USC Viterbi School of Engineering

AME 341bL Mechoptronics Laboratory

Units: 3

Term: Spring 2020: M Jan 13th – W Apr 29th

Location: Lecture MW 8-8:50am @SMG 124
Lab M, T, W or Th 2-4:50pm @BHE 301

Instructors:	Dr. Akshay Potnuru	Dr. Bo Jin
Office:	OHE 500E	PHE 332
Office Hours:	Th. 12p-1p; F. 12:30p-2:30p	M. 10:45a-1:45p
Contact Info:	potnuru@usc.edu	bochengj@usc.edu

Check Piazza for Office hours after Spring Break

TA	Sam Goldman	James Croughan	Hao Ji	Jingyi Liu
Contact Info:	sgoldman@usc.edu	jcrougha@usc.edu	haoji@usc.edu	liu027@usc.edu
Office:	BHE 301	BHE 301	BHE 301	BHE 301
Office Hours:	M 11am-2pm	T 11am-2pm	W 11am-2pm	Th 11am-2pm

Course Description

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

AME341bL: Mechoptronics Laboratory II

Textbooks: (optional) *Introduction to Mechatronics and Measurement Systems*, Alciatore & Histand (2011) McGraw-Hill
(optional) *Theory and Design for Mechanical Measurements*, Figliola & Beasley (2010) Wiley
(optional) *The Art of Electronics*, Horowitz & Hill (1989) Cambridge University Press

Lecture: MW 8-8:50a SGM 124 Lab: M/T/W/Th 2-4:50p BHE 301

Instructors:	Prof. A. Potnuru	OHE 500E	potnuru@usc.edu	Office hours: Th. 12p-1p; F. 12:30p-2:30p
	Prof. B. Jin	PHE 332	bochengj@usc.edu	Office hours: M. 10:45a-1:45p
TAs	Sam Goldman	BHE 301	sdgoldma@usc.edu	Office hours: M. 11a-2p (No Office Hours for Weeks 1, 8, & 10)
	James Croughan	BHE 301	jcrougha@usc.edu	Office hours: T. 11a-2p (No Office Hours for Weeks 1, 8, & 10)
	Hao Ji	BHE 301	haoji@usc.edu	Office hours: W. 11a-2p (No Office Hours for Weeks 1, 8, & 10)
	Jingyi Liu	BHE 301	liu027@usc.edu	Office hours: Th. 11a-2p (No Office Hours for Weeks 1, 8, & 10)

Learning Objectives

AME 341bL 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 nature 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 is employed. The results laboratories are communicated in a written technical format of publishable quality.

Prerequisite(s): MATH 126, PHYS 152, AME 341aL
Co-Requisite (s): n/a
Concurrent Enrollment: n/a
Recommended Preparation: n/a

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Week	Date		Lecture	Lab	Assn. Due	%
1	M 1/13	(1)	Introduction	**A9-a, A9-b:** take-home assignments. **A9-a** to be graded in Wk 2 Lab Time (T-Th) & **A9-b** graded during Wk 4 TA office hours.	Wk 2 Lab Visit "5-Min Slots" Sign-Up Sheet	
	W 1/15	(2)	2nd Order Systems			
2	M 1/20		**MLK DAY**	"**A9-a:** LabView Check" (team of 2) graded by TAs during Week 2 Lab Time (2-4:50p T, W, and Th) (@ BHE 301)	**A9-a** *LabView Check*	**2**
	W 1/22	(3)	Strain Gauges and Wheatstone Bridge		Wk 4 TA Office Hours "5-Min Slots" Sign-Up Sheet	
3	M 1/27	(4)	Dynamic Pressure, Turbulent Jets, and Plumes	**E10:** Strain Gauges / Vibrating Beams		
	W 1/29	(5)	LabView I - Stepper Motor Control			
4	M 2/3	(6)	LabView II - Safety, Sampling & Loops	**E11:** LabView – Turbulent Jets	**A9-b:** *LabView Check (group of 2, during TA's office hours)*	**2**
	W 2/5	(7)	Thermocouples			
	F 2/7	(8)	Convective Heat Transfer I			
5	M 2/10	(9)	Convective Heat Transfer II	**E12:** Thermocouples and Heat Transfer	**A10:** *Report*	**5**
	W 2/12	(10)	Engineering Ethics / MiniTalks info			
6	M 2/17		**PRESIDENT'S DAY**	**A12:** Individual PPT MiniTalk on " E12" (1-on-1 during the lab)	**A12:** *MiniTalk (submit PPT to TurnItIn, and hardcopy to TA)*	**8**
	W 2/19	(11)	Shock Tube 1 - Compressible Flows			
7	M 2/24	(12)	Shock Tube 2 - Measurement Methods	**E13/14: SE (Special Experiment) 1:** Shock Tube		
	W 2/26	(13)	Shape Memory Alloy 1 - Theory			
8	M 3/2 T 3/3 W 3/4 Th 3/5		(LP) Lab Practical (@ the BHE lab)			**15**
9	M 3/9	(14)	Shape Memory Alloy 2 - Experiment	**E13/14: SE1:** Shock Tube **E13/14: SE2:** Shape Memory Alloy	**A13:** *SE Report* (if any)	**16**
	W 3/11	(15)	No Lecture			
10	**M 3/16** **W 3/18**		**SPRING BREAK**	**No Lab**		
11	M 3/23	(16)	Optics 1 - Light and Lenses	**E13/14: SE2:** Shape Memory Alloy **E13/14: SE3:** Digital Image Correlation (Online)	**A13:** *SE Report* (if any)	
	W 3/25	(17)	Optics 2 - Digitization and Correlation			
	F 3/30	(18)	Junior Projects Info			
12	M 3/30	(19)	Wind Tunnel 1 - Engineering Aerodynamics	**E13/14: SE3:** Digital Image Correlation **E13/14: SE4:** Wind Tunnel (Online)	**A13:** *SE Report* (if any)	
	W 4/1	(20)	Wind Tunnel 2 - Lift and Drag of Airfoils			
13	M 4/6	(21)	SE - PowerPoint Presentation Skills	**E13/14: SE4:** Wind Tunnel **(Online)**	**A13:** *SE Report* (if any)	
	W 4/8	(22)	JP Details & How to Present		**A15: JP-P** *Proposal (Team of 4)*	**14**
14	M 4/13	(23)	Something Fascinating 2	**E15:** Individual SE Presentations (Online during the lab)	**A13:** *SE Report* (if any)	
	W 4/15	(24)	AME 441 - Top Groups!		**A14:** *SE Presentations*	**16**
15	M 4/20	(25)	Grad School?			
	W 4/22	(26)	No Lecture			
16	M 4/27	(27)	Final Review	**E16:** JP Presentations (Team of 4) (Online)	**A16:** *JP Presentations*	**16**
	W 4/29	(28)	No Lecture			
					Lab Performance	**6**
					Total Points	**100**

(1) 6% of the total grade will be determined by a performance measure compiled by staff over the whole semester. It includes all aspects of engagement in lectures, labs, the discussion board and office hours.

(2) The last four Special Experiments (SE1, SE2, SE3, and S4) are run for two weeks each. There will be sign-up sheets for each special experiment. Each student must complete 2 of the 4 Special Experiments:

2.a. A13, a full written report, is required for one of your two Special Experiments. It is due two weeks after your E14 is performed.

2.b. A14, a online presentation/demo of your E15, is required for the other Special Experiment of yours. It is given in a 10-minute timeslot on your regular lab day during week 14. Sign-up sheets will be provided.

(5) Junior Project (JP) will be a team project, with 4 students/team (same as your future AME 441 Senior Design Project) working together on your: JP Proposal and JP Presentation.

Course Notes

AME 341bL relies heavily on the USC Blackboard and Piazza webpage 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 this webpage.

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).

Required and Supplementary Materials

There are no "Required" text textbooks for AME 341bL. 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 (2011) McGraw-Hill.
(optional) Theory and Design for Mechanical Measurements, Figliola & Beasley (2010) Wiley.
(optional) The Art of Electronics, Horowitz & Hill (1989) Cambridge University Press.

Description and Assessment of Assignments

There will be one written exam on Wed Mar. 21st. The remainder of the course assignments will be based on experiments conducted in lab. All assignments are typically due within one week, unless otherwise noted. 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
A9-a	2
A9-b	2
A10	5
A12	8
LP	15
A13	8
A14	12
A15	3
A16	12
Exam	30
Lab Performance	3
Total	**100**

Assignment Submission Policy

Each assignment is due online via TurnItIn **before** lab begins, as specified at lab time or in class announcements. **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.**

There are no make-up labs. All labs and assignments will count towards the total grade (*i.e.*, none are dropped). Absences for medical reasons must be justified with reasonable evidence. It is not possible to pass the course if you are missing two or more assignments or any labs.

Additional Policies

See the Mechoptronics course readers and Piazza pinned rules for all policies, codes of conduct, and expectations. Read them in full.

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. Familiarize yourself with the discussion of plagiarism in *SCampus* in Section 11, *Behavior Violating University Standards* https://scampus.usc.edu/b/11-00-behavior-violating-university-standards-and-appropriate-sanctions/. **All forms of academic dishonesty are unacceptable.** See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the *Office of Equity and Diversity* http://equity.usc.edu or to the *Department of Public Safety* http://capsnet.usc.edu/department/department-public-safety/online-forms/contact-us. This is important for the safety of the whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. *The Center for Women and Men* http://www.usc.edu/student-affairs/cwm/ provides 24/7 confidential support, and the sexual assault resource center webpage http://sarc.usc.edu describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the *American Language Institute* http://dornsife.usc.edu/ali, which sponsors courses and workshops specifically for international graduate students. *The Office of Disability Services and Programs* http://dsp.usc.edu/ provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, *USC Emergency Information* http://emergency.usc.edu will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.