UNIVERSITY OF SOUTHERN MAINE

Department of Engineering

ELE 314 – Linear Signals and Systems — Required

Instructor: Mariusz Jankowski, mjankowski@usm.maine.edu, JMC 127, ph. 780-5580 Updated 08.26.2011

Schedule: Lecture: 2 - 1hr and 15min. lectures/week, M&W, 11 AM - 12:15 PM, JMC-151, Fall 2011

Laboratory: 2 - 1hr and 15min. sessions/week, M&W, 12:30 - 1:45 PM, JMC-151, Fall 2011

Course Description (Catalog):

Introduction to the theory of linear signals and systems. Linear time-invariant system properties and representations; differential and difference equations; convolution; Fourier analysis; Laplace and z transforms. Selected topics in sampling, filter design, digital signal processing, and modulation. Prerequisite: EGN 217. Credits: 4

Contribution to Professional Component:

25% Math and Basic Science, 75% Engineering Science

Textbook:

M.J. Roberts, Fundamentals of Signals and Systems, McGraw Hill, 1st ed., 2008 (required).

M. Jankowski, Introduction to Signals and System, (manuscript)

Topics:

1. Basic signals and properties of systems
2. LTI systems in the time domain: convolution, constant-coefficient difference and differential equations
3. Continuous-time LTI systems in the Fourier domain: Fourier series and transform
4. Discrete-time LTI systems in the Fourier domain: Fourier series and transform
5. Frequency selective filters: properties, analysis and design concepts
6. Sampling
7. Modulation
8. Laplace and z-transforms

Course Objectives:

1. To be familiar with time- and frequency-domain representations of LTI systems and to understand the inter-relationships between the two domains.
2. To understand the principles of sampling, filtering and modulation.
3. To develop the mathematical and computer skills to analyze signals and systems in time and frequency.

Assessment Methods:

1. Graded quizzes.
2. Graded exams.
3. Design projects.
4. Graded laboratory reports.
5. Graded oral presentations of design projects

Course Learning Outcomes:

Students will be able to…	Course Objectives (1, 2,…):	Assessment Methods (1, 2,…):	Program Outcomes (a-k):

Determine the output of an LTI system using convolution	1, 3	1, 2	a, e, k
Solve constant-coefficient difference and differential equations	3	1, 2, 3, 4	a, e, k
Obtain the impulse or step response of a system	1, 2 ,3	1,2, 3, 4	a, e, k
Calculate the Fourier series	1, 3	1, 2, 3, 4	a, e, k
Calculate the Fourier transform	1, 3	1, 2	a, e, k
Determine the output of an LTI filter using frequency domain analysis	1, 2, 3	1, 2	a, e, k
Calculate spectrum of AM signal	1, 2, 3	1, 2	a, e, k
Determine the sampling rate, and evaluate the effect of aliasing	1, 2, 3	1, 2	a, e, k
Design simple FIR filter	1, 2, 3	3, 4, 5	a, c, e, k
Compute and display the spectrogram of a signal	1, 3	3, 4, 5	a, e, k
Document their design and laboratory work.		3, 4	g, k
Use *Mathematica* to solve engineering problems	3	3	i, k

Grading Policy:

Students are expected to participate in class by being prepared for the lecture and laboratory and engage in discussions.

Grade Distribution:

Bi-weekly quizzes (5-7)	30%
Final exam	30%
Laboratory and design projects (3-5)	40%

Summary of Course Changes Since the 2003 ABET Self-Study Report:

2005: Added Quiz 0 to test students' retention of prerequisite material and to determine pace/depth of review.

2007: Added "concepts inventory" testing at beginning and end of semester

2009: Linked learning outcomes to course objectives, assessment methods and revised program outcomes.

Academic Support for Students with Disabilities: Students who may need assistance due to a disability are encouraged to contact the Office of Academic Support for Students with Disabilities, Luther Bonney 242, ph. 780-4076, TTY 780-4395.