

Fall 2021	MSCI-222C Introduction to Electronics
Section:	MSCI222C Section 01 (Math/Science elective)
Time and Location:	ONLINE - Synchronous sessions TUESDAYS 5:00-7:50pm
Credits:	3 (fulfills Undergraduate CORE course requirement)
Type of Course:	Lecture– via Remote Learning
Class Meetings:	14 ONLINE meetings, Final Exam
Prerequisites:	None (Recommended: Any basic physics course)
Class Zoom Materials:	Will be posted by 12:00pm NOON on Mondays
Class Resources:	On Canvas AND http://www.charlesrubenstein.com/220
Instructor:	Dr. Charles Rubenstein; Professor Email → crubenst@pratt.edu / Voicemail Mobile: +1 (516) 884-7642 Office Hours: Thursday Zoom Sessions <i>by appointment only</i>
Syllabus date:	28 August 2021 – Revision 2

I. Course Overview (Catalog Description):

This is a science course intended for the student curious about modern electronics and its use in enhancing their own designs as well as in preparation for Pratt's DDA and ID courses in interactive installations and robotics. Covering basic physics and electronics theory with practical applications in circuit design and interfacing, the course requires students to use critical and logical thinking to construct working electronic circuits that provide for control of input and output devices, the safe and reliable connection of one circuit to another, to an embedded controller (Arduino, Raspberry Pi, etc.), smart device or computer port.

II. Course Goals:

Using logic and critical thinking skills students will construct, and troubleshoot as necessary, at least ten working circuits using individual electronic components, transistors, integrated circuits, sensors (microphones and photoresistors) and output devices (light-emitting diodes, relays and speakers). These circuits include multi-component 'analog' circuits using diodes, transistors and 'analog' integrated circuits (e.g., comparators, operational amplifiers and 555 timing circuits) as well as use 'digital' integrated circuits configured as logic functions (AND, NAND, OR and NOR) and/or used in flip-flops, digital counters and shift registers – the building blocks of microcontrollers and microcomputers.

III. Learning Objectives:

Upon completion of the course (including the assembly of all circuit assignments) students will be able to:

- explain the concepts of voltage, current, resistance, Ohm's Law, and voltage divider circuits
- describe the basic properties of semiconductors - how diodes and transistors work
- demonstrate how electronic components and devices work
- interconnect electronic components and devices to make useful circuits
- construct working circuits from circuit diagrams with electronic symbols for resistors, capacitors, diodes, transistors, and integrated circuits
- use critical, logical and creative thinking to troubleshoot circuits to make them work
- analyze the voltages, currents, and power dissipation in simple circuits
- determine the logical function of several logic gates interconnected in different ways

IV. Course Resources

IV.a. Course Website: Pratt Canvas and <http://www.charlesrubenstein.com/222>

Each week, on the Thursday after class, I will have posted that week's class presentation in single slide and 6-up handout versions. To read these files you only need a pdf viewer, such as Acrobat Reader, which can be downloaded from: <https://get.adobe.com/reader/>

Make sure that you check your Pratt email frequently. "*I forgot to check my Pratt email*" is not a valid excuse for not getting any updated course information. The web server files contain homework assignments and additional material for the student interested in going beyond what is discussed in class. Should you have problems accessing the web server, please contact me via email *immediately* at crubenst@pratt.edu

IV.b. REQUIRED TEXTS are all electronically available on the class website in the **_references** folder at:
http://www.charlesrubenstein.com/222/_references

The **_references** folder includes an electronics component catalog as well as these pdf texts:

1. **armstrong.pdf**: Lessing, Lawrence 1969. "Man of High Fidelity: Edwin Howard Armstrong" Bantam Books #P4483. (*This scanned and edited version of the original, out-of-print, classic paperback text covers the history of FM radio and the life of inventor Edwin Howard Armstrong.*)
2. **ew1.pdf**: Mims, Forest M. 2000. "Electronics Workbook 1: Basic Electronics - Transistors & Integrated Circuits" Radio Shack Corp.
3. **ew2.pdf**: Mims, Forest M. 2000. "Electronics Workbook 2: Digital Logic Projects" Radio Shack Corp. (*Please note that in addition to the online Electronics Workbooks, a limited number of print copies of the Mims texts as well as of Lessing's "Man of High Fidelity: Edwin Howard Armstrong" are available on request for semester loan.*)
4. **sensors.pdf**: Mims, Forest M. 2001. "Radio Shack Electronic Sensors Lab" Radio Shack Corp.

IV.c. Each student will be assigned the following lab equipment for use in class only:

1. Pratt Electronics Toolkit (*includes various electronic tools, parts and a digital multimeter*).
2. A Radio Shack "Electronics Learning Lab" console (Model: 28-280, Catalog #: 28-027)

IV.d. Tutoring

If you are interested in receiving additional help, please note that the Department typically makes a Science and Math Tutor available (days and times will be announced in class). There is also the Pratt Writing Resource Room located on the first floor of North Hall (across from the bank). This center can help you produce the best work possible. You can make an appointment by phone (718-636-3459) or email (wtc@pratt.edu)

V. Method of Assessment and Grading:

Your final grade will be comprised of three parts; (a) ten weekly homework quizzes (30%), (b) ten supervised in class hands-on lab assignments (40%), and (c) a WTC-reviewed research paper on intellectual property: midterm draft (10%) and final paper (20%) .

V.a. Homework and Homework Quizzes: (30% of Final Grade)

There will be **ten (10) Quizzes (3% per quiz), Worth 30% of final grade**. There will be a quiz for each of the ten homework assignments. *Although homework only accounts for 30% of your final grade, the content of the homework assignments is used as the primary basis for midterm and final exams.*

V.b. Lab Assignments: (40% of Final Grade)

There are **ten (10) required Hands-on Lab Modules (4% per completed lab project), worth a total of 40% of your final grade**. *These hands-on, in-class, projects involve wiring working electronic circuits (without soldering) and showing these circuits working. Your lab grade is based on completion at least ten hands-on labs. There are two (2) OPTIONAL Arduino lab modules that you can complete after the required labs worth 5% extra credit each. Note: No lab work will be accepted after the last class.*

V.c. Research Paper on Intellectual Property: (30% of Final Grade; Draft=10% and Final=20%)

You are required to write a term paper that addresses the challenges of intellectual property (IP) you may experience in the future and an analysis of how the assigned reading on Edwin Armstrong's life and experiences with patents might impact you with respect to your own IP.

Your three-page **draft** paper must be reviewed by the Pratt Writing & Tutorial Center (WTC) **prior** to the date of the midterm. This draft as well as a WTC Visit Form and review, is due the class after the midterm break. It will be reviewed for appropriateness of the work to be done and returned. (**Draft Paper = 10%**).

Your **final** paper, which also must be reviewed by the WTC, is due at the last class and must consist of at least six (6) pages in 12-point type, double-spaced (about 1500 words), must include a bibliography of **at least four** additional references about electronics and intellectual property from legal, web and other IP resources. (**Final Paper = 20%**).

See the website file "**TermPaper.pdf**" for additional information and bibliography, etc., requirements.

V.d. Late Assignments and Extra Credit

Late paper assignments will NOT be accepted. Missed quizzes will NOT be made up.

There are NO opportunities for extra credit work to substitute for required assignments.

VI. Course Requirements

VI.a. Class participation - You are expected to contribute to classroom discussion at every class meeting: ask questions; make comments, observations; respond to questions asked by faculty, guest presenters or classmates; listen to what others have to say. I understand that for some of you speaking up is easier than for others, and some topics you might find more interesting than others, but you should try to make at least one contribution to the dialog each week. You are expected to contribute whether we'll have a large class discussion or you'll be working in smaller groups on the Labs.

VI.b. Announcements You are expected to check the course web site regularly for announcements, to download assignments, readings, lecture notes, and any additional information that might be posted.

It is expected that you check your Pratt e-mail for official course communication.

VI.c. Readings: *Reading assignments should always be completed before the next session. They should be regarded as required and questions from these will be included in homework assignments and on exams.*

VI.d. Homework: *Homework assigned at a class session will be due at the next class session. Homework will be reviewed via a five minute in class quiz the week AFTER the assignment is due. All homework and quizzes will be reviewed in class and become part of the class note set posted online.*

VI.e. Lab Modules: *There are ten required lab experiments. Each requires the student write a paragraph or two on how they might use the circuit(s) studied in their own work.*

VI.f. Research Paper: *A 'midterm draft' and a 'Final' research paper on intellectual property are required.*

VI.g. Smart Devices, like cellphones, computers, iPads, etc., may **not** be used in the classroom and must be turned off during class time. Should you have a reason for needing a smart device to help you in your studies, it is YOUR responsibility to discuss their use with me.

VI.h. No eating is permitted during class. Water bottles, in a closed container, may be permitted.

VI.i. Lateness and Absence: On-time attendance at each class meeting is expected. Lateness and absence can adversely affect your grade. Arriving more than fifteen minutes late will constitute a class absence. Partial attendance, *i.e., early departure*, will count as one-half an absence if not excused in advance (see possible excuses). On-time returns to class from break is also expected:

Two unexcused missed classes may result in one full grade reduction.

Three unexcused missed classes will result in a failing grade.

VI.j. Excused Absences: There are very few legitimate reasons to miss all or part of a class session, or for submitting assignments after deadlines. In order for an absence or lateness to be excused, you must provide formal documentation explaining the reason behind the absence. Valid excuses include personal health issues documented by the Health and Counseling Services; family emergencies. **HOWEVER**, crits, shows or class trips related to other courses are NOT acceptable unless *the instructor is informed of and allows a future absence IN ADVANCE*. Reasons that do not excuse lateness or absence include: oversleeping; forgetting; not-knowing; excessive workload in other classes; inability to use the website.

VI.k. How to Succeed in This Course? Some suggestions:

What you will get out of this class is determined by what you put in. *So give a damn!*

This course requires a commitment from you: a responsibility to prepare before class and attend class and participate in it, and to be prepared with assignments in time.

Simply showing up in class will *not* assure you passing this course.

Read the assigned readings before class. Should have questions about the material ask them in class. After covering the topics in class, go back and read and study them again. Study the slides from the previous week that will always be posted on the website within a few days after class. Attend class. Take advantage of the class time to minimize your efforts outside class. Take notes in class! Your own notes can be one of the best sources for studying. Participate. Ask questions. Try to answer questions and express your thoughts. Explaining to someone else is one of the great ways of learning.

I cannot know if you have difficulty with the class unless you tell me. *So talk to me! Email me!*

VII. Pratt Institute Policies

Policy 1. Academic Integrity Policy

The link to the full policy and standards (Last updated 2017) is <https://www.pratt.edu/student-life/student-affairs/office-of-the-vice-president-for-student-affairs/student-policies/community-standards/academic-integrity/>

At Pratt, students, faculty, and staff do creative and original work. This is one of our community values. For Pratt to be a space where everyone can freely create, our community must adhere to the highest standards of academic integrity.

Academic integrity at Pratt means using your own and original ideas in creating academic work. It also means that if you use the ideas or influence of others in your work, you must acknowledge them.

At Pratt,

- We do our own work,
- We are creative, and
- We give credit where it is due.

Based on our value of academic integrity, Pratt has an Academic Integrity Standing Committee (AISC) that is charged with educating faculty, staff, and students about academic integrity practices. Whenever possible, we strive to resolve alleged infractions at the most local level possible, such as between student and professor, or within a department or school. When necessary, members of this committee will form an Academic Integrity Hearing Board. Such boards may hear cases regarding cheating, plagiarism, and other infractions described below; these infractions can be grounds for citation, sanction, or dismissal.

Policy 2. Academic Integrity Code

When students submit any work for academic credit, they make an implicit claim that the work is wholly their own, completed without the assistance of any unauthorized person. These works include, but are not limited to exams, quizzes, presentations, papers, projects, studio work, and other assignments and assessments. In addition, no student shall prevent another student from making their work. Students may study, collaborate and work together on assignments at the discretion of the instructor.

Examples of infractions include but are not limited to:

1. Plagiarism, defined as using the exact language or a close paraphrase of someone else's ideas without citation.
2. Violations of fair use, including the unauthorized and uncited use of another's artworks, images, designs, etc.
3. The supplying or receiving of completed work including papers, projects, outlines, artworks, designs, prototypes, models, or research for submission by any person other than the author.
4. The unauthorized submission of the same or essentially the same piece of work for credit in two different classes.
5. The unauthorized supplying or receiving of information about the form or content of an examination.
6. The supplying or receiving of partial or complete answers, or suggestions for answers; or the supplying or receiving of assistance in interpretation of questions on any examination from any source not explicitly authorized. (This includes copying or reading of another student's work or consultation of notes or other sources during an examination.)

For academic support, students are encouraged to seek assistance from the Writing and Tutorial Center, Pratt Libraries, or consult with an academic advisor about other support resources. Refer to the Pratt website for information on **Academic Integrity Code Adjudication Procedures**: <https://www.pratt.edu/the-institute/administration-resources/office-of-the-provost/policies-processes-and-forms/>

Policy 3. Attendance Policy

The link to the full policy and standards (Last updated 2017) is https://www.pratt.edu/uploads/attendance_policy_clean_13_feb_17.pdf

[NOTE: the specific attendance policy for this course is contained in sections VI.f. and VI.g. above]

General Pratt Attendance Policy:

Pratt Institute understands that students' engagement in their program of study is central to their success. While no attendance policy can assure that, regular class attendance is key to this engagement and signals the commitment Pratt students make to participate fully in their education.

Faculty are responsible for including a reasonable attendance policy on the syllabus for each course they teach, consistent with department-specific guidelines, if applicable, and with Institute policy regarding reasonable accommodation of students with documented disabilities. Students are responsible for knowing the attendance policy in each of their classes; for understanding whether a class absence has been excused or not; for obtaining material covered during an absence (note: instructors may request that a student obtain the material from peers); and for determining, in consultation with the instructor and ahead of time if possible, whether make-up work will be permitted.

Consistent attendance is essential for the completion of any course or program. Attending class does not earn students any specific portion of their grade, but is the pre-condition for passing the course, while missing class may seriously harm a student's grade. Grades may be lowered a letter grade for each unexcused absence, at the discretion of the instructor. Even as few as three unexcused absences in some courses (especially those that meet only once per week) may result in an automatic "F" for the course. (Note: Students shall not be penalized for class absences prior to adding a course at the beginning of a semester, though faculty may expect students to make up any missed assignments.)

Pratt Institute respects students' requirements to observe days of cultural significance, including religious holy days, and recognizes that some students might need to miss class to do so. In this, or other similar, circumstance, students are responsible for consulting with faculty ahead of time about how and when they can make up work they will miss.

Faculty are encouraged to give consideration to students who have documentation from the Office of Health and Counseling. Reasonable accommodations for students with disabilities will continue to be provided, as appropriate.

Refer to the Pratt website for information on **Attendance**: <https://www.pratt.edu/the-institute/administration-resources/office-of-the-provost/policies-processes-and-forms/>

Policy 4. Students with Disabilities and Accessibility

Pratt Institute is committed to the full inclusion of all students. If you are a student with a disability and require accommodations, please contact the Learning/Access Center (L/AC) at LAC@pratt.edu to schedule an appointment to discuss these accommodations. Students with disabilities who have already registered with the L/AC are encouraged to speak to the professor about accommodations they may need to produce an accessible learning environment.

Requests for accommodation should be made as far in advance as reasonably possible to allow sufficient time to make any necessary modifications to ensure the relevant classes, programs, or activities are readily accessible. The Learning/Access Center (L/AC) is available to Pratt students, confidentially, with additional resources and information to facilitate full access to all campus programs and activities and provide support related to any other disability-related matters.

Policy 5. Human Rights, Equity, BERT, and Title IX

Pratt Institute seeks to provide an environment that is free of bias, discrimination, and harassment. If you have been the victim of harassment, discrimination, bias, or sexual misconduct, we encourage you to report this.

If you inform me of an issue of harassment, discrimination or bias, or sexual misconduct I will keep the information as private as I can, but I am required to bring it to the attention of the institution's Title IX Coordinator. You can access Title IX services by emailing titleix@pratt.edu. You can also speak to someone confidentially by contacting our non-mandatory reporters: Health Services at 718-399-4542, Counseling Services 718-687-5356 or Campus Ministries 718-596-4840.

In cases of Bias, this information may go to our Bias Education & Response Taskforce (BERT). You can contact BERT by either reaching out directly via bert@pratt.edu or by contacting the BERT Co-Chair and Title IX Coordinator, Dr. Esmilda Abreu.

For more information, please refer to the **Community Standards webpage**:

<https://www.pratt.edu/student-life/student-affairs/office-of-the-vice-president-for-student-affairs/student-policies/community-standards/>

Fall 2021 – Course Schedule – Rev 2. *SUBJECT TO REVISION*

Week	Date	Topic
1	8/31	Introduction and Basic Concepts Readings: Mims: <i>Electronics Workbook 1 (ew1.pdf)</i> : Pgs. 1-27 Lessing: <i>Man of High Fidelity-Edwin Howard Armstrong (armstrong2.pdf)</i> : Ch. 1 – 3
	9/7	<i>Class does not meet – Instructor’s Religious Holiday</i>
2	9/14	Basic Electronic Devices Readings: Mims: <i>Electronics Workbook 1 (ew1.pdf)</i> : Pgs. 28-65 Lessing: <i>Man of High Fidelity-Edwin Howard Armstrong (armstrong2.pdf)</i> : Ch. 4 – 6
3	9/21	Semiconductor Materials and Semiconductor Diodes Readings: Mims: <i>Electronics Workbook 1 (ew1.pdf)</i> : Pgs. 66-76 Lessing: <i>Man of High Fidelity-Edwin Howard Armstrong (armstrong2.pdf)</i> : Ch. 7 – 9
4	9/28	Transistors as Switches and Amplifiers; <i>Midterm Paper Topic Due</i> Readings: Mims: <i>Electronics Workbook 1 (ew1.pdf)</i> : Pgs. 77-END Lessing: <i>Man of High Fidelity-Edwin Howard Armstrong (armstrong2.pdf)</i> : Ch. 10 – 11
5	10/5	Analog and Digital Concepts. Readings: Mims: <i>Electronics Workbook 2 – Digital Electronics (ew2.pdf)</i> : Pgs. 1-50 and page 90; Lessing: (<i>armstrong2.pdf</i>): Ch. 12 – 13
	10/12	<i>PRATT INSTITUTE FALL BREAK – classes do not meet</i>
6	10/19	The Operational Amplifier (“Op-Amp”) Readings: Mims: <i>Electronics Workbook 2 (ew2.pdf)</i> : Pgs. 51 - 79; Page 10 CD4001 and CD4011 and pages 13 and 90 CD4511 ; Lessing: <i>Man of High Fidelity-Edwin Howard Armstrong (armstrong2.pdf)</i> : Ch. 14 – END; <i>Midterm Paper Due</i>
7	11/2	Digital Integrated Circuit (IC) Logic Gates Readings: Mims: <i>Electronics Workbook 2 (ew2.pdf)</i> : Pgs. 80 - END; and also Page 12: CD4013 IC “flip-flop” with two stable states that can remember a 0 or 1 , and CD4017 an IC that can count from 0 to 9; <i>Midterm Paper returned w/comments</i>
8	11/9	Flip-Flops and “Clocks” (Pulse Train Sources); <i>Midterm Exam</i> Readings: Mims: <i>Electronics Workbook 2 (ew2.pdf)</i> : Page 12 (CD4013 and CD4017).
10	11/16	Digital Counters; <i>Midterm Exam Reviewed</i> Readings: Mims: <i>Electronics Workbook 2 (ew2.pdf)</i> : Page 12 (CD4013 and CD4017).
11	11/23	Digital Shift Registers; <i>Six-page DRAFT FINAL Paper Due</i> Readings: Mims: <i>Electronics Workbook 2 (ew2.pdf)</i> : Page 37 (NE555 Timer IC).
12	11/30	Using Analog & Digital IC Circuits Together; <i>Final Paper Returned w/Comments</i>
13	12/7	Interfacing to Computers, Microcontrollers & Embedded Devices; Review of Coding Basics and RFID Concepts; <i>Six-page FINAL Paper Due</i> <i>This is the LAST DAY FOR LAB WORK and SUBMISSIONS</i>
14	12/14	<i>FINAL EXAM today</i>