SEMESTER AT SEA COURSE SYLLABUS

Voyage: Spring 2013
Discipline: Engineering, open to non-engineering students
ENGR 2500: Energy for the World
Lower Division
Faculty Name: Gearold Johnson

Pre-requisites: None

COURSE DESCRIPTION

Plentiful and affordable energy defines the modern industrialized world. How can affordable energy be provided in countries that currently lack this necessary infrastructure? This course introduces students to the fundamental concepts of power generation technologies: fossil fuel-burning power systems, nuclear power, hydropower, tidal power, geothermal power, wind power, solar power, biomass, and fuel cells. We will also discuss their economic and global environmental impacts as well as centralized vs. decentralized power systems. Special emphasis will be placed on the energy resources of the countries we visit on our voyage.

COURSE OBJECTIVES

The goal of this course is to develop students' knowledge and understanding of the highly complex issues surrounding energy, its availability, costs, environmental impacts, generation technologies and uses on a global basis. Special emphasis will be given to understanding systems in the countries visited on the Spring semester at sea voyage. This goal will be accomplished through three objectives:

1. To understand the sources of energy presently available and their current usage.

2. To understand the advantages and disadvantages of the various energy resources.

3. To understand the role of the environment, politics, economics, and society on worldwide future energy resources development.

REQUIRED TEXTBOOK

AUTHOR: Paul Breeze
TITLE: Power Generation Technologies
PUBLISHER: Elsevier
ISBN #: 0 7506 6313 8
DATE/EDITION: 2005/1st Edition
COST: $58.00

TOPICAL OUTLINE OF COURSE
NOTE: Readings are from Breeze (B)

Class 1: INTRODUCTIONS, COURSE OVERVIEW AND REQUIREMENTS, WHAT DO YOU KNOW ABOUT ENERGY?

Class 2: LET'S ORGANIZE YOUR ENERGY KNOWLEDGE, EXAMINE THE RESULTING TREE, WHAT DO WE SEE? POWER AND ENERGY UNITS, CONVERSIONS, ETC.

Class 3: POWER AND ENERGY OVERVIEW IN THE COUNTRIES TO BE VISITED

Class 4: ELECTRICITY GENERATION; B pp 1-7

Class 5: ENVIRONMENTAL CONSIDERATIONS; B pp 8-17

Class 6: FOSSIL FUEL-FIRED POWER PLANTS; B pp 18-42

Class 7: GAS TURBINES; B pp 43-56

Class 8: HEAT, POWER AND PISTON ENGINES; B pp 62-88

Class 9: HYDROPOWER; B pp 104-121

Class 10: TIDAL POWER; B pp 122-133

Class 11: OCEAN POWER; B pp 204-218

Class 12: MID-TERM EXAMINATION

Class 13: STORAGE TECHNOLOGIES; B pp 134-152

Class 14: FUEL CELLS; B pp 89-103

Class 15: WIND POWER; B pp 153-169

Class 16: SOLAR POWER; B pp 184-203

Class 17: GEOTHERMAL POWER; B pp 170-183

Class 18: BIOMASS AND POWER FROM WASTE; B pp 219-248 Class 1:

Class 19: NUCLEAR POWER; B pp 249-266

Class 20: SUSTAINABLE POWER SYSTEMS 1; notes from instructor

Class 21: SUSTAINABLE POWER SYSTEMS 2; notes from instructor

Class 22: TEAM PROJECT PRESENTATIONS

Class 23: TEAM PROJECT PRESSENTATIONS

Class 24: FINAL EXAMINATION

FIELD WORK

Required field lab will include presentations by faculty and researchers on the present and future energy resources development in China. Students will be expected to prepare written summaries of the field lab.

FIELD LAB

(At least 20 percent of the contact hours for each course, to be led by the instructor.)
Our course's field lab will take place on February 3 in China. Attendance is mandatory.

China has the largest population of any country on Earth and the goal of quickly becoming a fully developed nation. To achieve this goal, China needs a plan for wide-spread energy development. Until recently, China's main form of power generation was based on coal-fired power plants. However, carbon dioxide emissions from these plants is a significant source of global green house gas emissions and the Chinese government has launched a large-scale plan to use significantly more renewable resources for power generation including the construction of the world's largest hydro-electric power plant and many new wind farms stretching from the Gobi Dessert eastward. The Field Lab will consist of a visit to Shanghai Jiao Tong University located in the old French Quarter of Shanghai where we will tour the University campus, visit energy research laboratories and have presentations on the development of the Three Gorges Dam hydropower generation system and a proposed 1000 Megawatt off-shore wind farm.

The objective for the students following the field lab is to write a report describing what they've learned from the field trip, whether or not they think that the Chinese have constructed a realistic plan and describe any short-comings they identify. The report may include photographs and/or video. This report will be used as a comparison document to the energy analyses they do of other countries visited on the voyage in their group projects.

FIELD ASSIGNMENTS

- Students will be required to attend the Field Lab. Absence from the Field Lab will result in a loss of 20% of the course grade.
- Each student will prepare a written document describing the Field Lab experience highlighting what is learned and how it fits within material covered in class.
- For non-required field excursions, students will be expected to observe local power generation systems and investigate local perspectives on energy usage and environmental impact. The results of these observations are to be included in the written Team Project Report.

- Students will be expected to take photographs and/or videos of relevant energy-related activities.
- Each written document describing the Field Lab experience will be graded and returned to the student for further refinement.

METHODS OF EVALUATION / GRADING RUBRIC

TEAM PROJECT: The instructor will assign each student to a team of 2 or 3 students to work on a term long project. Each team will report on the status of power and energy services and the implications of this status on development in one of the countries visited on the voyage as a case study. Students may take and include photographs and videos. All the team projects will be assembled into an electronic portfolio documenting the energy issues in the countries visited as a take-away from the course.

10% Attendance and Class Participation
15% Mid-term Examination
25% Team Paper on Energy Resources and Uses in a Country Visited or Near By
20% Field Lab (participation and e-portfolio)
30% Final Examination
Total 100%

RESERVE LIBRARY LIST

AUTHOR: Robert U. Ayres and Edward H. Ayres
TITLE: Crossing the Energy Divide: Moving from Fossil Fuel Dependence to a Clean Energy Future
PUBLISHER: Wharton School Publishing
ISBN #: 978-0137015433
DATE/EDITION: December 2009/1st Edition
COST: $29.99

AUTHOR: John Randolph and Gilbert Masters
TITLE: Energy for Sustainability: Technology, Planning and Policy
PUBLISHER: Island Press
ISBN #: 978-1597261036
DATE/EDITION: June 2008/1st Edition
COST: **$100**

AUTHOR: Francis Vanek and Louis Albright
TITLE: Energy Systems Engineering: Evaluation and Implementation
PUBLISHER: McGraw-Hill Professional
ISBN #: 978-0071495936
DATE/EDITION: May 2008/1st Edition
COST: **$89.95**

ELECTRONIC COURSE MATERIALS
None

ADDITIONAL RESOURCES
May be supplied by the instructor through the course folder.

HONOR CODE
Semester at Sea students enroll in an academic program administered by the University of Virginia, and thus bind themselves to the University's honor code. The code prohibits all acts of lying, cheating, and stealing. Please consult the Voyager's Handbook for further explanation of what constitutes an honor offense.

Each written assignment for this course must be pledged by the student as follows: "On my honor as a student, I pledge that I have neither given nor received aid on this assignment." The pledge must be signed, or, in the case of an electronic file, signed "[signed]."