



ECE Department
ECE351 – Analog Electronics
Fall 2009

Instructor Information

Instructor: Marc E. Herniter
Office Hours : [See Schedule.](#)
Office Phone Number : 877-8512
Office Number : C211
WEB Address: <http://www.rose-hulman.edu/~herniter>
E-mail: Marc.Herniter@IEEE.ORG

CATALOG DESCRIPTION: *Amplifier design and analysis including discrete and integrated circuit topologies. Cascaded amplifiers, input and output stages, frequency response. Linear and non-linear Op-Amp circuits. Introduction to the non-ideal properties of Op-Amps. Integral laboratory.*

PREREQUISITE: [ECE250](#)

PREREQUISITE SKILLS

- 1) PSpice simulation.
- 2) Biasing of 3-terminal devices.
- 3) Diode rectifiers.
- 4) Small signal analysis
- 5) Circuit Analysis Techniques (Nodal Analysis and Superposition)

REQUIRED MATERIALS:

TEXTBOOK: *Schematic Capture With Cadence PSpice, 2nd Edition*, M.E. Herniter, Prentice Hall, 2003. ISBN: 0-13-048400-8. (The first edition is O.K. if you already have it.)

TEXTBOOK: *Microelectronic Circuits*, Sedra and Smith, Oxford, 2004, 5th Ed., ISBN: 0-19-514251-9.

NOTEBOOK: National Brand Computation Notebook Number 43-648. Or any notebook with non-removable pages and page numbers is required.

LECTURE NOTES: Lecture notes are available from the bookstore.

REQUIRED SOFTWARE:

PSpice: OrCAD PSpice and Capture version 15.7. Instructions for installing the software are available on my website at http://www.rose-hulman.edu/~herniter/Rose_Classes/ECE351/351_index.htm.

EVALUATION METHOD:

Homework	10%
Lab	20%
Pre-Lab	5%

Exams (3 at 65/3% each) 65%

- Three exams will be given during the quarter. The third exam will be held during the time scheduled for the final.
- The final has the same weight as the two other exams. **The final exam will last only three hours.**
- A grade of incomplete will only be given for circumstances beyond a student's control. Class load, extra curricular activities, and jobs are all circumstances that are under the control of a student and will not justify a grade of incomplete.
- Your grade will be based on the following schedule
 1. A : Total Average ≥ 92
 2. B+: $92 > \text{Final Average} \geq 87$
 3. B : $87 > \text{Final Average} \geq 82$
 4. C+: $82 > \text{Final Average} \geq 77$
 5. C : $77 > \text{Final Average} \geq 72$
 6. D+: $72 > \text{Final Average} \geq 67$
 7. D : $67 > \text{Final Average} \geq 62$
 8. F : $62 > \text{Final Average}$

EXAM SCHEDULE:

- Exam 1 – 29 Sept 2009 (Tuesday)
- Exam 2 – 29 Oct 2009 (Thursday)

COURSE POLICIES:

HOMEWORK: There will be 10 homework assignments (order of magnitude estimate). These assignments should be done independently. Homework is due at the beginning of class on the due date. Late homework will not be accepted. Solutions are available on [my web site](#). The files are downloadable and can be viewed with the Adobe Acrobat Reader. You are required to use the standard RHIT format for homework. All homework should have a standard RHIT cover page.

ATTENDANCE: Attendance is required.

LATE HOMEWORK: Homework is due at the beginning of class on the specified due date. Late homework will not be accepted.

EXAMS: These exams are open book, open notes, and open brain (your brain only). Personal computers may be used during exams only to view the class notes. You may not use Maple, MathCAD, or PSpice during the exam.

HONOR CODE: The honor code will be enforced in this class.

MAKEUP EXAMS: Makeup exams will not be given. If you miss an exam, it will be counted as a zero.

LABORATORY: Lab grading will be discussed in the lab. You must bring the following items to the lab:

- Nickels, dimes, and quarters to purchase parts.
- A breadboard. This can be purchased in the lab.
- A pre-cut prototyping wire kit.
- Hemostats.
- Your lab notebook.
- Glue. The preferred type is Elemer's Blue School Gel.
- Scissors.
- A Pen. Pencils are not allowed.

INSTRUCTIONAL PHILOSOPHY: Topics will be covered in three levels: Theoretical analysis, simulation, and laboratory verification. The following synthesis procedure is used to gain an understanding of circuits covered in the class: The theoretical analysis of the circuit is covered to understand the operation of the circuit or to design a circuit. Circuit simulation using industry standard analysis tools is verify the theoretical analysis or circuit design. If the simulations agree with theoretical analysis, the circuit is constructed in the lab. Measurements of the circuit performance are made and compared to the theoretical calculations and simulation results.

INSTRUCTIONAL OBJECTIVES (Approximate)

1. Small Signal Analysis Review
 - Bias
 - Small Signal Model
 - Gain Calculation
 - Design Example For Specified Gain And Swing
2. Current Sources
 - Current Mirror
 - Widlar Current Source
 - Calculation Of Parallel Resistance
3. Amplifier Topologies
 - Differential Amplifiers
 - Push-Pull Amplifier
4. Cascaded Amplifiers
5. Low Frequency Response
 - Simple RC Circuits
 - Amplifier Low-Frequency Response
 - Low-Frequency Small Signal Model
5. High Frequency Response
 - Simple RC Circuits
 - Miller's Theorem
 - Amplifier High-Frequency Response
6. Operational Amplifier Circuits
 - Review Of Feedback
 - Linear Circuits.
 - Inverting and Non-Inverting
 - Summing and Difference
 - Current to Voltage Converter
 - Integrator and Differentiator
 - Non-Linear Circuits.
 - Rectifiers and Limiters
 - Comparators and Schmitt Triggers
 - Non-Ideal Opamps
 - Bias Currents
 - Offset Voltage
 - Frequency Response