WASHINGTON STATE UNIVERSITY
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School of Engineering and Computer Science
MECH 402: Thermal Systems Design

Catalog Data:	**402 Thermal Systems Design** 3 (1-6) Course Prerequisite: MECH 404. Design and analysis of thermal-fluid systems using principles of thermodynamics, fluid mechanics, and heat transfer, thermal experimentations. Typically offered Fall.
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: - 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, convention, and radiation heat transfer
Textbook:	None (class and lab notes)
Course Coordinator:	Dr. Sun Ung Kim
Course Objectives:	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:	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. - 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 Student Outcomes	2.b. Apply the engineering design process (concept generation, modeling, evaluation, and iteration) to satisfy project requirements for the thermal system. 2.c. Analyze the realistic constraints, such as economic, environmental, social, cultural, global, public health, safety, welfare, and other factors in realizing the thermal system. 2.d. Produce solutions that meet specified needs for thermal systems engineering designs. 3.b. Deliver well-organized, logical oral presentations accommodating audience interests and background, including good explanations when questioned. 6.a. Identify the constraints, assumptions, and models for the thermal/fluid experiments. 6.b. Use appropriate equipment and techniques for thermal/fluid experimentation. 6.c. Conduct analysis and interpretation of the thermal system data for project report. 6.d. Draw conclusions by evaluating experimental results with respect to engineering knowledge.
	Other	1.d Apply mathematics, scientific and/or engineering principles toward solving engineering problems. 3.a. Write team project reports for technical audiences using appropriate formats and grammar with discipline-specific conventions including citations. 4.a. Evaluate thermal system project solutions in consideration of the global, economic, environmental, and societal impacts. 5.a. Establish common goals, tasks, timeline, etc., as a project team. 5.b. Share responsibilities and information on project schedule and tasks with other members as a project team. 5.c. Collaborate with individuals with diverse backgrounds, skills, and/or perspectives to meet project objectives. 7.a. Able to use resources effectively to learn new material not taught in class for project reports.
Required or Elective Course:		Required
Contribution to Professional Component:		Engineering Topics
Relationship of Course to Program:		Meets: Educational Objectives 1, 2, 3, 4 Student Outcomes 1, 2, 3, 4, 5, 6, 7
Prepared by:		Dr. Sun Ung Kim — Date: 8/14/2018 (DK/SK) (1.10.19 mb)
Approved by USC:		