Description
Introduction to the principles and application of circuit analysis, analog and digital electronics, electric power, and electric machinery, with an emphasis on practical applications relevant to mechanical and industrial engineering (3-unit for non-EE and non-CSE majors only)

Objectives
Students completing the course will know:
1. Basic electric circuit elements ($R$, $L$, $C$, independent sources) and analysis of simple circuits using conventional laws and techniques
2. Basic circuit theory in time and complex frequency domains
3. Characteristics of nonlinear circuit elements such as semiconductor diodes and transistors
4. Analysis of the operational amplifier and its applications
5. Basics of digital logic and gates, and of digital computers

Prerequisite
Math 132 & Physics 152 & Physics 154

Lectures
MWF 11:15 am – 12:05 pm, Engineering & Computer Science II Room #119

Instructor
Il-Seop Shin, Marcus Hall 203
Office Hours: Check the course website. (Please, send me an e-mail (umass.ece361@gmail.com) to make an appointment if you need to see me in times other than office hours.)

TAs
Gabrielle Mehlman (gmehlman@student.umass.edu)
Thursday, 4:00 – 5:30 PM at ELAB Computer Lab on 2nd floor

Todd Currier (tcurrier99@gmail.com)
Thursday, 12:45 – 2:15 PM at ELAB Computer Lab on 2nd floor

Course Website
http://www.ecs.umass.edu/ece/ece361
The course materials will be posted in this site. Students are expected to check the website regularly for updated course information and announcements.

Textbook
References

Exams
There are three closed-book, closed-note exams. A handwritten formula sheet will be allowed. No make-up exams will be allowed.
Exam 1: Friday, Oct. 16, 11:15 AM – 12:05 PM, ECSC #119
Exam 2: Monday, Nov. 16, 11:15 AM – 12:05 PM, ECSC #119
Exam 3: Tuesday, Dec. 15, 1:30 PM – 3:30 PM, ECSC #119

Homework
Eight homework sets will be assigned with five problems or more in each set. Homework will be collected at the beginning of class on the date specified for each assignment. Late homework will not be accepted.

Grading
An individual’s total score will be computed using the following method: (1) eight homework assignments 25 points each; (2) three exams 100 points each. After three exams, the first and second best exam scores will be counted twice such that the maximum possible points for the course would be 700 points (i.e., homework + best exam score ×2 + second best score ×2 + third best score = 200 + 200 + 200 + 100). The following grades are guaranteed if the total score earned during the semester is greater or equal to the points in the table shown below.

<table>
<thead>
<tr>
<th>Guaranteed</th>
<th>A</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Points</td>
<td>620</td>
<td>590</td>
<td>560</td>
<td>530</td>
<td>500</td>
<td>470</td>
<td>440</td>
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If you are within a few points below the cutoffs, you may be awarded to the next higher grade depending on your performance on exams, homework assignments, and unannounced attendance checks.

Honesty Policy
Working with other students on homework assignments is encouraged, but your solutions must reflect your own efforts. Exams must be entirely your own individual work. No form of cheating, plagiarism, fabrication, or facilitating dishonesty will be condoned in the University community. Any incident of academic dishonesty during an exam will be notified to the University Academic Honesty Board and handled in accordance with its policy. The UMass Academic Honesty Policy and Appeal Procedure can be found at [http://www.umass.edu/dean_students/codeofconduct/acadhonesty](http://www.umass.edu/dean_students/codeofconduct/acadhonesty).
Topics

Circuits

Introduction
1.1 Overview of Electrical Engineering
1.2 Circuits, Currents, and Voltages
1.3 Power and Energy
1.4 Kirchhoff’s Current Law
1.5 Kirchhoff’s Voltage Law
1.6 Introduction to Circuit Elements
1.7 Introduction to Circuits

Resistive Circuits
2.1 Resistances in Series and Parallel
2.2 Network Analysis by Using Series and Parallel Equivalents
2.3 Voltage-Divider and Current-Divider Circuits

Inductance and Capacitance
3.1 Capacitance
3.2 Capacitances in Series and Parallel
3.3 Physical Characteristics of Capacitors
3.4 Inductance
3.5 Inductances in Series and Parallel
3.6 Practical Inductors

Transients
4.1 First-Order RC Circuits
4.2 DC Steady State
4.3 RL Circuits
4.4 RC and RL Circuits with General Sources
4.5 Second-Order Circuits

Steady-State Sinusoidal Analysis
5.1 Sinusoidal Currents and Voltages
Handouts: Laplace Transform and Circuit Analysis in Frequency Domain

Digital Systems

Logic Circuits
7.1 Basic Logic Circuit Concepts
7.2 Representation of Numerical Data in Binary Form
7.3 Combinatorial Logic Circuits
7.4 Synthesis of Logic Circuits

Microcomputers
8.1 Computer Organization
8.2 Memory Types
8.3 Digital Process Control

Computer-Based Instrumentation Systems
9.1 Measurement Concepts
9.2 Signal Conditioning
9.3 Analog-to-Digital Conversion

Electronics

Diodes
10.1 Basic Diode Concepts
10.2 Load-Line Analysis of Diode Circuits
10.4 Ideal-Diode Model
10.5 Piecewise-Linear Diode Models
10.6 Rectifier Circuits
10.7 Wave-Shaping Circuits
10.8 Linear Small-Signal Equivalent Circuits

Bipolar Junction Transistors
13.1 Current and Voltage Relationships
13.2 Common-Emitter Characteristics
13.3 Load-Line Analysis of a Common-Emitter Amplifier
13.4 pnp Bipolar Junction Transistors
13.5 Large-Signal DC Circuit Models
13.6 Large-Signal DC Analysis of BJT Circuits
13.7 Small-Signal Equivalent Circuits
13.8 Common-Emitter Amplifiers

Operational Amplifiers
14.1 Ideal Operational Amplifiers
14.2 Inverting Amplifiers
14.3 Noninverting Amplifiers
14.4 Design of Simple Amplifiers
14.5 Op-Amp Imperfections in the Linear Range of Operation
14.6 Nonlinear Limitations
14.7 DC Imperfections
14.8 Differential and Instrumentation Amplifiers
14.9 Integrators and Differentiators
14.10 Active Filters
Handouts: More Applications of Op-Amps
### Relationship of Course Objectives to Program Outcomes

<table>
<thead>
<tr>
<th>PROGRAM OUTCOMES</th>
<th>COURSE OBJECTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well grounded in the fundamental concepts of math, physics, chemistry, computer science, and engineering science</td>
<td>x x x x x</td>
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<tr>
<td>Able to identify, formulate and solve problems in ECE</td>
<td>x x x x x</td>
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<tr>
<td>Able to design and conduct experiments, and to analyze and interpret measured data</td>
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<tr>
<td>Capable of designing analog and digital systems, components, and processes to meet desired needs</td>
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<td>Proficient in using modern engineering techniques and computing tools for effective engineering practice</td>
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<td>Experienced in engineering teamwork, and in solving technically diverse and multidisciplinary problems</td>
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<td>Able to communicate effectively orally and in writing, and through symbolic and graphical expression</td>
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<td>Aware of professional and ethical responsibilities as engineers</td>
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<td>Aware of the impact of ECE technology and decisions on society</td>
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<tr>
<td>Motivated about the importance of lifelong learning, scholarship and professional development</td>
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Prepared by: Il-Seop Shin
First Posted: September 1, 2009
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