ABET COURSE OUTLINE

Helen and John C. Hartmann Department of Electrical and Computer Engineering New Jersey Institute of Technology

Academic Year: **2025-2026**

Term: **Fall 2025**

Course Instructors:

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Course Numbers and Title*:* ***ECE 232-101: Circuits and Systems II***

(3 credits, 3 contact hours, required course)

PLEASE BUY (if you have budget):

Text book: Nilsson, J.W. and Riedel, S.A., Electric Circuits, 12th Edition, Pearson Prentice Hall, Upper Saddle River, NJ. [ISBN 0-13- 4746961-0]

Course Catalog Description (including prerequisites and co-requisites):

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.

Specific 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. Find responses of a first order circuit containing mutual inductances.
2. Solve for transient responses of a second order resonant circuit.
3. Determine Laplace Transform of an arbitrary signal including delays.
4. Demonstrate the ability to perform Inverse Laplace Transform of a rational function (including non-proper and function with exponential factors).
5. Determine the transfer function for a circuit and understand its properties (poles and zeros, memory, and weighting function concept)
6. Calculate the response of a circuit to an arbitrary signal using Laplace transform.
7. Use Transfer Function to find impulse, step, and steady state sinusoidal response of a linear system.
8. Use convolution to find the response of a linear system to an arbitrary time varying

excitation composed of studied time signals.
9. Develop a firm understanding of the concept of frequency response. Determine frequency response of a linear system by using Bode diagrams.
10. Design a passive/active high, low, band pass, and band reject filter.
11. Find a Fourier series representation of a periodic wave form.
12. Use National Instruments' Multisim circuit modeling and analysis application model.
13. Use Digilent Analog Discovery Portable Circuit Design Kit (aka Portable Lab) to perform simple analog circuit experiments.

Relevant Student Outcomes (ABET criterion 3):

SO1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

SO1.1. an ability to identify and formulate complex engineering problems by applying principles of engineering, science, and mathematics. (CLO 1-13)

SO1.2. an ability to solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1-13)

SO2. 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.
(CLO 2, 3, 10-13)

SO5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

SO5.1. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, (CLO 13)

SO5.2. an ability to establish goals, plan tasks, and meet objectives (CLO 12, 13)

SO6. an ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.

SO6.1. an ability to develop and conduct appropriate experimentation. (CLO 14)

SO6.2. an ability to analyze and interpret data. (CLO 6, 7, 9, 10, 13, 14)

SO6.3. an ability to use engineering judgment to draw conclusions. (CLO 7,12,13)

SO7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (CLO 1-13)

Course Outline:

Week	Chapter/ Sections	Topics	Suggested Extra Problems*
1-2		***PRE-TEST***	
	Ch 9.1-9.9	Sinusoidal Sources, Phasors. Passive Elements in Frequency Domain Kirchhoff's Laws in Frequency Domain, Argand Diagrams. Node Methods of Circuit Analysis with Harmonic excitation.	Chapter9: 9.1, 9.3, 9.8H, 9.9, 9.13, 9.15, 9.16*, 9.22, 9.24, 9.29.
3	Ch 7.1-7.2 Ch 7.3-7.7	First Order Systems, RL & RC. Natural Response. First Order Systems Step response. First Order Systems General Solution with Abrupt PowerChange, Sequential Switching of First order systems. *(Repeat Mutual Inductance problems)* Unbounded Response. Integrating amplifier.	Chapter 7: 7.2, 7.8*, 7.12, 7.23, 7.25, 7.28, 7.36, 7.39, 7.49, 7.57 Chapter 7: 7.55, 7.65, 7.66, *7.69, 7.70,* 7.75, 7.81, 7.85, 7.92, 7.95
4	Ch 8.1&8.	Second Order Systems, Series and Parallel Natural Response. Series and Parallel Step Response. General Solution with Abrupt Power Change.	HW#1 due Chapter 8: 8.1,8.5, 8.11, 8.17, 8.27, 8.35, 8.41, 8.44, 8.53, 8.57
5	Review	Problems solving, Q/A	***HW#2 due***
6	*Midterm*	Covering HW#1 and HW#2	
7	Ch. 12.1-12.6	Definition of Laplace Transform. Properties and Theorems.	Chapter 12: 12.2, 12.4, 12.5, 12.7, 12.12, 12.17, 12.22, 12.29, 12.31
8	Ch. 12.7-12.9	Functional Transforms, Properties of Operational Transforms. Inverse Laplace Transform. Initial/Final value Theorem.	Chapter 12: 12.34, 12.40, 12.43, 12.45, 12.47, 12.50, 12.54
9	Ch. 13.1-13.3	Circuit Analysis using S-domain.	Chapter 13: 13.2, 13.5, 13.9, 13.13, 13.16**(plot)*, 13.21, 13.25, 13.28, 13.32, 13.36, 13.43
10	Ch. 13.4-13.5	Transfer Functions	***HW#3 due*** Chapter 13: 13.48, 13.49, 13.51, 13.52, 13.56, 13.57*(plot)*
11	Ch. 13.6-13.7	Convolution. Steady State Sinusoidal Response.	Chapter 13: 13.60, 13.64, , 13.69, 13.74
12	Appendix E	Frequency Response. power levels and dB, Half-Power point, Gain and Attenuation. Bode Diagrams.	***HW#4 due***
13	Ch. 14.4-15.4 Ch. 16.1-16.4 Ch. 16.5	Passive and Active Filters Fourier Series, Symmetries, Complex Form Application of Fourier Series to Linear System Analysis	Chapter 14: 14.5, 14.11, 14.18, 14.25 Chapter 15&16: 15.5, 15.15, 15.30, 16.2, 16.12, 16.28, 16.34
14	*FINAL*	Covering HW#3 and HW#4	

*15% of problems (marked with asterisk) should be solved using MultiSim

Grading Policy:	Homework, Attendance, Class Participation:	32%
	Mid-term examinations:	33%.
	Final examination:	35%

Total: 100 points (A: 90 or above; B+: 80-89.9; B: 70-79.9; C+: 60-69.9; C: 50-59.9; D: 40-49.9; F: below 40).
Tests and final exams are closed notes and books, formula sheets provided with the tests.
Attendance: required at class lectures. **Cellular phones, Beepers, and Computers:** Shut off or in quiet mode. Calculator allows.

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