ME 343-003 Mechanical Laboratory I (Fall 2023)

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Class Notes: to be sent after each class
Office hours: Wednesdays: 4:00-5:00 pm

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 1, 4	Random and precision errors; Least square method; Uncertainty analysis
Linear and Rotation Speed Measurements	Note 3	Cross-correlation theory; Oscilloscope applications Lab abstract writing
Temperature measurements	8.5,8.6, 8.8, 8.9, 2.7 Notes 3; 5	Thermocouple; thermo-resistance; pyrometers Full lab report writing
Force and Torque Measurements (Strain gage)	10.3-10.8 Notes 6-7; supplements	Strain-stress relationship; strain gage; Wheatstone bridge; Force and deformation of elastic collisions
Flowrate & Velocity Measurements	7.3, 7.4, 7.6, 7.13 Note 8; supplements	Venturi, orifice & rotameter; Pitot tube, LDV and PIV; Flow visualization
Programmable Logic Control	Note 9; supplements	PLC, Ladder logic diagram
Acoustics	11.5; Note 10	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	Wednesday	Due noon of Friday
1	9/6	-
2	9/13 (lab-1)	HW-1
3	9/20	Lab-1
4	9/27 (lab-2)	HW-2
5	10/4	Lab-2
6	10/11 (lab-3)	HW-3
7	**10/18 (MT)**	-
8	10/25	Lab-3
9	11/1 (lab-4)	-
10	11/8	Lab-4
11	11/15 (lab-5)	HW-4
11/22 follows Friday's class schedule		
12	11/29	Lab-5
13	12/6 (lab-6)	HW-5
14	12/13 (review)	Lab-6 & all re-sub

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

(1)   Grade Calculations

45% Full Lab Reports or Extended Abstracts (3; 10% each) and Lab Abstracts (3; 5% each)
15% Homework Assignments (6; 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.

(2)   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**).

- Lab report must follow the formal report or abstract format (see lecture notes).

- 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).

(3)   Homework Requirements

(a) Assignments are due on **noon of Friday** 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.

(4)   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

(5) Mid-term/Final Exam Requirement

(a) A 1.5 hour mid-term exam will be given, mainly covering topics of Data Analysis and Theories 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.

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