Course Number and Title: ELC 282 Signals and Systems

Campus Location:
Georgetown, Dover, Stanton

Effective Date:
2020-51

Prerequisite:
MAT 292, ELC 266

Co-Requisites:
none

Course Credits and Hours:
4.00 credits
4.00 lecture hours/week
0.00 lab hours/week

Course Description:
This course is an introduction to signals and systems with an emphasis on time and frequency characterization of linear, time-invariant systems. Topics include discrete and continuous time systems; sampling; and Fourier, Laplace, and z-transforms. Application examples include medical imaging, radar, audio and image processing, virus delivery protocols, and biological networks.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
TI-84+ or TI-89 Calculator.

Schedule Type:
Classroom Course

Disclaimer:
None

Core Course Performance Objectives (CCPOs):

1. Analyze linear time-invariant systems. (CCC 1, 2, 5, 6; PGC 2, 4)
2. Apply Fourier transforms to continuous and discrete time signals. (CCC 1, 2, 5, 6; PGC 1, 2, 4)
3. Apply Laplace transforms to analyze signals. (CCC 1, 2, 5, 6; PGC 2, 4)
4. Analyze signals and systems using the z-transform. (CCC 1, 2, 5, 6; PGC 1, 2, 4)
5. Apply the sampling theorem to signals. (CCC 1, 2, 5, 6; PGC 1, 2, 3, 4, 6)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Analyze linear time-invariant systems.
    1. Differentiate between continuous-time and discrete-time signals.
    2. Identify periodic even and odd signals.
    3. Identify continuous-time and discrete-time complex exponential and sinusoidal signals.
    4. Interpret basic signal responses for the unit impulse and step functions.
    5. Explain the basic system properties of discrete-time and continuous-time systems.
    6. Analyze discrete-time, *linear time-invariant* (LTI) signals using the convolution sum.
    7. Analyze continuous-time signals using the convolution integral.
    8. Describe the properties of LTI systems.
    9. Identify linear constant coefficient differential and difference equations.
    10. Identify the response of LTI systems to complex exponentials.
    11. Analyze the Fourier series representation of continuous-time periodic signals.
    12. Explain the properties of continuous-time Fourier series.
    13. Determine the Fourier series representation of a periodic signal.
    14. Identify the properties of discrete-time Fourier series.
    15. Apply frequency selective and frequency shaping filters to LTI systems.
2. Apply Fourier transforms to continuous and discrete time signals.
    1. Identify the continuous-time Fourier transform.
    2. Explain the Fourier transform representation of an aperiodic signal.
    3. Analyze the continuous-time Fourier transform.
    4. Calculate the Fourier transform of periodic signals.
    5. Explain the properties of the continuous-time Fourier transform.
    6. Identify the multiplication and convolution properties of the Fourier transform.
    7. Apply the tables of Fourier properties and basic Fourier transform pairs.
    8. Identify the discrete-time Fourier transform.
    9. Explain the discrete-time Fourier transform representation of an aperiodic signal.
    10. Calculate the discrete-time Fourier transform of periodic signals.
    11. Explain the properties of the discrete-time Fourier transform.
    12. Identify the multiplication and convolution properties of the discrete-time Fourier transform.
    13. Apply the tables of Fourier properties and basic Fourier transform pairs to the discrete-time Fourier transform.
3. Apply Laplace transforms to analyze signals.
    1. Identify the Laplace transform.
    2. Identify the inverse Laplace transform.
    3. Determine parameters of unstable systems.
    4. Create pole-zero plots of the Laplace transform.
    5. Calculate the Laplace transform of first order systems.
    6. Calculate the Laplace transform of second order systems.
    7. Identify the properties of the Laplace transform.
    8. Analyze LTI systems using the Laplace transform.
    9. Create block diagram representations of LTI systems.
4. Analyze signals and systems using the z-transform.
    1. Identify the discrete-time z- transform.
    2. Identify the inverse z-transform.
    3. Create pole-zero plots of the z-transform.
    4. Calculate the z-transform of first order systems.
    5. Calculate the z-transform of second order systems.
    6. Identify the properties of the z-transform.
    7. Analyze and characterize LTI systems using the z-transform.
    8. Create block diagram representations of discrete-time LTI systems.
    9. Determine the difference equation from the block diagram representation.
    10. Identify common z-transform pairs.
5. Apply the sampling theorem to signals.
    1. Represent a continuous-time signal by samples.
    2. Calculate the maximum sampling frequency of a system to avoid aliasing.
    3. Explain aliasing.
    4. Reconstruct a signal from its samples.
    5. Perform discrete-time processing of continuous-time signals.
    6. Analyze the impulse-train sampling of a discrete-time signal.

Evaluation Criteria/Policies:
Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	–	100	=	A
83	–	91	=	B
75	–	82	=	C
0	–	74	=	F

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):

1. Integrate modern tools of the engineering discipline into the field of study.
2. Apply mathematics, science, engineering, and technology theory to solve electrical and computer engineering and electronics engineering technology problems.
3. Conduct, analyze, and interpret experiments using analysis tools and troubleshooting methods.
4. Identify, analyze, and solve electrical and computer engineering and electronics engineering technology problems.
5. Explain the importance of engaging in self-directed continuing professional development.
6. Demonstrate basic management, organizational, and leadership skills that commit to quality, timeliness, and continuous improvement.

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.