Helen and John C. Hartmann
Department of Electrical and Computer Engineering
New Jersey Institute of Technology
Term: Fall 2023

Course Instructor: Dr Sumit Balguvhar
Email: sumit.balguvhar@njit.edu;
Time: Friday 6:00-10:05 PM (ECEC 100)
Delivery Format: Face-to-Face

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 0-13-611499-7]

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 circuits 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.
6. Calculate the response of a circuit to an arbitrary signal using Laplace transform.
7. Develop a firm understanding of the concept of frequency response. Determine frequency response of a linear system use Bode diagrams.
8. Determine the transfer function for a circuit and understand its properties (poles and zeros).
9. Use transfer function to find impulse, step and steady-state sinusoidal response of a linear system.
10. Use convolution to find the response of a linear system to an arbitrary time-varying excitation composed of studied time signals.
11. Design a passive/active high, low, band pass, and band reject filter.
12. Find a Fourier series representation of a periodic waveform.
13. Perform power calculation for a circuit with periodic function.
14. Calculate a steady state response of a linear system to an arbitrary periodic wave.
15. Use National Instruments' Multisim circuit modeling and analysis application model.

Relevant student outcomes (ABET criterion):
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLO 1-12).
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 1-15).
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (CLO 15).

Course Outline

WK	CH/SEC	Topics	Problems*
1	Review	Complex Numbers, Mathematical expression of a signal	Review
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. Power levels and dB, half power point, Gain and Attenuation.	
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 Power Change Sequential Switching of First order systems.	HW1
4	Ch 8.1,8.2, 8.3 &8.5	Second Order Systems, Series and Parallel Natural Response. Series and Parallel Step Response. General Solution with Abrupt Power Change.	**HW 2**
5	Ch. 12.1-12.6	Definition of Laplace Transform. Properties and Theorems.	
6		TEST 1	
7	Ch. 12.7-12.9	Functional Transforms, Properties of Operational Transforms. Inverse Laplace Transform. Initial/Final value Theorem.	
8	Ch. 13.1-13.3	Circuit Analysis using S-domain.	
9	Ch. 13.4-13.5	Transfer Functions	**HW 3**
10	Ch. 13.6-13.7	Convolution. Steady State Sinusoidal Response.	
11		**TEST 2**	**Assignment**
12		**Thanksgiving Holidays**	
13	Appendix E	Frequency Response. Bode Diagrams.	
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	**HW 4**
15		Review	
16		Final Test	

Grading Policy:

Homework, class participation/effort:	5%
Two class examinations:	25%, 25%
Final examination:	35%
Home Assignments:	10%

All exams are closed notes and books, formula sheets allowed for Test 1 (one page), Test 2 (two pages) and Final (three pages). No solved numerical examples allowed in the note sheets. **Phones are NOT ALLOWED DURING EXAMS**. *Failure to adhere to these rules forfeits the test grade.*

Attendance: Required for lectures.

Academic Integrity:

"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"*