Bogazici University
Department of Computer Engineering

CMPE 362 Introduction to Signals for Computer Engineers

An introduction to discrete- and continuous-time signals and systems with applications in computer engineering. Topics include time-domain representations of signals, impulse responses of linear time-invariant systems, and convolution. The course further covers Fourier series, spectral representations of signals, the Fourier transform, digital signals and sampling theory, signal reconstruction, and digital filtering. Additional subjects include the Z-transform, the discrete Fourier transform, and computational algorithms for generic signal processing. Consideration is also given to floating-point representation and quantization errors. Practical exercises emphasize applications in audio/image processing as well as machine learning.

Prerequisites: MATH 202

Course Objectives: As part of this course, students:
1. will understand mathematical representation of discrete-time and continuous-time signals.
2. will be introduced to signal processing and characterization techniques, such as filtering,frequency response
3. Gain laboratory experience in computer-based signal processing.

Textbook: McClellan, Shafer, and Yoder, *Signal Processing First*, Prentice Hall, 2003.
MATLAB: http://www.mathworks.com/help/pdf_doc/matlab/getstart.pdf
Optional read: A. V. Openheim, A. S. Willsky, Signals and Systems (2nd ed), Prentice Hall 1996

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Teaching Assistants: Berrenur Saylam, PhD.
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Lectures and Problem Sessions:
Wednesday 1400-1450 (L)
Thursdays 1200-1350 (L)
Friday 1200-1400 (PS) Tentative.

Grading: 4-8 sets of homework problems, which contain a mix of laboratory exercises in MATLAB and classical example exam questions. There are two in-class mid-term exams and a final exam.
Grading Policy:
20% of Midterm 1, Week 7
20% of Midterm 2, Week 11
30% of (Project, Homeworks, Quiz)
30% of Final exam, (TBA)

Prepared by: Prof. Dr. Şuayb Ş. Arslan

Date: 2025

Course Outline:

Week 1: Course Overview, Introduction, People, Signals, Properties, computational analysis, applications.

Week 2: Sinusoids, Complex Numbers, Complex Exponentials, Phasors

Week 3: Spectrum representation and introduction to Fourier Series, properties.

Week 4: Convolution, LTI Systems, FIR Filters

Week 5: Frequency Response of FIR Filters, Continuous-time signals and systems

Week 6: Impulse response, Convolution revisited, Frequency Response of Continuous-time LTI Systems

Week 7: Continuous-time signals, CT Fourier Transform and its properties

Week 8: Sampling and discretization of continuous-time signals & Discrete-time Fourier Transform

Week 9: The z-transform and its properties

Week 10: Analysis of discrete-time systems using z-transform

Week 11: Difference Equations, IIR filtering, stability, frequency response

Week 12: Floating point representation, quantization errors

Week 13: Algorithms for signal and image processing, Amplitude Modulation

Week 14: Computer Engineering Applications: Image processing, Neural nets, etc.

Course and Class Policy Guidelines

- **Attendance**: Not mandatory, but active participation is strongly recommended. It can help improve your grade, especially if your preliminary grade is near a borderline.
- **Make-up Exams**: There will likely be no make-up exams. In cases of valid health or personal emergencies, the corresponding portion of the final exam will count toward the missing midterm grade.
- **Moodle Usage**: Moodle will be used to distribute class materials and serve as a communication channel between you and the course admin team. If you encounter any access issues, notify us ASAP so we can resolve them in time.

Academic Honesty

- **Policy Awareness**
  Lack of knowledge of the academic honesty policy is not a valid excuse for violations.
- **Consequences**
  - Violators will fail the course.
  - University plagiarism and misconduct procedures will be applied.
- **Expectations**
  Students must avoid all forms of academic dishonesty, including but not limited to:
  - **Plagiarism**
    - Using another person's words without quotation marks or attribution.
    - Paraphrasing or modifying another's work and presenting it as one's own.
    - Extended paraphrasing, even with a citation, may still qualify as plagiarism.
  - **Collusion**
    - Collaborating with another person on assignments when explicitly prohibited by the instructor.
  - **Cheating on Exams/Quizzes**
    - Giving or receiving information or using unauthorized prepared materials.
  - **Falsification of Data**
    - Manufacturing or falsifying data.
    - Providing false or misleading information.
    - Selective use of data to distort conclusions or avoid actual research.
- **Use of Large Language Models (LLMs)**
  - Use is discouraged due to the risk of unintelligible or poor–quality output.
  - Detected use (via human review or automated tools) will result in penalties, based on similarity/perplexity scores and exam performance.
  - **LLMs are strictly prohibited** in exams.