E84: Introduction to Electrical Engineering

Syllabus

Faculty:
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Grutors:
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Schedule

Lecture  MW9-9:50  Shanahan 3460
Office Hours  M1-3  Parsons 2374
  M3-4  Parsons 2372
  Tu2-4  Parsons 2372
  Th10  Parsons 2374
Tutoring Hours  SuM 7-10  ECF (Parsons B178)

Text and Supplies

You will need to purchase a National Instruments myDAQ and associated software, along with a kit of parts, to do the weekly labs. The myDAQ works as an oscilloscope, multimeter, waveform generator, triple-output power supply, and data acquisition system in one small USB-powered package, and comes with LabView, MultiSim, and UltiBoard, all of which (except UltiBoard) you will use in the class. NI heavily discounts the myDAQ for students. Purchase your package through Studica for $199; allow time for shipping.


You will need LabView and MultiSim, which are available on Windows. Mac or Linux users can run Windows under VMWare or Parallels, or can use the software in the ECF.

You will also need a lab kit with components, a breadboard, and jumper wires. This year, the department is fully subsidizing the kit cost. Pick up your kit from the stockroom.

You may also use resistors and capacitors (10 μF or less) from the student stockroom. Take exactly what you need and no more. Do not return components to the stockroom drawers because damaged or misfiled components cause much grief.

There is no required textbook for this class. Lecture notes are available on the class web site. However, we believe that there is a lot to learn by reading a good book that covers the same material from a slightly different perspective, whether to gain deeper understanding of a topic or clarify a topic that was difficult to follow in lecture. The recommended text for this course is Foundations of Analog and

Electronic Communication

Web Page: http://fourier.eng.hmc.edu/e84/
Email: eng-84-l@hmc.edu
Sakai: sakai.claremont.edu under HM ENGR 84

Be sure that you are on the class email list. If you don’t receive mail at the start of the semester, add yourself to the list or risk missing important late-breaking announcements. To subscribe, send email to listkeeper@hmc.edu with one line in the body:

subscribe eng-84-l

You will also need a Harvey Mudd College computer account to complete your labs. If you are not an HMC student, email the instructor with your full name and school affiliation and we will request an account for you.

Course Description

Introduction to the fundamental principles underlying electrical and electronic components and devices, and their applications in various circuits and systems. Topics include electrical and magnetic properties of electrical components; analysis of both DC and AC passive linear circuits; semiconductor devices; analysis of active nonlinear circuits, including elementary transistor amplifiers and operational amplifiers; and simple electronic circuit design.

By the end of this course, you should be able to:

• Describe and apply the physical principles underlying the operation of electrical and electronic circuits.
• Operate electrical test and measurement equipment
• Design, analyze, simulate, build, and characterize circuits
  o DC Circuits
    ▪ Supplies, resistors, sensors,
  o Electronic Circuits
    ▪ Op-amps, diodes, transistors
    ▪ Power supplies: linear regulators and batteries, rectifiers
  o AC Circuits
    ▪ RLC circuits, active filters, oscillators
  o Magnetic Circuits
    ▪ Motors, speakers
• Recognize and account for nonidealities of components
• Use Multisim to verify and optimize circuit designs
• Design and build a printed circuit board
Assignments and Grading

Each week’s assignment has a written portion to familiarize you with circuit analysis and a laboratory component in which you will design, analyze, simulate, build, and characterize circuits. Turn in both parts together electronically on Sakai before the start of class on Wednesdays. Your laboratory writeup should be no longer than necessary but comprehensible to somebody unfamiliar with the assignment. Use equations, schematics, and figures liberally.

The course will be graded as follows:

- Assignments: 50%
- Midterm Exam: 20%
- Final Exam: 25%
- Class Participation: 5%

Honor Code Policy

1. All students enrolled in this course are bound by the HMC Honor Code. More information on the HMC Honor Code can be found in the HMC Student Handbook.
2. It is your responsibility to determine whether your actions adhere to the HMC Honor Code. If this document does not clarify the legitimacy of a particular action, you should contact the course instructor and request clarification.
3. Work you submit for individual assignments should be your own, and you should complete all assignments based on your own understanding of the underlying material. If you work with, or receive help from, another individual on an assignment, provide a written acknowledgement in complete sentences that includes the person’s name and the nature of the help.
4. This document is not meant to be an exhaustive list of every possible Honor Code violation. Infractions not explicitly mentioned here may still violate the Honor Code.
5. Boundaries of Collaboration
   Verbal collaboration with other students on individual assignments is encouraged AFTER you have given serious thought to each component yourself. However, all submitted written work should be written by yourself individually, and not a collaborative effort or copied from a common source (e.g., a chalkboard). It is NOT acceptable to work on labs in lockstep with another classmate.
6. Use of Published Solutions
   You may check your answers against the solutions in the back of the textbook after completing problems, but may not reference step-by-step solution instructions in separately published solution manuals.
7. Use of Computer Software
   The use of graphing calculators and computer software to aid in course work is acceptable, as long as it does not substitute for an understanding of the course material.
8. Use of Web Resources
   The use of Internet resources to aid in course work is acceptable, as long it does not substitute for an understanding of the course material. Plagiarism and direct copying from online (or any other) sources is strictly prohibited. You may NOT refer to solutions to textbook problems floating around on the Web.
9. Use of Your Own Work from Previous Semesters
   If you have previously attempted this course, you may resubmit your work from previous semesters as this semester’s coursework, as long as you understand the underlying material.
10. Use of Other Course Resources from Previous Semesters
    You may not reference assignments (labs, problem sets, activities) of this course from previous semesters.
11. Retention of Course Resources
    Assignments and exams from this course may not be committed to dorm repositories or otherwise used to help future students.
## Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Mon</th>
<th>Wed</th>
<th>Assignment Due (Wed)</th>
<th>Reading</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1/19</td>
<td>MLK Day: NO CLASS</td>
<td>Intro, Elements &amp; Laws</td>
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<td>Ch 1</td>
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<tr>
<td>2</td>
<td>1/26</td>
<td>Source &amp; Load</td>
<td>KCL &amp; KVL</td>
<td>1: Measurements</td>
<td>Ch 2</td>
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<td>3</td>
<td>2/2</td>
<td>Thevenin &amp; Norton</td>
<td>Energy Sources</td>
<td>2: Resistive</td>
<td>Ch 3</td>
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<td>4</td>
<td>2/9</td>
<td>DC Circuit Analysis</td>
<td>Ideal Op-Amps</td>
<td>3: Sensors</td>
<td>Ch 15</td>
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<tr>
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<td>2/16</td>
<td>Non-ideal Op-Amps</td>
<td>Op-Amp Circuits</td>
<td></td>
<td>Ch 15</td>
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<tr>
<td>6</td>
<td>2/23</td>
<td>Semiconductors</td>
<td>Diodes</td>
<td>4: Multimeter</td>
<td>Ch 16</td>
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<tr>
<td>7</td>
<td>3/2</td>
<td>BJT's</td>
<td>Large signal analysis</td>
<td>5: Op-Amps &amp; Diodes</td>
<td></td>
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<tr>
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<td>Small signal analysis</td>
<td>Midterm Review</td>
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<td>Midterm</td>
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<td>3/16</td>
<td>Spring Break</td>
<td>Spring Break</td>
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<tr>
<td>10</td>
<td>3/23</td>
<td>Phasors and Impedance</td>
<td>AC Circuit Analysis</td>
<td>6: Transistors</td>
<td>Ch 9</td>
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<td>3/30</td>
<td>Time &amp; Freq Response</td>
<td>Resonance</td>
<td>7: PCB Design</td>
<td>Ch 10-14</td>
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<td>12</td>
<td>4/6</td>
<td>Active Filters I</td>
<td>Active Filters II</td>
<td>8: RLC</td>
<td></td>
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<tr>
<td>13</td>
<td>4/13</td>
<td>Magnetic Circuits</td>
<td>Speakers</td>
<td>9: Resonance</td>
<td></td>
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<tr>
<td>14</td>
<td>4/20</td>
<td>Motors</td>
<td>FETs</td>
<td>10: Active Filters</td>
<td>Ch 6</td>
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<tr>
<td>15</td>
<td>4/27</td>
<td>Voltage Regulators</td>
<td>Final Review</td>
<td>11: Magnetic Ckts</td>
<td>Final</td>
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