Energy Production Systems Engineering Course Syllabus

Course No. & Title: EIN-4933-191/194, EIN6936-191/194: Energy Production Systems Engineering
Term & Meeting Info: Spring 2012, Wednesdays, 6:00pm – 8:50pm, LAC1286 & Off Campus
Instructor Info: Thomas Howard Blair, P.E., tom@thomasblairpe.com
Phone: (813) 630-7008, Fax: (813) 630-6930, Department Office Phone: None
Office Hours: By appointment
Website: http://www.thomasblairpe.com/ppe.htm

Designation: Undergraduate / Graduate elective course

Course Description: 3CR. This course will review the application of engineering principles to design, operation, and maintenance of energy production systems. This course will present engineering methods utilized to optimize the system for cost, safety and reliability considerations of the process. Fossil Fuel, Nuclear, Hydro, Gasification, Natural Gas and renewable energy technologies are explored. Types of equipment and systems needed for various fuel technologies are addressed along with requirements unique to energy production for this equipment. The combustion process will be reviewed. Thermodynamic cycles will be reviewed. Electrical safety standards for both installation and safe work practices will be reviewed.

Textbook: Energy Production Systems Engineering, Thomas Howard Blair, P.E., draft edition.

Prerequisites: Electric Circuits 1&2 or instructor permission.

Course Objectives:
Apply the principles of thermodynamic cycle analysis to heat balance equations.
Review energy production facility efficiency calculations and concept of "heat rate"
Review of Rankine Cycle, Brayton Cycle, and combined cycle power plant design.
Perform fundamental combustion analysis.
Understand the fundamental equipment and systems used in various types of energy production facilities.
Awareness of various political, environmental, economic and safety issues.
Improve written and oral communication skills.

Course Outcomes:
1. Students will become familiar with power plant systems, terms and definitions and basic Electrical Machines and Drives design calculations. Crit. 3(a) (e) (k) (m)
2. Students will become familiar with the proper design and application of power plant related equipment. Crit. 3(a) (c) (e) (k) (m)
3. Students will become familiar with methods of diagnosing and correcting equipment mis-operation or mis-application. Crit. 3(a) (e) (k) (m)
4. Students will become familiar with recognized standards utilized in the design and operation of power plant equipment. Crit. 3(a) (c) (f) (k) (m)
5. Students will prepare and present topical issues relevant to power plant design and operations. Crit. 3(a) (c) (e) (g) (k) (m)
Note: For a definition of the components of ABET Criterion 3, please refer to the "Relation of Course to Dept. Program Outcomes" section later in this syllabus.

Topics Covered:
Introduction to thermodynamics
Combustion analysis
Energy production equipment and systems, both electrical and mechanical, for coal, oil, gas, hydro, nuclear and alternate energy based plants.
Safety, political, environmental, and economic considerations of plant design and operation.
Standards usage in the design and operation of power system.
Generation station grounding design & analysis.
Electrical System design and analysis.
Electrical safe work practices and installation safety standards.

Project:
A comprehensive project is assigned in the course. Typically, this is either a report on a current topic in energy production or a design of a system of an energy production facility. A project report is required as part of this project. Project requirements are available at class website; http://thomasblairpe.com/ppe.htm

Written/Oral Communications
A project report addressing an area of energy production will be required. Various areas may be, but are not limited to, comparison of types of fuel, future of new technology in power generation, mechanical / electrical design considerations of power plants, or another energy production related topic.

Specialization: This course is useful for the engineer involved with the planning, design, engineering and/or operation of power plants.

Professional Component: Engineering Science – 50% Engineering Design – 50% (Eng. Science = math/science required for creative applications; Eng. Design = decision making process of devising a system, component or process to meet a desired need). This course is useful for the engineer involved with the planning, design, engineering and/or operation of power plants.

Additional Course Features: This course will include a project and will require the student to provide a technical report on the engineering topic chosen. Additionally, this course will include a tour of an operating power plant. Although attendance will not be taken (other than the first day of class, per university policy), attendance and participation is strongly suggested to enhance the learning experience for all students. Academic dishonesty of any kind will not be tolerated. If caught cheating, the guilty parties will be subject to AT LEAST failure of the course, up to and possibly including expulsion from the university. Refer to University Policies for further information.

Relation of Course to the Department Program Outcomes:
Program Outcome "a": An ability to apply knowledge of basic math, science and engineering.
Program Outcome "c": An ability to design systems, components, or processes to meet desired needs.
Program Outcome "e": ability to identify, formulate and solve engineering problems.

Class/Laboratory Schedule:
3 lecture hours per week. 2 tours of energy production facilities

Topics Covered
W 01/11/2012 Introduction to Energy Production Systems & Safety
W 01/18/2012 Steam Power Plants, Steam Fundamentals, Plant Design, Boilers & Steam Generators, Boiler Auxiliaries
W 01/25/2012 Steam Power Plants, Steam Fundamentals, Nuclear Plant Systems, Fission Theory, Steam Supply, Operation and Maintenance, Reactor Safety
W 02/01/2012 Nuclear Plant Systems, Fission Theory, Steam Supply, Operation and Maintenance, Reactor Safety, Cooling Towers, Water Treatment
W 02/08/2012 Prime Movers, Steam Turbines, Gas Turbines, Hydraulic Turbines, Reciprocating Engines
W 02/15/2012 Plant Electric Systems, AC Generator and Protection, In Plant Distribution System
W 02/22/2012 Plant Electric Systems, Transformers and Protection,
W 02/29/2012 Review for Mid-term Exam & Project Summary Due
W 03/07/2012 Midterm Exam (6:00PM – 8:00PM)
W 03/14/2012 Spring Break
W 03/21/2012 Field Trip – First power plant site – refer to web site for details
W 03/28/2012 Plant Electric Systems, In Plant Distribution System
W 04/04/2012 Plant Electric Systems, AC Motors and Applications, Cable & Busway Applications
S 04/07/2012 Field Trip – Second power plant site – refer to web site for details.
W 04/11/2012 Instrumentation & Control, Plant Instruments, Combustion Control, Burner Management
W 04/18/2012 Review for Final Exam & Final Project Report Due
W 04/25/2012 Final Exam (6:00PM – 8:00PM)

Test & Grading Info: Grading – plus/minus grading will be used.
Homework: 25%
Midterm: 25% (open book/open notes)
Project: 25%
Final: 25% (open book/open notes)
Test Conflicts due to illness, religious observances, or travel may be rescheduled by contacting the instructor as soon as possible.