Stony Brook University

Course Syllabus

MEC 220: Practical Electronics for Mechanical Engineers

Spring 2024

Instructor	Amin Fakhari, Ph.D., Department of Mechanical Engineering
Office	165 Light Engineering, Stony Brook University
Office Hours	Mon. 12:00 – 1:00 PM, Thu. 5:30 – 6:30 PM (and, any other time by appointment)
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* All non-personal course-related questions should be posted on Brightspace Discussions Forum (see section Tools below). Email should be used only for strictly personal issues. I will respond to your emails as soon as possible, however, please allow up to 48 hours for a response. Your SBU email must be used for all your communications.

Teaching Assistant	Su Li (Su.Li.3@stonybrook.edu)
Office Hours & Office	Thursday 1–2 PM, 158 Light Engineering

Course Details

Title	MEC 220: Practical Electronics for Mechanical Engineers
Credit	3
Lecture	MoWeFr 11:00 – 11:53 AM, Javits 101
Prerequisites	PHY 127, PHY 132, or PHY 142

Course Description

An overview of basic electronics at the practical level. The course provides mechanical engineering students with the fundamentals to perform basic electronics work needed in laboratories, subsequent courses and their professional careers. Topics include both passive and active components, AC and DC circuits, and a focus on operational amplifier and transistor driven circuits needed for instrumentation and control. Hands-on work in each area complements theoretical analysis, and ensures that students can implement these circuits and devices practically; students will analyze and build circuits both from circuit diagrams, as well as from product datasheets.

Course Learning Objectives

1. Ability to analyze resistive, capacitive, and inductive circuits.
2. Ability to analyze circuits with operational amplifiers.
3. Ability to analyze circuits with transistors and diodes.
4. Ability to analyze AC circuits prevalent in MEC field.
5. Ability to read and interpret circuit diagrams.
6. Ability to use information from product datasheets to solve a circuit design problem to meet given specifications in the absence of a prescribed solution.

Required Materials

Students will require one set of electrical components (see section **Required Parts List** on the last page in this document) which must be ordered by the students from an appropriate supplier.

Recommended Textbook

- Charles Alexander and Matthew Sadiku, *Fundamentals of Electric Circuits*, 7th Edition, McGraw Hill Education, 2021 [Publisher, Amazon].
- David G. Alciatore, *Introduction to Mechatronics and Measurement Systems*, 5th Edition, McGraw-Hill Education, 2018 [Publisher, Amazon].
- Paul Horowitz, Winfield Hill, *The Art of Electronics*, 3rd Edition, Cambridge University Press, 2015 [Publisher, Amazon].

Tools

Brightspace: It is required that you use the Brightspace for this course. Brightspace is used for facilitation of communications between faculty and students, posting of the course materials, important announcements, and grades, and submission of assignments. You need to check your SBU email and Brightspace announcements regularly [Android App, iOS App].

Brightspace Discussions Forum: By using the Discussions tool/forum in Brightspace, you can get help fast and efficiently from your classmates, the TA(s), and the instructor. All non-personal course-related questions that might be of interest to other students should be posted (either anonymously or identified) on the Brightspace Discussions forum and not emailed to the TA(s) or the instructor. Email should be used only for strictly personal problems or issues.
Note that this discussion forum is for additional learning and assistance. It is not the place for cyber-bullying, memes, grade complaints, concerns/comments/criticisms about the course, or in general, anything unrelated to the course material and student learning. Improper behavior will result in reporting of the individual's behavior to the Office of Student Conduct and Community Standards.

Calculator: Only NCEES Allowed Calculators will be permitted to be used on all quizzes, midterm, and final exams. Please see the Calculator Policy on Stony Brook and NCEES websites.

LabVIEW: LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a visual programming language and development environment. It is developed by National Instruments and used for data acquisition, automation, and instrument control.

Arduino IDE: Arduino IDE is an open-source software program designed by Arduino that is used to write, compile, and upload code to Arduino boards.

Homework Assignments

Homework problems for each topic, along with their solutions, will be posted on Brightspace. Homework will not be graded because of the accessibility of solutions on the Internet. They will be mainly posted to provide students with an opportunity to practice the principles discussed during lectures and effectively prepare for examinations.

Lab Responsibilities

- Students will form into lab groups of 4 (or 3) individuals at the beginning of the semester to perform a number of laboratory experiments and submit reports as a group.
- All the group members must contribute equally in performing all the experiments and writing the reports. It is each group member's responsibility to ensure that their reports are properly submitted before the deadline. Students found to be making insufficient contributions to their group's work will be removed from the group, and will receive a grade of zero for all lab work, at the sole discretion of the instructor. If any of your group members is not contributing to the lab work, please discuss this with the instructor ASAP to avoid negative impacts on your group. Be careful to select students that you will trust to do work reliably and on time; do not necessarily pick your "friends".
- Lab reports must be submitted through the Brightspace before the deadline. For each day your lab report is late, its grade will be reduced by 30%. The tentative lab report due dates are as follows.

Labs	Due Date/Time
Lab #1	Fri. 03/01/2024, 11:59 PM
Lab #2	Fri. 03/08/2024, 11:59 PM
Lab #3	Fri. 03/22/2024, 11:59 PM
Lab #4	Fri. 03/29/2024, 11:59 PM
Lab #5	Fri. 04/05/2024, 11:59 PM
Lab #6	Fri. 04/12/2024, 11:59 PM
Lab #7	Fri. 04/19/2024, 11:59 PM
Lab #8	Fri. 04/26/2024, 11:59 PM

- The labs are all designed to be at-home experiments.
- Since the lab work is entirely group-based, each group can either purchase one kit of parts and share it, provided they can manage the sharing, or purchase individual kits. It is important to note that students in different locations may face challenges in safely swapping kits. If there is any uncertainty, it is recommended that each group member buys their own kit.

Examinations

Midterm Exam #1 Wednesday, Feb. 21, 2024 (in class)
Midterm Exam #2 Wednesday, Apr. 3, 2024 (in class)
Final Exam Monday, May 13, 2024, 11:15 AM – 1:45 PM (in class)

(a) Make-up exams are considered only for students who provide documentation of a compelling reason (e.g., medical emergency) before, or within three days following the missing exam. There will be no make-up exams for reasons that can be within your control (e.g., pre-arranged travel or other engagements). An unexcused exam absence will be scored as a zero.

(b) The exam dates are subject to change. Students will be notified in a timely manner of any changes.

Grading Policy

Lab and Design Work	40%
Midterm Exam #1	20%
Midterm Exam #2	20%
Final Exam	20%

(a) Above distributions are subject to minor adjustments.
(b) Any disagreement with exam and lab report grading must be settled within one week after posting the grades.
(c) No individual extra credit work or extra points will be offered to improve grades.

Grading Scale

A	[100, 90]%	**A**$^-$	(90, 85]%		
B$^+$	(85, 80]%	**B**	(80, 75]%	**B**$^-$	(75, 70]%
C$^+$	(70, 65]%	**C**	(65, 60]%	**C**$^-$	(60, 55]%
D$^+$	(55, 50]%	**D**	(50, 45]%	**F**	(45, 0]%

(a) Depending on the class performance, the grades may be curved.

Tentative Course Schedule

Topic 1: Error Analysis in Engineering Measurements
Topic 2: Basic Concepts and Laws
Topic 3: Nodal and Mesh Analyses
Topic 4: Circuit Theorems
Topic 5: Operational Amplifiers
Topic 6: Capacitors and Inductors
Topic 7: Diodes
Topic 8: Transistors
Topic 9: Sinusoids and Phasors
Topic 10: Sinusoidal Steady-State Analysis
Topic 11: AC Power Analysis
Topic 12: Three-Phase Circuits

Syllabus Disclaimer

The instructor views the course syllabus as an educational understanding between the instructor and students. Every effort will be made to avoid changing the course schedule, materials, assignments, and deadlines, but the possibility exists that unforeseen events will make syllabus changes necessary. The instructor reserves the right to make changes to the syllabus as deemed necessary. Students will be notified in a timely manner of any syllabus changes via email or Brightspace announcements.

University Policies and Statements

Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report

any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html.

Student Accessibility Support Center (SASC) Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center (SASC). For procedures and information go to Evacuation Guide for People with Physical Disabilities and search Fire Safety and Evacuation and Disabilities.

Critical Incident Management Statement

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Copyright Statement

Required Parts List (all through-hole components)

#	Item Type	Value	Quantity
1	Resistor	100Ω	10
2	Resistor	1kΩ	10
3	Resistor	10kΩ	10
4	Resistor	100kΩ	10
5	Resistor	1MΩ	10
6	Capacitor	0.01μF	2
7	Capacitor	0.1μF	2
8	Capacitor	1μF	2
9	Capacitor	10μF	2
10	Capacitor	100μF	2
11	Capacitor	470μF	2
12	Integrated Circuit (IC)	LM555	1
13	Integrated Circuit (IC)	LM324	1
14	Integrated Circuit (IC)	LM317	1
15	Integrated Circuit (IC)	CD4511B	1
16	Transistor	FQP30N06L	1
17	Transistor	TIP31C	1
18	Potentiometer	10kΩ	2
19	Potentiometer	100kΩ	1
20	Misc.	Small DC Motor, M260, Rated voltage: 3 V DC, No load current: 110 mA, No Load Speed: 6600 RPM	1
21	Diode	1N4148	2
22	Diode	LED, Red	2
23	Diode	7-Segment LED Array, NKR161 (Common Cathode)	1
24	Microcontroller	Arduino Uno (get a genuine one to ensure compatibility)	1
25	Prototyping	Solderless Breadboard (at least 10×30 with 2 power busses)	1
26	Measurement	Multimeter (one that reads voltage, current, resistance, and continuity)	1
27	Prototyping	Jumper wire assortment	1
28	Prototyping	9-volt battery	1
29	Prototyping	9-volt battery holder	1
30	Misc.	USB cable for Arduino	1
31	Misc.	Parts Box	1