ECE 2214: Physical Electronics (Spring 2026) Syllabus

MWF 9:05 am -9:55 am **NCB 360** (TC Poon)
MWF 10:10 am – 11:00 am **NCB 320** (TC Poon)
MWF 10:10 am -11:00 am **SURGE 104D** (MK Hudait)

To excel in this class, follow these guidelines: Attend lectures and focus on understanding the content. Complete all homework assignments. Read and comprehend the textbook. Study and understand all the provided examples. Additionally, when attending lectures, fully engage in the learning process.

Silence all cell phones, and PC flaps down before the lecture begins.

Instructors: Dr. TC Poon (tcpoon@vt.edu) and Dr. MK Hudait (mantu@vt.edu)

Office Hours & Communication: All inquiries regarding homework and lab projects should be directed to the TAs listed below. They will be equipped with homework solutions and can assist you effectively. For class logistics and lecture-related queries, please approach the course instructors.

- MK Hudait (Meeting ID: 849 6691 9611; Passcode: 680890)
    - Tuesday: 11:30 am – 12:30 pm, or send email requests for Zooms or in-person, please wear a mask

TA office hour information: TBD

ECE2214 TA Discussion/Recitation Sections:

- Time and Location: TBD

Course Description:

This is a sophomore-level, 3-credit course, required for electrical and computer engineering students. This course introduces basic electronic devices, including p/n junction diodes, field effect transistors, and their operating principles, and analysis of electronic circuits operating under DC bias and switching conditions. Moreover, this course also emphasizes CMOS digital logic gate circuits. In addition, this course covers the fundamentals of electrostatics and magnetostatics, transmission lines, and electromagnetic waves. Electronic circuit design adhering to professional and ethical practices.

Upon successful completion of this course, students will be able to:

1. Using semiconductor physics principles, calculating carrier concentrations, drift currents, and diffusion currents in semiconductor materials.

2. Analyze PN diode circuits with the ideal diode equation and linear circuit equations.
3. MOSFET operation principle, transistor biasing, and logic circuits.
4. Determine voltage gain, input and output resistance of metal-oxide-semiconductor field-effect transistors (MOSFET) MOSFET amplifiers using DC circuit Q-point analysis and small-signal AC circuit analysis.
5. Calculate the capacitance and inductance of devices using electrostatics and magnetostatics principles.
6. Determine the reflection coefficient and standing wave ratio using transmission line fundamentals.
7. Analyze transformer voltage/current conversion and generator performance with Faraday's Law.
8. Calculate the phase velocity of uniform plane electromagnetic (EM) waves using Maxwell's equations and the EM wave equation.

Prerequisite: ECE 2024 (C or above).

Required Text:

1. D. A. Neamen, **Microelectronics Circuit Analysis and Design**, 4th edition; McGraw-Hill. ISBN 0073380644

2. Steven W. Ellingson, **Electromagnetics, volume 1** ; Below is the site you can download a free copy. Please download file **Electromagnetics_Vol1_screen-reader-friendly.pdf** for our course. https://vtechworks.lib.vt.edu/items/6f75e22e-ea6a-48a3-b441-65ce5ebf5331

Required Course Materials:

The Lab-in-A-Box kit (previously used in ECE1004 and ECE2024)

Course Grade:	**Points**
Exams	60 %
Homework	15 %
Lab projects	15%
Course attendance	10 %
Total	**100%**

Exams

- There will be **no cumulative final exam**.
- **Four exams** will be administered throughout the course.
- **No makeup exams** are allowed, including emergencies. Refer to the relaxed policy for details.
- Exam content will be derived from lectures, homework, and associated textbook materials.
- All grading is definitive. If you identify a grading error, bring it to the grader's attention within a week of the date the exam is returned. For clarity on your course progress and standing, feel free to consult with the instructor.
- Each exam permits a **1-page (double-sided) handwritten formula sheet** comprising equations, figures, or theoretical data (Honor Code enforced). However, no solution sets are permitted. Calculators are allowed but must not contain any course material, such as homework solutions or lecture notes (Honor Code enforced).
- If you dispute a graded exam, review the solutions thoroughly first and then approach the grader in their office within a week of the date the exam is returned.
- **Relaxed Policy**: The lowest score from the first three exams will be disregarded. However, **the score from Exam 4 is non-negotiable. Note: Exam 4 will take place on the last day of classes.**

Homework/Lab Assignments

- Assignments will be posted on Canvas. All tasks must be submitted by 11:59 pm on the stipulated deadline. No late HWs and Labs will be accepted.
- Assignments and labs must be submitted electronically as a single PDF through Canvas. Any submissions in alternative formats, such as Microsoft Word, will be ineligible for grading. Refer to the "PDF Preparation" section for details. Solutions should be clear, legible, and professional, clearly detailing problem statements and their corresponding solutions.
- Homework and lab reports should be written on standard 8.5 x 11-inch paper with your name clearly printed on the top right corner of the first page.
- **PDF Preparation:** Ensure you're adept at creating PDFs before your assignment is due. If you're submitting handwritten work, please scan it into a legible PDF. Graphs should be computer-generated, preferably using MATLAB, and must be clearly labeled, including all axes, with appropriate units. Any related m-files should be submitted alongside the assignment.
- Collaborative discussion on homework/lab problems is encouraged. However, submitted work must be individual and original. Any homework not adhering to these standards will receive zero credits.
- Graders may only assess a random selection of problems from each homework set. You're advised to complete all assigned problems.

Course attendance

- The course attendance will be recorded multiple times over the semester without pre-notification. Dean's letter is requested to relax the class absence in advance. No Late notification will be accepted.

Classroom Expectations

At Virginia Tech, we prioritize the health and safety of our entire community. Students implicitly agree to adhere to the Virginia Tech Wellness principles by enrolling in this class. To maintain a safe environment in this class, students must:

- Isolate themselves from campus if they test positive for COVID-19 or exhibit symptoms potentially related to COVID-19. For more on symptoms, visit the CDC's guide on COVID symptoms.
- Ensure they respect the well-being of their peers by practicing good personal hygiene and maintaining appropriate physical distance when possible.
- Refrain from attending class in person if showing even minor signs of illness. In such cases, students should reach out to the instructor for guidance on continuing their coursework and consult the health tips provided by Virginia Tech.
- Understand that these requirements are non-negotiable. Students unable to meet these classroom expectations due to medical reasons or those who are uncomfortable with them should consider alternative online course offerings.
- Beyond the classroom, it's imperative to adopt behaviors such as frequent handwashing and social distancing. Virginia Tech's complete wellness guidelines are available here.

Office of Undergraduate Academic Integrity

The Virginia Tech Honor Code establishes the standard for **ACADEMIC INTEGRITY** in this course and will be strictly enforced. *Discussion* of class material with your classmates or the instructor is encouraged; however, ALL submitted work must represent your efforts. The Office of Undergraduate Academic Integrity is poised to help students become successful through their academic and leadership involvement. The Office seeks to foster an environment that promotes fairness, personal responsibility, and integrity. For more details on the relevant honor codes, consult the websites listed below:

- https://honorsystem.vt.edu/content/honorsystem_vt_edu/en/resources/syllabus.html

Honor Code Pledge for Assignments:

The Undergraduate Honor Code pledges that each member of the university community agrees to abide by the following:

"As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do."

Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Students are strongly discouraged from misusing sites such as Chegg and CourseHero, as well as misusing ChatGPT and other Generative Artificial Intelligence. Students are strongly encouraged to consult their faculty members regarding the use of such outside materials, as the misuse of these sources may constitute a violation of the Honor Code. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code. For additional information about the Honor Code, please visit:

- https://www.honorsystem.vt.edu/

- All assignments submitted shall be considered "graded work," and all aspects of your coursework are covered by the Honor Code. All projects and homework assignments are to be completed individually unless otherwise specified.
- Commission of any of the following acts shall constitute academic misconduct. This listing is not, however, exclusive of other acts that may reasonably be said to constitute academic misconduct. Clarification is provided for each definition with some examples of prohibited behaviors in the Undergraduate Honor Code Manual located at https://www.honorsystem.vt.edu/

A. CHEATING

- Cheating includes the intentional use of unauthorized materials, information, notes, study aids, or other devices or materials in any academic exercise or attempts thereof.

B. PLAGIARISM

- Plagiarism includes copying the language, structure, programming, computer code, ideas, and/or thoughts of another and passing off the same as one's original work or attempts thereof.

C. FALSIFICATION

- Falsification includes the statement of any untruth, either verbally or in writing, concerning any element of one's academic work, or attempts thereof.

D. FABRICATION

- Fabrication includes making up data and results, recording or reporting them, or submitting fabricated documents, or attempts thereof.

E. MULTIPLE SUBMISSION

- Multiple submission involves the submission for credit—without authorization of the instructor receiving the work—of substantial portions of any work (including oral reports) previously submitted for credit at any academic institution or attempts thereof.

F. COMPLICITY

- Complicity includes intentionally helping another to engage in an act of academic misconduct or attempts thereof.

G. VIOLATION OF UNIVERSITY, COLLEGE, DEPARTMENTAL, PROGRAM, COURSE, OR FACULTY RULES

- The violation of any University, College, Departmental, Program, Course, or Faculty Rules relating to academic matters that may lead to an unfair academic advantage by the student violating the rule(s).

Honor Code Pledge for Assignments

- The Undergraduate Honor Code pledges that each member of the university community agrees to abide by the states:
- **"I have neither given nor received unauthorized assistance on this assignment."**
- Students enrolled in this course are responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any assignment is responsible for obtaining specific guidance from the course instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code. For additional information about the Honor Code, please visit www.honorsystem.vt.edu. Students should report alleged honor code violations to their course instructors. ***THE HONOR CODE WILL BE STRICTLY ENFORCED IN THIS COURSE. HONESTY IN YOUR ACADEMIC WORK WILL DEVELOP INTO PROFESSIONAL INTEGRITY***.

Academic Misconduct Sanctions

"If you have questions or are unclear about what constitutes academic misconduct on an assignment, please speak with your course instructor. We take the Honor Code very seriously in this course. The normal sanction we will recommend for a violation of the Honor Code is an **F*** sanction as your final course grade. The F represents failure in the course. The "*" is intended to identify a student who has failed to uphold the values of academic integrity at Virginia Tech. A student who receives a sanction of **F*** as their final course grade shall have it documented on their transcript with the notation "FAILURE DUE TO ACADEMIC HONOR CODE VIOLATION." You would be required to complete an education program administered by the Honor System to have the "*" and notation "FAILURE DUE TO ACADEMIC HONOR CODE VIOLATION" removed from your transcript. The "F," however, would be permanently on your transcript."

SSD Accommodation

Students with SSD accommodation should email their instructor with their available times for the scheduled exam dates by February 3, 2026. This information is needed to arrange exam times with the SSD office. If instructors do not receive your availability by that date, it will be assumed that you will take the exams with the rest of the class.

Announcements

See the announcement periodically in CANVAS for recitation and the course-related topic.

Health and COVID-19 Precautions

By participating in this class, all students agree to abide by the Virginia Tech Wellness principles.