ABET COURSE OUTLINE

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New Jersey Institute of Technology

Academic Year: **2019-2020**
Term: **Spring 2020**

Course Instructor: ***Oksana Manzhura***
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office hours/open classroom workshop:
office hours and extra sessions schedule provided separately by email and posted on class CANVAS page
24/7 by e-mail.
Extra WEBEX meetings available upon request.

Course Number and Title: ***ECE 232 102, HM04: Circuits and Systems II- Remote Access Revision***
(3 credits, 3 contact hours, required course and required Honors course)

Text book:
Nilsson, J.W. and Riedel, S.A., Electric Circuits, 10th Edition, Pearson Prentice Hall, Upper Saddle River, NJ. [ISBN 0-13-376003-0]

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):
(a) an ability to apply knowledge of mathematics, science, and engineering (CLO 1-14)
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints (CLO 1-14)
(e) an ability to identify, formulate, and solve engineering problems (CLO 1- 14)
(i) a recognition of the need for, and an ability to engage in life-long learning (CLO 14)
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (CLO 14).

Course Outline:

Week	Chapter/ Sections	Topics	Problems*
1		***PRE-TEST***	
		Pre-Test Common mistakes correction	
2		**Complex Numbers. Mathematical expression of signals.**	**Complex Numbers Homework**
3	**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.**	**9.1, 9.2, 9.3, 9.7, 9.8H, 9.9, 9.11, 9.13, 9.15, 9.16*, 9.18H, 9.22, 9.23, 9.24, 9.28, 9.29, 9.30.**
4	**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.**	**7.1, 7.2, 7.4, 7.8,* 7.12, 7.14, 7.23, 7.25, 7.26, 7.28, 7.337.36, 7.37, 7.39, 7.42 *H*, 7.44, 7.49, 7.50, 7.57** **7.50, 7.55, 7.60, 7.65, 7.66 *H*, *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 *H*, 7.95**
5	**Ch 8.1-8.2**	**Second Order Systems, Series and Parallel Natural Response.**	**8.1, 8.4, 8.5, 8.6 8.7, 8.11, 8.14, 8.17 *H*, 8.27,**
6	**Ch 8.3-8.5**	**Second Order Systems, Series and Parallel Step Response.** **General Solution with Abrupt Power Change.**	**8.30, 8.35, 8.38, 8.41, 8.42, 8.44, 8.45, 8.46, 8.53, 8.54, 8.57 *H***
7		***Midterm I***	
8	**Ch. 12.1-12.6**	**Definition of Laplace Transform.** **Properties and Theorems.**	**12.1, 12.2, 12.3, 12.4, 12.5 *H*, 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**
9-10		***Spring Vacation and COVID-19 closures***	***!!new rules are described below!!***
11	**Ch. 12.7-12.9**	**Functional Transforms,** **Properties of Operational Transforms.** **Inverse Laplace Transform. Initial/Final value Theorem.**	**12.34, 12.36, 12.40, 12.41, 12.42, 12.43, 12.44 *H*, 12.45 *H*, 12.47, 12.50, 12.51, 12.53, 12.54**
12	**Ch. 13.1-13.3**	**Circuit Analysis using S-domain.** *Home Lab Assignment #2* *(Materials distributed during previous week)*	**13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.9, 13.10, 13.13, 13.16*(plot), 13.18, 13.21, 13.23, 13.25, 13.27, 13.28, 13.32*H*, 13.35, 13.36, 13.43, 13.44**
13	**Ch. 13.4-13.5**	**Transfer Functions**	**13.48, 13.49, 13.51, 13.52, 13.56, 13.57*(plot)***
14	**Ch. 13.6-13.7**	**Convolution.** **Steady State Sinusoidal Response.**	**13.59, 13.60, 13.61, 13.63, 13.64, 13.65, 13.66, 13.67, 13.69, 13.73, 13.74**
15	**Appendix E**	**Frequency Response. Bode Diagrams.**	**Problems assigned in class**
15		***Midterm II***	
16	**Appendix E (Continued)** **Ch. 14.4-15.4** **Ch. 16.1-16.4 Ch. 16.5**	**Bode Diagrams.** **Passive and Active Filters** **Fourier Series, Symmetries, Complex Form** **Application of Fourier Series to Linear System Analysis**	**14.1, 14.2, 14.5, 14.9, 14.11, 14.12, 14.14, 14.18, 14.19, 14.20, 14.25, 14.32, 15.1, 15.5, 15.14, 15.15, 15.30** **16.1, 16.2, 16.12, 16.13, 16.15, 16.28, 16.30, 16.34**

Grading Policy:

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Two class examinations:	27%, 27%
Final examination:	40%
Homework, Pop quizzes, class participation:	5%
*and Optional Multisim Project **H***	*5% extra*

*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

Problems marked ***H*** are mandatory for Honors sections. Honors class fulfills 15% more work in form of homework, test problems and projects.

*!!*Remote lectures will be offered two times a week. Each lecture will be 2 hrs long. Recorded videos will be uploaded to CANVAS with corresponding PDF notes also twice a week. All students must attend live lectures at least once a week and review all videos every week.

All students are required to complete all assigned homework. Homework problems are not submitted for grading. Pop quizzes may be provided based on homework problems.

Tests and final exams are closed notes and books, formula sheets will be provided for tests 1(two pages), test 2 (four pages) and final (6 pages).

Tests will be carried out through Canvas submission under RESPONDUS proctoring software. No late submission will be accepted.

Attendance: At least one Webex Live 2 hr lectures must be attended each week. Review of all WEBEX course videos are mandatory each week.

NJIT Honor Code will be upheld, and any violations will be brought to the immediate attention of the Dean of Students.