

School of Engineering and Computer Science
Mech 402: Thermo/Fluid Systems Design

Catalog Data:	Mech 402 Thermal Systems Design; 3 credits (1-6) Experimental design and analysis of thermal-fluid systems using principles of thermodynamics, fluid mechanics, and heat transfer, thermal and fluid experimentation.
Class Schedule:	One 50-minute lectures per week, for one semester.
Laboratory Schedule:	Two 2-1/2 hour lab session per week, for one semester.
Prerequisites by Course:	Mech 404
Prerequisites by Topic:	Knowledge and understanding the fundamentals of: <ul style="list-style-type: none"> - engineering thermodynamics; thermodynamic properties of matter, work and heat, 1st and 2nd laws of thermodynamics - engineering fluid mechanics; fluid properties, Newton's 2nd law, similitude, laminar and turbulent flow, pipe flow, boundary layer flow - engineering heat transfer; conduction, convection, and radiation heat transfer
Recommended Texts:	None (class and lab notes)
Course Coordinator:	Dr. Amir Jokar
Course Objectives:	<ol style="list-style-type: none"> 1. Combine the fundamentals of engineering thermodynamics, fluid mechanics, and heat transfer to analyze thermal systems. 2. Apply the conservation laws, i.e., mass, momentum, and energy, to thermal systems under steady-state conditions. 3. Analyze the methodology of heat exchanger calculations and designs. 4. Design, build, and run a small-scale thermal system as a team, and participate in an in-class design project competition. 5. Design and conduct thermal and fluid experiments as well as interpret and analyze the experimental data. 6. Collaborate and work with other students, as teammates, on designing and conducting experiments and projects.
Topics Covered:	<ol style="list-style-type: none"> 1. Introduction to Thermal Systems 2. Heat Exchangers 3. Thermodynamics Lab 4. Fluids Lab 5. Heat Transfer Lab 6. Thermal systems design projects
Lab Experiments and Activities:	There will be three sets of experiments in this course within the subjects in Thermodynamics, Fluid Mechanics and Heat Transfer. <ul style="list-style-type: none"> - For the thermodynamics lab, the students will design and conduct experiments on steam power plants and gas turbines. - For the fluids lab, the students will design and conduct experiments on pressure measurement, flow rate measurements, pumping system, pressure drops through pipes/joints, and flow over immersed bodies in a water tunnel. - For the heat transfer lab, the students will design and conduct experiments on conduction, convection, and radiation heat transfer.

Course Outcomes:	Students will be able to:		
	Assessed for Program Outcomes	<p>B-1. Design an appropriate experimental procedure and investigate the constraints, assumptions, and models for each thermal/fluids experiment.</p> <p>B-2. Utilize appropriate equipment in the thermal/fluids laboratory to collect data using the lab guidelines/notes.</p> <p>B-3. Analyze and interpret the collected experimental data using appropriate statistical tools/software.</p> <p>B-4. Compare and verify the results of experimental data with the results obtained from analytical/numerical solutions.</p> <p>C-2. Carry out the design process, such as modeling, calculation, and iteration, to satisfy project requirements for the thermal system.</p> <p>C-3. Work within realistic constraints, such as economical, environmental, manufacturability, health and safety, ethical, and sustainability, in realizing the thermal system.</p> <p>C-4. Build the thermal system based on the required specifications.</p>	
	Other	<p>C-1. Investigate the needs to produce a problem definition for a small-scale thermal system.</p> <p>D-1. Participate in teamwork activities and share responsibilities/information on schedule with other team members.</p> <p>D-2. Attend team meetings for the development and selection of ideas.</p> <p>G-1. Prepare lab/project reports, individually or in team, using appropriate formats and grammar with discipline-specific conventions, including citations/references.</p> <p>G-2. Deliver a well-organized oral presentation, including good explanations when questioned, for the design projects at the end of semester.</p> <p>H-2. Examine economic tradeoffs in the design projects or in some specific thermal/fluids problems.</p> <p>H-3. Evaluate the environmental factors of engineering solutions in design projects or in some specific thermal/fluids problems.</p> <p>I-1. Use resources and information not taught in class in the design projects.</p> <p>K-1. Setup/operate data acquisition systems to collect experimental data in the design projects</p>	
Required or Elective Course:	Required		
Contribution to Professional Component:	Engineering Topics		
Relationship of Course to Program:	Meets: Educational Objectives <u>1, 2, 3, 4</u> Program Outcomes <u>B, C, D, G, H, I, K</u>		
Prepared by:	Dr. Amir Jokar	Date:	October 10, 2008
Approved by CAC:			