EE 321 – Electrical Circuits II

EE 321: 3 credits; 3 lecture hours per week, MWF 2:10-3:00 pm.
Prerequisite: EE 261 with a C or better, certified major in Electrical Engineering, Computer Science, or Computer Engineering.

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Office: EME Room 404. Office hours: MW 3:10-4:30 pm, or by arrangement.


Numerical Tools Computational tools are required to complete some of the homework problems and the semester project. There are several options. Matlab is available to WSU students via a university site license. The Control toolbox is needed in this course. The Signal Processing, DSP, and Image Processing Toolboxes may prove useful in subsequent courses. Open source “Octave” is available for download from the GNU Octave web page. Many Matlab scripts and functions can run directly using Octave. (After installing Octave, it is necessary to install various packages (roughly equivalent to Matlab toolboxes). For EE 321 applications, it is necessary to install the Control (and all related) packages. In many cases, Matlab scripts and functions can be run, without modification, using Octave. There are, however, occasional differences, and some minor program adjustment may be required. Caveat emptor.) It is also possible to use “Mathematica” instead of Matlab or Octave to complete the EE 321 Homework assignments and Project. The instructor will provide examples of the use of Matlab (and Octave), but not Mathematica.

If not familiar with Matlab, it is recommended that you get a good reference. Here are a few.

MATLAB Tutorials – There are many Matlab tutorials available on the web, e.g.

Spend some time reading (at least) introductory material, to become familiar with basic commands, syntax, vector and matrix notation, and plotting. Learn how to create your own functions (m-files).

Course Requirements

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<td>Project</td>
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<td>Tests (2)</td>
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Homework Policy: The homework and course project assignments will be assigned and collected in class. Assignments handed in after class are late. Students may hand in late assignments any time until the next class after the assignment due date for a 20% reduction in grade. Papers handed in more than one class late will receive zero credit and not be graded.

Test Dates:

Test 1 – Anticipated date: Wednesday, February 13
Test 2 – Anticipated date: Wednesday, April 3
Final Exam – Friday, May 3, 8:00–10:00 am.

The final exam is comprehensive.
Effort and Grading: For each hour of lecture equivalent, students should expect to have a minimum of two hours of work outside of class. Grades are based on rounded (to the nearest integer) overall numerical averages, and assigned as 93-100 A; 90-92 A-; 87-89 B+; 83-86 B; 80-82 B-; 77-79 C+; 73-76 C; 70-72 C-; 67-69 D+; 60-66 D; ≤59 F.

Attendance Policy: Students are expected to attend lectures. WSU’s Academic Regulation Rule #72 (regarding student absences) is followed to determine if any missed work may be made up.

Course Project: The course project involves analysis and design of circuits using several different methods and MATLAB. A typed project report will be required. The project will be assigned early in the semester. There will be an intermediate due date for a preliminary report to ensure students have started the project and are on the right track. Projects are to be individual effort only: No collaboration with other students is allowed on the course project.

Academic Integrity: Academic integrity is the cornerstone of higher education. As such, all members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship. Academic integrity will be strongly enforced in this course. Students who violate WSUs Academic Integrity Policy (identified in Washington Administrative Code (WAC) 504-26-010(3) and -404) will receive a grade of F for the course, will not have the option to withdraw from the course pending an appeal, and will be reported to the Office of Student Conduct.

Cheating includes, but is not limited to, plagiarism and unauthorized collaboration as defined in the Standards of Conduct for Students, WAC 504-26-010(3). You need to read and understand all of the definitions of cheating: http://app.leg.wa.gov/WAC/default.aspx?cite=504-26-010. If you have any questions about what is and is not allowed in this course, you should ask course instructors before proceeding.

If you wish to appeal a faculty member’s decision relating to academic integrity, please use the form available at conduct.wsu.edu.

Accommodation: Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call your campus resource to schedule an appointment. All accommodations MUST be approved through the campus resource. For more information contact a Disability Specialist on your campus: Pullman or WSU Online: 509-335-3417, Washington Building 217, Access.Center@wsu.edu, accesscenter.wsu.edu

Safety: Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the Alert, Assess, Act, protocol for all types of emergencies and the Run, Hide, Fight response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able). Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the FBIs Run, Hide, Fight video and visit the classroom safety page provost.wsu.edu/classroom-safety.
EE 321 LEARNING GOALS & OUTCOMES

Student Learning Outcomes
Overview and Objectives: EE 321 provides a comprehensive development of core systems and signals concepts, and their application to linear circuit analysis and design. The outcomes are assessed by graded homework, tests, a semester project, and the final exam. Upon successful completion of the course, students will be able to

a) derive differential-equation models for linear circuits, and put these circuit differential equations into standard, state-space-, and Laplace-domain forms;
b) solve linear differential equations for circuits using several methods, including the method of undetermined coefficients, the convolution-based approach, Laplace-domain solutions, and state-space-based solutions (by computer);
c) understand core system-theory concepts and constructs such as the transfer function, frequency response, and impulse response;
d) design and analyze filter circuits;
e) understand the operation of mutual inductors, as an additional circuit component;
f) understand and be able to apply several mathematical techniques underlying systems/signal analysis, including Laplace-domain analysis and Fourier Series.

ABET Outcomes (Assessment via Homework, Tests, Project, and Final Exam)

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
EE 321 – Topics and Approximate Number of Lectures

“Electrical Circuits II Prereq EE 261 with grade of C or better. State space analysis, Laplace transforms, network functions, frequency response, Fourier series, two-ports, energy and passivity.”

WSU General Catalog

Major Topics, Reading Assignments, and Approximate Number of Lectures, in order of coverage:

Week 1: Introduction; Review of EE 261: circuit analysis and differential equation description; State variables and circuit analysis (Read Text, Chap. 8, notes)

Week 2: State Variables and Circuit Analysis (2 classes, notes)

Weeks 3-4: Laplace Transform (Read Text Chapter 12)
- Step and impulse functions;
- Operational transforms;
- Inverse Laplace transform;
- Partial fraction expansion;
- Initial and final value theorems

Weeks 5-8: Circuit Analysis using Laplace Transforms (12 classes, Text Chap 13)
- Circuit analysis in the s-domain;
- Transfer function; Poles, Zeros;
- Frequency response (Read, Text Appendix E)
- Impulse response, unit step response;
- Convolution

Weeks 9-10: Frequency Selective Circuits (6 classes; Text Chap 14)
- Low-Pass, High-Pass, Band-Pass, Band-Reject Filters;

Weeks 11-12: Active Filters (6 classes, Chap 15, Notes)

Weeks 13-14: Fourier Series (6 classes, Text Chap 16, Notes)

Week 15: Mutual Inductance and Transformers (2 classes, Chap 9, Chap 13);
- Two-Port Parameters (1 class, Chapter 18)

Anticipated Test Dates:

**Test 1 Wednesday, February 13**

**Test 2 Wednesday, April 3**

**Final Exam – Friday, May 3, 8:00–10:00 am**

Recommendation: Each student should develop a personal “study book” for this (and every) course. In addition to the notes taken during class lecture, this should include the following.

1. All homework submitted, and all homework solutions.
2. All subsequent study notes on the homework, including correction of any errors made on the homework assignments.
3. All notes taken on the textbook (or any other) reading related to the topics covered in the course. (This would include any derivations of equations, questions that arise during the reading, etc.)
4. All assessment or drill problems from the text that the student works out.
5. All additional end-of-chapter problems worked out (in addition to the homework problems).
6. A summary of the work completed for the semester design project.