# GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical and Computer Engineering

**ECE 6412**  
**ANALOG INTEGRATED-CIRCUIT DESIGN**  
**Fall 2018**

**INSTRUCTOR:** Prof. Gabriel A. Rincón-Mora, Ph.D. (URL: Rincon-Mora.gatech.edu)  
E-Mail Address: Rincon-Mora@gatech.edu, Atlanta Office: Van Leer 482

**MEETING TIMES:** At 3:10 p.m. 2–3 times/week for 225–226 min./week (as specified further below).

**TIME FOR QUESTIONS:** During and after class (and over e-mail for on-line students).


SPICE or PSPICE Reference Manual (available from class URL).

**CLASS URL:** Rincon-Mora.gatech.edu/classes.

**SYLLABUS:** Linked under sub-link "ECE 6412" on class URL.

**SPICE SIMULATOR:** Software accessible from class URL.

**COURSE DESCRIPTION:** ECE 6412 extends the concepts of semiconductor devices, integrated circuits (ICs), and applications begun in ECE 3040, ECE 3400, and ECE 4430. The material presents, explains, and shows how to understand, develop, and use semiconductor devices to model, analyze, and design transistor-level analog ICs with and without negative feedback using bipolar and CMOS technologies. The underlying aim is to cultivate and develop insight and intuition for how semiconductor devices work individually and collectively in microelectronic circuits. For this, the presentation seeks to furnish an intuitive view of ICs that transcends mathematical and algebraic formulations to empower engineers with the tools necessary to design ICs that perform practical and complex analog functions.

**PREREQUISITE:** ECE 4430 Analog Integrated Circuits (or equivalent)

**COURSE-GRADE COMPOSITION:**
- Midterm Exam = 30%
- Assignments = 30%
- Final Exam = 35%
- Professionalism: Adherence to syllabus and ECE policies. = 5%

Possible extra credit for distinguishable and extraordinary effort and professionalism.

**SCHEDULE:**

<table>
<thead>
<tr>
<th>Event</th>
<th>Dates</th>
<th>Class Time</th>
<th>Total Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Cr. 50-min. MWF Atl.</td>
<td>Aug. 20 (Mon)</td>
<td>150 min./Wk</td>
<td></td>
</tr>
<tr>
<td>First Day</td>
<td></td>
<td>113-min. MW</td>
<td>14(113)</td>
</tr>
<tr>
<td>Labor Day</td>
<td>Sept. 3 (Mon)</td>
<td>75-min. MWF</td>
<td>6(75)</td>
</tr>
<tr>
<td>Fall Recess</td>
<td>Oct. 8–9 (Mon–Tue)</td>
<td>80-min. Midterm Sep. 26 (Wed)</td>
<td>80-min. Midterm Sep. 26 (Wed)</td>
</tr>
<tr>
<td>Thanksgiving</td>
<td>Nov. 21–23 (Wed–Fri)</td>
<td>Total Minutes: 14(113) + 6(75) + 80 min. = 2112 min.</td>
<td></td>
</tr>
<tr>
<td>Last Day</td>
<td>Dec. 4 (Tue)</td>
<td>Drop Date</td>
<td>Oct. 27 (Sat)</td>
</tr>
<tr>
<td><strong>Total Minutes:</strong></td>
<td></td>
<td>42 × 50 min. = 2100 min.</td>
<td></td>
</tr>
</tbody>
</table>

**Last Assignment Due Oct. 31 (Wed)**  
Final Nov. 3 at 9:00–11:50 a.m. (Fri)

**IN CLASS:** Ask questions when in doubt, but refrain from asking questions on material missed due to absences.
COURSE EXPECTATIONS AND GUIDELINES

IN CLASS: No auditors allowed.
- Be seated and ready before class begins.
- Cellular phones, laptops, and tablets must be off and out of sight.
- No smoking or eating in class.
- Students are responsible for all material and information announced in class and over e-mail.

EXAMS: No textbooks or notes allowed.
- Calculators cannot be used in the programmable mode.
- No make-up exams (without prior approval two or more weeks in advance).
- In case of medical emergencies, work with the Office of the Dean of Students.
- List problems in numerical order, circle and mark answers clearly, and staple pages together.
- Grades become final one week after exams are graded and returned.

ASSIGNMENTS:
- No electronic "e-mail" submissions allowed for in-class students.
- No collaboration allowed (unless otherwise stipulated).
- Late submissions receive 20% reduction for each day they are late (including weekends).
- Attach a cover sheet that includes "ECE 6412", your name, date, and assignment number.
- List problems in numerical order, circle and mark answers clearly, and staple pages together.
- Grades become final one week after they are available.

SPICE: Use only text version of SPICE and include net list and control text used to generate all results.
- Label all nodes, voltages, currents, and component values in schematics.
- Highlight important information and remove unnecessary details from SPICE-generated results.

PREPARING FOR CLASS: Review lecture notes and references that correspond to the topics to be discussed in class.

PREPARING FOR EXAMS: Review lecture notes, examples, and assignments.

ASSISTANCE: Provided in direct proportion to the effort demonstrated in your own attempts to understand and resolve misunderstandings and problems.

MISSED LECTURES: Contact classmate for missed assignments, announcements, and material covered in class.

ACADEMIC INTEGRITY: All Georgia Tech students must know and follow Georgia Tech's Academic Honor Code (linked at www.catalog.gatech.edu/policies/honor-code). In accordance with the Honor Code, I expect your cooperation in reporting suspicious acts relating to academic misconduct. I must and will therefore report all instances of academic dishonesty to the Office of Student Integrity, who will investigate incidents and mandate appropriate penalties for violations. So out of respect for your peers, professors, Georgia Tech, and alumni, which also includes me, please do not engage in dishonest activities in the classroom or anywhere at Georgia Tech.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES: If you have learning needs that require special accommodations, schedule an appointment with the Office of Disability Services at disabilityservices.gatech.edu to discuss your needs and send me a note afterwards that explains your situation and their recommendations.

STUDENT–FACULTY EXPECTATIONS: At Georgia Tech, we strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and students. See catalog.gatech.edu/rules for basic expectations that you can have of me and I of you. Respect for knowledge, hard work, and cordial interactions will help build the environment we seek, so please remain committed to these ideals in and outside of class.

TENTATIVE COURSE TOPICS

1. Introduction
2. Overview/Review of Microelectronic Devices
3. Overview/Review of Single-Transistor Primitives
4. Analog Building Blocks
5. Negative Feedback
6. Operational Amplifiers
7. Comparators
8. Reference Circuits