ME 343-005 Mechanical Laboratory I (Fall 2024)

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Class Notes: to be sent after each class
Office hours: Wednesdays: 8:30-9:30 am or by appointments

Textbook: J. P. Holman, Experimental Methods for Engineers, 8th Edition, McGraw Hill, 2011

Course Content

Topic	Reading Assignment	Key concepts
Introduction; Data analysis	2.7, 3.2-3.9, 3.11-3.14, Notes	Random and precision errors; Least square method; Uncertainty analysis
Linear and Rotation Speed Measurements	Notes	Cross-correlation theory; Oscilloscope applications Lab abstract writing
Temperature measurements	8.5,8.6, 8.8, 8.9, 2.7 Notes	Thermocouple; thermo-resistance; pyrometers Full lab report writing
Force and Torque Measurements (Strain gage)	10.3-10.8 Notes;	Strain-stress relationship; strain gage; Wheatstone bridge; Force and deformation of elastic collisions
Flowrate & Velocity Measurements	7.3, 7.4, 7.6, 7.13 Notes	Venturi, orifice & rotameter; Pitot tube, LDV and PIV; Flow visualization
Programmable Logic Control	Notes	PLC, Ladder logic diagram
Acoustics	11.5; Notes	Sound pressure level (dB); Attenuation
Signal Conditioning	4.12, 14.3	RC filtration; Power spectrum; Digital filtration

Course Arrangement

Week	Lecture/Lab: Wednesdays: 10:00 am-2:20 pm (Lectures and/or Labs)			
	Topic	HW/Lab	Topic	**Due noon of Fridays**
1	Introduction; Chap 3 Random data statistics; regression method; Linear and rotation speed measurements	HW#1	Random error; least square regression	-
2	Lab abstract requirement of rotation speed	Lab-1	Rotation speed	HW#1
3	HW#1 Solution; Thermometry: Chap 8, Chap 2; Uncertainty analysis; Chap 3; Signal response & sensitivity	HW#2	System uncertainty; Temperature	Rotation (abstract)
4	Lab report requirement of temperature	Lab-2	Temperature & signal response time	HW#2
5	HW#2 Solution; Stress & strain; strain gage: Chap 10; Strain gage rosette & dynamic force	HW#3	Stress & dynamic force (Strain Gages)	Temperature (**full**)
6	Lab abstract requirement of force	Lab-3	Force	HW#3
7	**Mid-term**	-	Lect/HW/Lab: 1&2	-
8	Mid-term solution; Control Theory (PLC)	-	PLC	-
9	HW#3 Solution; Lab abstract requirement of PLC	Lab-4	PLC	Force **(extend abstract)**
10	Flow visualization, Flow rate: Chap 7; Flow velocity; frictional pressure loss	HW#4	Flowrate	Control (abstract)
11	Lab abstract requirement of flowrate	Lab-5	Flow	HW#4
12	HW#4 Solution; Acoustics: Chap 11	HW#5	Acoustics	Flow (**extend abstract**)
13	Signal Conditioning; Abstract requirement of Lab-6	Lab-6	Acoustics	HW#5
14	HW#5 Solution; Review for Final	-	-	Acoustics (abstract) **Report resubmissions**

Week	Monday	Due noon of Monday
1	9/4	-
2	9/11 (lab-1)	HW-1
3	9/18	Lab-1
4	9/25 (lab-2)	HW-2
5	10/2	Lab-2
6	10/9 (lab-3)	HW-3
7	**10/16 (MT)**	-
8	10/23	Lab-3
9	10/30 (lab-4)	-
10	11/6	Lab-4
11	11/13 (lab-5)	HW-4
12	11/20	Lab-5
(11/27 follow Friday's schedule!)		
13	12/4 (lab-6)	HW-5
14	12/11 (review)	Lab-6 & all re-sub

---------- Class Rules & Grading Policy ----------

(1) ***This course expects students to work without artificial intelligence (AI) assistance*** *in order to better develop their skills in this content area. As such, AI usage is not permitted throughout this course under any circumstance.*

(2) Grade Calculations

45% Full Lab Reports or Extended Abstracts (3; 10% each) and Lab Abstracts (3; 5% each)
15% Homework Assignments (5; 3% each)
15% Mid-term Examination (1)
25% Final Examination (1)

Bonus points (about 10%) are given to some lab assignments and exams.

Final Grade is based on the total grade.
In general, above 90% guarantees an "A" grade and below 60% will result in an "F" grade.
No make-up exams.

(3) Lab Report/Abstract Requirement

All reports should be individually completed and submitted before due. Group discussion is encouraged but not for "Group Report". For identical reports or very similar reports, the grade is divided by the number of students involved (**such incidence will be reported to the department for record keeping**).

- Team-work is encouraged to acquire raw data from experiment, with leadership and quality control.
- Lab report must follow the formal report or abstract format.
- Lab grade will be given based on the grading guideline (grading criteria of individual lab contents will be discussed in class ad distributed before reports due).
- **Absolutely no AI-assisted lab report is allowed (such incidence results zero points on the report with no resubmission permitted).**

(4) Homework Requirements

(a) Assignments are due on **noon of Firday** of the due week; with no late or resubmission.

- Homework should be submitted directly to my office (MEC204) or in class; **DO NOT leave it to my mailbox in ME department office.**

(b) Homework grade is based on "completeness" and "reasonableness", not necessarily on "correctness".
- Completeness: answer all questions asked in the problems;
- Reasonableness: solution of reasonable application approaches to the questions asked.

(c) Homework solutions will be explained in class, typically in the following week of due.

(5) Late Submission and Resubmission of Reports

- Late or resubmission will be accepted, with a 50% grade deduction.
- The final grade will be the average with the original grade.
- Only one late or resubmission is allowed for each assignment.
- No resubmission of lab report 6

(6) Mid-term/Final Exam Requirement

(a) A 1.5-hour mid-term exam will be given, mainly covering topics of Data Analysis, Theories and Lab Reports for Speed and Temperature Measurements.

(b) A 2.5-hour final exam will be given, mainly covering topics of Strain-gage Theory, Theory of Flow Measurement, PLC, Theory of Acoustics Measurement, and Signal Conditioning, as associated Lab Reports.

(c) **All exams are open book and notes (hard copies only!)**. No computer/iPad/iPhone/any internet-connectable device!