USC Viterbi School of Engineering

AME 341bL Mechoptronics Laboratory
Units: 3
Term: Spring 2019 :: M Jan 7th – F Apr 26th

Location:	Lecture	MWF 8am	SMG 101, SMG 124
	Lab	M, T, W or Th 2-5pm	BHE 301

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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.

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

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).

Week	Date		Lecture	Lab	Assn. Due	%
1	M	1/7 (1)	Introduction	**E9:** LabView I – Basics		
	W	1/9 (2)	2nd Order Systems I			
	F	1/11 (3)	Strain Gauges			
2	M	1/14 (4)	Wheatstone Bridge	**E10:** Strain gauges/Vibrating Beams	**A9** *Tech Memo*	4
	W	1/16 (5)	2nd Order Systems II			
3	**M 1/21**		**MLK Day**	**No Lab**		
	W	1/23 (6)	Lab View I - Stepper Motor Control			
4	M	1/28 (7)	Lab View II - Safety, Sampling, & Loops	**E11:** LVII – Basic Motor Control	**A10** *Report*	10
	W	1/30 (8)	Turbulence, Jets and Plumes			
	F	2/1 (9)	A10 Recap			
5	M	2/4 (10)	Dynamic Pressure	**E12:** LVIII – Advanced Motor Control	**A11** *LabView Check*	2
	W	2/6 (11)	More on Turbulent Jets			
6	M	2/11 (12)	TBD	**E13:** Turbulent Jets	**A12** *LabView Check*	2
	W	2/13 (13)	Thermocouples			
7	**M 2/18**		**President's Day**	**No Lab** … but MiniTalks	**A13** *MiniTalk*	10
	W	2/20 (14)	Convective Heat Transfer I			
	F	2/22 (15)	A13 Recap			
8	M	2/25 (16)	Convective Heat Transfer II	**E14:** Thermocouples and Heat Transfer		
	W	2/27 (17)	Wind Tunnel 1 - Engineering Aerodynamics			
	F	3/1 (18)	Wind Tunnel 2 - Lift and Drag of Airfoils			
9	M	3/4 (19)	Junior Project Proposal (JP-P) Info	**SE1:** Wind Tunnel	**A14** *Spreadsheet*	10
	W	3/6 (20)	TQ Preview			
	F	3/8 (21)	A14: TC-SS Recap			
10	**M 3/11**		**SPRING BREAK**	**No Lab**		
	W 3/13					
11	M	3/18 (22)	Optics 1 - Light and Lenses	**SE1:** Wind Tunnel **SE2:** Digital Image Correlation	**TQ** *Quiz*	15
	W	3/20	**Terror Quiz (TQ)**		**SE1** *Report*	12
	F	3/22 (23)	Optics 2 - Digitization and Correlation			
12	M	3/25 (24)	Shock Tube 1 - Compressible Flows	**SE2:** Digital Image Correlation **SE3:** Shock Tube	**SE1, SE2** *Report*	
	W	3/27 (25)	Shock Tube 2 - Measurement Methods		**JP-P** *Proposal*	6
	F	3/29 (26)	TQ Post Mortem			
13	M	4/1 (27)	SE-SpreadSheet Presentation Details	**SE3:** Shock Tube	**SE2, SE3** *Report*	
	W	4/3 (28)	Something Fascinating I			
14	M	4/8 (29)	E15: No lecture – plan E17 in lab	**No Lab** … but SE: 1-on-1 Spreadsheet Presentations	**SE3** *Report*	
	W	4/10 (30)	AME 441 - I		**SE** *Presentations*	12
15	M	4/15 (31)	A15: JP-T Details :: How to present your JP	**E15:** Junior Project		
	W	4/17 (32)	AME 441 - II			
16	M	4/22 (33)	Something Fascinating II	**No Lab** … but Junior Project Presentations	**A15** *Presentations*	12
	W	4/24 (34)	Grad School		**441-bb** *Piazza Post*	2

· 3% 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.
· The last three Special Experiments (SE1, SE2 and SE3) are run for two weeks each. There will be sign-up sheets for each.
  Each student must complete at least 2 of the 3 Special Experiments.
· A15, a full written report, worth 12% of the course grade, is required for one of the Special Experiments.
  It is due one week after the experiment is performed.
· A16, a 1-on-1 presentation/demo of data analysis, worth 12% of the course grade, is required for the other Special Experiment.
  It is given in a 10- minute timeslot on your regular lab day during week 14.

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	4
A10	10
A11	2
A12	2
A13	10
A14	10
TQ	15
SE-R	12
JP-P	6
SE-T	12
JP-T	12
441	2
Lab Performance	3
Total	**100**

Assignment Submission Policy

Each assignment is due **before** lab begins, as specified at lab time or in class announcements. Physical documents must be handed in at the lab in BHE 301. They must be handed in on time. **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 μs) 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). Absences for medical reasons must be justified with some 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 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.