Syllabus

Technical Elective – Thermal System Design
Fall Semester 2022

Lecture Time:	Thu. 13:50 – 16:25	**Instructor:**	Dr. John Pien
Classroom:	4-201	**Office:**	3-223
Office Hours:	Wed. 14:00 – 17:00	**Email:**	john.pien@scupi.cn

Catalog Description:

In this course, we will combine the three subjects of fluid mechanics, heat transfer, and thermodynamics to study the design of thermal systems. These principles are applied using a system perspective to analyze and understand how interactions between components, such as pump, piping, heat exchanger, and those in the thermodynamic power generation cycles, would affect the performance of the entire system. We will begin with system design concepts and economic analysis, and proceed with mathematical modeling techniques, and conclude with system simulation and optimization. At the end, we will not only be able to analyze the system but explore optimization opportunities on design improvements to minimize, for example, the energy consumption or operating costs.
Prerequisites: *PHYS 0174, ENGR 0145, MATH 0290*.

Required Textbook:

- No required textbooks are assigned. Relevant reading materials will be provided electronically. Lectures and handouts are all complementary, and necessary for understanding the course material.

- Also, you will likely be needing to refer to your old text books in heat transfer, fluid mechanics, or thermodynamics at many points during the semester. We will review some of the materials from those classes, but not all of it, and we will be expanding on much of what you have already learned.

References:

Stoecker, *Design of Thermal Systems*, McGraw-Hill.
Jaluria, *Design and Optimization of Thermal Systems*, McGraw-Hill.
Majumdar, *Design of Thermal Energy Systems*, Wiley.
Bejan, Tsatsaronis and Moran, *Thermal Design and Optimization*, Wiley.

Course Outcomes:

- To understand engineering design process and to define design objectives and understand the basis and criteria for the design of thermal systems.
- To state the requirements of a design problem and show workable solutions that meet the requirements.
- To model thermal system components by integrating thermodynamics, fluid mechanics, and heat transfer and using curve fits of tabulated or experimental data.
- To introduce economics into thermal systems analysis and design.
- To combine models of various thermal system components to simulate the performance of a complete thermal system.
- To apply optimization tools to a thermal system to find the best set of operating or design parameters.

Course Outline:

- General Introduction
- Basics in Design
- Economic Analysis
- Mathematical Background
- Modeling Thermal Equipment
- Thermal System Simulation
- Thermal System Optimization

Course Grading:

Homework	15%
Exam I	25%
Exam II	25%
Final Exam	35%

Exam Schedule:

Exam I	Oct. 20th
Exam II	Nov. 24th
Final	Dec. 29th