

MEC 220 Practical Electronics for Mechanical Engineers – subject to change
(3 Credits) Fall 2021

Instructor: Noah D. Machtay, Ph.D., P.E.

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Virtual Office Hours: Th, 12:00PM-3:00PM, meet.google.com/zoj-rdib-swx

Lecture: MWF 9:15AM-10:10AM, SB Union 103-02

Attendance policy: It is the responsibility of the student to make arrangements with a classmate to get any notes that are missed during absences.

Recommended Text: Horowitz and Hill, "The Art of Electronics," 3rd Edition, Cambridge University Press 2015. ISBN: 978-0-521-80926-9.

Required Materials: Each student will require and must provide one (1) set of components (see list of these necessary parts in this document) which must be ordered by the students from an appropriate supplier.

Assignments: Homework problems have been assigned for the duration of the semester, and have been posted along with their solutions. Homework is not graded, due to the prevalence of website selling solutions to homework sets. Homework is assigned solely for the benefit of the student, so that they may practice the principles discussed during lecture, evaluate their understanding, and, in part, prepare for examinations. There will also be a number of laboratory projects that must be completed and submitted. Assignments are due and must be submitted as specified on Blackboard, through the Blackboard system; it is each group member's responsibility to ensure that their reports are properly submitted through Blackboard before the deadline; late submissions will result in a grade of zero for the assignment.

Lab work: Students will form into lab groups. Lab groups are responsible for conducting experiments and design work as instructed, and preparing and submitting reports as a group. It is each student's responsibility to ensure that the group functions well and achieves the assigned goals. 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. Students will complete labs 1-7 using their purchased kits, and include high-resolution photographs of their completed circuit to document its completion. A video demonstration of Lab 8 will be posted to Blackboard, along with a sample data set, which students will use to complete the report for Lab 8.

Lab Due Dates:

The report for lab 1 is due: 9/29/2021 by 9AM

The report for lab 2 is due: 10/6/2021 by 9AM

The report for lab 3 is due: 10/13/2021 by 9AM

The report for lab 4 is due: 10/20/2021 by 9AM

The report for lab 5 is due: 10/27/2021 by 9AM

The report for lab 6 is due: 11/3/2021 by 9AM

The report for lab 7 is due: 11/10/2021 by 9AM

The report for lab 8 is due: 11/17/2021 by 9AM

Exams/Term Project: *Two midterm exams and a final exam.* Midterm 1 will be held on 10/20/2021, and Midterm 2 will be held on 11/17/2021. Final exam as scheduled by the registrar. Exams will be closed book and open notes; students may have notes they have prepared in their own handwriting; no printed materials. Exams will be administered using the Respondus system, and students are responsible for preparing this system on their computers, and ensuring that they have a proper testing environment available, with suitable hardware, internet, privacy, etc. and so on. In place of any or all exams, instructor, at their discretion, may substitute term projects to be worth an equivalent percentage of the semester grade.

Grading: *1st midterm: 10%, 2nd midterm: 10%, Lab and Design work: 50%, Final: 20%, Participation: 10%.*

Cell phone and electronic device policy: Cellular phones or other communication devices are not permitted in lectures or labs, and are especially prohibited from exams. If you are found to be in possession of such a device during an exam, you will be ejected from the exam and will receive a grade of zero. Audio or video recording or photography during lectures is strictly prohibited, and anyone found in violation will be ejected from the course with a failing grade.

Excused absences: From the university policy statement regarding religious holidays, students will be expected to notify their professor in advance, but definitely before the final date of the 'add/drop' period of their intention to be out for religious observance. Notification of intention to be out for a religious holiday **MUST** be made through the CEAS Undergraduate office, who will verify and evaluate the notification, and provide the instructor with appropriate instructions; you must include your name, SBID#, and the course number when contacting CEAS in regards to your absence.

For hopefully obvious reasons, students may not come to the lectures when ill. Students are excused from lecture attendance due to illness without penalty; just make arrangements with a classmate to get any notes that you miss.

Making a false request for an excused absence is an act of academic dishonesty and will be prosecuted accordingly.

Course Objectives: This is a lecture and laboratory course that will overview basic electronics from a practical level (versus a theoretical approach) to provide mechanical engineering students with the fundamentals to do basic electronics work needed for laboratories, subsequent courses and their professional careers.

Prerequisites: PHY127, PHY132, or PHY142.

Statement on Academic Dishonesty

Academic dishonesty is an extremely serious offense and will not be tolerated in any form. Academic dishonesty in general is the presentation of intellectual work that is not originally yours. Examples include, *but are not limited to*, copying or plagiarizing class assignments including homework, reports, designs, and other submitted materials; copying or otherwise communicating answers on exams with other students; bringing unapproved aids, either in physical (written) or electronic form to an exam; obtaining copies of an exam prior to its administration, etc. Academic dishonesty violates both the ethical and moral standards of the Engineering profession and all infractions related to academic dishonesty will be prosecuted to the fullest via the CEAS CASA committee. For you, the honest student, academic dishonesty results in lower class curves, hence a depression in your GPA and class standing, while cheapening the degree you earn. Please note that failing to provide proper citations in a paper or report constitutes plagiarism and will be prosecuted accordingly. Be sure to cite your sources!¹

Allowed Calculators

For both security and uniformity in this class **only** the following calculators will be allowed to be used on the midterm and final exams. There will be no exceptions.

Casio: All FX-115 and FX-991 models. Any Casio calculator must contain fx-115 or fx-991 in its model name.

Hewlett Packard: The HP 33s and HP 35s models, but no others.

Texas Instruments: All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

¹ Dr. Jon Longtin, Department of Mechanical Engineering, Stony Brook University

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

Grading Policy:

Undergraduate:	
100-95 = A	
94-90 = A-	
89-87 = B+	
86-84 = B	
83-80 = B-	
79-77 = C+	
76-74 = C	
73-70 = C-	
69-65 = D+	
64-60 = D	
<60 = F	

Note: All grades are TRUNCATED, not rounded.

Approximate Course Schedule, subject to revision (subject to change):

Topic 1	Introduction, Course Objectives, Error Analysis and Statistics
Topic 2	Current, Voltage, Power, Resistance, Ohm's Law, Dependent vs. Independent Sources, Kirchoff's Current and Voltage Laws
Topic 3	Node Voltage Analysis, Current Mesh Analysis,
Topic 4	Thévenin and Norton Equivalent Circuits, Superposition Principle
Topic 5	Operational Amplifiers, Instrumentation Amplifiers, Voltage Comparator, Common Mode Voltage, Linear Voltage Regulators
Topic 6	Diodes (rectifier, LED, Zener), Half- and Full-Wave Rectifiers, Voltage Clamping
Topic 7	Transistors (BJT, Darlington, FET), Push-Pull Follower, Transistor Biasing, H-Bridge
Topic 8	Inductors and Capacitors, Time Dependent Components
Topic 9	Time dependent Op-Amp circuits, Filters, Complex Impedance
Topic 10	Alternating Current, Root Mean Square Voltage and Current
Topic 11	Impedance in AC circuits, AC Power, Real vs. Reactive Power vs Apparent Power
Topic 12	AC Motors: Power, Power Factor, Power Factor Correction
Topic 13	Three Phase Power (Delta vs. Wye Configuration), Transformers
Topic 14	Interactive In-Class Electrical Product Design Process, Case Studies in Electronics and Electrical Design

University required statements:

“STUDENT ACCESSIBILITY SUPPORT CENTER (SACS) STATEMENT (must be the following language)

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, 128 ECC Building, (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. For procedures and information go to the following website:

<https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-people-physical-disabilities> and search Fire Safety and Evacuation and Disabilities.

ACADEMIC INTEGRITY STATEMENT (must be the following language as approved by the undergrad council):

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 are 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/uaa/academicjudiciary/>

CRITICAL INCIDENT MANAGEMENT (must be the following language as approved by the undergrad council):

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs 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.”

“Mode of Conduct for Exams and Summative Quizzes: using LockDown Browser and a Webcam for Online Exams

This course requires the use of LockDown Browser and a webcam for online exams. The webcam can be built into your computer or can be the type that plugs in with a USB cable. Watch this [short video](http://www.respondus.com/products/lockdown-browser/student-movie.shtml) (<http://www.respondus.com/products/lockdown-browser/student-movie.shtml>) to get a basic understanding of LockDown Browser and the webcam feature. A student [Quick Start Guide \(PDF\)](http://www.respondus.com/products/monitor/guides.shtml) (<http://www.respondus.com/products/monitor/guides.shtml>) is also available.

Then, download and install LockDown Browser from this link:
<http://www.respondus.com/lockdown/download.php?id=772113517>

Don't Google for a download link — it may be for the wrong school! Our version of the LockDown Browser is tied to Stony Brook University.

If you get a warning message from your anti-virus software, please white-list this download.

To ensure LockDown Browser and the webcam are set up properly, do the following:

- Start LockDown Browser, log into Bb, and select this course.
- Locate and select the **Help Center** button on the LockDown Browser toolbar.
- Run the **Webcam Check** and, if necessary, resolve any issues.
- Run the **System & Network Check**. If a problem is indicated, see if a solution is provided in the Knowledge Base. Troubleshooting information can also be emailed to our institution's help desk.
- Exit the Help Center and locate the Respondus Test named RespondusTest, which is part of the *Getting Started* menu.
- Upon completing and submitting the Respondus Test, exit LockDown Browser.

When taking an online exam that requires LockDown Browser and a webcam, remember the following guidelines:

- Ensure you're in a location where you won't be interrupted
- Turn off all other devices (e.g. tablets, phones, second computers)
- Clear your desk of all external materials not permitted — books, notes, other devices
- Remain at your computer for the duration of the test
- If the computer or networking environment is different than what was tested above, repeat the Webcam and System checks prior to starting the test
- To produce a good webcam video, do the following:
 - Avoid wearing baseball caps or hats with brims
 - Ensure your computer or tablet is on a firm surface (a desk or table) — not on your lap, a bed, or other surface that might move
 - If using a built-in webcam, avoid tilting the screen after the webcam setup is complete
 - Take the exam in a well-lit room and avoid backlighting, such as sitting with your back to a window
- Remember that LockDown Browser will prevent you from accessing other websites or applications; you will be unable to exit the test until all questions are completed and submitted.”²

² Dr. Anurag Purwar, Department of Mechanical Engineering, Stony Brook University

Required Parts List (all through-hole components):

Item type	Value	Quantity
Resistor	100 Ω	10
Resistor	1k Ω	10
Resistor	10k Ω	10
Resistor	100k Ω	10
Resistor	1M Ω	10
Capacitor	0.01 μ F	2
Capacitor	0.1 μ F	2
Capacitor	1 μ F	2
Capacitor	10 μ F	2
Capacitor	100 μ F	2
Capacitor	470 μ F	2
Integrated Circuit (IC)	LM555	1
Integrated Circuit (IC)	LM324	1
Integrated Circuit (IC)	LM317	1
Integrated Circuit (IC)	CD4511B	1
Transistor	FQP30N06L	1
Transistor	TIP31C	1
Potentiometer	10k Ω	2
Potentiometer	100k Ω	1
Misc.	Small DC Motor, M260, 3VDV rated voltage, 110mA no load current, 6600rpm no load speed	1
Misc.	Parts Box	1
Diode	1N4148	2
Diode	LED, Red	2
Diode	7-Segment LED Array, NKR161 (cathode common)	1
Microcontroller	Arduino Uno (get a genuine one to ensure compatibility)	1
Prototyping	Solderless Breadboard (at least 10x30 with 2 power busses)	1
Test and Measurement	Multimeter (one that reads voltage, current, resistance, and continuity)	1
Prototyping	Jumper wire assortment	1
Prototyping	9-volt battery	1
Prototyping	9-volt battery holder	1
Misc.	USB cable for Arduino	1

Course Delivery Mode and Structure:

This course utilizes the Blackboard learning management system (LMS). Students must be mindful of all course expectations, deliverables and due dates. All assignments will utilize internet technologies. See "Technical Requirements" section for more information. In Blackboard, you will access online course materials, and resources.

HOW WE WILL COMMUNICATE:

Course-related questions should be asked during lectures. If you use Blackboard's Email Tool, it will automatically include your full name, course name and section when you send me an email. I strive to respond to your emails as soon as possible, but I generally get to replies in approximately 48 hours. Your Stony Brook University email must be used for all University related communications. You must have an active Stony Brook University e-mail account and access to the Internet. *All instructor correspondence will be sent to your SBU e-mail account.* Please plan on checking your SBU email account daily for course related messages.

Technical Requirements:

This course uses Blackboard for the facilitation of communications between faculty and students, submission of assignments, and posting of grades. The Blackboard course site can be accessed at <https://blackboard.stonybrook.edu> If you are unsure of your NetID, visit <https://it.stonybrook.edu/help/kb/finding-your-netid-and-password> for more information. You are responsible for having a reliable computer and Internet connection throughout the term. **Caution! You will be at a disadvantage if you attempt to complete all coursework on a smart phone or tablet.** It may not be possible to submit the files required for your assignments.

The following list details a minimum recommended computer set-up and the software packages you will need to have access to, and be able to use:

- PC with Windows 10
- Latest version of Chrome, Firefox or Explorer; (A complete list of supported browsers and operating systems can be found on the My Institution tab of the [Blackboard website.](#))
- Sufficient RAM, CPU, GPU, and storage to properly run all required software
- High speed internet connection
- Printer
- Word processing software (Microsoft Word, Pages, etc.)
- Headphones
- Microphone
- Webcam
- Ability to download and install software applications and plug-ins (note: you must have administrator access to install applications and plug-ins).
- National Instruments Labview
- Arduino IDE
- Microsoft Office

TECHNICAL ASSISTANCE:

If you need technical assistance at any time during the course or to report a problem with Blackboard you can:

- submit a help ticket on the web at <http://it.stonybrook.edu/services/itsm>
- call (631) 632-9800 (technical support, log-in issues, computer support, wifi, software & hardware)
- call (631) 2-CELT [631-632-2358]
- Note that the course instructor cannot provide technical assistance

Attendance and Late Work Policy:

Late Work Policy: Late work will not be accepted. Late work will receive a grade of zero.

Course and University Policies

Disability Support Services (DSS) Statement:

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, Room 128, (631)632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

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 are 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 **Important Note:** Any form of academic dishonesty, including cheating and plagiarism, will be reported to the Academic Judiciary.

Critical Incident Management:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University 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.

UNDERSTAND WHEN YOU MAY DROP THIS COURSE:

It is the student's responsibility to understand when they need to consider disenrolling from a course. Refer to the Stony Brook Academic Schedule for dates and deadlines for registration:

http://www.stonybrook.edu/commcms/registrar/calendars/academic_calendars

Incomplete Policy:

Under emergency/special circumstances, students may petition for an incomplete grade. Circumstances must be documented and significant enough to merit an Incomplete. If you need to request an incomplete for this course, contact the CEAS undergraduate office for approval as far in advance as possible.

Course Materials and Copyright Statement:

Course material accessed from Blackboard, SB Connect, SB Capture, Echo, Zoom, Google, or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor who retains ownership of all materials.

Students are bound by the following statement, to which they must agree:

"Academic integrity is expected of all students at all times, whether in the presence or absence of members of the faculty. Understanding this, I declare that I shall not give, use, or receive unauthorized aid in this examination. I have been warned that any suspected instance of academic dishonesty will be reported to the appropriate office and that I will be subjected to the maximum possible penalty permitted under University guidelines."