Course Outline Form
Department of Electrical and Electronic Engineering
School of Engineering and Computer Science
Brac University

EEE 205/ ECE205 Electronic Circuit I

EEE 205L/ECE205L Electronic Circuit I Laboratory – v3
EEE 206/ECE206 Electronic Circuit I Laboratory (1.5 credits) – v1, v2

A. Course General Information:

Course Code:	EEE 205 EEE 205L
Course Title:	Electronic Circuit I Electronic Circuit I Laboratory
Credit Hours (Theory + Laboratory):	3 + 1
Contact Hours (Theory + Laboratory):	3 + 3
Category:	Program Core
Type:	Required, Engineering, Lecture + Laboratory
Prerequisites:	EEE 203 Electrical Circuit II EEE 203L Electrical Circuit II Laboratory
Co-requisites:	None
Equivalent Course	ECE 205 Electronic Circuit I ECE 205L Electronic Circuit I Laboratory EEE 206 Electronic Circuit I Laboratory (1.5 credits) – v1, v2 ECE 206 Electronic Circuit I Laboratory (1.5 credits) – v1, v2

B. Course Catalog Description (Content):

Fundamental concepts of the semiconductor: electrons and holes, concept of doping, acceptors and donors, p and n-type materials. PN junction Diode and circuits: Operation principle, Current-Voltage characteristics, Diode models, diode large-signal analysis (DC analysis), Diode AC analysis: Rectifier Circuits-Half wave/Full wave, rectifier with filter capacitors, Clipper and Clamper circuits. Zener diode: IV characteristics, zener shunt regulator.
Metal-Oxide-Semiconductor Field-Effect-Transistor (MOSFET): structure and physical operation of MOSFETs, Threshold voltage, I-V characteristics, Types of MOSFET: NMOS, PMOS and CMOS. MOS large signal model. Large signal analysis of MOSFET circuits. MOSFET biasing circuits for various configurations and load line analysis, small signal analysis of MOSFET amplifier: AC equivalent circuits, small signal model, Analysis of various configurations, voltage and current gain, input and output impedance. MOSFET as switch. Basic logic circuits using MOSFET and CMOS.
Bipolar Junction Transistor (BJT): Basic structure, BJT region of operation, BJT Currents, BJT Terminal Voltages, BJT configurations and BJT I-V characteristics. BJT large signal models, large signal analysis of BJT circuits. Bipolar Junction Transistor Biasing: The dc load line and bias point, biasing the BJT for discrete circuits. small signal equivalent circuit models and small signal analysis of BJT amplifiers.

C. Rationale of the Course:

1. This course is considered as the backbone to modern technology. Electronic devices such as Diodes, Transistors are the essential building blocks for all the electronic systems that encompass our life everywhere and every moment. The rationale of the course is to enable the students to develop the fundamental knowledge of electronic devices, its operation. As one of the core courses for the EEE program, the knowledge from the course will be applied in almost all the future EEE courses such as Electronic Devices-2, Power electronics, Digital Electronics, Robotics etc.

D. Course Objective:

The objectives of this course are to

a. Introduce the fundamental concepts of semiconductor materials and their properties required to understand the construction of electronic devices.
b. Provide the students with the knowledge of the construction, operation principles, characteristics of the basic electronic devices (Diode, BJT, MOSFET etc.), and subsequently, with the ability to represent those devices into equivalent circuit models (large signal and small signal).
c. Teach the students different methods to Analyze electronic circuits consisting of electronic devices: Diodes, BJTs and MOSFETs for DC and AC signals.
d. Expose the students with the introductory design process of Amplifier circuits.
e. Provide the students with the skills to simulate electronic circuits and construct, troubleshoot/debug them, and finally, extract experimental data with a view to solidifying the underlying knowledge of the devices.

E. Course Outcomes (COs):

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

Sl.	CO Description
CO1	**Apply** large signal equivalent circuit models of Diode and BJT to solve electronic circuits.
CO2	**Solve** electronic circuits consisting of different electronic devices such as diodes, BJT, MOSFETs for both DC and AC signals.
CO3	**Design** various electronic circuits employing different electronic devices.
CO4	**Investigate** the effect of different circuit parameters including load resistance on the Amplifier performances in terms of Gain, input/output impedance, faithful reproducibility, stability in biasing etc.
CO5	**Use** simulation tool to construct electronic circuits and simulate in schematic level

F. Mapping of Course Outcomes (COs) with Program Outcomes (POs):

COs	PO-a	PO-b	PO-c	PO-d	PO-e	PO-f	PO-g	PO-h	PO-i	PO-j	PO-k	PO-l
CO1	✓											
CO2	✓											
CO3			✓									
CO4				✓								

CO5					✓							

G. 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 205 Electronic Circuit I					
CO1	**Apply** large signal equivalent circuit models of Diode and BJT to solve electronic circuits.	a	Cognitive/ Apply	Lectures, notes	Assignment, Quiz, Exam
CO2	**Solve** electronic circuits consisting of different electronic devices such as diodes, BJT, MOSFTEs for both DC and AC signals.	a	Cognitive/ Apply	Lectures, notes	Assignment, Quiz, Exam
CO3	**Design** various electronic circuits employing different electronic devices.	c	Cognitive/ Create	Lectures, notes	Assignment, Exam, Project
EEE 205L Electronic Circuit I Laboratory					
CO4	**Investigate** the effect of different circuit parameters including load resistance on the Amplifier performances in terms of Gain, input/output impedance, faithful reproducibility, stability in biasing etc.	d	Cognitive/ Evaluate, Psychomotor/ Manipulation	Lectures, notes	Open-ended Lab Experiment
CO5	**Use** simulation tool to construct electronic circuits and simulate in schematic level	e	Cognitive/ Apply Psychomotor/ Manipulation	Lab class	Lab Work, Software Exam

Mapping of CO - PO Indicators - Knowledge Profile

CO No.	PO No.	Applicable PO Indicator	Knowledge Profile
CO1	a	a1, a4	K1, K3
CO2	a	a1, a4.	K1, K3
CO3	c	c1, c4	K5
CO4	d	d1, d2, d3, d4,D5	K2, K3, K5
CO5	e	e3	K6

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
	a4. Apply fundamental and specialized engineering knowledge to solve complex electrical and electronic engineering problems

(c) Design/ development of solutions: Design solutions for complex (*electrical and electronic / electronic and communication)* engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5)	c1. Define specifications, analyze technical requirements and constraints of the system/subsystem, component or process for the solutions of complex engineering problem.
	c4. Evaluate whether the design solutions meet the desired need.
(d) Investigation: Conduct investigations of complex (*electrical and electronic / electronic and communication)* engineering problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.	d1. Design and set up experiments.
	d2. Conduct experiments and perform measurements.
	d3.Detect the experimental faults and troubleshoot them.
	d4. Analyze and Interpret data, graph, charts etc.
	d5. Synthesize the information and findings obtained through research and/or experiments to reach valid conclusions
(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).	e3. Use appropriate modern engineering, IT including modelling and simulation tools and techniques to develop and evaluate the solution of complex engineering problems.

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
K5	**Engineering design**	Knowledge that supports engineering design in a practice area
K6	**Engineering practice**	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline

H. Course plan specifying content, COs, co-curricular activities (if any), teaching learning and assessment strategy mapped with COs:

Class Week	Topic	Teaching-Learning Strategy	Assessment Strategy	Corresponding COs
1	Fundamental concepts of the semiconductor: electrons and holes, concept of doping, acceptors and donors, p and n-type materials.	Lecture, Notes		
2	PN junction Diode, Operation principle, Current-Voltage characteristics, Diode models, diode large-signal analysis (DC analysis)	Lecture, Notes, Pre-recorded video lectures		CO1, CO2
3	Diode AC analysis: Rectifier Circuits-Half wave/Full wave, Clipper and Clamper circuits.	Lecture, Notes, Pre-recorded video lectures	Quiz, Assignment, Midterm exam.	CO2
4	Rectifier with filter capacitors, Zener diode: IV characteristics, voltage regulator.	Lecture, Notes, Pre-recorded video lectures	Quiz, Assignment, Midterm exam.	CO2
5	MOSFET: Basic Structure, Operation Principle, Region of operation, Types of MOSFET: NMOS, PMOS and CMOS, I-V characteristics.	Lecture, Notes,	Quiz, Assignment Midterm Exam	
6	MOS large signal model. Large signal (DC) analysis of MOSFET circuits.	Lecture, Notes,	Quiz, Assignment Midterm Exam	CO2
7	MOSFET as switch. Basic logic circuits using MOSFET and CMOS.MOSFET biasing circuits for various configurations, loadline analysis,	Lecture, Notes,	Quiz, Assignment Midterm Exam	CO2
8	Concept of amplification using MOSFET amplifier. Small signal analysis of MOSFET amplifier: AC equivalent circuits, small signal model, Analysis of various configurations, voltage and current gain, input and output impedance.	Lecture, Notes, Pre-recorded video lectures	Quiz, Assignment Midterm Exam	CO2, CO3

9	Bipolar Junction Transistor (BJT): Basic structure, BJT region of operation, BJT Currents, BJT Terminal Voltages, BJT configurations and BJT I-V characteristics.	Lecture, Notes, , Pre-recorded video lectures		
10	BJT large signal models, BJT DC circuit Analysis.Switching operation of BJT circuit.	Lecture, Notes, , Pre-recorded video lectures	Quiz, Assignment Final Exam	CO1, CO2
11	BJT load line analysis, biasing the BJT for discrete circuits and biasing stability. small signal equivalent circuit models.	Lecture, Notes, Pre-recorded video lectures	Quiz, Final Exam	CO2
12	BJT small signal analysis: Single-stage BJT amplifier circuits and their configurations, Amplifier design.	Lecture, Notes, Pre-recorded video lectures	Quiz, Final Exam, Design Assignment	CO2, CO3

Laboratory:

	Topic	**Week #**	**Related CO**
1	Investigation of I-V characteristics of PN junction diode **(Hardware)**	Week 1	
2	Implementation of Half-wave/Full-wave rectifier circuits **(Hardware)**	Week 2	
3	Implementation of Clipper & Clamper network **(Hardware)**	Week 3	
4	Investigation of Zener diode IV characteristics and Implementation of voltage regulator circuit **(Hardware)**	Week 4	
5	Simulation of experiment 2-5 using PSpice Software	Week 5	CO5
6	Investigation of I-V characteristics of MOSFET **(Hardware)**	Week 6	
7	Implementation of Common Source MOSFET Amplifier Circuits **(Hardware)**	Week 7	
8	Investigation of I-V characteristics of BJT **(Hardware)**	Week 8	
9	Implementation and study of BJT Biasing Circuits **(Hardware)**	Week 9	
10	Implementation of Common Emitter BJT Amplifier Circuits **(Hardware)**	Week 10	CO4
11	Simulation I-V characteristics of BJT, BJT Biasing Circuits, Common Emitter BJT Amplifier Circuits using PSpice Software **(Software)**	Week 11	CO5
12	Software exam	Week 12	
13	Hardware exam	Week 13	

I. Learning Materials:

Sl.	**Title**	**Author(s)**	**Publication Year**	**Edition**	**Publisher**	**ISBN**
1	Microelectronics circuits	Adel S. Sedra, Kenneth C. Smith	2014	7th ed.	Oxford University Press	ISBN-13: 978-0199339136
2	Microelectronics Circuit Analysis & Design	Donald A. Neaman	2010	4th ed.	McGraw-Hill	ISBN 978–0–07–338064–3

J. Assessment and Evaluation:

Assessment Strategy

During the course duration, marking policy and guidance for students are mentioned as follows. These policies will be followed strictly and can only be amended as per the course instructor only.

- To assess the understanding and knowledge of the students, a total of 5 quizzes will be taken, spread out evenly over the semester. Best 4 out of 5 quizzes will be counted. No make-up quizzes will be taken.
- One mid-term exam and one final exam will be taken with 1 hour and 2 hours respectively. Students will be assessed on their level of attainment of CO1 and CO2 through these exams.
- Students will be given a design project in order to assess their ability to design and analyze an electronic circuit that meets the required specifications under certain constraints (CO3). Students will be conducting the project in groups for a certain number of weeks during the semester period.
- All graded work including the assignments must be done independently. Plagiarism is strictly prohibited and will result in the loss of grades. Depending on the severity of the plagiarism, disciplinary action may be taken against the students involved in plagiarism.

CO Assessment Plan:

Assessment Tools	Course Outcomes				
	CO1	CO2	CO3	CO4	CO5
Assignment	✓	✓			
Quiz	✓	✓			
Design Project			✓		
Exam	✓	✓			
Lab Work (Software)					✓
Open-ended Lab				✓	
Lab Exam (Software)					✓

Marks distribution:

Theory:

Assessment Tools	Weightage
Class Performance & Attendance	5%
Assignment	5%
Quiz	30%
Midterm Exam	20%
Final Exam	30%
Design Project	10%

Laboratory:

Assessment Tools	Weightage
Lab Attendance	5%
Lab Work (Hardware)	15%
Lab Work (Software)	10%
Lab Report	20%
Open-ended Lab	20%
Lab Exam (software, Hardware)	30%

Make-up Procedures:

Students are not encouraged to give make-up mid-term except on certain special circumstances.

Make-up examinations will only be allowed to the students with extreme medical condition OR death in the immediate family during the semester. (Recommendations from 30th Syndicate and 69th Academic Council, BoT approved in the 27th meeting)

Students must notify in writing before the exam if he/she is going to miss the exam and needs to sit for a make-up exam. Students need to apply to sit for the make-up exam by filling out the appropriate form available at the office, take the necessary approval and submit the form to the registrar office with required fees for the make-up exam.

K. CO Attainment Policy:

As per the course outcome attainment policy of the Department of Electrical and Electronic Engineering

L. Grading policy:

As per Brac University grading policy

M. Course Coordinator:

Dr. Mohammed Belal Hossain Bhuian