Mechanical Engineering and Mechanics

MEM 402 Power Plant Design

Fall 2006

Designation: Elective

Catalog Description: Covers use of steam to produce electric power, including heat cycle

arrangement, equipment selection, analysis of cost demands, and diversity factors. Includes economic studies of plant and cycle arrangements.

Prerequisites: Thermodynamic Analysis I (MEM 310)

Textbook(s) and other required material:

Required: Power Plant Technology, M.M. El-Wakil, McGraw-Hill Primis Custom

Publishing, 2002

Course Objectives:

1. Describe the basic layout of a modern Rankine cycle steam power plant.

- 2. Define the basic operational aspects of a power plant.
- 3. Perform mass & energy balances on various pieces of equipment and systems.
- 4. Apply principles of thermal fluid systems to the economic analysis of a steam power plant.
- 5. Describe the role of the power plant in the operation of the power system.

Topics:

- 1. Basic analysis of the Rankine cycle
- 2. Cycle enhancements reheater, heat cycle
- 3. Analysis/design of major components -boiler, turbine, condenser, heat cycle
- 4. Auxiliary equipment & system design
- 5. Environmental aspects of plant design & operation
- 6. Integration of the plant with the power system
- 7. Alternatives to the Rankine cycle

Class Schedule: 3 hours/week lecture (3 credits)

Contribution to Professional Component:

A senior level course which integrates prior learning in the thermal systems area and adds aspects of control systems. Prepares students for industrial work in thermal system design and analysis.

Relationship to Program Outcomes:

Outcomes a - k	Content	Explanation	Evidence
a. An ability to apply knowledge of mathematics, science and engineering	2	This course requires the students to extend their understanding of thermodynamics, fluid mechanics,	Homework, exams
and engineering		heat transfer, and control systems. The students learn how to apply and synthesize their knowledge of mathematics, science, and engineering.	

b. An ability to design and conduct experiments as well as to analyze and interpret data c. An ability to design a system, component or process to meet	2	Classroom discussion of approaches to determine and analyze plant problems. Some assigned homework problems require analysis and design to meet	None Homework, exam problems on condensers & feedwater
desired needs		the objectives.	heater trains
d. An ability to function on multidisciplinary teams	0	NA	NA
e. An ability to identify, formulate and solve engineering problems	2	The problems require students to identify, formulate, and solve engineering problems which are not always completely defined.	Homework, exams
f. An understanding of professional and ethical responsibility	1	This is emphasized as part of the engineer's overall responsibility.	Classroom discussion of environmental issues
g. An ability to communicate effectively	1	Classroom discussion of documentation of work, written sections of final exam.	Final exam
h. The broad education necessary to understand the impact of engineering solutions in a global/societal context	1	The impact of engineering design on the environment (thermal, particulate and chemical emissions of the plant)	Classroom discussion of environmental issues
 i. A recognition of the need for and ar ability to engage in lifelong learning 	0	Class discussion of need for professional registration	None
j. A knowledge of contemporary issues	1	Class discussions of economic and environmental impacts on plant type and design	None
k. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice	1	Students are encouraged to use computer packages to explore the solution domain for homework	Homework

Prepared by: Peter J. Clelland, 23 November 2006