

**College Now at Bronx Community College**  
**Summer 2016**  
**EST 11 – Introduction to Energy Technology**  
**M - T 9am-4pm**

**COURSE DESCRIPTION**

This course is an introduction to energy concepts and resources, energy conversion systems, institutions and their global implications. We will explore how energy is organized (sometimes called “infrastructure”) and the many facets of technology at the micro- (such as the household and personal electrification) and at the macro-scale (such as transportation and electricity). We will also examine how societies generate and use energy by paying particular attention to the evolution of and alternatives to present dominant energy systems. Finally, we will connect these issues to recognizing and evaluating energy infrastructure, use, waste and costs in everyday life.

This course is also an excellent opportunity to enrich your math skills, which is essential to being a successful college student.

**SCHEDULE**

EST 11 meets Monday through Thursday:

Lectures are 9am-11am in Carl Polowczyk Hall Room 207  
Lunch from 11am-12pm at BCC Cafeteria (Lunch vouchers provided daily)  
Math Recitation from 12:15pm-1pm in Carl Polowczyk Hall Room 207  
Lab from 1pm-4pm in Carl Polowczyk Hall Room 207

\*Note: During Week 2 the schedule will be adjusted as follows: Lab and Math Recitation/Lectures times will be exchanged: Lectures from 2pm-4pm and Lab from 9am-12pm (in Meister Hall Room 801); Lunch from 12pm – 1pm and Math Recitation from 1:15pm – 2pm.

Requirements and Grading:

Weekly Homework	30%
Class Participation	20%
Final Exam	25%
Weekly Quizzes (4)	25%

## Learning Objectives:

- Use abstract reasoning, including the ability to analyze, interpret, evaluate and integrate information; apply the results; and formulate and solve problems
- Use reading, writing, listening and speaking to find, interpret and communicate information in various modes, including aesthetic, statistical, symbolic and graphic
- Understand energy resources and conservation
- Ability to read and analyze an electric bill
- Basic ability to recognize and quantify energy use and efficiency
- Awareness of global patterns and problems of energy use
- Understand basics of electrical system infrastructure
- Understand transportation drivers, planning and implications
- Awareness of career options related to energy

## **COURSE BLOG**

Each week students will be required to write on an issue/problem/idea that resonated with him or her during that week (from the lectures or lab). The writing should be between 250-500 words and posted no later than Sunday of that week. Blog assignments will be counted as part of your class participation.

## **ATTENDANCE**

College Now policy requires that a student attend every class. Unexcused absences will thus adversely affect your grade.

*Participation* will account for a large portion of your grade. This includes doing the reading, listening and positively contributing to the class debates/discussions, helping to foster a lively environment, and behaving appropriately.

## **ACADEMIC INTEGRITY**

*Plagiarism/cheating*: students must follow CUNY's policies on plagiarism and academic integrity. Those who commit plagiarism will receive an F in the course at the discretion of the instructor. This is a strong case for not doing it.

No Cell Phones

No Eating

Be Respectful Towards One Another

## *Class Schedule*

### **Week 1: Introduction to Energy and Energy Resources**

**July 4:** *Independence Day Holiday*, no class

**July 5:**

1. Energy & Global Issues
  - a. Energy and Society
  - b. Energy Use in the United States
  - c. Energy Production and Consumption
  - d. Environmental Challenges
  - e. The Future

**July 6:**

2. Energy Principles
  - a. Units
  - b. Speed, Velocity, and Acceleration
  - c. Newton's laws
  - d. Energy and Work
  - e. Household energy use

**July 7:**

3. Resources
  - a. Coal
  - b. Petroleum
  - c. Oil
  - d. Renewables
  - e. Batteries
  - f. Energy Density
  - g. Energy Consumption

**Week 1 Lab: *Ballistics*** - The purpose of this lab is to introduce students to the concepts of ballistic motion, and how they can be applied to everyday life. These concepts are, but are not limited to, Power, Force, Work, Velocity, Sin, Cos, and Tan trigonometric functions and quadratic equations. To achieve this objective students will utilize their table mounted projectile launchers to depict the aforementioned concepts.

## **Week 2: Introduction to Electricity, Thermodynamics and Renewable Resources**

### **July 11**

4. Principles of Electricity
  - a. Electric force and charge
  - b. Atomic structure
  - c. Electric Power and Energy
  - d. Electric Generators
  - e. Transformers
  - f. Transmission
  - g. Customer Demand

### **July 12**

5. Energy Conversion: Principles of Thermodynamics
  - a. Ideal gas law
  - b. Internal energy
  - c. Heat
  - d. First law of Thermodynamics
  - e. Steam Turbine
  - f. Second Law of thermodynamics

### **July 13**

6. Basic Biological Chemistry and Alternative Fuel Technologies (Socha via Google)
  - a. Introduction to Organic Chemistry, Cell Biology and Photosynthesis
  - b. Alternative fuels (Biodiesel, Ethanol and Biogas)
  - c. Engine fundamentals (combustion, octane/cetane rating, emissions)
  - d. The Food vs. Fuel Debate

### **July 14**

7. Environmental Impacts & Policies
  - a. Electromagnetic radiation
  - b. Greenhouse gasses
  - c. The Volkswagon Scandal
  - d. Particulate matter
  - e. Global warming
  - f. Regulation

**Week 2 Lab: *Biodiesel from Cooking Oil*** – It turns out that cooking oil (new or used) has very similar chemical properties to diesel fuel. As such, we can perform a simple reaction to convert one into the other. Students will learn the principals of waste oil analysis using titration, the basic chemistry and calculations for biodiesel synthesis as well as basic separation science and quality control. Students may bring up to 250 mL of used cooking oil from home, or else oil will be supplied. [Point-slope form] *\*Basic Chemical Lab Safety will be taught at the beginning of the week's lab*

## **Week 3: Forms of Alternative Energy: Solar and Wind Energy**

### **July 18**

8. Solar Energy – Day 1
  - a. What is solar energy?
  - b. What are semi-conductors?
  - c. What is the photovoltaic effect?
  - d. Types of PV systems – Grid connected, Off grid, Hybrid, Stand alone

### **July 19**

9. Solar Energy – Day 2
  - a. Equipment used in PV systems – Combiner Box, Disconnects, Inverters, Batteries, Wires, Conduits, Service Panels
  - b. Principles of AC and DC electricity
  - c. How can one get maximum power? – Orientation, Tilt, Tracking, MPPT

### **July 20**

10. Wind Energy – Day 1
  - a. What is wind energy?
  - b. What are the principles of aerodynamics? What are airfoils?
  - c. What is electromagnetism?
  - d. How does wind and solar energy compare with conventional sources?

### **July 21**

11. Wind Energy – Day 2
  - a. How does a wind turbine work?
  - b. What is pitch, wind speed, blade root and tip?
  - c. Where do airfoil get used – birds, planes, wind turbines, helicopters
  - d. Are superheroes that fly aerodynamic?

**Week 3 Lab 1 & 2: Solar Powered Phone Chargers** – In a global economy radicalized by energy thirsty developing nations, the US and particularly Europe are aggressively pursuing renewable energy alternatives to ensure this and future generations can soften the impact of fossil fuels. Solar and Wind energy are key resources to the United States which ranks 5<sup>th</sup> and 3<sup>rd</sup> respectively in the world in installed capacity. SOLAR: In this class students will learn the physics behind how the sun's energy is converted into electricity. They will also learn how to solder an electronic circuit to a solar panel and watch it charge a mobile phone. WIND: In the wind energy class, students will learn the principles of aerodynamics, wind pressure (lift and drag) and electromagnetism. They will build a wind turbine and use an oscilloscope to visually assess the energy being produced. Both labs for solar and wind will use trigonometry and algebra to find best configurations so the maximum possible energy may be produced with the given resources.

## **Week 4: Population Dynamics, Nuclear Energy and Careers in Renewable Energy**

### **July 25:**

12. Settlement Patterns, Food & Transportation
  - a. Population growth
  - b. Population density
  - c. Global soil quality
  - d. Fresh water and Food Production
  - e. Invasive species

### **July 26:**

13. Alternative Technologies: Fuel Cells and Batteries
  - a. Principles of redox chemistry
  - b. Electrolysis
  - c. Membranes
  - d. Hydrogen storage
  - e. Electric cars

### **July 27:**

14. Nuclear Energy
  - a. Nuclear physics principles
  - b. Radioactivity
  - c. First generation reactors
  - d. Accidents
  - e. Waste production and storage
  - f. Second generation reactors and beyond

### **July 28:**

15. Careers in Energy
  - a. Bureau of Labor Statistics
  - b. Mechanical, Chemical, Electrical Engineering
  - c. College Course of Study
  - d. Local and Regional Companies
  - e. City Agencies
  - f. National Labs

**Week 4 Lab: *Fuel Cells*** – Fuels cells are highly effective devices for converting energy from one form to another, they are more energy-efficient than combustion engines, and a variety of sources can be used to power them. In particular, Polymer Electrolyte Membrane (PEM) fuel cells, also create electricity. They are typically used in automobiles. When pure hydrogen is used as a fuel, these fuel cells emit only heat and water as byproducts, eliminating concerns about air pollutants and greenhouse gases. The purpose of this lab is to introduce students to the concepts of fuel cells technology, and how to decompose water through electrolysis. Among these concepts are: Friction, Work, Power, Energy, and Chemical Reactions. To achieve this objective, students will learn how to assemble and fill the fuel cell, understand how a fuel cell operates, and appreciate the efficiency of fuel cell powering a car.

**Aug 1-3: Math Review**

**Aug 5: Final Exam**

Basic Course Rules:

Homework will be assigned at the beginning of each week and is due the Thursday.

Math Recitation is used for questions on homework assignments.

Laboratory procedures for the upcoming week are given each Thursday and available online at [http://www.csebcc.org/college\\_now.html](http://www.csebcc.org/college_now.html). A copy of this syllabus is also posted on the site and lecture notes will be uploaded weekly. ***You will be expected to read the laboratory procedures prior to arrival in lab each Monday.*** Lab procedures will not be explained in detail before lab, but there will be 15-20 Q&A and safety discussions prior to starting lab.