Green Energy materials found in practice
- Evaluation of Green Energy material performance
- Green Engineering Storage Devices
- Green Engineering harvesting Materials and Devices
- Nano-materials
- Nano-manufacturing

Course Grading Scheme:

Module-1: 25% (Instructors: Aditya Akundi/Dr. Bill Tseng)

Objective:
This module introduces fundamental concepts of environmentally conscious (benign) manufacturing. This module also acquaints students with the energy and environmental issues surrounding product and process design decisions. Identification and development of strategies, techniques, and methods that can used to make more environmentally responsible decisions are discussed. The life cycle assessment (LCA) is implemented and illustrated with software and case studies.

Software:
Green manufacturing software package (LCA), GaBi™ v.5
(Software tutorial will be provided)
Note: The software will be used for practice in the class.

Course Content:

- Course Introduction and Overview
- Life Cycle Assessment
- GaBi Tutorial with a case study
- Student Mini-Project

Mini- Project:
Students need to describe the problem considered for your min project and propose a model and/or solution approach for solving the problem using GaBi™ v.5, a tool to create life cycle balances, to interpret and analyze the summarized results of life style impact assessment in decision making.
More details will be provided in the class.

Grading (Undergraduates):

- **Exam:** One in-class exam (10%)
- **Mini-project Report:** Mini-project report with results (5%)
- **Homework:** Two Homework's (10%)

Grading (Graduates):

- **Exam:** One in-class exam (10%)
- **Mini-project Report:** Mini-project report with results (5%)
- **Homework:** Two Homework's (5%)
- **Journal Paper Summary:** A two page report summarizing two journal/industry papers on LCA or LCA tools along with your findings. (5%)

Note: Homework's are due by 9:40 am on the day indicated on the assignment.
Some homework's that may be due in more than one day, you may drop off the homework in TAs office (E-201E).
Mini-Project report and Paper Summary (for Graduates only) submission guidelines will be given in class.

Module-2: Total 25% (Instructor: Dr. Norman Love)

Objective:
This module will expose students to green technologies and their uses in industrial and commercial applications. This includes efficiency measurements taken from green energy devices such as solar photovoltaic panels, composite material wind turbine systems, and thermoelectrics. Fundamental discussions will be given from an energy perspective including financial considerations and from an overall efficiency perspective. This module of the course emphasizes project-based practices of green energy technology and use of classroom lectures that supplement practice. The format for projects will be team-based while the exam and quiz will be individually assessed.

Course Content:

- Introduction to different green energy technologies in practice and discussion of performance from an efficiency and financial perspective
- Assessment of performance of different green energy technologies (solar, wind, heat recovery, and recyclable material heat transfer performance)

- Student hands-on measurement of performance of photovoltaic solar panel, wind turbine system, and thermoelectric exhaust heat recovery unit

Grading (Undergraduates):

Quizzes: One in-class quiz (15%)
Exam: One in-class exam (50%)
Report: Detailing experimental measurements conducted. Details on the report format will be given during class. (35%)

Grading (Graduates):

Quizzes: One in-class quiz (15%)
Exam: One in-class exam (40%)
Report: A compiled report detailing all experiments conducted by the student teams during the summer. Details on the report format will be given during class. (30%)
Journal Paper Summary: A two page report summarizing two journal/industry papers on topic related to your experiments. (15%)

Module-3: Total 50% (Instructor: Dr. Yirong Lin)

Objective:
This module is to expose undergraduate students with state-of-the-art fabrication advancement of green energy devices such as solar cells, advanced lithium-ion-batteries, super capacitors, vibration energy harvesters, thermoelectrics, and electrochromic coatings (smart windows). Emphasis will be focused on nano-fabrication technologies such as hydrothermal, chemical vapor deposition, and physical vapor deposition for thin films, nanoparticles, and nanowires. In the classroom lecture, fundamentals on green energy harvesting and storage devices fabrication, current state-of-the-art, and future development trend will be introduced; while in the term paper session, students will be divided into groups to perform investigation of green energy harvesting and storage devices fabrication such as dye-synthetized solar cell, super capacitors, lithium-ion batteries.

Exam: One in-class exam (final) will be given.

Course Content:

- Course Introduction and Overview
- Lecture on Green Energy Materials
- Lecture on Green Energy Storage Devices
- Projects
- Term papers (Graduate students only) and presentation

Research paper:
Design of energy storage devices. Students will be asked to write a review article on energy storage devices and present in class.

Grading (Undergraduates):

- **Quiz:** One in class quiz (5%)
- **Lab report:** Lab reports with results (20%)
- **Exam:** 1 Exam (10%)
- **Presentation:** 15 minutes presentation/Group (15%)

Grading (Graduates):

- **Quiz:** One in-class exam (5%)
- **Lab report:** Lab reports with results (10%)
- **Exam:** 1 Exam (10%)
- **Research paper:** A three-page research paper (15%), send electronically to instructor's email.
- **Presentation:** 15 minutes presentation/Group (10%)