

**ÇANKAYA UNIVERSITY**  
**FACULTY OF ENGINEERING**  
**MECHANICAL ENGINEERING DEPARTMENT**

**ME415 DESIGN OF THERMAL SYSTEMS**

**Instructor**

Prof. Dr. Haşmet TÜRKOĞLU,

**Teaching Assistant**

Sühan MERGEN

**Course Objective**

Using the basic knowledge from thermodynamics, fluid mechanics and heat transfer, analyze the thermal system components (pipe, pump, fan, heat exchanger, etc.) and design thermal systems.

**Course Outcomes**

Students are expected to be comfortable with thermal system component analysis and their synthesis in integral systems. Design of complete systems is stressed. Students are also expected to do thermoeconomic analysis, thermoeconomic optimization and evaluation.

**Grading Procedure**

Midterm Exam (2 exams): 35%

Term Project: 15%

Attendance: 5%

Homework : 5%

Final Exam : 40%

**Reference Books**

Design of Thermal Systems, W. F. Stoecker, McGraw Hill, 1989.

Design of Fluid Thermal Systems, W. S. Janna, PWS, Second Edition, 1998

Design and Simulation of Thermal Systems, N. W. Suryanarayana and Öner Arici, McGraw Hill, 2003.

Week	Topics
1	<b>Introduction to Thermal System Design:</b> Classification of Thermal Systems. Design Process.
2	<b>Equation Fitting:</b> Mathematical Modeling. Matrices. Solution of Simultaneous Equations. Polynomial Representations, Lagrange Interpolation, Function of Two Variables, Exponential Forms, Best Fit: Method of Least Squares.
3	<b>Fluid Properties and Basic Equations:</b> Fluid Properties, Measurement of Viscosity, Measurement of Pressure, Basic Equations of Fluid Mechanics.
4	<b>Piping Systems:</b> Pipe and Tubing Standards, Equivalent Diameters for Noncircular Ducts, Equation of Motion for Flow in a Duct.
5	<b>Piping Systems:</b> Friction Factor and Pipe Roughness, Minor Losses, Series Piping Systems.
6	<b>Piping Systems:</b> Flow Through Noncircular Cross Sections, Equivalent Length of Fittings, System Behavior, Pipes in Parallel, Support Systems for Pipes.
7	<b>Pumps:</b> Types of Pumps, Pump Testing Methods, Cavitation and Net Positive Suction Head,
8	<b>Pumps:</b> Dimensional Analysis of Pumps, Specific Speed and Pump Types, Piping System Design Practices.
9	<b>Fans and Compressors:</b> Types of Fans, Fan Performance, Fan Testing Methods.
10	<b>Heat Exchangers:</b> Types of Heat Exchangers, Heat Exchanger Design
11	<b>Modeling and Numerical Simulation of Thermal Systems:</b> Introduction, Types of Models, Mathematical Modeling, Numerical Modeling, Solution Procedures.
12	<b>Modeling and Numerical Simulation of Thermal Systems:</b> Numerical Model for a System, System Simulation, Simulation Methods
13	<b>Optimization of Thermal Systems:</b> Introduction, Classical Optimization Techniques, Single Variable Optimization.
14	<b>Optimization of Thermal Systems:</b> Multivariable Optimization with no Constraints, Multivariable Optimization with Equality Constraints, Solution by the Method of Lagrange Multipliers.