BENG 380  
Introduction to Circuits and Electronics  
Fall 2017 Syllabus

Instructor
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Volgenau School of Engineering  
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Office Location: 3707 Engineering Bldg.; Office Hours: By Appointment

Teaching Assistant: Alex Kaiser (akaiser4@gmu.edu)

Class Schedule: Wednesday 4:30 pm – 7:10 pm @ Robinson Hall B124

Recitation: Tuesday 12:00 pm – 12:50 pm (Engin. 2608) or 1:30 pm – 2:20 pm (Innov. Hall 330)

Course Description
This course is designed to introduce students to the properties of fundamental electronic devices and how to perform circuit analysis. The course covers linear circuit elements (resistors, capacitors, and inductors), operational amplifiers, semiconductor devices (diodes and transistors), and digital logic elements. Relevance to biological signal acquisition and biomedical instrumentation will be emphasized as examples.

Prerequisites: Grade of C or better in PHYS 260 (Waves, Electricity, and Magnetism) and a grade of B- or better in MATH 214 (Differential Equations); Corequisite: BENG 320 (Bioengineering Signals and Systems).

Course Objectives
After successfully completing this course, students will be able to:

- Use Kirchhoff’s Current and Voltage Laws, and mesh and nodal analysis techniques to solve linear circuits.
- Apply phasor analysis to derive linear circuit outputs for AC inputs.
- Formulate and solve first-order and second-order differential equations derived from linear circuits to derive transient response.
- Analyze and design circuits based on operational amplifiers including active filters.
- Analyze circuits containing non-linear devices such as diodes and transistors.
- Analyze and design digital circuits containing logic gates and combinatorial logic modules.
Relationship to Bioengineering Program Outcomes

It is expected that this course will help students achieve the following:

1) An ability to apply knowledge of mathematics (including differential equations and statistics), science (including biology and physiology), and engineering to solve problems at the interface of engineering and the life sciences.

2) An ability to design a system, component, or process to meet desired requirements within realistic constraints such as economic, environmental, social, political, health and safety, manufacturability, and sustainability.

3) An ability to identify, formulate, and solve engineering problems, addressing issues associated with the interface of engineering and the life sciences.

Homework

Weekly homework assignment is required to be submitted on Blackboard. No late homework will be accepted except for documented emergencies.

The only way to develop skill in solving circuits is through practice. After you have worked on problems alone, I encourage you to discuss difficult problems with your classmates and work together in solving them. However, these are individual assignments and each student must hand in their own work. Copying a solution from any source is a violation of academic integrity and will certainly not lead to proficiency in solving circuits.

Recitation Session

The purpose of the recitation session is to allow additional time for students to ask questions, review homework problem solutions, to conduct review and practice for exam preparation, and to review exam performance. Unless otherwise announced, attendance to the recitation is not required.

Quiz and Exam

There will be Quiz, Midterm, and Final in the course; all are closed book and closed notes. Use of calculators is permitted, but all formulas, notes, etc. stored in the calculator memory must be cleared. Formula sheets will be provided. Non-emergency use of cell-phones or smartphones is not permitted for any reason during the quizzes or the exams.

No make-up on missed quizzes. Make-up examinations or incompletes will be considered only in documented emergencies. Unexcused absence from an examination will result in 0%.
Textbook

Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Text Sections</th>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Aug. 30</td>
<td>2.1 – 2.2</td>
<td>Course Organization; Fundamentals of Electric Circuits</td>
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<tr>
<td>2</td>
<td>Sept. 6</td>
<td>2.2 – 2.6</td>
<td>Fundamentals of Electric Circuits</td>
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<tr>
<td>3</td>
<td>Sept. 13</td>
<td>3.1 – 3.5</td>
<td>Resistive Network Analysis</td>
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<td>4</td>
<td>Sept. 20</td>
<td>3.6 – 3.8 ; 4.1</td>
<td>Equivalent Circuits and Power; Capacitor and Inductors; <em>QUIZ #1</em></td>
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<tr>
<td>5</td>
<td>Sept. 27</td>
<td>4.2 – 4.3 ; 5.1</td>
<td>Phasors; Transient Response</td>
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<tr>
<td>6</td>
<td>Oct. 4</td>
<td>5.1 – 5.4</td>
<td>Transient Response – initial and final conditions; Laplace Transforms</td>
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<tr>
<td>7</td>
<td>Oct. 11</td>
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<td><strong>MIDTERM</strong></td>
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<tr>
<td>8</td>
<td>Oct. 18</td>
<td>5.5 ; 6.1 – 6.2</td>
<td>Transient Response of 2\textsuperscript{nd} Order Circuits; Frequency Response</td>
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<tr>
<td>9</td>
<td>Oct. 25</td>
<td>6.2 – 6.3 ; 8.1 – 8.3</td>
<td>Frequency Response and Filters; Operational Amplifiers</td>
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<td>10</td>
<td>Nov. 1</td>
<td>8.3 – 8.5</td>
<td>Active Filters; <em>QUIZ #2</em></td>
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<tr>
<td>11</td>
<td>Nov. 8</td>
<td>9.1 – 9.5 ; 10.1 – 10.2</td>
<td>Semiconductors; Bipolar Junction Transistors</td>
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<tr>
<td>12</td>
<td>Nov. 15</td>
<td>10.3 – 10.4 ; 12.1 – 12.3</td>
<td>Bipolar Junction Transistor Operating Modes; Digital Logic and Boolean Algebra</td>
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<tr>
<td>13</td>
<td>Nov. 22</td>
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<td><strong>THANKSGIVING</strong></td>
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<td>14</td>
<td>Nov. 29</td>
<td>12.3 – 12.5</td>
<td>Boolean Algebra; Combinatory Logic</td>
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<td>15</td>
<td>Dec. 6</td>
<td></td>
<td>Final Review</td>
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<tr>
<td>16</td>
<td>Dec. 13</td>
<td></td>
<td><strong>FINAL EXAM (4:30 pm – 7:15 pm)</strong></td>
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Grading Policy

- Homework: 10%
- Quiz (2): 20%
- Midterm exam: 30%
- Final exam: 40%

Grading Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>&gt; 92%</td>
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<tr>
<td>A-</td>
<td>90–92</td>
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<tr>
<td>A+</td>
<td>87–89</td>
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<tr>
<td>B</td>
<td>83–86</td>
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<tr>
<td>B-</td>
<td>80–82</td>
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<tr>
<td>C</td>
<td>77–79</td>
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<tr>
<td>C-</td>
<td>73–76</td>
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<tr>
<td>C+</td>
<td>70–72</td>
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<tr>
<td>D</td>
<td>60–69</td>
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<tr>
<td>F</td>
<td>&lt; 60%</td>
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Mason Email Accounts

Students must use their MASONLIVE (http://masonlive.gmu.edu/) email account to receive important University information, including messages related to this class.

Academic Integrity

The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code (http://oai.gmu.edu/the-mason-honor-code-2/) with clear guidelines regarding academic integrity; cheating, plagiarizing, stealing, and lying. Three fundamental and rather simple principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification.

In addition to the general guidelines, specific requirements for this course include the following:

- In quizzes and examinations, all work must be performed individually with no communication with others. Only materials and tools that have been explicitly approved may be used, but cannot be shared.
- For homework assignments, solutions to problems may be discussed with fellow students, but each student must submit his or her own version of the solution of the assignment in writing. Any external material used, as well as the source of that material, must be clearly cited.

Office of Disability Services

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474 (http://ods.gmu.edu). All academic accommodations must be arranged through the ODS.

WAVES: Wellness, Alcohol and Violence Education and Services

WAVES promotes wellness within the Mason community through health education, alcohol/drug assessment and education, and violence awareness, prevention and sexual assault response. We help students make healthy, safe choices and encourage lifelong, thoughtful healthy decision-making through individualized support, creative programming, and evidence-based education and outreach.

WAVES office 703-993-9999
SUB I, Suite 3200
24-Hour Sexual and Intimate Partner Violence Crisis Line 703-380-1434
waves.gmu.edu
• 703-360-7273 (Fairfax County Office for Women and Domestic and Sexual Violence Services 25 hotline)
• 703-228-4848 (Arlington County Domestic Violence Services Hotline)
• 703-368-4141 (Prince William County Sexual Assault Victims Advocacy Services (SAVAS) hotline)
• 1-800-838-8238 (Virginia Family Violence and Sexual Assault Hotline)
• 1-800-656-HOPE (Rape, Abuse and Incest National Network)
https://ohl.rainn.org/online/

CAPS: Counseling and Psychological Services

Counseling and Psychological Services (CAPS) provides a wide range of free confidential services to students, faculty, and staff. Services are provided by a staff of professional clinical psychologists, social workers, counselors, learning specialists, and psychiatric providers. CAPS individual and group counseling, workshops, and outreach programs are designed to enhance students’ personal experience and academic performance.

Visit us at caps.gmu.edu for additional resources.

• For consultation or emergency assistance during office hours call 703-993-2380
• For assistance during non-office hours, call University Police at 703-993-4357
• 703-527-4077 (CrisisLink)
• 1-800-273-8255 (National Suicide Prevention Lifeline)
• 1-877-838-2838 (Veterans' Crisis Hotline)

Student Health Services (SHS) – Provides confidential health care to enrolled students in emergency and non-emergency circumstances on the Fairfax, Arlington and Prince William campuses. If there is a medical emergency and Student Health Services (SHS) is closed, please contact the free after-hours nurse ((703) 993-2831), a hospital emergency room, an urgent care facility, or call 911.

SUB 1, Suite 2300
703-993-2831

University Police

Emergency: 911 Non-Emergency: (703) 993-2810
Reporting a Crime (Crime Solvers Anonymous Tip Hot-Line): (703) 993-4111
Mason Police Website: http://police.gmu.edu/
Eric Heath, Chief of Police Phone: (703) 993-3840 E-mail: eheath2@gmu.edu