

COURSE DESCRIPTION			
Program	Biomedical Engineering, Electronics and Communication, Electronics Engineering, Electronics and Computer Engineering, Integrated Circuit Design & Fabrication, Micro Electronics		
Course Title	Electronic Devices and Applications Lab		
Course Code	2049	Semester	II
Type of Course	Lab	Contact Hours	45
Teaching Scheme (L: T:P:R)	0:0:3:0	Credits	1.5
CIE Marks	60	ESE Marks	40

Introduction

This course provides hands-on experience in constructing and testing rectifier, filter, RC, clipper, clamper, and voltage multiplier circuits. It also includes a practical study of bipolar junction transistor behavior through plotting and observing input and output characteristics in common emitter configuration. The course supports the development of practical skills, analytical ability, and familiarity with basic electronics laboratory practices.

Course Objectives

1	To construct rectifier, filter, and RC circuits to study their performance characteristics
2	To construct clipper circuits and observe their effect on input waveforms
3	To construct clamper and voltage multiplier circuits and study their effect on input waveforms.
4	To set up a BJT in common emitter configuration and study its input and output characteristics.

Course Pre-requisite

Topic	Course code	Course Title	Semester
Electronic components and their applications	1041	Elementary concepts of Electronics	I
Semiconductor devices and circuits	2042	Electronic devices and applications	II

Course Outcome

CO	Course Outcome	Blooms Taxonomy Level
CO1	Demonstrate the application of rectifier, filter, and RC circuit concepts through circuit construction and performance evaluation	Apply
CO2	Implement clipper circuits for input waveform shaping	Apply
CO3	Illustrate clamper circuits for DC level shifting and voltage multiplier circuits for amplitude scaling.	Apply
CO4	Use a BJT in common-emitter configuration to plot input and output characteristics.	Apply

CO-PO mapping

COURSE ARTICULATION MATRIX											
Course Outcomes	PROGRAM OUTCOMES										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	2	-	-	-	-	-	-
CO2	3	2	2	-	2	2	-	-	-	-	-
CO3	2	2	-	-	2	1	1	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	2
Total	11	9	2	-	8	3	1	-	-	-	2
Correlation Level	2.67	2.25	2	-	2	1.5	1	-	-	-	2

Legends: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

Teaching and Assessment Scheme

Teaching Scheme/Week				Self-learning (SS)/Week	Total Hours/Semester	Credits C	Examination Scheme						
							Theory			Practical			Total
L	T	P	S				CIE	ESE	Total	CIE	ESE	Total	
0	0	3	0	1.5	4.5	1.5				60	40	100	100

L: Lecture (One unit is of one-hour duration with one credit), T: Tutorial (One unit is of one-hour duration with one credit), P: Practical (One unit is of one-hour duration with 0.5 credit), S: Project (One unit is of one-hour duration with 0.5 credit) SS: Self-Learning, CIE: Continuous Internal Evaluation, ESE: End Semester Examination

Detailed Syllabus

Expt No.	Experiment name	Practical Outcome	Mapped CO	Taxonomy Level	Instructional Hours
Module I					
1	Half wave rectifiers	Construct a half-wave rectifier circuit with and without filter and record the output voltage and ripple factor in both cases	CO1	Apply	3
2	Full wave centre tap rectifiers	Construct a centre tap full wave rectifier circuit with and without filter and record the output voltage and ripple factor in both cases	CO1	Apply	3
3	Full wave bridge rectifiers	Construct a full wave bridge rectifier circuit with and without filter and record the output voltage and ripple factor in both case	CO1	Apply	3
4	RC circuits	Construct an RC differentiator and RC integrator circuits and record output waveforms.	CO1	Apply	3
Module II					
5	Series diode clipper	Construct a series diode clipper with and without bias and record the clipped output waveform.	CO2	Apply	3
6	Parallel diode clipper	Construct a parallel diode clipper with and without bias and record the clipped output waveform.	CO2	Apply	3
7	Combinational diode clipper		CO2	Apply	3
	Series Exam - I	Construct a combinational diode clipper and record the clipped output waveform.	CO2	Apply	3
Module III					
8	Positive clamper	Construct a positive clamper with and without bias and record shifted waveforms	CO3	Apply	3
9	Negative clamper	Construct a negative clamper with and without bias and record shifted waveforms.	CO3	Apply	3
10	Voltage doublers	Construct half wave and full wave voltage doublers and measure the output voltage.	CO3	Apply	3
Module IV					
11	Input characteristics of BJT	Construct the BJT in CE configuration and plot the input characteristics	CO4	Apply	3
12	Output characteristics of BJT	Construct the BJT in CE configuration and plot the output characteristics	CO4	Apply	3
	Series Exam - II		CO4	Apply	3
	Open Ended Experiment		CO4	Apply	3

Open-ended experiment

Objective:

To encourage creativity, innovation, and application of knowledge by allowing students to design and perform an experiment beyond the prescribed list, using the concepts learned during the course.

Description:

At the end of the laboratory course, each student (or group of students) shall undertake one open-ended experiment. In this activity, students are expected to conceive, design, and implement an experiment of their own choice related to the course outcomes. The aim is to apply theoretical knowledge and laboratory skills to a new or practical problem not explicitly covered in the regular experiments. Any 3 to 5 open ended problems may be chosen and divided among student groups.

Students may choose to:

Modify or extend an existing experiment to explore additional parameters or behaviors like improved ripple.

Integrate multiple concepts from the syllabus into a combined application.

Design a mini-setup or prototype to demonstrate a principle or solve a simple engineering problem, like DC power supply/charger.

Perform a comparative study or performance analysis of a circuit/system/component.

Student Activities for Self-Learning

Week	Self-Learning description	Hours
Module I		
1	Perform prior study on the working of rectifiers	1.5
2	Study the effect of filter capacitor value on the output waveform of a full wave rectifier.	1.5
3	From the observations prepare a chart comparing half wave, full wave center tap, and bridge rectifier circuits and their parameters.	1.5
4	Identify and list real life applications of an RC differentiator and an RC integrator	1.5
Module II		
5	Perform prior study on different clipper circuits	1.5
6	Compare series and parallel diode clippers based on circuit connection and output waveform	1.5
7	List real life applications of diode clipper circuits	1.5
Module III		
8	Perform a prior study on different Clamper circuits as well as voltage multipliers .	1.5
9	List practical application of a clamper circuit	1.5
10	Compare half wave and full wave voltage doubler	1.5
11	State real life applications of voltage multiplier circuits	1.5
Module IV		
12	Perform a prior study on BJT, configurations and characteristics.	1.5
13	State the importance of the common emitter configuration in electronic circuits.	1.5
14	State the regions of operation observed in the CE output characteristics.	1.5
15	List practical applications of a BJT operating in CE configuration.	1.5
Total Self-Learning hours		22.5

Learning Resources

TEXT BOOK			
Sl. No.	Title	Author	Publication
1	A Text Book of Applied Electronics	R S Sedha	Tata Mc Graw Hill
2	Basic Electronics and Linear Circuits	N N Bhargava, Kulshreshtha and S C Gupt	Tata Mc Graw Hill
3	Electronic Devices and Circuits	Robert Boylestad	Tata Mc Graw Hill

REFERENCE			
Sl. No.	Title	Author	Publication
1	Basic Electronics: A Text-lab Manual	Paul B. Zbar, Albert Paul Malvino, Michael A. Miller	McGraw-Hill Publishing Company
2	Electronics Lab Manuals	K A Navas	PHI
3	Electronics Lab Manuals	Syammohan S, Kuriachan D	Ayodya

WEB RESOURCES		
Sl. No.	URL	Modules Covered
1	https://be-iitkgp.vlabs.ac.in/	I & IV
2	http://vlabs.iitkgp.ac.in/ssds/newexp1/index.html	II

3	https://nptel.ac.in/courses/108101091	II & III
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Major Equipment/Instruments/Components required for a batch of 30 students

Sl. No.	Particulars	Specifications	Quantity
1	Digital Storage Oscilloscope	3 MHz, Dual channel	15
2	Signal/ Function Generator	3 MHz minimum	15
3	Power Supply Unit	30V, Dual	15
4	Multimeter	DMM	15

Major Software required for a batch of 30 students

Sl. No.	Particulars	Specifications	Quantity
	NIL		

Assessment Methodology - Lab

Mode	Attendance	CE	CA1	CA2	OEE	ESE
		Continuous evaluation	Practical test (first half of experiments)	Practical test (second half of experiments)	Open-ended experiment	Practical
Duration			3 hours	3 hours		3 hours
Exam mark		50	40	40	50	40
Converted to		30	15	15	10	
Marks	5	30	15		10	
Total marks	60					40
Tentative schedule	End of semester	Every lab slot	7th week	14th week	15th week	

Scheme of Evaluation - Practical (Continuous Internal Evaluation)

Sl. No.	Criteria	Description	Marks
1	Preparation & Punctuality	Attendance, timely submission of record, pre-lab preparation, understanding of experiment objectives and theory.	10
2	Experimental Setup & Procedure	Ability to identify components/equipment, correct circuit connections/setup, systematic and safe execution of the procedure.	10
3	Observation & Data Recording	Accuracy and neatness of readings, correct use of units, tabulation, and systematic recording of results.	5
4	Analysis & Result Interpretation	Proper calculations, graphical representation, result verification, discussion, and logical conclusion.	10
5	Viva Voce / Concept Understanding	Clarity of theoretical concepts, explanation of procedure, ability to answer questions related to the experiment.	10
6	Workmanship, Discipline & Teamwork	Laboratory discipline, care of instruments, teamwork, attitude, and safety practices.	5
Total			50

Scheme of Evaluation - Practical Test & End Semester Evaluation

Category	Things to evaluate	Marks
Write-up / Procedure (before experiment)	Aim, circuit diagram/flowchart, stepwise procedure.	10
Experiment Setup & Execution	Correct circuit connections / coding / setup. Handling of instruments/software. Accuracy of execution.	10
Observation & Result / Output	Proper tabulation of readings. Calculations/graphs/program output. Correctness of result / expected outcome.	8
Viva Voce	Conceptual understanding of experiment. Related theoretical knowledge.	8
Record	Completion & neatness of practical record. Proper certification by faculty.	4
Total		40

Scheme of Evaluation - Open-ended experiment

Category	Things to evaluate	Marks
Originality and Relevance of the Idea	Assesses how creative, innovative, and relevant the chosen experiment is to the course objectives.	10
Clarity of Objectives and Experimental Plan	Evaluates how clearly the student defines the aim, scope, and systematic plan of the experiment.	10
Correctness of Execution and Data Recording	Checks the accuracy, safety, and neatness in performing the experiment and recording observations.	10
Analysis, Interpretation, and Presentation of Results	Measures the student's ability to analyze data, interpret outcomes, and present results logically.	10
Teamwork and Innovation Demonstrated	Judges the level of collaboration, initiative, and creativity shown during the experiment.	10
Total		50

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