Fall **MAE107** **Y. Wang**
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THERMAL FLUID SCIENCE LABORATORY SYLLABUS

Catalog Data: **MAE107: Fluid Thermal Science Laboratory** (Credit Units: 4). Fluid and thermal engineering laboratory. Experimental analysis of fluid flow, heat transfer, and thermodynamic systems. Probability, statistics, and uncertainty analysis. Report writing is emphasized, and a design project is required. (Design units: 1).

Textbooks: Y. Wang, Practical Handbook of Thermal Fluid Science, Bentham Science (2023) (link) (Available at UCI library for free)
Recommended:
Holman, J.P. *Experimental Methods for Engineers,* 6th Edition, McGraw-Hill Inc., 1994.
Figliola, R.S. and Beasley, D.E. *Theory and Design for Mechanical Measurements,* 2nd Edition, John Wiley and Sons, 1995.
(The above two books are not required for the class)

References: Students are to refer to books from courses MAE 91, 130A/B, 115/112 and 120. Students are encouraged to consult the UCI Library and the Web. Also see Mechanical Engineers Handbook, TJ151. M395 1998.

Instructor: Prof. Wang (4231EG) email: yunw@uci.edu Office Hour: see Canvas.

TAs: See Lab Schedule.

Course Outcomes: Students will be able to: (1) practice/exercise basic experimental skills to conduct thermal-fluid labs; (2) apply theoretical concepts developed in course work of thermodynamics, fluid mechanics, and heat transfer with hands-on experiments; (3) prepare a design project including economic analysis and mortgage; (4) learn concepts in statistics/probability including standard deviation, error analysis, and probability distributions with hands-on experiments.

Prerequisites By Topic: Introduction to Thermodynamics (MAE 91), Viscous Incompressible Flow (MAE 130A)

Lecture Topics:

Statistics	(3 hours)
Central Plant (major components and power cycles such as the Brayton and Rankine cycles)	(3 hours)
Central Plant Energy Analysis	(3 hours)
Heat Transfer: Conduction/ Convection	(3 hours)
Wind Tunnel	(3 hours)
Pipe Flow	(3 hours)
Carnot, Otto and Diesel Cycles	(3 hours)
Mechanical Refrigeration and Heat Pump	(3 hours)
Design Project	(3 hours)

Class Schedule: Each class meets ~3 hours per week for 10 weeks and students are assigned to a ~2 hour laboratory session per week.

Computer Usage: Used for data collection (National Instruments), data analysis (Excel, Matlab, Mathcad), and report writing (Word, LaTex).

Laboratory Projects:

Statistics, Probability, Significant Figures, Graphs	(2 hours)
UCI Central Plant (Lab at CP)	(2 hours)
UCI Central Plant Energy Analysis (Lab at CP)	(2 hours)
Heat Transfer	(2 hours)

Wind Tunnel	(2 hours)
Pipe Flow	(2 hours)
Otto and Diesel Cycles	(2 hours)
Vapor-Compression Refrigeration	(2 hours)
Design Project Review	(2 hours)

Professional Component: Contributes toward the Mechanical Engineering Topics courses and Major design experience.

Relationship to Program Outcomes: This course relates to Program Outcomes as stated at:
http://plaza.eng.uci.edu/degree-program/mechanical/mission
The course provides experiments which reinforce, amplify, and extend the concepts of thermodynamics, fluid flow and heat transfer.
This course contributes to students' abilities to demonstrate the following Program Outcomes:
EAC1: an ability to apply knowledge of mathematics, science, and engineering
EAC1: an ability to identify, formulate, and solve engineering problems, and particularly to conceptualize objectives and constraints, identify governing principles, apply fundamental analytical tools, and predict performance
EAC2: an ability to design a system, component, or process to meet desired needs
EAC3: Demonstrate an ability to conduct experiments in a group with effective oral communication
EAC5: provide leadership in the group lab work and create a collaborative and inclusive environment to accomplish the tasks within the timeframe of each lab session
EAC6: an ability to design and conduct experiments, as well as to analyze and interpret data
EAC7: Demonstrate an ability to learn new software and apply it to study engine performance

Design Content Description *Approach:* Students are given a capstone open-ended design problem including economic analysis. Students are encouraged to consider design alternatives and their costs. Design is emphasized in the laboratory experiments. Laboratory reports contain uncertainty analyses where appropriate.
Lectures: 50% *Laboratory Portion:* 50%

Grading Criteria:

Reports:	70%
Quizzes:	20% (5% online)
Participation:	10%
	100%

Estimated ABET Category Content:
Mathematics and Basic Science: ___ credit units or ___%
Engineering Science: 3 credit units or 75 %
Engineering Design: 1 credit units or 25 %