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

COURSE OUTLINE
January 2024

EEE 163 – Introduction to Electrical Engineering

PART A: General Information

1.	Course Number	EEE 163
	Course Title	Introduction to Electrical Engineering
	Credit (Contact) Hours	3.0
2.	Level and Term (Section)	Level-1, Term-I
	Academic Term	January 2024
3.	Type of Course	Core Course
	Offered to	CSE
4.	Pre-requisite Course(s)	None
5.	Course Website	Designated Microsoft Teams for each section
6.	Lecture Schedule	**Section C:** Sun 9 am, Mon 9 am, Tue 9 am - Room 903
7.	Important Dates	For important dates and examination schedules and latest updates, please follow the course website
8.	Course Teacher(s)	**Section A: Dr. Apratim Roy** Professor Dept. of EEE, BUET **Section B: Dr. Ahmed Zubair** Professor Dept. of EEE, BUET **Section C: Dr. Hafiz Imtiaz** Professor Dept. of EEE, BUET Email: hafizimtiaz@eee.buet.ac.bd Office: Room # 128, ECE Building Website: https://hafizimtiaz.buet.ac.bd/

PART B: Course Details

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

Direct current: Basic Concepts, Charge, Current and Voltage, Power and Energy, Circuit Elements, Applications; Basic Laws, Ohm's Law, Nodes, Branches, and Loops, Kirchhoff's Laws, Series Resistors and Voltage Division, Parallel Resistors and Current Division, Solution of simple circuits with both dependent and independent sources, Wye-Delta Transformations, Applications; Nodal and Mesh Analysis, Applications; Linearity Property, Superposition, Source Transformation, Thevenin's and Norton's Theorem, Maximum Power Transfer Theorem.

Alternating current: Sinusoids and Phasors, Phasor Relationships for Circuit Elements, Impedance and Admittance, Impedance and Admittance, Kirchhoff's Laws in the Frequency Domain, Impedance Combinations, Applications; Sinusoidal Steady-State Analysis, Nodal and Mesh Analysis, Superposition Theorem, Source Transformation, Thevenin and Norton Equivalent Circuits; AC Power Analysis, Instantaneous and Average Power, Maximum Average Power Transfer, Effective or RMS Value, Apparent Power and Power Factor, Complex Power, Conservation of AC Power, Power Factor Correction, Applications.

Three-Phase Circuits: Balanced Three-Phase Voltages, Balanced Wye-Wye Connection, Balanced Wye-Delta, Delta-Delta and Delta-Wye Connection, Power in a Balanced System.

Ideal operational amplifier circuits: Ideal operational amplifier and op-amp circuits; Op-amp applications: inverting amplifier, non-inverting amplifier, summing amplifier, differential amplifier, logarithmic amplifier, operational transconductance amplifiers exponential amplifier, differentiator, integrator, voltage to current converter, voltage follower, and other applications.

Active & Passive filters: High pass, Low pass, Band pass & Band stop filters using R, L & C. Construction of active filters using Op-Amp.

10. Course Objectives

- To learn about the different circuit components and electrical quantities of interest of an electrical circuit.
- To learn about the fundamental circuit laws (e.g. Ohm/Kirchoff) and different methods of analysis for solving an electrical circuit.
- To gain fundamental engineering knowledge about linear and non-linear systems for application in linear circuit analysis.
- To identify the most suitable analysis method for circuit solving.
- To gain knowledge about sinusoids and phasors (complex numbers) and their applications in study of alternating current.
- To design A.C. circuits to achieve certain power factor improvements.
- To understand the basic concepts of three phase systems in the context of power systems.
- To solve balanced three phase systems with balanced loads.
- To explain the model of operational amplifier and analyse Op-Amp circuits to perform different operations such as integration, differentiation and filtering on electronic signals.
- To understand the construction and applications of different types of filters.

11. Background Knowledge required

Intermediate level (H.S.C.) math and physics concepts.

12. Course Outcomes

CO No.	CO Statement	Corresponding PO(s)	Domains and Taxonomy level(s)	Delivery Method(s) and Activity(-ies)	Assessment Tool(s)
1	**Apply the concepts of** circuit elements, circuit, circuit variables, direct current, voltage, dependent and independent sources, circuit laws, analysis methods, theorems to solve various circuits.	PO(a)	C3	Lectures, Tutorials, Homeworks	Assignment, Class test, Final exam
2	**Derive** the expressions of voltage, current and power/energy of RL, RC and RLC circuits based on the concepts of phasors	PO(a)	C3	Lectures, Tutorials, Homeworks	Assignment, Class test, Final exam
3	**Employ** circuit laws, analysis methods, theorems to solve various AC circuits.	PO(b)	C4	Lectures, Tutorials, Homeworks	Assignment, Class test, Final exam
4	**Analyse** the 3-phase circuits with different combination of sources and loads that are used in power systems.	PO(b)	C4	Lectures, Tutorials, Homeworks	Assignment, Class test, Final exam
5	**Explain** the operation of Op-Amp and its applications in mathematical and filtering circuits	PO(a)	C2	Lectures, Tutorials, Homeworks	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.
- A final exam will be taken which will cover the entire syllabus of the course.

14. Distribution of Marks

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

15. Main Textbook

- Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N.O. Sadiku; McGraw-Hill, 2013

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

16. Reference Textbooks and relevant resources

- Operational Amplifiers and Linear Integrated Circuits by R. F. Coughlin and F. F. Driscoll
- Introductory Circuit Analysis by Rober L. Boylestad; Pearson, 2007
- Alternating-Current Circuits by Russell M. Kerchner and George F. Corcoran

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	1-3	Introduction to the course; Familiarization with electrical circuit components and electrical quantities, Overview of Ohm's Law; Kirchoff's Laws; Solving basic circuits; Wye-Delta transformation
2	4-6	Introduction to methods of analysis for solving electrical circuits; Nodal analysis; Mesh analysis; supernodes and supermeshes
3	7-9	Introduction to circuit theorems; source transformation; principle of superposition; Thevenin's theorem
4	10-12	**Class Test #1** Norton's theorem and maximum power transfer theorem; Study of worked out DC circuit problems
5	13-15	Introduction to AC circuits; Familiarization with sinusoids and phasors; Representation of circuit elements by means of complex numbers; phasor algebra
6	16-18	Analysis of sinusoidal waveforms; rms value calculation; Impedance and admittance in AC circuits; RLC circuit analysis in AC
7	19-21	**Class Test #2** AC circuit solving using principles and concepts learned in DC circuit analysis; AC power analysis; Complex power; Apparent power; Real power and Reactive power
8	22-24	Phasor diagram construction and analyses for RLC circuits; Power Factor Correction; Study of worked out problems
9	25-27	Introduction to three phase AC circuits; Advantages of three phase over single phase; Balanced and unbalanced three phase circuit analysis **Class Test #3**
10	28-30	Y-Y, Δ-Δ, Y-Δ, Δ-Y systems and their analyses; Study of worked out problems; Interactive discussions
11	31-33	Introduction to Op-Amp, its ideal characteristics inverting & non-inverting amplifier, summing & differential amplifier, inverting integrator & differentiator using Op-Amp; Applications of Op-Amp.
12	34-36	Active and passive filters, different types of passive filters & their application **Class Test #4**

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