

MECHATRONICS ME 340 (#17885)- Fall 2020

Instructor Info —

- Barshid Alambeigi, Ph.D.
- 🕐 ETC 3.144
-) Office Hrs days: Tues & Thurs
- Office Hrs time: 1:30-2:30 p.m.
- Personal Website
- D Farshid.Alambeigi@austin.utexas.edu

Course Info ——

- 📋 Tues & Thurs
 - 3:30 p.m.-5:00 p.m.
- 🕐 Online
- Canvas

TA Info ——

Yang Liu

Office Hrs: Mon. & Wed. TBD

liu.yang@utexas.edu

Online

Description of the Course

- Theory and application of electrical circuits, electromechanics, and electronics;
- Concepts in electrical power transmission, instrumentation, and Feedback;
- Integration of electronics and instrumentation with mechanical engineering systems (mechatronics).

Topics

- Brief theories of direct current (DC) and alternating current (AC) circuits: electric current, voltage, and power;
- Semiconductor electronics: diodes and transistors, operational amplifiers, transformers, logic devices;
- Electric machinery: elements of power conversion and transmission.

Goals

- Gain knowledge on electrical and electromechanical principles that modern mechanical engineers are expected to have (*HOW to USE*?).
- Develop abilities to aid <u>design and/or analysis of systems</u> having functionality and performance measures that rely on the behavior of electrical, electromechanical and/or electronic components (*WHY and WHERE to USE?*).
- Build a foundation to support continued learning about modern mechatronic and power system principles.

Prerequisites

Mathematics 408D, Mechanical Engineering 205 or 318M, and Physics 303L and 103N, concurrent enrollment in Mechanical Engineering 140L.

Material

Text Book

Allan R. Hambley, "*Electrical Engineering: Principles and Applications*", 7th Ed., ISBN-13: 978-0-13448414-3.

References

- Carryer, Ohline, and Kenny, "*Introduction to Mechatronics Design*", Prentice Hall/Pearson, 2011, ISBN 978-0-13-143356-4.
- Kerns, David V. Jr., and J. David Irwin, "*Essentials of Electrical and Computer Engineering*", Pearson-Prentice Hall, 2004, ISBN 0-13-923970-7.
- Smaili, A., and F. Mrad, "*Applied Mechatronics*", Oxford University Press, 2008, ISBN 978-019-530702-3.
- deSilva, Clarence W., "*MECHATRONICS: An Integrated Approach*", CRC Press, 2004, ISBN 08493-1274-4.
- Kuphaldt, TonyR., "Lessons In Electric Circuits", 5th Ed., (©2000-2009).
- Kaplan, Daniel M., and Christopher G. White, "*Hands-On Electronics: A Practical Introduction to Analog and Digital Circuits*", Cambridge University Press, 2003, ISBN 978-0-52-181536-9.
- Scherz, Paul, "*Practical Electronics for Inventors*", McGraw-Hill/TAB Electronics, 2006, ISBN 007-145281-8.
- "Schaum's Outline of Basic Circuit Analysis", Edition 2 by John O'Malley

Assessment

- *Homework assignments*: <u>Weekly homework</u> will be assigned with its solution on Canvas.
- *Quizzes*: <u>3 quizzes</u> based on homework assignments will be conducted. No makeup quiz at any circumstance.
- *Midterm exams*: Two mid-term exams; Exam I: October 3, Thursday. Exam II: November 12, Tuesday.
- Final Exam: Comprehensive final exam per UT final exam schedule .

FAQs

- Po we perform any experiments in this course?
- No, The goal of this coarse is to introduce the theoretical aspects of Mechatronics systems. ME 140L MECHATRONICS LAB-ORATORY covers the experimental aspects of this course.
- Is the final exam Comprehensive?
- Yes, but the focus of the exam would be mostly on the final lectures.
- Is there any Bonus/optional project for this course?
- I have not decided yet! We might have an optional course project depending on the time line of the course.
- What's your main goal for teaching this class?
 - My teaching philosophy for this class is to help students learn general concepts of Mechatronics and build confidence to approach, model, and solve any generic mechatronics-related problems.

15% or 20% ${\sim}10$ Homework

15% or 10% $\,\sim\!\!3$ Quiz

Grading 20%	Midterm Exam I
20%	Midterm Exam II
30%	Final Exam

- For the Homework and Quiz grades, the best combination is considered for students i.e., either 15%-15% or 20%-10% for the Homework and Quiz grades, respectively.
- Note that a minimum quiz score and Homework grade will be automatically dropped for the mentioned calculations.
- The final grade will be assigned using curved grading based on the grand average and standard deviation of the above grades.

Course Web Page:

Course materials will be posted on Canvas. This includes course syllabus, class notes, announcements, homework assignments, and homework and exam solutions.

Miscellaneous Items

- The deadline for dropping a course without possible penalty can be found in the current semester UT calendar online.
- Allegations of Scholastic Dishonesty will be dealt with according to the procedures outlines in Appendix C, Chapter 11 of the General Information Bulletin.
- Student misconduct and academic integrity issues will be reported to Office of the Dean of Students.
- The University of Texas at Austin provides, upon request, appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4241 TDD, or the College of Engineering Director of Students with Disabilities, 471-4321.
- Collaboration on homework assignments with other students is encouraged. However, all the submitted must by your own work. Any evidence of plagiarism or other forms of scholastic dishonesty will be grounds for a failing grade of the course.
- Homework assignments are due in class. *For late assignments, check the Late Assignment policy*.
- Ntional Instrument software MultiSim is useful for understanding fundamentals. It is available in the Mechatronics Lab, the ME Application server, and the CSE website.

Exam Make-up Policy

Make-up exams will only be allowed for students who have a substantiated excuse *approved by the instructor and <u>at least two weeks before the due date</u>. Leaving a phone message or sending an e-mail without confirmation is not acceptable.*

Late Assignment Policy

Each student has a <u>48 hours/semester budget</u> for handing in late assignments. You can use this budget for one assignment or through the semester without losing any grade. However, if you use the entire budget and have another late assignments, your grade for those assignments would be zero!

Emailing Policy

Please put <u>"ME340-Mechatronics"</u> in the subject of your emails if you want the instructor and TA(s) find and answer your emails quickly.

Class Schedule (Tentative)

Week 1	Introduction to Mechatronics	Course Syllabus, What is Mechatronics, Examples of Mechatronic System, Kirchhoff's Laws (Chapter 1).
Week 2	Basic Concepts and Resistive Circuits	V, I, R, Series and Parallel Networks, Voltage Divider, Cur- rent Divider, Node Voltage Analysis (Chapter 2).
		Mesh Current Analysis, Thevenin and Norton Equivalent, Superposition Principle, Wheatstone Bridge (Chapter 2).
Week 3	Homework 1 due R, L, C Circuits	Inductance and Capacitance, Series and Parallel Connec- tions, First Order RL and RC Circuits (Chapter 3).
		First-Order Transient Analysis, Time Constant, Steady- state, General Sources (Chapter 4).
Week 4	Homework 2 due	Second-Order RLC Circuits, Resonance and Damping Co- efficient, (Chapter 4).
	<mark>Quiz 1</mark> Sinusoidal Analysis	Phasors, Complex Numbers, Complex Impedance, Circuit Analysis Using Phasors, (Chapter 5).
Week 5	Homework 3 due	Power in AC circuits, Thevenin and Norton equivalent cir- cuits, (Chapter 5).
	Dynamic Systems	Frequency Response, Bode Plots, and Resonance, Trans- fer Function, Filters, (Chapter 6)
Week 6	Homework 4 due	Catch up syllabus and Review Module 1 for Exam I
	EXAM I (October 3)	MIDTERM 1
MODULE	2: Electronics	
Week 7	Foundations of Electronics	PN junctions, Diodes, Zener Diodes, Rectifier Circuits, (Chapter 9).
		BJT Transistors, Load Line Analysis, Bias Circuits, LargeS- ignal DC Analysis, (Chapter 12).
Week 8	Homework 5 due	Small Signal AC Analysis, Common Emitter Amplifier, Emitter Follower Amplifier, (Chapter 12).
		Field-Effect Transistors (FET), Transistor Types: JFET, CMOS, NMOS, (Chapter 11).
Week 9	Homework 6 due	Ideal Operational Amplifiers, Feedback concepts, Invert- ing & non-inverting amplifiers, (Chapter 13).
	Quiz 2	Differential Instrumentation Amplifiers, Integrating and Differentiating amplifiers, Active filters Circuits (Chapter 13).
Week 10	Homework 7 due	Voltage and Current Limitations of Op Amps, GainBand- width Product, Slew-rate Limitation, (Chapter 13).

MODULE 1: Theories of direct current (DC) and alternating current (AC) circuits

	Digital Systems	Number representation, Boolean algebra, Logic realiza- tion, SOP, Logic Circuits, Karnaugh Maps, (Chapter 7).
Week 11	Homework 8 due	Flip Flops, Sequential Logic State Machines, (Chapter 7). <u>Review for Exam 2</u>
		Microprocessors and microcontrollers, computer-based instrumentation systems, (Chapter 8).
Week 12	EXAM II (November 12)	MIDTERM II
	Measurement Systems	Sensors, Measurement system concepts, Signal Condi- tioning, Sampling, Analog/Digital Conversion, (Chapter 8).
MODULE	3: Electromechanics	
Week 13	Homework 9 due Electromechanics I	Magnetic Circuits and Transformers, DC machines, Shunt- & Series Connected DC Motors, Speed Control, (Chapter 15).
	Holiday	Happy Thanksgiving :)
Week 14	Electromechanics II	AC Machines, three-phase induction motors, Equivalent Circuits, (Chapter 16).
	Quiz 3 Electromechanics III	Steppers & Brushless DC motors, (Chapter 16).
Week 15	Homework 10 due	Catch up syllabus
		Review for Final Exam
Final Exa	ım (comprehensive): Per Universi	ty schedule