EEL 3135    Introduction to Signals and Systems

1. Catalog Description – (3 credits) Continuous-time and discrete-time signal analysis including Fourier series and transforms; sampling; continuous-time and discrete-time linear system analysis with FIR and IIR systems; impulse response, frequency response and system function.

2. Prerequisites - CGS 2425 and MAC 2313; Corequisite - MAP 2302 and one of: EEL 3105, MAS 3114 or MAS 4105

3. Course Objectives - To provide analytical background and skills necessary for further study in communications, control, and signal processing

4. Contribution of course to meeting the professional component (ABET only – undergraduate courses) - 3 credits of Engineering Science

5. Relationship of course to program outcomes: Skills student will develop in this course (ABET only undergraduate courses) - EE1, EE2, a, e, k

6. Instructor – Dr. Jose Diaz
   a. Office location:
   b. Telephone:
   c. E-mail address: jadiaza@yahoo.com
   d. Class Web site:
   e. Office hours:

7. Teaching Assistant -
   a. Office location:
   b. Telephone:
   c. E-mail address:
   d. Office hours:

8. Meeting Times – T 5th – 6th, R 6th

9. Class/laboratory schedule - 3 class periods consisting of 50 minutes each

10. Meeting Location – A101 CSE

11. Material and Supply Fees - None

12. Textbooks and Software Required -
   a. Title: Signal Processing First
   b. Author: McClellan, Schafer, Yoder
   d. ISBN number: 0-07-229135-4
13. Recommended Reading - None
   a. Title:
   b. Author:
   c. Publication date and edition:
   d. ISBN number:

14. Course Outline -
   Introduction
   a. Mathematical representation of signals
   b. Mathematical representation of systems
   c. Thinking about systems

Sinusoids
   a. Tuning fork experiment
   b. Review of sine and cosine functions
   c. Sinusoidal signals
   d. Sampling and plotting sinusoids
   e. Complex exponential and phasors
   f. Phasor addition
   g. Physics of the tuning fork
   h. Time signals: more than formulas

Spectrum Representation
   a. The spectrum of a sum of sinusoids
   b. Beat notes
   c. Periodic waveforms
   d. Fourier series
   e. Spectrum of the Fourier series
   f. Fourier analysis of periodic signals
   g. Time-frequency spectrum
   h. Frequency modulation: Chirp signals

Sampling and Aliasing
   a. Sampling
   b. Spectrum view of sampling and reconstruction
   c. Strobe demonstration
   d. Discrete-to-continuous conversion
   e. The sampling theorem

FIR Filters and Systems
   a. Discrete-time systems
   b. The running-average filter
   c. The general FIR filter
   d. Implementation of FIR filters
   e. Linear time-invariant (LTI) systems
   f. Convolution and LTI systems
   g. Cascaded LTI systems
   h. Example of FIR filtering

Frequency Response of FIR filters and Systems
   a. Sinusoidal response of FIR filters
b. Superposition and the frequency response
c. Steady-state and transient response
d. Properties of the frequency response
e. Graphical representation of the frequency response
f. Cascaded LTI systems
g. Running-average filtering
h. Filtering sampled continuous-time signals

Z-Transforms
a. Definition of the z-transform
b. The z-transform and linear systems
c. Properties of the z-transform
d. The z-transform as an operator
e. Convolution and the z-transform
f. Relationship between the z-domain and the ω-domain
g. Useful filters
h. Practical bandpass filter design
i. Properties of linear-phase filters

IIR Filters and Systems
a. The general IIR difference equation
b. Time-domain response
c. System function of an IIR filter
d. Poles and zeros
e. Frequency response of an IIR filter
f. Three domains
g. The inverse z-transform and some applications
h. Steady-state response and stability
i. Second-order filters
j. Frequency response of second-order IIR filters

Computing the Spectrum
a. Finite Fourier sum
b. Time-windowing
c. Analysis of a sum of sinusoids
d. Discrete Fourier transform
e. Spectrum analysis of finite-length signals
f. Spectrum analysis of periodic signals
g. The Spectrogram
h. The fast Fourier transform (FFT)

15. Attendance and Expectations - Attendance is not required

16. Grading – methods of evaluation (e.g., quizzes 20%, homework 15%, term paper 30%, final exam 35%)

17. Grading Scale (e.g., 90-100 A, 85-89 B+, 80-84 B, etc.) If grades are to be curved, so state. Values should not overlap and the full grade to percentage/points map must be included.
A: 93-100
A-: 90-92
B+: 87-89
B: 83-86
B-: 80-82
C+: 77-79
C: 73-76
C-: 70-72
D+: 67-69
D: 63-66
D-: 60-62
E: 0-59

“A C- will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

18. Make-up Exam Policy – If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed. For information on UF policies concerning attendance, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx#absences

19. Honesty Policy – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

20. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. UF Counseling Services – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
   • UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
   • Career Resource Center, Reitz Union, 392-1601, career and job search services.

22. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator.
Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.