ABET COURSE OUTLINE

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

Academic Year: **2023-2024**
Term: **Spring 2024**

Course Instructor: ***Oksana Manzhura***

email: oksana.manzhura@njit.edu; office: 205 ECEC, tel.: 973 596-3504

Course Number and Title*:*

ECE 232_101: Circuits and Systems II **(3 credits, 3 contact hours, required course)**

Text book:

Nilsson, J.W. and Riedel, S.A., Electric Circuits, 10th 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.
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. Calculate a response of a circuit to an arbitrary signal using Laplace transform.
6. Develop a firm understanding of a concept of frequency response. Determine frequency response of a linear system, use Bode diagrams.
7. Determine the transfer function for a circuit and understand it's properties (poles and zeros, memory and weighting function concept)
8. Use transfer function to find impulse, step and steady state sinusoidal response of a linear system.
9. Use convolution to find response of a linear system to an arbitrary time varying excitation composed of studied time signals.
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. Perform power calculation for a circuit with periodic function.
13. Calculate a steady state response of a linear system to an arbitrary periodic wave.
14. Use National Instruments' Multisim circuit modeling and analysis application model.

Relevant Student Outcomes (ABET criterion 3):

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1-15)
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 (CLO 2, 3, 13-15)
5. 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 (CLO 14,15)
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (CLO 7,12,13,14,15)
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.(CLO1-15)

Course Outline:

Week	Chapter/ Sections	Topics	Problems*
1		***PRE-TEST*** **Pre-Test Common mistakes correction. Mathematical expression of signals, power levels and dB, half power point, Gain and Attenuation.**	***HW1*** **Complex Numbers Homework.**
2	**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.**	***HW2*** **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.**	***HW3*** **7.2, 7.8,* 7.12, 7.23, 7.25, 7.28, 7.36, 7.39, 7.49, 7.57** ***HW4*** **7.55, 7.65, 7.66 *H*, *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.**	***HW5*** **8.1,8.5, 8.11, 8.17 *H*, 8.27, 8.35, 8.41, 8.44, 8.53, 8.57 *H***
5		***QUIZ I***	
6	**Ch. 12.1-12.6**	**Definition of Laplace Transform. Properties and Theorems.** *Home Lab Assignment #1* *(Materials distributed during previous week)*	***HW6*** **12.2, 12.4, 12.5 *H*, 12.7, 12.12, 12.17, 12.22, 12.29, 12.31**
7	**Ch. 12.7-12.9**	**Functional Transforms, Properties of Operational Transforms. Inverse Laplace Transform. Initial/Final value Theorem.**	***HW7*** **12.34, 12.40, 12.43, 12.45 *H*, 12.47, 12.50, 12.54**
8	**Ch. 13.1-13.3**	**Circuit Analysis using S-domain.**	***HW8*** **13.2, 13.5, 13.9, 13.13, 13.16****(plot)*, 13.21, 13.25, 13.28, 13.32*H*, 13.36, 13.43**
9		***QUIZ II*** *Home Lab Assignment #2* *(Materials distributed during previous week)*	
10	**Ch. 13.4-13.5**	**Transfer Functions**	***HW9*** **13.48, 13.49, 13.51, 13.52, 13.56, 13.57*(plot)***
11	**Ch. 13.6-13.7**	**Convolution. Steady State Sinusoidal Response.**	***HW10*** **13.60, 13.64, , 13.69, 13.74**
12	**Appendix E**	**Frequency Response. Bode Diagrams.**	***HW11*** **Problems assigned in class**
13		***QUIZ III***	
14	**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**	***HW12*** **14.5, 14.11, 14.18, 14.25** ***HW13*** **15.5, 15.15, 15.30, 16.2, 16.12, 16.28, 16.34**

*15% of problems (marked with asterisk) should be solved using MultiSim (available in Computer Labs and for purchase as Student License). Getting started link: http://www.ni.com/white-paper/10710/en

Grading Policy:

Homework, Attendance, Class Participation:	4%
Three class examinations:	22%, 22%, 22%.
Final examination:	35%
Take-Home Laboratory assignments:	*4% +3%extra (all reports and simulations required)*
Optional Multisim Project	*5% extra*

Project is mandatory for the Honors section. Project is due week 14.

Honors class fulfills 15% more work in form of homework (extra problems marked with ***H***), test problems and projects.

Tests and final exams: are closed notes and books, formula sheets provided with the tests.

Attendance: required at class lectures. **Cellular phones and Beepers:** Shut off or in quiet mode.

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*