

Syllabus

Technical Elective – Thermal Systems Design

Fall 2023

Instructor: Dr. Feng C. Lai (Office: 4 – 223)

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Office Hours: 9:00 - 11:00 Tuesday or by appointment

Course Description:

In this course, three subjects of fluid mechanics, heat transfer, and thermodynamics will be integrated 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. The class will begin with the system design concepts and conclude with system simulation and optimization. It will focus on two systems (a power generation system and a HVAC system) to demonstrate the approach used in design and optimization. At the end, one will not only be able to analyze the system but also explore optimization opportunities on design improvements to minimize the energy consumption or operating costs.

Prerequisites: PHYS 0174, ENGR 0145, MATH 0290.

Textbook:

No required textbooks are assigned. Relevant reading materials will be provided/distributed electronically. Handouts are distributed in class and are necessary for understanding the course material.

In addition, the previous textbooks in heat transfer, fluid mechanics, and thermodynamics are very helpful, and they are referenced frequently throughout the semester. Some materials from these classes will be reviewed and expanded for the enrichment of learning experience.

References:

Fundamentals of Thermal-Fluid Sciences by Y. A. Cengel, J. M. Cimbala and A. Ghajar, 6th ed., McGraw Hill, 2022.

Course Outcomes:

- To be able to understand engineering design process and define design objectives as well as understand the basis and criteria for the design of thermal systems.
- To be able to state the requirements of a design problem and show workable solutions that meet the requirements.
- To be able to integrate the knowledge of thermodynamics, fluid mechanics, and heat transfer to model thermal system components.
- To be able to include economics analysis into thermal system design.
- To be able to combine models of various components to simulate the performance of a complete thermal system.
- To be able to optimize a thermal system to find the best set of operating conditions or design parameters.

Course Outline:

- General Introduction
- Review of Thermodynamics, Fluid Mechanics, and Heat Transfer
- Evaluation of the Performance of a Thermal System
- Optimization of a Thermal System
- Basic Design of a Power Generation System
- Optimal Design of a Power Generation System
- Basic Design of a HVAC System
- Optimal Design of a HVAC System

Course Policies:

Make-up Policy: No make-up lecture/exam will be given if no prior arrangement (due to sickness or official business) has been made/approved.

Absences: Absence from class is strongly discouraged. Absence due to sickness or official business need to be approved before or at the occurrence of the event with proper document.

Other Policies: Late submission of assignment will not be accepted unless prior arrangement has been made.

Grade:

Homework/Quiz (8-10)	10%
Project (2)	40%
Mid-term Exams (2)	30%
Final Exam	20%

Tentative Exam Schedule: (The actual dates will be announced in class)

Exam I	Oct. 17 th
Exam II	Nov. 21 st
Final	Dec. 26 th