GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical and Computer Engineering

ECE3040 Fall Semester, 2026

TITLE: "Microelectronic Devices and Circuits"

COURSE DELIVERY: In-class lectures

INSTRUCTOR: Professor Ali Adibi

CONTACT INFORMATION:
Office: 103 Bunger Henry Building, Phone: (404)385-2738, Email: ali.adibi@ece.gatech.edu.

OFFICE HOURS: MW 2:00 PM-3:15 PM.

GENERAL COURSE INFORMATION

GENERAL OVERVIEW
ECE3040 is the first course in the microelectronics area. It introduces basic concepts in semiconductor materials, devices, and circuits and provides the foundation for subsequent courses in ICs and VLSI design. In so doing, the course provides information and problem-solving techniques needed for future coursework and professional activities.

COURSE OBJECTIVES
Upon completion of this course, students will be able to explain and implement the fundamental concepts of: 1) physics of semiconductor materials (crystal lattices, energy band diagram, intrinsic versus extrinsic semiconductors, electrons and holes, drift and diffusion of charged particles), 2) physics and circuit aspects of pn junctions (excess carriers, current components, depletion region, law of junction, voltage-current characteristics, pn junction diodes, analysis of circuits involving pn junction diodes), 3) physics and circuit aspects of bipolar junction transistors (important parameters in the current-voltage characteristics, different operation regimes, DC analysis, small-signal model), 4) physics and circuit aspects of field-effect transistors (metal-oxide-semiconductor junctions and their properties, important parameters in the current-voltage characteristics, different operation regimes, DC analysis, small-signal model), 5) transistor amplifiers (different amplifier configurations, important device parameters (gain, input/output resistance, method of analysis, design of amplifiers formed by bipolar junction transistors or field-effect transistors, multi-stage amplifiers), 6) operational amplifiers (ideal operational amplifiers and their applications, amplifier parameters, method of analysis, non-ideal operational amplifiers), and 7) digital logic gates (structure of the basic transistor inverters, forming important logic functionalities using transistors). These provide the students with the necessary background for explaining and analyzing both the physics and the circuit aspects of diode and transistor-based devices and systems.

TEXTBOOK:
Semiconductor Device Fundamentals, Pierret, 1996 (or any version after that).
Microelectronic Circuit Design, Jaeger and Blalock, 2006 (or any version after that).

REFERENCES:
Microelectronics: An Integrated Approach, Howe and Sodini, 1997. Some general-purpose reference book describing SPICE and/or PSpice is recommended. One such book is *Introduction to PSpice* by S. Riedel and J. Nilsson, Addison-Wesley, 1996.

PREREQUISITES: ECE 2030, ECE 2040, Math 3301, Chem 1211

COURSE PRESENTATION:
Lectures
Class lectures will be held on MW 3:30-5:25 PM (George Tower Scheller Tower 0370).

COURSE ASSESSMENT AND GRADING

Homework

Homework assignments will usually be issued each week and will be due the following week (unless there is an exam that week). The due date and time of each homework is clearly specified on the homework sheet. If not specified, the homework will be due at 11:59 PM of the due date.

Late and Makeup Homework

Late homework is accepted, but there will be a 20% penalty for each day. Extensions can be requested from the instructor; they may be granted under reasonable conditions assessed by the instructor. Collaboration on homework problems is allowed and encouraged. However, each student must write the solution alone.

Exams

There will be three midterm exams and one comprehensive final exam. The exams will be in-class exams. All exams will be closed book and notes. However, a one-page formula sheet will be allowed (four pages will be allowed for the final exam). Calculators are not to be used in the programmable mode on the exams.

Submission of Assignments

Homework must be submitted via Canvas as pdf files.

Grading and Feedback

All Homework and exams will be graded within one week of the due date. The solutions will be posted on Canvas upon finalizing the grading.

Grades

Grades will be calculated based on the following two formulas, and the higher grade will be considered. Note that there is a 5% extra credit when homework contribution is included.

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	Formula 1	Formula 2
Homework	15%	0%
Exam 1	20%	23%
Exam 2	20%	23%
Exam 3	20%	24%
Final Exam	30%	30%

Extra Credit Opportunities

Questions with assigned extra credits will be raised by the instructor during the regular lectures and announced help sessions.

Finding each mistake (excluding spelling and grammar) during the in-class lectures or help sessions provides one extra credit to the person who finds it first.

Letter Grade

The letter grades will be assigned based on the overall grade distribution. However, the following ranges are guaranteed for different letter grades.

A	90-100%
B	80-89.9%
C	70-79.9%
D	60-69.9%

TECHNOLOGY REQUIREMENTS AND SKILLS

Laptop or desktop computer with reasonable speed and memory to enable downloading/uploading the course materials and/or assignments.

A calculator to be used in the non-programming mode.

Ability to use Adobe PDF software for reading the course materials and submitting the assignments.

Technology Skills

Navigating a computer operating system; using Zoom for synchronous help sessions (if needed), launching and quitting applications; connecting to the Internet; using a web browser to search the World Wide Web; downloading, saving, and uploading files; and sending and replying to email.

Canvas

This class will use Canvas to deliver ALL course materials.

Technology Help Guidelines

30-Minute Rule: When you encounter struggles with technology, give yourself 30 minutes to 'figure it out.' If you cannot, then post a message to the discussion board; your peers may have suggestions to assist you. You are also directed to contact the Helpdesk 24/7.

When posting or sending email requesting help with technology issues, whether to the Helpdesk, message board, or me use the following guidelines:

- Include a descriptive title for the subject field that includes 1) the name of course 2) the issue. Do NOT just simply type "Help" into the subject field or leave it blank.
- List the steps or describe the circumstance that preceded the technical issue or error. Include the exact wording of the error message.
- When possible, always include a screenshot(s) demonstrating the technical issue or error message.

COURSE POLICIES, EXPECTATIONS, AND GUIDELINES

Communication Policy

- Email course questions and personal concerns, including exam grading questions, to me privately using ali.adibi@ece.gatech.edu. Do NOT submit posts of a personal nature to the discussion board.
- Email will be checked regularly. During the week, I will respond to all emails within 24 hours; on weekends and holidays, allow up to 48 hours. If there are special circumstances that will delay my response, I will make an announcement to the class.
- Office hours and help sessions will be held in-person. If needed, please feel free to request one-on-one discussion using Zoom. I will set the time and will send you the link for the discussion.

Student Conduct and (N)etiquette

Communicating appropriately in the online classroom can be challenging. In order to minimize this challenge, it is important to remember several points of ***"internet etiquette"*** that will smooth communication for both students and instructors:

- Read first, Write later. Read the ENTIRE set of posts/comments on a discussion board before posting your reply, in order to prevent repeating commentary or asking questions that have already been answered.
- Avoid language that may come across as strong or offensive. Language can be easily misinterpreted in written electronic communication. Review email and discussion board posts BEFORE submitting. Humor and sarcasm may be easily misinterpreted by your reader(s). Try to be as matter-of-fact and professional as possible.
- Follow the language rules of the Internet. Do not write using all capital letters, because it will appear shouting. Also, the use of emoticons can be helpful when used to convey nonverbal feelings.
- Consider the privacy of others. Ask permission prior to giving out a classmate's email address or other information.
- Keep attachments small. If it is necessary to send pictures, change the size to an acceptable 250kb or less (one free, web-based tool to try is picresize.com).
- No inappropriate material. Do not forward virus warnings, chain letters, jokes, etc. to classmates or instructors. The sharing of pornographic material is forbidden.

NOTE: The instructor reserves the right to remove posts that are not collegial in nature and/or do not meet the Online Student Conduct and Etiquette guidelines listed above.

University Use of Electronic Email

A university-assigned student email account is the official university means of communication with all students at Georgia Institute of Technology. Students are responsible for all information sent to them via their university-assigned email account. If a student chooses to forward information in their university email account, he or she is responsible for all information, including attachments, sent to any other email account. To stay current with university information, students are expected to check their official university email account and other electronic

communications on a frequent and consistent basis. Recognizing that some communications may be time-critical, the university recommends that electronic communications be checked minimally twice a week.

Plagiarism and Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. All students enrolled at Georgia Tech, and all its campuses, are to perform their academic work according to standards set by faculty members, departments, schools, and colleges of the university; and cheating and plagiarism constitute fraudulent misrepresentation for which no credit can be given and for which appropriate sanctions are warranted and will be applied. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Copyright

The instructor provided course materials (prepared completely by the instructor may be shared). For all other materials, the students are advised to observe all relevant copyright rules.

"The Educators Guide to Copyright, Fair Use, and Creative Commons:"

- You cannot use everything you find on the Web
- There are resources you can use
    - Understanding Fair Use
    - What Can Be a Violation
- What is Creative Commons?
    - Look for a Creative Commons License
    - Finding Creative Commons Images
    - Creative Commons and Image Attribution
    - Adapting Creative Commons Images
- What are Free and Public Domain Images?
    - Attributing free to use and public domain images
    - Suggested free and public domain image Websites
        - Pixabay
        - Openclipart
        - Wikimedia Commons
        - The Commons
        - Getty Open Content Images
        - Getty Images
- Copyright and Videos
    - YouTube Copyright Basics
    - Curriculum and Text

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also email me as soon as possible in order to set up a time to discuss your learning needs.

Attendance and/or Participation

Students are expected to participate in lectures each week. Participation in the help sessions is optional, but highly encouraged as it provides problem-solving strategies as well as extra credit opportunities.

Collaboration and Group Work

Collaboration on homework problems is allowed and encouraged. However, each student must write the solution alone. Collaboration on the exams is not allowed.

Extensions, Late Assignments, and Re-Scheduled/Missed Exams

Late homework is accepted, but there will be a 20% penalty for each day. Extensions can be requested from the instructor; they may be granted under reasonable conditions assessed by the instructor.

Students are expected to participate in the exams at the assigned time period. Makeup exams are only arranged under special circumstances allowed by the institute regulations. Please communicate such situations clearly to me before the exam.

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.