



Physics 0839

POWERING the FUTURE

Spring 2015

Lectures and Labs SERC 214

Tuesday and Thursday 11:00 AM – 12:20 AM

Instructor: Dr. Tsvetelin D. Tsankov

E-mail: tsankov@temple.edu

Office: SERC 478, Phone: (215) 204-3168

Office Hours:

Tuesday and Thursday 2:00-5:00 PM

Program Objective: This course is part of the Science and Technology section of the General Education (GenEd) program. GenEd intends to develop your ability to think, solve problems and communicate effectively. GenEd courses are designed to help you understand how your professor's field of study relates to important controversies, issues or themes, and/or how it is connected to other fields of study. The goal of the program overall is that you become active in the process of learning, not only absorbing facts, but finding, evaluating and using information to create new knowledge.

Course Objective: This course will discuss the physical principles behind conventional and alternative energy sources and their impact on our environment. While oriented to the future, the course will make students understand the extent and impact of their energy usage today.

Course Learning Goals:

1. Expand students' knowledge of the world's current energy system.
2. Develop students' understanding of the sustainability problems and ways in which these problems might be minimized through the use of improved technologies.
3. Develop students' ability to make informed judgments about energy systems such as solar thermal, solar photovoltaic, nuclear, biofuel, hydro, and wind systems.

4. Develop collaborative learning and teamwork skills.
5. Develop students' information literacy skills.
6. Develop student's thinking and communication skills.

Materials:

- **Textbook:** Roger A. Hinrichs, Merlin Kleinbach, *Energy, Its Use and the Environment*, Cengage Learning, Fifth Edition, ISBN: 9781111990831.
- **Scientific calculator**

Learning components: The basic learning strategy in *Physics 0839* can be summarized as follows:

1. Experience it (Lab).
2. Read about it (Textbook) and untangle it (Lecture).
3. Apply it (Tests and Homework Assignments).
4. Research it (Sustainability project).
5. Synthesize it (Final exam).

Research Project in Sustainability: Students will form discussion groups of up to 4 members. Each group will research one topic among the following topics related to Sustainability:

- Solar Thermal Systems (passive).
- Permaculture (sustainable agriculture).
- Alternative home-building (earth-sheltered, straw bale, stone, mud brick etc.).
- Small-wind systems (up to 20 kW).
- Biogas (small-scale production and applications).
- Radical car designs (cutting edge research).
- Lawns vs. Fruit and Vegetable Gardens (a comparative study in suburban sustainability).

The outcome of the investigation of each group should be presented in the form of a research report (about 10-12 pages long, including diagrams and images). The report should contain some background history, main exposition which highlights the fundamental principles concerning the particular topic, examples of actual implementations and some quantitative information. Each group must elect a representative who will communicate directly with the instructor regarding the project. The grade of the research report will be determined partially (60%) by the quality of the work and partially (40%) by the individual contribution of each student. The individual contribution will be evaluated through filling out feedback forms where each team member will rate his/her own contribution and the contribution of their peers.

The groups will be given the opportunity to present their work via slide presentation at the end of the semester and earn extra credit in the amount of up to 10% of the course grade. The extra credit is awarded via anonymous voting by all students.

Tests: Open-book multiple-choice tests, each consisting of 10 questions, will be given after the completion of the relevant part of the course material (about 7 tests for the entire semester). The exact date and the included material will be announced on Blackboard and in class ahead of time.

Students are allowed to use their lecture notes, the PowerPoint presentations shown in class, and the textbook. Each student is allowed to make up one missed test per semester.

Homework: Homework assignments require simple quantitative analysis of technical problems related to energy technologies. There will be 3 homework assignments for the entire semester.

Final Exam: The final exam is on **Tuesday, May 5, 10:30-12:30**. The final exam is *closed* book and multiple-choice. The exam consists of 60 questions, most of which are taken from the tests taken during the semester. Also 2 questions for each Research Project topic will be included. Some of the exam questions will be new, but still based on the course material discussed in class.

Laboratories: The course includes several lab investigations designed to give students the opportunity to explore practically energy concepts after reading about them and discussing them in lectures. During lab investigations, you are supposed to keep a careful record of all activities, measured data, calculations, tables, graphs and conclusions in a special notebook, used specifically for that purpose. Your lab grade will be determined based on (a) attendance (20%) and (b) the content of your lab notebook (80%). The lab manuals will be posted on Blackboard.

Grading: The grade contribution of the different assessment tools is as follows:

Final exam	30%
Laboratory	20%
Diagnostic Tests	20%
Collaborative Research Project	20%
Quantitative Homework	10%
TOTAL	100%

A	100%...90%
A-	89%...86%
B+	85%...80%
B	79%...75%
B-	74%...70%
C+	69%...67%
C	66%...60%
C-	59%...55%
D	54%...46%
F	45%...0%

Last day to drop the course (tuition refund available): **Monday, January 26.**

Withdrawal from classes: Last day to withdraw: **Tuesday, March 17.**

Course Schedule – Physics 0839

Week #1 (January 12 – January 16) Course Introduction

Course Overview.

Math Review. Measurement Units. Energy and Power. [Chapter 2]

Week #2 (January 19 – January 23) Energy Patterns and Trends

Energy Supply and Consumption. [Chapter 1 and 7]

Energy and Mineral Resources and Sustainability. [Chapter 7, 8 and 9]

Week #3 (January 26 – January 30) Energy Fundamentals

Basics of Energy Science. [Chapter 3 and 4]

Introduction to Electricity. [Chapter 10]

Week #4 (February 2 – February 6) Electric Power Systems

Steam-driven electric power plants. [Chapter 11]

Nuclear Power. [Chapter 13 and 14]

Week #5 (February 9 – February 13) Sustainable Electricity-Part 1

Hydro-electric Power Plants. [Chapter 12]

Geothermal Plants. [Chapter 18]

Wind Energy and Solar Energy. [Chapter 6 and 12]

Week #6 (February 16 – February 20) LABS

Week #7 (February 23– February 27) LABS

Week #8 (March 2– March 8) SPRING BREAK

Week #9(March 9 – March 13) Sustainable Electricity-Part 2

Fuel Cells and Stirling Engines. [Chapter 4 and 10]

Week #10 (March 16– March 20) Sustainable Electricity-Part 3

Photovoltaic Systems.

Week #11 (March 23 – March 27) LABS

Week #12 (March 30 – April 3) LABS

Week #13 (April 6– April 10) Sustainable Transportation

Alternative Transportation Fuels. [Chapter 17]

Transportation Energy and Efficient Vehicles. Emerging Vehicle Technologies.

(Lab notebooks and Research Reports due on Thursday April 9)

Week #14 (April 13 – April 17) Sustainable Buildings

Energy Efficiency for Buildings. [Chapter 5 and 10]

Week #15 (April 20– April 24)

Research reports presentations.

Final Exam: Tuesday, May 5, 10:30-12:30 in SERC 214.