

ME 4122

Heat Transfer, Thermodynamics and Fluid Mechanics Laboratory Fall 2010

Labs: T 10:00 – 11:50, T 1:00 – 2:50, Th 8:00 – 9:50, Th 10:00 – 11:50 (VKH 164)
Lecture: M 4:00 – 4:50 (Engr 118), M 4:00 – 4:50 (BohH 343)

Professor: Daniel N. Pope, Ph.D.

E-mail: dpope@d.umn.edu

Office: VKH 113

Phone: 726-6685

Office Hours: Mon, Wed, Fri 11:00-12:00, Tues 3:00-4:00 (or by appointment)

Alison Hoxie, Ph.D.

E-mail: ahoxie@d.umn.edu

Office: VKH 121

Phone: 726-8957

Office Hours: Mon, Wed, Fri 2:00-3:00, (or by appointment)

Recommended Textbooks:

- [1] Munson, Bruce R., Young, Donald F., Okiishi, Theodore H., *Fundamental of Fluid Mechanics, 4th Edition*, John Wiley & Sons, Inc. (2002).
- [2] Çengel, Yunus A., Boles, Michael A., *Thermodynamics, An Engineering Approach, 4th Edition*, McGraw Hill, (2002).
- [3] Çengel, Yunus A., *Heat Transfer, A Practical Approach, 2nd Edition*, McGraw Hill, (2003).

Course Web Page: We will use Moodle for the course website. To access the course site, go to the My Courses tab at the myU portal: <http://myu.umn.edu> or use the following link: <https://moodle.umn.edu/course/view.php?id=12512> (you will have to log in).

Course Catalog Description: (2.0 cr; prereq & 4112 or #; BSIE or BSME cand; no Grad School credit; A-F only) Heat transfer and Thermo-Fluids lab, experimental evaluation of conductive, convective and radiation heat transfer, and analysis of performance of various energy systems such as compressors, turbines, fans, refrigerators and combustion engines.

Prerequisites: & ME 4112, BSME cand. or #

Course Components: The course consists of two **major labs** and several **minor labs**. Each lab has an associated lecture that precedes the lab. Every student will be a member of a two or three person **lab team** for the entire course and will **evaluate the other members** of their lab team. Lab reports will be submitted for each lab.

Major Labs: The performance of a complex mechanical engineering system will be analyzed in each of the major labs. Each lab team will obtain data and analyze the system. Each lab

team will submit a **formal report** for **both of the major labs**. The two major labs for this semester are; the *Air Conditioning Lab* and the *Jet Engine Lab*.

Minor Labs: Several minor labs that focus on one or two aspects of a mechanical engineering system or instrumentation will be conducted over the course of the semester. Students will prepare an individual **lab memo** for each minor lab.

Grading: The final percentage grade in the course is based on the following components:

Component	Percentage
Formal Reports (20% per report)	40
Group Member Evaluations	15
Minor Lab Memo Average	45
Total	100

The corresponding minimum letter grade a student will receive is listed in the table below.

Percentage Grade		Letter Grade
Greater than or equal to	Less than	
0.0	59.5	F
59.5	66.5	D
66.5	69.5	D+
69.5	72.5	C-
72.5	76.5	C
76.5	79.5	C+
79.5	82.5	B-
82.5	86.5	B
86.5	89.5	B+
89.5	92.5	A-
92.5		A

The final letter grade awarded for the class may be higher than the minimum “earned” letter grade but will never be lower. Additional grading policies are listed in the **Attendance/Policies** section below.

Attendance/Policies: Attendance at all labs and lectures is mandatory. Exceptions to this attendance policy will be made under extraordinary circumstances (e.g. personal or family emergency) or when the student arranges for an absence in advance. Every attempt will be made to accommodate an excused absence; however, it is the student’s responsibility to make arrangements to perform the lab and submit the associated lab report in a timely manner.

The following additional policies apply during this course.

- Late assignments (unless prior arrangements are made) will be penalized 25%.
- Assignments that are handed in after solutions have been posted will not be given credit.

- Students are expected to act with honesty and respect (see the following)
 - Student Academic Integrity Policy: <http://www.d.umn.edu/assl/conduct/integrity>
 - Student Conduct Code: <http://www.d.umn.edu/assl/conduct/code>
- Unless specific instructions are given to the contrary, working with others on a given assignment is permissible (and encouraged).
- Copying someone else's work is NOT permissible. Copied assignments will be given NO CREDIT.
- Using figures or text from a source without citing the source (plagiarism) is NOT permissible. If there is significant plagiarism within an assignment, the assignment will receive NO CREDIT.
- **Disabilities:** It is the policy and practice of the University of Minnesota Duluth to create inclusive learning environments for all students, including students with disabilities. If there are aspects of this course that result in barriers to your inclusion or your ability to meet course requirements – such as time limited exams, inaccessible web content, or the use of non-captioned videos – please notify the instructor as soon as possible. You are also encouraged to contact the Office of Disability Resources to discuss and arrange reasonable accommodations. Please call 218-726-6130 or visit the DR website at www.d.umn.edu/access for more information.
- **Equal Opportunity:** The University of Minnesota is committed to the practice that all of its students shall have equal educational opportunities. The University expressly forbids discrimination on the basis of race, color, gender, sexual orientation, disability, veteran's status, ethnicity, religion, creed, national origin, or marital status.

Lab Safety: This lab course includes the operation of electrical and mechanical devices. Compliance with posted instructions and verbal commands given by the instructor is essential to maintaining a safe environment. When in the lab, observe the following guidelines:

- There is a fire danger associated with volatile liquids. Know the location and operation of all fire fighting equipment.
- Loose clothing is a hazard around rotating machinery. Remove ties, etc.
- High voltages are associated with some tests. Never operate associated equipment until you are absolutely sure of procedures.
- Some accessible lab equipment may attain very high temperatures (e.g. exhaust manifold on gasoline engine).
- No yelling, horseplay or other inattentive behavior.
- Know how to stop every piece of equipment.
- Be alert for unusual sounds, vibrations, pressure changes, etc. in the equipment.

Class Assignment and Reading Schedule

Week	Day	Date	Reading Assignment	Topic	Assignment Due
ONE	Mon	6 Sep	Labor Day		
	Tues/ Thurs	7/9 Sep	NO LAB		
TWO	Mon	13 Sep		Course Introduction/ PID Review	
	Tues/ Thurs	14/16 Sep	Instrumentation Lab	Lab Instrumentation	
THREE	Mon	20 Sep	Heat Conduction Lab, [3] Ch 2 and 3	Heat Conduction	
	Tues/ Thurs	21/23 Sep	Heat Conduction Lab, [3] Ch 2 and 3	Heat Conduction	Instrumentation Lab
FOUR	Mon	27 Sep	Psychrometrics Lab, [2] Ch 10	Psychrometrics	
	Tues/ Thurs	28/30 Sep	Psychrometrics Lab, [2] Ch 10	Psychrometrics	Heat Conduction Lab
FIVE	Mon	4 Oct	Air Conditioning Lab, [2] Ch 10	Air Conditioning	
	Tues/ Thurs	5/7 Oct	Air Conditioning Lab, [2] Ch 10	Air Conditioning	Psychrometrics Lab
SIX	Mon	11 Oct	Uncertainty Analysis	Uncertainty Analysis	
	Tues/ Thurs	12/14 Oct		Optional A/C Lab Discussion	
SEVEN	Mon	18 Oct	Jet Engine Lab, Part 1, [2] Ch 8	Jet Engine	
	Tues/ Thurs	19/21 Oct		Optional A/C Lab Discussion	
EIGHT	Mon	25 Oct	Jet Engine Lab, Part 2, [2] Ch 8, 14	Jet Engine	
	Tues/ Thurs	26/28 Oct		Air Conditioning Lab Due	Air Conditioning Lab

Class Assignment and Reading Schedule

Week	Day	Date	Reading Assignment	Topic	Assignment Due
NINE	Mon	1 Nov	Jet Engine Performance	Jet Engine	
	Tues/ Thurs	2/4 Nov	Jet Engine Lab, [2] Ch 8, 14	Jet Engine Lab	
TEN	Mon	8 Nov	Combustion Lecture, [2] Ch 14	Basics of Combustion	
	Tues/ Thurs	9/11 Nov		Optional Jet Engine Discussion	
ELEVEN	Mon	15 Nov			
	Tues/ Thurs	16/18 Nov		Optional Jet Engine Discussion	
TWELVE	Mon	22 Nov			
	Tues/ Thurs	23/25 Nov	Thanksgiving		
THIRTEEN	Mon	29 Nov	Flow Meters Lab, [1] Ch 3	Flow Meters	
	Tues/ Thurs	30 Nov 2 Dec	Flow Meters Lab, [1] Ch 3	Flow Meters	Jet Engine Lab
FOURTEEN	Mon	6 Dec	Pump Lab, [1] Ch 12	Pumps	
	Tues/ Thurs	7/9 Dec	Pump Lab, [1] Ch 12	Pumps	Flow Meters Lab
FIFTEEN	Mon	13 Dec		Course Review & Evaluation	
	Tues/ Thurs	14/16 Dec			Pumps Lab