GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical and Computer Engineering

ECE 6445 POWER INTEGRATED-CIRCUIT DESIGN Fall 2021

INSTRUCTOR: Prof. Gabriel A. Rincón-Mora, Ph.D. (URL: Rincon-Mora.gatech.edu)
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LECTURE HOURS: Announced on Canvas

OFFICE HOURS: Live on-line sessions (announced on Canvas)

COURSE URL: Rincon-Mora.gatech.edu/classes
SPICE Simulator: Linked under "SPICE Page" link
Syllabus: Linked under "ECE 6445 Power Integrated Circuit Design" link

COURSE DESCRIPTION: ECE 6445 teaches how to analyze and design CMOS switched-inductor dc–dc power supplies. The underlying aim of the course is to cultivate and develop the skillset necessary to model (steady state and across frequency), analyze (steady-state, across-frequency, and time-domain signals), and design dc–dc power-supply systems. The course reviews and details how diodes and MOSFETs conduct current and power; switched inductors operate, transfer and consume power, and respond (across frequency); and feedback circuits control and stabilize power-supply systems. The material places emphasis on insight and intuition and presents a perspective on design that transcends math and fosters innovation.

PREREQUISITE: None

EDUCATIONAL OUTCOMES: Upon successful completion of this course, students should be able to:
1. Analyze and design dc–dc switched-inductor CMOS power supplies.
2. Identify and quantify power losses.
3. Analyze frequency response and feedback dynamics.
4. Analyze and design feedback controllers.
5. Use SPICE to simulate switched-inductor power supplies.

GRADE COMPOSITION: Midterm Exam = 30%
Assignments = 30%
Final Exam = 35%
Professionalism: Adherence to syllabus & ECE policies. = 5%
Possible extra credit for distinguishable and extraordinary effort & professionalism.

IMPORTANT DATES: First Day of Class August 24 (Tuesday)
Midterm/Final Exams Announced on Canvas
Last Day to Drop Course October 30 (Saturday)
Last Day of Class December 7 (Tuesday) – Last assignment due on this date.

LECTURES FROM:
- Diodes & BJTs (www.amazon.com/dp/1099750253)
- MOSFETs (www.amazon.com/dp/107788821X)
- Switched-Inductor Power Supplies (www.amazon.com/dp/1070311006)
- Power Losses in Switched Inductors (www.amazon.com/dp/B08CJXNC29)
- Switched Inductor's Frequency Response (www.amazon.com/dp/B08KQY7VM2)
- Switched Inductors: Feedback Controller (www.amazon.com/dp/B08PXB6W7D)
- Switched Inductors: Control Loops (www.amazon.com/dp/B0977H73MX)
- Switched Inductors: Building Blocks (www.amazon.com/dp/B099ZSS7WH)

ADVICE: Review material presented after each lecture. Write notes. Ask questions.
Start working on assignments when first announced so questions can be posed early.
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.
Grades become final one week after exams are graded and returned.
*List problems in numerical order, circle and mark answers clearly, and staple pages together.

ASSIGNMENTS:
No collaboration allowed (unless otherwise stipulated).
No late submissions without prior approval.
Approved late submissions lose 20% for each day they are late (including weekends).
Grades become final one week after they are available.
*Attach a cover sheet that includes "ECE 6445", your name, date, and assignment number.
*List problems in numerical order, circle and mark answers clearly, and staple pages together.

SPICE: Only text version of SPICE allowed.
*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 previous lecture before each lecture. Read ahead.

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

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

ACADEMIC INTEGRITY: All Georgia Tech (GT) students must know and follow GT's Academic Honor Code (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, please do not engage in dishonest activities in or outside of class.

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.

INSTITUTE ABSENCE POLICY: See Georgia Tech's policies on absences at www.catalog.gatech.edu/rules/4.

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.

TENTATIVE COURSE TOPICS

1. Power-Supply Systems
2. Power Devices
3. Power Stages
4. Power Losses
5. Frequency Response
6. Feedback Controller
7. Control Loops
8. Building Blocks [as time allows]