Course Description and Outcomes
Department of Electrical and Electronic Engineering
School of Engineering
Brac University

EEE 203 Electrical Circuits II

EEE 203L Electrical Circuits II Laboratory – v3
EEE 204 Electrical Circuits II Laboratory (1.5 credits) – v1, v2

A. Course General Information:

Course Code:	EEE203 EEE203L
Course Title:	Electrical Circuits II Electrical Circuits II Laboratory
Credit Hours (Theory + Laboratory):	3 + 1
Contact Hours (Theory + Laboratory):	3 + 3
Category:	Program Core
Type:	Required, Engineering, Lecture + Laboratory
Prerequisites:	EEE 101 Electrical Circuits I EEE 101L Electrical Circuits I Laboratory MAT 120 Mathematics II Integral Calculus and Differential Equations
Co-requisites:	MAT 215 Mathematics III Complex Variables and Laplace Transformations
Equivalent Course	ECE 203 Electrical Circuits II ECE 203L Electrical Circuits II Laboratory EEE 204 Electrical Circuits II Laboratory (1.5 credits) – v1, v2 ECE 204 Electrical Circuits II Laboratory (1.5 credits) – v1, v2

B. Course Catalog Description (Content):
This course is considered as one of the fundamental courses to understand Electrical Circuits. It introduces the generation of alternating source and analyze parameters and perform mathematical calculations of real power, reactive power, apparent power, power factor, reactive factor for different types of AC circuit. Moreover, this course provides the concept of complex number calculations and solve all the DC circuits' concepts such as- series and parallel RL, RC and RLC circuits, nodal and mesh analysis, application of network theorems in ac circuits. Furthermore, this course introduces the concept of three phase circuits; balanced and unbalanced circuits and power calculation which are the essential building blocks for most of the electrical systems. The rationale of the course is to enable the students to develop sound understanding of electrical circuits, design and analyze these basic electrical circuits. As one of the core courses for the EEE program, the knowledge from the course will be applied in future EEE courses such as Energy Conversion I, Energy Conversion II, Power System I, Power System II, Power Electronics and Switchgear and Protection Courses. This course has 3 hours/week separate mandatory laboratory session.

C. Course Objective:
The objectives of this course are to:

a. Introduce basic understanding of phasors and phasor diagrams to analyze voltage, current, power and impedance for AC circuit.
b. Teach how to apply different network theorems to solve AC circuits in phasor domain.

c. Introduce the design and analyze the concept of series and parallel resonance circuits
d. Make understand the phase rotation and Wye/Delta connections for balanced and unbalanced 3-phase systems
e. Introduce how to calculate AC power and power factor for single and three phase ac circuits.
f. Prepare students to understand the frequency response of low-pass, high-pass, band-pass, and band-reject filters and circuit response to non-sinusoidal input.
g. Introduce computer simulations and extensive laboratory sessions to investigate each major topic.

D. Course Outcomes (COs):

Upon successful completion of this course, students will be able to

Sl.	CO Description
CO1	**Apply** different network theorems to solve AC circuits.
CO2	**Analyze** circuit problems on resonance and poly phase system for different types of loads
CO3	**Use** simulation tool to investigate AC circuits in schematic level
CO4	**Construct** and **troubleshoot** AC circuits using laboratory equipment
CO5	**Demonstrate** the findings of hardware and software experiments through reports

E. Mapping of CO-PO-Taxonomy Domain & Level- Delivery-Assessment Tool:

Sl.	CO Description	POs	Bloom's taxonomy domain/level	Delivery methods and activities	Assessment tools
EEE 203 Electrical Circuits II					
CO1	**Apply** different network theorems to solve AC circuits.	a	Cognitive/ Apply	Lectures, notes	Quiz, Assignment, Exam
CO2	**Analyze** circuit problems on resonance, power, and poly phase system for different types of loads	b	Cognitive/ Analyze	Lectures, notes	Assignment, Exam
EEE 203L Electrical Circuits II Laboratory					
CO3	**Use** simulation tool to investigate AC circuits in schematic level	e	Cognitive/ Apply, Psychomotor/ Precision	Lab class	Lab Work, Lab Exam, Project
CO4	**Construct** and **troubleshoot** AC circuits using laboratory equipment	e	Cognitive/ Understand, Psychomotor/ Precision	Lab class	Lab Work, Lab Exam, Project
CO5	**Demonstrate** the findings of hardware and software experiments through reports	j	Affective/Valuing	Lab Class, Lecture	Lab Reports, Project Presentation

Mapping of CO - PO Indicators - Knowledge Profile

CO No.	PO No.	Applicable PO Indicator	Knowledge Profile
CO1	a	a1, a2, a4	K2, K3
CO2	b	b1, b3	K3
CO3	e	e3	K6
CO4	e	e1, e3	K6
CO5	j	j1, j2, j4	

Description of PO Indicators

PO Description	Indicator Description
(a) Engineering knowledge: Apply knowledge of mathematics, natural science, (*electrical and electronic / electronic and communication)* engineering fundamentals, and specialization to the solution of complex (*electrical and electronic / electronic and communication)* engineering problems. (K1 to K4)	a1. Understand the concepts of mathematics, science and engineering knowledge required to solve complex electrical and electronic engineering problems
	a2. Apply the appropriate knowledge of mathematics (Probability and Statistics, Differential and Integral Calculus, Differential Equations, Linear Algebra etc.) to solve complex electrical and electronic engineering problems
	a4. Apply fundamental and specialized engineering knowledge to solve complex electrical and electronic engineering problems
(b) Problem analysis: Identify, formulate, research literature and analyse complex (*electrical and electronic / electronic and communication)* engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4)	b1. Identify the key issues, variables, requirements and domain of the complex engineering problem and Formulate the problem statement
	b3. Analyze complex engineering problem using relevant analytical skills and fundamental knowledge of mathematics, natural sciences and engineering sciences and reach substantiated conclusion
(e) Modern tool usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex (*electrical and electronic / electronic and communication)* engineering problems, with an understanding of the limitations. (K6).	e1. Select appropriate techniques, resources, modern engineering and IT tools to solve complex engineering problems
	e3. Use appropriate modern engineering, IT including modeling and simulation tools and techniques to develop and evaluate the solution of complex engineering problems
(j) Communication: Communicate effectively on complex activities with the (*electrical and electronic / electronic and communication)* engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	j1. Write effective technical reports, prepare assignments, design documentation etc. on complex engineering activitie
	j2. Prepare multi-media presentations, posters on engineering activitie
	j4. Deliver effective oral presentations, participate in technical discussions on complex engineering activities

Description of Applicable Knowledge Profiles

K1	**Natural Sciences**	A systematic, theory-based understanding of the natural sciences applicable to the discipline
K2	**Mathematics**	Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline
K3	**Engineering fundamentals**	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
K6	**Engineering practice**	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline

F. Course Materials:

Text and Reference Books:

Sl.	Title	Author(s)	Publication Year	Edition	Publisher	ISBN
1	Introductory Circuit Analysis	Robert.L. Boylestad	2012	12th ed.	Pearson Education	ISBN-0-13097417-XII
2	Electric Circuits	J.W.Nilsson and S.Riedel	2014	7th ed.	Prentice Hall	ISBN 978–0–07–352955–7

Other materials (if any)

a. Lecture notes
b. Lab hand-outs
c. Lab usage manual
d. Simulation tool

F. **Lesson Plan:**

Sl.	Topic	Week/ Lecture#	Related CO (if any)
1	Basic AC concepts: Sinusoidal functions: Instantaneous current, voltage, power, effective current and voltage, average power	Lecture 1-3	CO1, CO2
2	Mathematical Operation with Complex Numbers: phasors and complex quantities, impedance, real and reactive power, power factor.	Lecture 4-6	CO1, CO2
3	Analysis of single phase ac circuits: Series and parallel RL, RC and RLC circuits, nodal and mesh analysis	Lecture 7--9	CO2, CO2
4	Network Theorems in ac Circuits: Superposition, Thevenin & Norton's theorem, Maximum Power Transfer	Lecture 10-11	CO1, CO2
5.	Midterm		
6	Resonance in ac circuits: Series and parallel resonance.	Lecture 13-16	CO2
7	Magnetically Coupled circuits: Mutual Inductance, Reflected impedance, equivalent circuits	Lecture 17-19	CO2
8	Analysis of three phase circuits: Three phase supply, balanced and unbalanced circuits, power calculation.	Lecture 20-22	CO2
9	Non-Sinusoidal Circuits: circuits simultaneously excited by sinusoidal sources of several frequencies	Lecture 23	CO2

10	Review	Lecture 24	
11.	Final Exam		

Lesson Plan (Laboratory):

Activity	Week/ Lecture#	Related CO
Group Formation, Marks Distribution, Report Structure, Project Requirement, Activity List, Course Outcome Assessment, Student Feedback, Google Classroom etc.	1	
Experiment 1: Familiarization with the Alternating Current (AC) waves	2	
Experiment 2: Verification of KVL in AC circuits	3	
Experiment 3: Verification of KCL in AC circuits	4	
Experiment 4: Familiarization with the Alternating Current (AC) waves and Verification of KVL and KCL in AC circuits using PSpice	5	
Experiment 5: Familiarization with Passive Filters	6	
Midterm examination of theory courses	7	
Experiment 6: Familiarization with Series Resonance in AC circuits	8	
Experiment 7: Series Resonance - Bandwidth and Selectivity	9	
Experiment 8: Familiarization with Passive Filters, Series Resonance in AC circuits and Bandwidth and Selectivity using PSpice	10	
Hardware examination	11	
Project submission	12	CO3, CO5

G. Assessment Tools for Grading

Theory:

Assessment Tools	Weightage
Class Performance	5%
Assignment	10%
Quiz	15%
Midterm Exam	30%
Final Exam	40%

Laboratory:

Assessment Tools	Weightage
Attendance	10
Hardware class performance	10
Hardware report	10
Software report	10
Project	30
Hardware examination	30

H. CO Assessment Plan:

Assessment Tools	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
Assignment	x	x			
Quiz	x				
Exam (Midterm, Final)	x	x			
Lab Work			x	x	
Lab Exam			x	x	
Lab Report					x
Project			x	x	x

I. **CO Attainment Policy:**
As per the course outcome attainment policy of the Department of Electrical and Electronic Engineering

J. **Grading policy:** As per Brac University grading policy

K. **Course Coordinator:** Md. Ehsanul Karim ehsanul.karim@bracu.ac.bd