ENEE 307
Electronics Circuits Lab

Instructor: Professor Neil Goldsman

Office Hours: TBD

Website: www.ece.umd.edu/˜ neil/enee307

Required Text: ENEE 307 Laboratory Manual by N. Goldsman

Recommended Texts: The following books are recommended as references and are on reserve in the library.

1) *The Art of Electronics* by P. Horowitz and W. Hill
2) *Microelectronics Circuits* by A. Sedra and K. Smith

Objective: To give the student a detailed knowledge of multi-device (many transistors, diodes, etc.) circuits. This is a class which should help prepare students for employment in circuit design, as well as for more advanced circuit classes. The course can be fun, especially since you make things that are actually useful.

Doing Labs: Simulation and Prototyping on Breadboard This semester students will be doing labs 1-4 using the regular lab hardware and benches in the ENEE 307 room. You will be prototyping the circuits on breadboards, applying the necessary signals and using the oscilloscopes to see the signals propagating in your circuits. Labs 5 and 6 will be done using the circuit simulator CoolSPICE.

CoolSPICE CoolSPICE is a circuit simlation program which you can download from the class website. Knowing SPICE is a very valuable skill, that is imperative for circuit analysis and design. It is also an excellent learning tool since you can very easily check if your circuit ideas are correct, as well as easily see the effects of circuit modifications.

Laboratories: The course contains the following six labs. You are expected to complete them all.

1. Diodes and Operational Amplifiers: Build your own power supply.
2. Simple Bipolar Junction Transistor (BJT) Amplifiers
3. Power Amplifiers: Build your own Hi-Fi system.
4. Frequency Response of Simple Transistor Circuits
5. Differential Amplifiers and Op-Amp Basics
6. MOS Transistor Amplifiers and CMOS Digital Circuits

Preparation and Preliminary Questions: Lab time is very valuable. To make the most of it, you should come to lab well prepared. This means you should know as much as possible, from a theoretical point of view, the expected outcome of each lab exercise before doing the lab. In other words, know what's going on in lab before you start. To help with this, at the end of each chapter in the lab manual are preliminary questions. You are required to answer

all preliminary questions for each lab BEFORE you are permitted to start the lab. Hand in your answers to your TA before starting the lab.

Lab Reports: Each student is required to turn in a lab report to your TA one week after completing the lab. This means that lab reports are due approximately every two weeks. The reports should not be more than 5 to 10 pages, and should contain schematics of your circuits, as well as answers to the questions asked throughout the lab. Each lab should contain your measured data, and a comparison with what you would expect to observe theoretically. Each experiment should contain a printout of your results as well as your own labeled sketch of the waveforms. A brief explanation of how each circuit works is also required.

Grading: There will be no tests and no final exam in this class. Your grade will be determined on how well and how much effort you put into the labs.

- The base grade for doing the required work will be a maximum of 85%, and that will earn students the grade of "B".
- **Up-Grades:** You can "Up-Grade" to earn a higher grade by doing Up-Grade suggestions provided for each lab and posted on the class website. This will provide a maximum of 15 more points. Assume the Up-Grade will require about one to two hours more for each lab. The extra work for the Up-Grade is instead of having exams. The Up-Grades will be reported in the same manner and included in your lab reports, but in a separate Up-Grade section. Also, precise instructions will not be given for the Up-Grade, this will be a chance for students to explore and try to do some design work on their own. *Upgrades can only be done using CoolSPICE*
- Maximum Grade is 100 points for each lab: 85 Base + 15 Up-Grade.
- Detailed Grade Breakdown is as follows: Prelab: 10; Lab Performance: 35; Lab Report: 40; Up-Grade: 15: Total Possible Points for Each Lab is 100.
- There will be six (6) labs

Lab Report Requirements

1. Each student is required to turn in a lab report to your TA one week after completing the lab.
2. The reports should not be more than 10 pages.
3. For each separate experiment in the labs, a circuit diagram should be included.
4. One example sketch of the input and output waveforms should be made. Make sure to label the axes.
5. Answer all questions for each experiment.
6. Provide the analytical answers based on the theory and equations in the lab manual. Write the equations used, and the values of the parameters used. ($\beta, R_L, V_{BE}, V_{CC}, etc.$)
7. Write down the measured (or simulated) values.
8. Compare your analytical results with the measured or simulated ones. If there is a very large difference (more than 30%) try to explain the discrepancy.

9. Organization and neatness: Make sure your report is well organized so that the TA can easily read it and understand what you are reporting.

10. Before doing the experiment, do the pre-lab.

11. Include a sample printout of an oscilloscope or CoolSPICE trace for each experiment.