ECE232: Circuits and Systems II
Syllabus

Basic information

Instructor: Prof. Josh Taylor (jat94@njit.edu)
Office: 211 ECEC
Office hours: 1:30-2:30pm on Tuesdays, starting Sept. 9

Course reading

The material will be contained by the course lectures. I will periodically post notes and exercises on key concepts. For supplemental reading and problems to work, I recommend the textbook:

Nilsson, J.W. and Riedel, S.A., Electric Circuits, 10th Edition, Pearson Prentice Hall

Course description

A continuation of circuits and systems with special emphasis on transient response. Topics include Laplace transform analysis, transfer functions, convolution, Bode diagrams, and Fourier series.

Prerequisites: ECE 231. Co-requisite: Math 222.

Course learning outcomes (CLO)

The student will be able to

1. Solve for transient responses of first order resonant circuit with single or sequential switching.
2. Solve for transient responses of a second order resonant circuit.
3. Determine Laplace Transform of an arbitrary signal including delays.
4. Take the Inverse Laplace Transform of a rational function.
5. Calculate the response of a circuit to an arbitrary signal using the Laplace transform.
6. Understand the and determine the frequency response of a linear system, including with Bode diagrams.
7. Determine the transfer function for a circuit and understand it's properties.
8. Use transfer function to find the impulse, step, and steady-state sinusoidal response of a linear system.
9. Use convolution to find the response of a linear system to an input signal.

10. Design passive/active high, low, band pass, and band reject filters.
11. Find the Fourier series representation of a periodic signal.
12. Perform power calculations for a circuit with periodic input.

Relevant student outcomes (ABET criterion 3)

(a) an ability to apply knowledge of mathematics, science, and engineering (CLO 1-15)
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints (CLO 1-15)
(e) an ability to identify, formulate, and solve engineering problems (CLO 1- 15)

Grading

- 64%: midterms
- 36%: final

The three midterm exam will be on

- Sept. 30
- Oct. 30
- Nov. 25.

The honors section will have slightly different exam questions.

The midterm portion of the grade will be based on the highest two marks. For example, if the three midterm marks are 60%, 70%, and 90%, the grade will be based on the 70% and 90% marks, and the 60% mark will not be counted.

Homework

I will post suggested homework assignments most weeks. They will not be collected or graded.

Course outline

Week	Book sections	Topics	Suggested problems
1	9.1-9.9	Mathematical expression of signals; sinusoidal sources, phasors; passive elements in frequency domain; Kirchhoff's Laws in frequency domain	Complex Numbers Homework; 9.1, 9.2, 9.3, 9.7, 9.8, 9.9, 9.11, 9.13, 9.15, 9.16, 9.18, 9.22, 9.23, 9.24, 9.28, 9.29, 9.30
2	7.1-7.2	First-order systems; RL & RC circuits	7.1, 7.2, 7.4, 7.8, 7.12, 7.14, 7.23, 7.25, 7.26, 7.28, 7.33
3	7.3-7.6	Natural and step response of first-order systems; switching	7.50, 7.55, 7.60, 7.65, 7.66 , 7.68, 7.69, 7.70, 7.71, 7.72, 7.74, 7.75, 7.81, 7.83, 7.85, 7.87, 7.92, 7.94 , 7.95
4	8.1-8.4	Second-order systems; natural and step response	8.1, 8.4, 8.5, 8.6 8.7, 8.11, 8.14, 8.17, 8.27, 8.30, 8.35, 8.38, 8.41,8.42, 8.44, 8.45, 8.46, 8.53, 8.54, 8.57
5		Midterm 1	
6	12.1-12.6	Laplace Transform definition and properties	12.1, 12.2, 12.3, 12.4, 12.5 , 12.7,12.8, 12.12, 12.14, 12.17, 12.19,12.20, 12.22, 12.24, 12.27, 12. 28, 12.29, 12.30, 12.31
7	12.7-12.9	Functional and operational transforms; Inverse Laplace Transform; Initial and Final Value Theorems	12.34, 12.36, 12.40, 12.41, 12.42,12.43, 12.44 , 12.45 , 12.47, 12.50, 12.51, 12.53, 12.54
8	13.1-13.3	Circuit analysis in the s-domain	13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.9, 13.10, 13.13, 13.16, 13.18, 13.21, 13.23, 13.25, 13.27, 13.28, 13.32, 13.35, 13.36, 13.43, 13.44
9		Review, Midterm 2	
10	13.4-13.5	Transfer Functions	13.48, 13.49, 13.51, 13.52, 13.56, 13.57
11	13.6-13.7	Convolution; sinusoidal steady-state	13.59, 13.60, 13.61, 13.63, 13.64, 13.65, 13.66, 13.67, 13.69, 13.73, 13.74
12	14.4-15.4, Appendix E	Frequency response, Bode Diagrams, passive and active filters	14.1, 14.2, 14.5, 14.9, 14.11, 14.12, 14.14, 14.18, 14.19, 14.20, 14.25, 14.32
13		Midterm 3	
14	16.1-16.4, 16.5	Fourier Series	16.1, 16.2, 16.12, 16.13, 16.15, 16.28, 16.30, 16.34