USC Viterbi School of Engineering

AME 341aL Mechoptronics Laboratory

Units: 3

Term: Fall 2023 **M Aug 21st – W Dec 6th**

Location: Lecture MWF 8am THH 301
Lab M, T, W or Th 2-5pm BHE 301
See course Blackboard page
http://software.usc.edu/ (install Matlab)

Instructors:	Dr. Matthew Gilpin	Dr. Emma Singer
Office:	OHE 500H	RRB 228
Office Hours:	M: 10a-12, Th: 10a-11, F: 1p-2	T: 11a-1p, W: 10a-12
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Teaching Assistants: TBD
Contact Info: TBD
Office: BHE 301
Office Hours: See Piazza

Course Description

A coordinated laboratory and lecture sequence on aeromechanical instrumentation and device control stressing the integration of mechanical, optical and electronic components. This course is intended for junior level aerospace, astronautical and mechanical engineering students, and is designed to develop self-sufficient, capable, and critically thinking engineers.

Learning Objectives

AME 341aL teaches the basics of aerospace and mechanical experimentation; this includes how to make a measurement, perform analysis, and report on technical findings. Laboratory experiments introduce the students to a variety of digital and analog measurement devices and often require the construction of basic circuits; the physical principles of these devices are presented during the lecture section, and the capabilities and limitations are explored during the laboratory section. Assignments focus on clarity in technical communication both written and graphic. Diligent data collection followed by detailed data analysis is required and both Matlab and MS-Excel computational methods and data presentation are employed. Lab results are communicated in a written technical format of publishable quality.

Prerequisite(s): MATH 126, PHYS 152
Co-Requisite (s): n/a
Concurrent Enrollment: n/a
Recommended Preparation: n/a

Course Notes

AME 341aL relies heavily on the USC Blackboard and Piazza for all course communications. This includes discussion forums for assignments, course documents, and grade reporting. Before the semester begins, students should verify they have access to all web content.

Technological Proficiency and Hardware/Software Required

Matlab: student license available at http://software.usc.edu/
MS-Excel: student license available at https://itservices.usc.edu/officestudents/

Access to both programs is required. These programs are also installed in all USC computer labs as well as in the Mechoptronics Lab (BHE 301).

	Date		Lecture	Lab Contents	Assignment Due	%
1	M	8/21	(0) The Basic Ideas	(0) Intro to Lab; Data Presentation Essentials		
	W	8/23	(1) Error Analysis I			
	F	8/25	(2) Error Analysis II			
2	M	8/28	(3) Error Analysis III	(1) Physical Measurements	**A0 Due**	**4**
	W	8/30	(4) Elements of Electronics			
	F	9/1	(5) A0 Recap			
3	M	9/4	**Labor Day**			
	W	9/6	(6) Linear Circuits I			
	F	9/8	(7) Linear Circuits II			
4	M	9/11	(8) Linear Circuits III	(2) Real and Virtual Instruments	**A1 Due**	**6**
	W	9/13	(9) 1st Order Systems I - Phasors and Complex Exponentials			
	F	9/15	(10) A1 Recap			
5	M	9/18	(11) 1st Order Systems II - Principles	(3) Linear Circuits	**A2 Due**	**6**
	W	9/20	(12) 1st Order Systems III - Practical Examples			
6	M	9/25	(13) A2 Recap	(4) Transfer Function of a 1st Order System	**A3 Due**	**2**
	W	9/27	(14) Op Amps I - Steady State			
	F	9/29	(15) A3 Recap			
7	M	10/2	(16) Op Amps II - Frequency Response		**A4 Due**	**10**
	W	10/4	(17) Op Amps III - Additional Configurations			
	F	10/6	(18) A4 Recap			
8	M	10/9	(19) LP Preview			
	W	10/11	(20) Digital Circuits I - How to Build a Computer			
	F	10/13	**Fall Recess**			
9	M	10/16	(21) Digital Circuits II - Analog-Digital Converters	**(LP) Lab Practical**		**10**
	W	10/18	(22) Digital Circuits III - Analysis of Discrete Signals			
	F	10/20	(23) How to Write a Report			
10	M	10/23	(24) Op Amps IV - Lab Prep / Review	(5) Properties of Op-Amps		
	W	10/25	(25) LP Results			
11	M	10/30	(26) Digital Signal Processing I	(6) Digital Circuits		
	W	11/1	(27) Digital Signal Processing II			
	F	11/3	(28) Acoustics I - The wave equation			
12	M	11/6	(29) Acoustics II - Plane waves	(7) Analysis of Discrete Time Series	**A5 Due (Report #1)**	**12**
	W	11/8	(30) Acoustics III - Production & measurement of pressure waves			
	F	11/10	*No Lecture*	**Last day to drop with a mark of W**		
13	M	11/13	(31) How to Write a Report II	(8) Making Noise - Acoustic Waves	**A7 Due**	**10**
	W	11/15	(32) A5 Recap			
	F	11/17	(33) A7 Recap			
14	M	11/20	*No Lecture*			
	W	11/22	**Be Thankful**			
15	M	11/27	(34) Something Fascinating!		**A8 Due (Report #2)**	**15**
	W	11/29	(35) Exam Review			
	F	12/1	(36) Course Summary			
16	M	12/4	**Study Days**		**Final Exam**	**15**
	W	**12/6**	**Final Exam: 8am - 10am**			

Required and Supplementary Materials

There are no "Required" text textbooks for AME 341aL. A course reader will be provided which includes background information related to the topics discussed during lecture and lab. The course reader supplements the topics covered in class; thus, by definition, it is not as detailed as the material presented during lecture and lab. There are several *optional* textbooks outlined below, but note there are several copies available for reading in BHE 301 (these copies are to remain in the lab):

(optional) Introduction to Mechatronics and Measurement Systems, Alciatore & Histand (2019) McGraw-Hill.
(optional) Theory and Design for Mechanical Measurements, Figliola & Beasley (2019) Wiley.
(optional) The Art of Electronics, Horowitz & Hill (2015) Cambridge University Press.

Description and Assessment of Assignments

There will be one written final exam (see published university exam schedule) and one lab practical exam (conducted during your regularly scheduled lab time). The remainder of the course assignments will be based on experiments conducted in lab. All assignments are due on your registered lab day as shown in the course schedule. All assignments will be produced using a technical report writing style, which will be detailed during lecture. Data analysis will be performed using both MATLAB and MS Excel. For some assignments you can choose which software to use; however, several assignments require specifically MATLAB or specifically Excel, as detailed in the lab handbook.

Grading Breakdown

Subject to change; see Course Schedule

Assignment	% of Grade
A0	4
A1	6
A2	6
A3	2
A4	10
A5	12
LP	10
A7	10
A8	15
Final Exam	15
Attendance	5
Lab Performance	5
Total	**100**

Assignment Submission Policy

Each assignment is due ***before*** lab begins on your registered lab day. All assignments will be submitted *digitally* to Blackboard via Turn-It-In. Assignments must be submitted on time. Do not wait until the last minute to submit and ensure that you receive a submission receipt. **A late assignment will be docked 50% and no assignment will be accepted after 8am on the day following the due date. One microsecond ($1\ \mu s$) late is considered late and there are no exceptions.** For similar reasons, there are no make-up labs. All labs and assignments will count towards the total grade (*i.e.*, none are dropped). It is not possible to pass the course if you are missing two or more assignments or any labs. Instructors must be notified ASAP in the case of documented illness or emergency.

Attendance

In-person attendance is expected for lecture. This is required to facilitate discussion and ensure class-wide engagement with course content before labs. Four (4) "grace days" will be given to account for interviews, competitions, etc. Instructors must be notified ASAP in the case of documented illness or emergency.

Email Subject Line

Please begin all email subject lines with [AME 341] when emailing professors or TAs regarding this course. For example, your email subject line would read "[AME 341]: Homework A0 Question"

Additional Policies

See the Mechoptronics course reader for all policies, codes of conduct, and expectations. Please read the course reader in full. The course reader will be provided during Week 1.

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on Research and Scholarship Misconduct.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
eeotix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
osas.usc.edu
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.
USC Campus Support and Intervention - (213) 821-4710
campussupport.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
ombuds.usc.edu
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

*Occupational Therapy Faculty Practice - (323) 442-33*40 or otfp@med.usc.edu
chan.usc.edu/otfp
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.