Department of Electrical and Electronic Engineering (EEE)
Bangladesh University of Engineering and Technology

COURSE OUTLINE
July 2023

EEE 211 – Continuous Signals and Linear Systems

PART A: General Information

1.	Course Number	EEE 211
	Course Title	Continuous Signals and Linear Systems
	Credit (Contact) Hours	3.0
2.	Level and Term (Section)	Level-2, Term-I
	Academic Term	July 2023
3.	Type of Course	Core Course
	Offered to	EEE
4.	Pre-requisite Course(s)	None
5.	Course Website	Designated Microsoft Teams for each section
6.	Lecture Schedule	**Section A:** Sun 11 am, Tues 11 am, Wed 11 am - Room 925 **Section B:** Sun 09 am, Mon 09 am, Tues 09 am - Room 236 **Section C:** Sat 10 am, Tue 08 am, Wed 09 am - Room 920
7.	Important Dates	For important dates and examination schedules and latest updates, please follow the course website
8.	Course Teacher(s)	**Section A: Dr. S. M. Mahbubur Rahman** Professor Dept. of EEE, BUET Email: mahbubur@eee.buet.ac.bd Office: Room 326, ECE Building Website: http://mahbubur.buet.ac.bd **Section B: Dr. Hafiz Imtiaz**, Associate Professor Dept. of EEE, BUET Email: hafizimtiaz@eee.buet.ac.bd Office: Room # 128, ECE Building Website: https://hafizimtiaz.buet.ac.bd/ **Section C: Bejoy Sikder** Lecturer Dept. of EEE, BUET Email: bejoy@eee.buet.ac.bd Office: Room # 132, ECE Building Website: https://eee.buet.ac.bd/people/faculty/bs

PART B: Course Details

9. Course Content (As approved by the Academic Council)

- Classification of signals and systems: signals - classification, basic operation on signals, elementary signals, representation of signals using impulse function; systems- classification.
- Properties of Linear Time Invariant (LTI) systems: Linearity, causality, time invariance, memory, stability, invertibility.
- Time domain analysis of LTI systems: (i) Differential equations - system representation, order of the system, solution techniques, zero state and zero input response, system properties; (ii) impulse response

- convolution integral, determination of system properties; (iii) state variable - basic concept, state equation and time domain solution.

- Frequency domain analysis of LTI systems: (i) Fourier series - properties, harmonic representation, system response, frequency response of LTI systems; (ii) Fourier transformation - properties, system transfer function, system response and distortion-less systems.
- Applications of time and frequency domain analyses: solution of analog electrical and mechanical systems, amplitude modulation and demodulation, time-division and frequency-division multiplexing.
- Laplace transformation: properties, inverse transform, solution of system equations, system transfer function, system stability, frequency response and application.
- Solution of analog electrical and mechanical systems

10. Course Objectives

- To develop a solid foundation on the continuous time signals and systems, and the essential techniques required for their analysis and synthesis for pursuing further studies in the field of telecommunications and signal processing
- To study the most widely used techniques for transforming and analyzing signals and systems, both in time domain and frequency domain
- To investigate the behavior of linear time invariant (LTI) systems with continuous time signals as input using various techniques, such as convolution, differential equations and state equations.
- To explore the analogy between the electrical systems and mechanical or electromechanical systems, and apply this analogy for problem solving

11. Background Knowledge required

Fundamental concepts of mathematics, fundamentals of electrical circuits and mechanical systems.

12. Course Outcomes

CO No.	CO Statement	Corresponding PO(s)*	Domains and Taxonomy level(s)**	Delivery Method(s) and Activity(-ies)	Assessment Tool(s)
CO1	**Apply** the fundamental concepts of continuous time signals, based on the understanding of their properties, to analyze input/output behavior of LTI systems in time-domain.	PO1	C3	Lectures, Discussions	Assignment, Class test, Final exam
CO3	**Apply** the concept of frequency domain transformation (Fourier series and Fourier transform) of continuous time signals to analyze LTI system behaviour	PO1	C3	Lectures, Discussions	Assignment, Class test, Final exam
CO4	**Analyze** input/output behavior of LTI systems using Laplace transform	PO1	C4	Lectures, Discussions	Assignment, Class test, Final exam
CO5	Solve problems based on the understanding analogy between electrical systems and electromechanical systems	PO2	C3	Lectures, Discussions	Assignment, Class test, Final exam

***Program Outcomes (PO): PO1** Engineering Knowledge, **PO2** Problem Analysis, **PO3** Design/development Solution, **PO4** Investigation, **PO5** Modern tool usage, **PO6** The Engineer and Society, **PO7** Environment and sustainability, **PO8** Ethics, **PO9** Individual work and teamwork, **PO10**. Communication, **PO11** Project management and finance, **PO12** Life-long Learning

PO1: *Engineering Knowledge: Apply knowledge of mathematics, science, and engineering to solve complex electrical and electronic engineering problems.*

****Cognitive Domain Taxonomy Levels: C1** – Remember, **C2** – Understand, **C3** – Apply, **C4** – Analysis, **C5** – Evaluation, **C6** – Synthesis/Design

13. Assessment Strategy

- Class participation will be judged by in-class evaluation; attendance will be recorded in every class.
- Continuous assessment will be done in the form of class tests, assignments, in-class evaluations.
- Final Examination: A comprehensive term final examination will be held at the end of the Term following the guideline of academic Council.

14. Distribution of Marks

Class Participation	10%
Homework, Assignment and Quizes	20%
Final Examination	70%
Total	100%

15. Main Textbook

- Continuous and Discrete Signals and Systems (2nd edition) - Samir S. Soliman and Mandyam D. Srinath
- Signals and Systems (2nd Edition) - Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab
- Analysis of Linear Systems – David K. Cheng

16. Reference Textbooks and relevant resources

- Signals, Systems, and Transforms – Charles L. Phillips, John M. Parr, Eve A. Riskin (4th Ed)
- Signal Processing and Linear Systems – B. P. Lathi (2nd Ed)
- Continuous-Time Signals and Systems – Michael D. Adams

N.B.: Besides going through relevant topics of the textbooks, it is strongly advised that the students follow the class lectures and discussions regularly for a thorough understanding of the topics.

17. Lecture Plan

Week	Lectures	Topic
1-2	1-6	*Classification of signals and systems:* signals - classification, basic operation on signals, elementary signals, representation of signals using impulse function; systems- classification.
3	7-9	*Properties of Linear Time Invariant (LTI) systems:* Linearity, causality, time invariance, memory, stability, invertibility.
4-6	10-18	*Time domain analysis of LTI systems: (i) Differential equations* - system representation, order of the system, solution techniques, zero state and zero input response, system properties**;** *(ii) impulse response* - convolution integral, determination of system properties; (iii) *state variable* - basic concept, state equation and time domain solution.
7-8	19-24	*Frequency domain analysis of LTI systems: (i) Fourier series* - properties, harmonic representation, system response, frequency response of LTI systems.
9-10	25-30	*Frequency domain analysis of LTI systems: (ii) Fourier transformation* - properties, system transfer function, system response and distortion-less systems.
11	31-33	*Applications of time and frequency domain analyses:* solution of analog electrical and mechanical systems, amplitude modulation and demodulation, time-division and frequency-division multiplexing.

Week	Lectures	Topic
12-13	34-39	*Laplace transformation:* properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application.
14	40-42	Solution of analog electrical and mechanical systems.

18. Important University Policies

- Please check the following link for Rules and regulations for the undergraduate programmes: https://www.buet.ac.bd/info/Academicinformation/RulesUndergradprogram