BIRZEIT UNIVERSITY

Faculty of Engineering and Technology
Electrical and computer Engineering
Second Semester 2020-2021

SYLLABUS

Course number and name: ENEE2312- Signals & Systems

Credits and contact hours: Credit: 3 (Lectures: 3 hours)

Instructors:

- Qadri Mayyala, Alhareth Zyoud, Ashraf Rimawi

Textbook:

Signals and Systems, Continuous and Discrete, R. Ziemer, W. Tranter & R. Fannin, McMillan, 4th edition, 1998

Reference:

Signals, Systems, and Transformations, C. Phillips, J. Parr & E. Riskin, 4th edition, 2008.

Specific course information

- **Description**: Signals and Systems representation and transforms.
- **Prerequisites:** MATH331

Grading: Midterms 20% **Quizzes 30%**

Activity and assignments 15% **Final Exam 35%**

Specific goals for the course

1. To understand the concepts of signals and systems for both continuous and discrete case
2. To be able to define the proper signal model and to classify signals.
3. To be able to classify the systems and their characteristics.
4. To be able to determine and analyze system response for the elementary signals.
5. To understand and apply the integral form of system solution(convolution)
6. To be able to understand and determine the Fourier series and transform.
7. To be able to determine and analyze the system frequency response.
8. To be able to understand discrete signals and systems models.
9. To be able to define LTI discrete system using difference equations and transfer functions.
10. To be able to convert between continuous and discrete signals and system models.
11. To be able to understand the Z-transform and its applications in signal and systems.
12. To be able to understand practical applications of signals and systems.

(ABET) Relationship of course to Computer Engineering Program Student Outcomes:

(a) Ability to apply mathematics, science and engineering principles.

(k) Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Brief list of topics to be covered.

Continuous Signals and Systems

I. Signals

- Signals representation and classification in time domain.
- Mathematical expression and operations on signals
- Elementary signals (singularity signals, as step, ramp, delta)
- Phasor representation
- Frequency representation (signal spectrum)
- Signal distortion

II. Systems

- System representation and modeling
- Classification of systems
- System differential equation model (First order DE)
- Impulse response of LTI system
- System response in integral form (Convolution integral)
- Stability of LTI system in time domain
- Steady state response in time domain

III. Transforms and Transforms Applications:

- Fourier series of periodic signals
- Fourier Transform as limit of Fourier Series.
- Fourier series and transform Theorems (properties)
- Fourier transform of energy signals.
- Fourier transform of non-integrable signal.
- Fourier transforms of periodic functions.
- Signal spectrum
- Energy and power spectral density
- Hilbert Transform
- Power and energy of signals (Parseval's Theorem)
- Steady state response by periodic input
- Transfer function of LTI system
- Stability of linear system
- System modeling and simulation

Discrete Signals and Systems

I. Signals

- Discrete Signals and Systems
- Signal conversion(discretization)
- Sampling Theorem
- Reconstruction of a signal
- Discrete elementary signals
- Convolution sum

II. Systems

- Discrete system representation and modeling
- Classification of discrete systems
- System difference equation model
- Impulse response of LTI system
- LTI System response in convolution form (Convolution sum)

- IIR and FIR systems
- Stability of linear system
- System modeling and simulation (direct form)

III. Z-transform and applications

- Definition, properties, and theorems
- Z-transform of elementary signals
- Inverse z-transform of rational functions
- System transfer function in z-domain
- The frequency response of a discrete LTI system
- Impulse and frequency response by z-domain representation
- Stability of LTI systems in z-domain
- System modeling in z-domain (direct form)
- The frequency response method
- Stability in the frequency domain
- The design of feedback control systems