EK307 – Electric Circuits
Spring 2024, Semester Section A2

Instructor: Josh Semeter (office: PHO 537, email: jls@bu.edu)
Lecture: Mon/Wed 9:00–10:45, PHO 211
Office hours: Tuesday 12:30-1:30, Friday 11:30-12:30
On Zoom (for now): https://bostonu.zoom.us/j/728984093

Lab instructor: Vladimir Klepstyn vklep@bu.edu

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Course Websites: https://learn.bu.edu (You should see two Blackboard sites for EK307: one for the main course, and the other for the labs)

Course Description:
Introduction to electric circuit analysis and design; voltage, current, and power, circuit laws and theorems; element I-V curves, linear and nonlinear circuit concepts; operational amplifier circuits; transient response of capacitor and inductor circuits, sinusoidal-steady-state response, frequency response, transfer functions; includes design-oriented laboratory.
Prerequisite: CAS PY 211 or CAS PY 251, Corequisite: CAS MA 226.

Course Methodology:
EK307 includes a coordinated set of lectures, labs, homework, and exams. Lab sessions meet in PHO105 where students will perform circuit experiments using components and a breadboard. Students will have weekly discussion times with TAs to discuss course material and get help with homework and exam preparation.

Textbook:
Alexander and Sadiku, *Fundamentals of Electric Circuits, 7th Edition*, McGraw Hill, 2021. This text is available for rent at the publisher’s website at a reasonable price ($55). Earlier editions are also okay, but you may have to map Section numbers from Edition 7 to your edition.

There is also a free textbook available, with material organized in a similar fashion: https://services.publishing.umich.edu/publications/ee/#circuit-analysis
We will be using some examples from this text in the course.

Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Labs</td>
<td>20%</td>
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<tr>
<td>Homework and Participation</td>
<td>10%</td>
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<tr>
<td>Mid-term Exam I</td>
<td>20%</td>
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<tr>
<td>Mid-term Exam II</td>
<td>20%</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
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Exams: The exams will be closed book, closed notes. There will be two midterm exams and a Final. **The midterm exams will be during lecture, on Monday February 26 and Monday April 8.** Do not make any plans to be away from BU on these dates!
Missed Exam Policy:
Absence from an exam can be excused only for reasons as stipulated by BU’s academic policies, such as illness, or unavoidable travel. Permission of the instructor in advance is required. A written note of authorization by a physician (in case of illness) or other appropriate authorized signature is required.

Homework: Homework sets will be distributed approximately weekly, and submitted via scan and upload to Blackboard. Please see the Homework link on Blackboard for details. Late homework will not be accepted.

Collaboration on Homeworks:
Learning takes place in many ways and is different for all students. You are permitted to collaborate on homework, however each of you needs to submit your own original work. You are not allowed to copy someone else’s answers. All students must comply with the University’s Universal Academic Conduct Code: http://www.bu.edu/academics/resources/academic-conduct-code/.

Lecture: In-person attendance at lecture is expected. Lectures will focus on connecting concepts to problem solving. The lectures will include material not covered in the textbook, but important for exams and homework.

Discussion Sections:
Discussion sessions are offered throughout the week (see Blackboard for full schedule). You are welcome to attend any session that fits your schedule. The TA staff will be available for the first hour of each session and will stay longer if you arrive within that time or otherwise notify the TA ahead of time. The discussions sections are problem solving sessions, where you will have the opportunity to work with the TAs and your classmates on homework and lecture problems and discuss course concepts.

Labs: Lab information will be posted on a separate dedicated Blackboard site (learn.bu.edu). Everyone should have ordered their individual lab kits online. You are expected to bring those to each lab session. The labs are a required part of EK307. You are required to complete all labs by the assigned deadlines in order to receive a passing grade in this course, regardless of performance on exams and homeworks. The lab grade is based on demonstrating your circuits to the lab TA staff and completing lab worksheets. More information will be given at your first lab session.

Inclusion: I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.
### Lecture Schedule, EK 307 (A2), Spring 2024 (tentative)

<table>
<thead>
<tr>
<th>Lec#</th>
<th>Date</th>
<th>Topic</th>
<th>Reading, Alexander &amp; Sadiku</th>
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</thead>
</table>
| 1    | M 1/22 | Course Introduction, System of Units  
Charge, Current and Voltage; Power and Energy | Chapter 1                   |
| 2    | W 1/24 | Basic Circuit Elements, Ohm’s law; KVL, KCL, Dependent sources       | 1.6, 2.1–2.4               |
| 3    | M 1/29 | Resistors in Series and voltage division  
Resistors in parallel and current division | 2.5-2.6, 2.8-2.9            |
| 4    | W 1/31 | Node-Voltage Method  
Solving circuits with linear algebra | 3.1–3.3                    |
| 5    | M 2/5  | Mesh-current method  
Transistor model and dependent sources | 3.4–3.5, 3.9–3.10           |
| 6    | W 2/7  | Linearity, superposition, source transformation  
Thevenin & Norton circuits, Part I | 4.1–4.5                    |
| 7    | M 2/12 | Thevenin & Norton circuits, Part II  
Maximum Power Transfer | 4.6, 4.8, 4.10, 4.11         |
| 8    | W 2/18 | Introduction to operational amplifiers  
Inverting and non-inverting amplifiers | 5.1–5.5                    |
| 9    | W 2/21 | Op-amp analysis techniques  
Basic op-amp architectures: Voltage follower, Summing Amplifier. Exam 1 review | 5.6 – 5.8                  |
| 10   | M 2/26 | **EXAM 1 (Lectures 1-8)** |                           |
| 11   | W 2/28 | Digital-to-analog converters (DAC), Differential amplifiers,  
Instrumentation amplifiers | 5.10, 5.11                  |
| 12   | M 3/4  | Introduction to Capacitors and Inductors  
Integrator and Differentiator circuits | Chapter 6                   |
| 13   | M 3/6  | First order circuits: source-free RL and RC circuits | 7.1-7.3                    |
| 14   | M 3/18 | Singularity Functions  
Step response of RL and RC circuits | 7.4–7.6                    |
| 15   | W 3/20 | First order op-amp circuits | 7.7, 7.9–7.10              |
| 16   | M 3/25 | Intro to second order circuits  
Series/parallel RLC circuits | 8.1-8.4                    |
| 17   | W 3/27 | RLC circuits, step response | 8.5-8.7, 8.12              |
| 18   | M 4/1  | Sinusoidal steady state and phasors  
Phasor relations for circuit elements | 9.1 – 9.4                  |
| 19   | W 4/3  | Impedance and admittance. Exam 2 review.  
Exam 2 review | 9.5-9.8, 9.9               |
| 20   | M 4/8  | **EXAM 2 (Lectures 8-18)** |                           |
| 21   | W 4/10 | Circuit analysis with phasors: KVL, KCL, Thevenin, Norton. | 10.1-10.2, 10.4 – 10.7, 10.10 |
| 22   | M 4/15 | AC Power Analysis: instantaneous vs. average, RMS | 11.1–11.4                 |
| 23   | W 4/17 | Intro to frequency analysis. Transfer Functions, Decibel and Bode plots | 14.1-14.4                 |
| 24   | M 4/22 | Passive filters (high pass, low pass, band pass), Resonance | 14.7                      |
| 25   | W 4/24 | Active Filters: Analysis | 14.8                      |
| 26   | M 4/29 | Active Filters: Design and Applications | 14.12                     |
| 27   | W 5/1  | Final Exam Review |                           |
| **TBD** | **FINAL EXAM (Entire course, emphasis on lectures 18-27)** |                           |