ECE 2214: Physical Electronics (Spring 2021)

MWF 11:15 am – 12:05 pm Online (MK Hudait)
MWF 10:10 am -11:00 am NCB 230 (D Herrera)
MWF 10:10 am -11:00 am NCB 250 (W Zhou)

How to be successful in this class: Come to lectures and understand them, do all HWs, read the book, and understand all worked-out Examples. When you come to the lecture, please devote yourself to it. All cell phones should be silenced before the lecture starts.

Instructors: Dr. MK Hudait (mantu@vt.edu), Dr. D Herrera (dherrera@vt.edu), & Dr. W Zhou (wzh@vt.edu)

Instructor office hours & Zoom IDs: Any questions on HWs and lab projects should be directed to the TA. We will send HW solutions to TAs, and they should be able to help you effectively.

- M K Hudait: Tuesday 10:00am-12:00pm (Zoom ID: 86363294861)
- D Herrera: Wednesday 1:30-3:30 pm (Zoom ID: 85727520396)
- W Zhou: Thursday 9:00-11:00 am (Zoom ID: 82342596405)

TA, TA office hours, & TA Zoom IDs:

- Yizhou Qian (qyzhou95@vt.edu); TBD
- Peter Kent (pjke2911@vt.edu); TBD
- Wonil Nam (nam23@vt.edu); TBD
- Ramonika Sengupta (ramonika@vt.edu); TBD

Course Description:

Fundamentals of electrostatics and magnetostatics, transmission lines, EM waves, basic operating principles of pn junctions and MOSFETs (metal-oxide-semiconductor field-effect transistors). Designing MOSFET biasing and amplifying circuits, and differential amplifier circuits. Basic operating principles of complementary metal-oxide-semiconductor (CMOS) device and its application as a digital inverter.

Prerequisite: ECE 2024 (C or above), ECE 2544 (C or above).

Having successfully completed this course, the student will be able to:

1. Determine the capacitance and inductance of devices using principles of electrostatics and magnetostatics.
2. Employ the fundamental principles of transmission lines
3. Analyze impedance matching networks
4. Examine the basic wave concept of electromagnetic (EM) waves
5. Apply the basics of semiconductor materials and pn junctions
6. Analyze MOSFET biasing circuits
7. Analyze single-ended and differential signaling methods
8. Design MOSFET amplifier circuits
9. Employ the operating principles of CMOS
10. Demonstrate professional and ethical behavior in the field of electrical and computer engineering.

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://www.faculty.ece.vt.edu/swe/oem/

Required Course Materials:

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

Course Grade:	**Points**
Exams	75%
Homeworks	15%
Lab projects	10%
Total	**100%**

Exams:

- **NO FINAL EXAM**
- **4 Exams will be given during the semester.**
- **No Makeup Exams Even for Emergency Cases (see the relaxed policy).**
- Exams follow the lectures, homework, and corresponding textbook materials.
- **All gradings are final**. However, grading errors will be corrected if they are brought to the grader's attention **within one week from the date the exam is returned.** If you have any questions about your progress and standing in the course, don't hesitate to ask us in my office.
- On each exam, **2 pages (which means 2 sides only)** (8 1/2 x 11) of hand-written equations, figures, or theoretical materials are allowed (**Honor Code enforced**). NO solutions of any kind are allowed. Submit these pages at the end of the test. A calculator is also allowed but with no storage of any class materials (such as HW solutions, lecture notes, etc. **Honor Code enforced**).
- If you have found some problems with the graded exam, please see the grader in the office only after you have checked against the solutions thoroughly.
- **Relaxed Policy: The lowest grade of the first 3 exams will be dropped**. The grade for **Exam 4** can not be dropped.

Homework/Lab Assignments:

- The assignments will be announced in class and uploaded to Canvas. All homework/labs **are due by 11:59 pm on the due date,** and **No Late Assignment will be accepted**.
- **Submission of Assignments/labs: They must be submitted electronically as a single PDF via Canvas.** Submissions in any other format, including Microsoft Word, will not be graded and will receive no credit. See "PDF Preparation" below. Work must be presented in a clear, legible, and professional manner with problem statement, solution details, and answers clearly identified.
- Homework problems and lab reports must be worked on standard 8 1/2 x 11 papers with your name printed on the upper right-hand corner of the first page.
- PDF Preparation: Please make sure you know how to make PDFs before your submission is due. Hand-written submissions are then scanned to be PDFs. Just make sure the resulting document is legible. Plots must be computer-generated by MATLAB, appropriately scaled, and clearly labeled, including all axes, with units. Any m-files must be submitted along with the HW/Lab.
- Students are encouraged to discuss HW/lab problems among themselves. However, the real solution to be turned in for grading should be the original work of the individual. **HOMEWORK NOT COMPLYING WILL BE UNGRADED AND RECEIVED ZERO CREDITS.**
- The grader may only grade a subset of the HW problems (randomly chosen) from each homework set, and you are advised to work on all assigned problems.

Classroom Expectations:

Virginia Tech is committed to protecting the health and safety of all members of its community. By participating in this class, all students agree to abide by the Virginia Tech Wellness principles. To uphold these principles, **in this class, you must do the following**:

- **Wear a face covering**, preferably a mask, during class, including as you enter and exit the classroom.
- Maintain the designated distancing requirement to **stay 6 feet apart** or more.
- Enter and exit the classroom according to posted signage.
- **Cease in-person attendance for the course if you exhibit the slightest sign of illness**. Contact the instructor to determine how to continue to participate in the course and follow the guidance provided at https://vt.edu/ready/health.html#tips.
- These requirements will not be waived. Students who cannot comply with the classroom requirements due to medical reasons or who do not feel comfortable with the requirements should explore alternative online course options.
- In addition to the expectations stated above, there a numerous out-of-class behaviors, including social distancing and washing hands frequently and properly that are strongly encouraged. These measures are stated in Virginia Tech's full list of wellness principles, which can be found at:

  https://vt.edu/content/dam/vt_edu/covid-19/ready/wellness-commitment-8.5x11_VT.pdf

Honor Code:

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

"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. 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***.