

## MEC 220 Practical Electronics for Mechanical Engineers

### Spring 2020

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**Instructor:** Noah D. Machtay, Ph.D., P.E., 146 Heavy Engineering Building, 2-9014  
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(emails will generally be answered within 2 business days)

**Office Hours:** MWF 8:30-9:30AM, HE146

**Lecture:** MWF 11:00-11:53AM, Frey 102

**Attendance policy:** Lectures are required – there will be no make-ups for announced or unannounced in-class assignments. When scheduled, lab sessions are absolutely mandatory. Students who are late for or miss a lab session will receive a grade of zero for that lab report.

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

**Required Materials:** Each lab group will require and must provide one (1) of the electronics kits used for MEC101 (see campus bookstore for pricing); a delta kit containing supplementary materials will be provided by the lab, and must be returned to the lab at the end of the semester.

**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.

#### **Lab Due Dates:**

The report for lab 1 is due: 2/19/2020 at 11AM

The report for lab 2 is due: 2/26/2020 at 11AM

The report for lab 3 is due: 3/4/2020 at 11AM

The report for lab 4 is due: 3/11/2020 at 11AM

The report for lab 5 is due: 3/25/2020 at 11AM

The report for lab 6 is due: 4/1/2020 at 11AM

The report for lab 7 is due: 4/8/2020 at 11AM

The report for lab 8 is due: 4/29/2020 at 11AM

**Exams:** *Two midterm exams and a final exam.* Midterm 1 will be held on 3/11/2020, and Midterm 2 will be held on 4/6/2020. Final exam as scheduled by the registrar. No make-up exams will be given. Exams will be closed book and closed notes, no scrap paper is permitted.

**Assessment Questions:** In order to receive a passing grade for this class, students must answer a set of assessment questions which will be administered throughout the semester. Assessment questions represent straightforward applications of concepts which are fundamental to the topic of this course.

**Grading:** *1<sup>st</sup> midterm: 10%, 2<sup>nd</sup> midterm: 10%, Lab and Design work: 40%, Final: 30%, 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. Students may not use personal electronic devices during lectures, exams, or lab sessions – this includes but is not limited to cell phones, laptop computers, cameras, music devices, etc.

**Excused absences for religious observance and severe illness:** 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. Requests for an excused absence for severe illness must be made through CEAS in the same manner. Documentation from a health care provider will be required, including their National Provider Identifier (NPI) for verification. 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 2 credit 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!<sup>1</sup>

### **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.

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<sup>1</sup> 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.

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](mailto: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.”

**Approximate Course Schedule, subject to revision:**

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

**Delta Kit Parts List:**

Item type	Value	Quantity
Resistor	100 $\Omega$	10
Resistor	1k $\Omega$	10
Resistor	10k $\Omega$	10
Resistor	100k $\Omega$	10
Resistor	1M $\Omega$	10
Capacitor	0.01 $\mu$ F	2
Capacitor	0.1 $\mu$ F	2
Capacitor	1 $\mu$ F	2
Capacitor	10 $\mu$ F	2
Capacitor	100 $\mu$ F	2
Capacitor	470 $\mu$ 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 $\Omega$	2
Potentiometer	100k $\Omega$	1
Misc.	DC Motor	1
Misc.	Parts Box	1
Diode	1N4148	2
Diode	LED	2
Diode	7-Segment LED Array	1