ECE 3204 - Signals and Systems (4)
Section #11349
Winter 2018

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Teaching Asst: To be announced (TBA) **Office Hours:** TBA
Class Schedule: MW, 3:30pm – 5:17pm **Classroom:** **270 SFH**
Prerequisite: **ECE 276** **Credit Hours:** 4.00

Text: B.P. Lathi, *Linear Systems and Signals,* 2h Edition, Oxford Univ. Press, NY, 2005.
Also, supplementary notes (to be distributed) for selected topics.

Reference: F. T. Ulaby and A. E, Yagle, Engineering Signals and Systems, NTS Press,
ISBN: 978-1-934891-16-2

Course description in catalog:
Basic signals, average value, average power, and energy. Laplace transform and inverse Laplace transform, and transfer function concept and approach in the analysis of electrical and mechanical lumped-parameter linear systems. Systems modeling and analysis in Laplace and differential equation domains. Natural and forced responses of linear time-invariant systems, and concept of convolution. Fourier analysis of signals and systems: Fourier series and Fourier transform, power spectral density, energy spectral density, band width, and filters. Prerequisite(s): ECE 276.

ABET/Program Outcomes:
The Program Outcomes are a set of skills that assure the achievement of the program educational objectives. Before graduating, SECS students will demonstrate their skills in the following key areas:

a. an ability to apply knowledge of mathematics, science, and engineering
b. an ability to design and conduct experiments, as well as to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Objectives:
The following objectives shall be accomplished upon completion of this course:

(1) Be able to use Laplace transform and inverse Laplace transform to solve signal and system problems, such as the partial fraction expansion (residue) method combined with Matlab. (a, b, e, k)

(2) Be able to write and solve the dynamical equations for simple electrical and mechanical systems. (a, e, k)
(3) Be able to use transfer functions to model and analyze dynamic systems. (a, e, k)
(4) Be able to model systems using state-space techniques, such as the controllable and observable canonical forms. (a, e, k)
(5) Be able to understand the concept and properties of Fourier series and Fourier transform. (a, e, k)
(6) Be able to analyze simple filters and sketch their characteristics using Bode plots (a, e, k)
(7) Be able to use Matlab to solve problems and simulate system responses with Matlab – Matlab helps and enhances our learning process. (a, b, e, k)
(8) Be able to use knowledge of mathematics, science, and engineering to analyze signals, systems, and their characteristics (a, e, k)

Topics Covered (following Lathi's text):

- Introduction to signals and linear systems (Ch.1)
- Time domain analysis of continuous-time systems (Ch. 2)
- Laplace transform and its inverse (Selected sections of Ch. 4)
- Modeling of mechanical and electromechanical systems (Ch.1 and supplementary notes)
- Applications of Laplace transform (Selected sections of Ch. 4)
- Frequency response of linear time-invariant systems, Bode plots, Filtering (Selected sections of Ch. 4 and supplementary notes)
- Frequency domain signal analysis using Fourier series (Ch. 6)
- Frequency domain signal analysis using Fourier transform (Ch. 7)
- State space analysis (Selected sections of Ch. 10)

Assignments: Approximately 8 or 9 assignments will be given – some of these involve use of MATLAB. The Student version of MATLAB is available on the PCs in EC.

Grading: Assignments (Homeworks) 25%, Midterm Tests (Two best out of three): 40%, Final: 35%.

Dates for Midterm Tests and Final Examination:

Tests 1-3 (Tentative): 01/31/18, 02/28/18, 03/28/18
Final: Wednesday, 04/25/18, 3:30 – 6:30 PM. (TO BE CONFIRMED)

Academic Conduct: Please see OU student handbook for rules and regulations on academic conduct. Any kind of cheating is not acceptable. Anyone caught cheating faces penalties ranging from a zero for the exam, homework and/or project, and other punishments decided by the Academic Conduct Committee.

Note: Please get familiar with **MATLAB** soon.

- A good tutorial (from **Appendix D of Ogata's text**) will be posted on Moodle.
- Also, there are some excellent online tutorials. For links to some of these, please visit these Mathworks websites:
  http://www.mathworks.com/academia/student_center/tutorials/launchpad.html
  http://www.mathworks.com/matlabcentral/linkexchange/?term=tag%3A%22tutorials%22
- Alternatively, run Matlab, then type "demos" and hit "Enter". Then choose the appropriate help item from the menu.