ENGR 123 Energy and the Environment

Fall Semester 2009

Instructor: Dr. Camille M. George

Time: Section 01: MWF 9:35-10:40
Lab Sections 51: Tues: 9-11:35; 52: Thurs: 9-11:35; 53: Tues: 1:30-4:00

Location: Section 01: OWS 257
Lab: OSS LL13

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Office Location & Office hours OSS 112, M/W/F 11:00-12:00 or by appointment.

Required Text: ENERGY In the 21st Century , J. Fanchi, World Scientific Publishing (2005) ISBN 981-256-195-1

Lab Mentor: Nick Dalbec nick305@hotmail.com

Course Description: The course examines the core concepts of energy and power technologies. A hands-on laboratory will examine how refrigerators, swamp coolers, motors, generators, wind turbines, solar panels and car engines work. The class covers how electricity from fossil fuels is generated and transported, and the status of the technology behind harnessing geothermal resources, solar panels, fuel cells, wind power, and biomass energy. Students will be introduced to the first law of thermodynamics (energy conservation) and the second law of thermodynamics (restrictions on energy transformations), trade-off charts and the design process. The cultural, social, and economic impacts of energy production are discussed as well as their effects on the environment.

Course Goals:

1. To understand and appreciate the need to satisfy the world's energy requirements in a sustainable and socially just manner.
2. To explain and use the 1st law of thermodynamics; energy cannot be destroyed or created only transformed.
3. To be aware of the 2nd law of thermodynamics; spontaneous events can be harnessed to produce useful energy.
4. To identify the technologies of energy production, appreciate their limitations and

be able to make responsible decisions.

Course Objectives: *The student will:*

1. Define units of energy and power.
2. Articulate the history of an energy technology and its impact on society.
3. Operate a multi-device system to gain insight into a given technology.
4. Use a trade-off chart to evaluate an energy-related question, policy or technology.
5. Be able to explain the 1^{st} & 2^{nd} laws of thermodynamics.
6. Diagram and explain the energy transformations in a power cycle and a cooling cycle. (Rankine & Rankine Reverse)
7. Describe the connection between a material phase and a measured property.
8. Describe the ideal gas law.
9. Be able to describe how electricity is generated and distributed from a power plant and from a wind turbine.
10. Be able to describe how an internal combustion engine transfers energy.
11. Compare the performance of fossil fuels and biomass fuel.
12. Be able to describe how a refrigerator works.
13. Be able to describe how a fuel cell works.
14. Be able to describe how a solar photovoltaic panel works.
15. Develop quantitative reasoning by acquiring data and interpreting that data in a laboratory setting.
16. Be challenged to think about contemporary issues governing energy options.
17. Practice technical communication in both the written and oral format.
18. Develop team skills.

Learning Outcomes:

A. **Homework Problems**: Demonstrate that the student understands and is able to apply basic terminology and concepts.
B. **Oral Presentations**: Addresses the role of technology from a larger sociological and economic perspective; and develops the ability to give an oral presentation.
C. **Trade-off charts:** Demonstrates the ability to interpret information, evaluate risk and obtain a well-reasoned solution to an open-ended problem; develops practical skills; develops the ability to critically evaluate a technology; helps develop decisions making.
D. **Laboratory Work:** Develops inquiry-based thinking; includes data acquisition, organization and data analysis. Develops an intuitive understanding of the thermodynamic laws. Strengthens understanding of the limitations of technology.

Course Methodology Class sessions will consist of lectures, student presentations and problem solving. Laboratory will have hands-on exploration.

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Major Assignments

- **Oral Presentations**: Interdisciplinary topics exploring technologies' impact on society. (10-15 minutes)
- **Trade-off charts**: Exercises examining many of the energy technologies covered in class.
- **Laboratory Assignments**: Data acquisition, organization and analysis will be graded through in-class worksheets and take-home lab reports.
- **Research papers:** Two five page papers.
- **Final Exam**: In- class exam emphasizing the ability to critically evaluate energy technologies.

Assessment Method:

Quizzes & HW: 10 %
Labs: 25%
Oral Presentation: 10 %
Research Papers: 20 %
Mid-term: 10%
Final: 20%
Class Participation: 5%

Classroom Policy: The class will be conducted with a mature and respectful atmosphere. Everyone will be expected to actively participate. Disrespectful students will be asked to leave.

Attendance Policy: Students are expected to attend all class sessions. Circumstances which prevent attendance will be honored up to two instances. Contact the instructor when a special situation arises. **All absences require that the instructor be informed in advance**.

Disability Requests: If you need course accommodations due to a disability, please make an appointment in the Enhancement Program-Disability Services, located on the St. Paul campus OEC 119, 651-962-6315. http://www.stthomas.edu/enhancementprog/

Academic Integrity: All students are expected to understand and follow the University of St. Thomas policies on Academic Integrity.
http://www.stthomas.edu/policies/student_policy_book/Academic_rights_and_procedures.asp

Instructor Biography: Camille George grew up in Chicago. She is a third generation engineer.
Her favorite activity is traveling (47 states and 45 countries).