Regulation 2023

Program Structure

Diploma in Electronics and Communication Engineering

Program Outcomes (POs)

POs are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, analytical ability, attitude, and behavior that students acquire through the program.

The POs essentially indicate what the students can do from subject-wise knowledge acquired by them during the program. As such, POs define the professional profile of an engineering diploma graduate.

NBA has defined the following seven POs for an Engineering diploma graduate:

PO1: Basic and Discipline-specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and an engineering specialization to solve the engineering problems.

PO2: Problem analysis: Identify and analyze well-defined engineering problems using codified standard methods.

PO3: Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO4: Engineering Tools, Experimentation, and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO5: Engineering practices for society, sustainability and environment: Apply appropriate technology in the context of society, sustainability, environment and ethical practices.

PO6: Project Management: Use engineering management principles individually, as a team member or as a leader to manage projects and effectively communicate about well-defined engineering activities.

PO7: Life-long learning: Ability to analyze individual needs and engage in updating in the context of technological changes.

Credit Distribution

Semester	No of Courses	Periods	Credits
Semester I	8	640	20
Semester II	9	640	20
Semester III	8	640	20
Semester IV	7	640	20
Semester V	8	635	22
Semester VI	3	660	18
Total			**120**

Semester III

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1040233110	Electronic Devices and Circuits	4-0-0	60	4	Theory
2	Program Core	Theory	1040233210	Digital Electronics	4-0-0	60	4	Theory
3	Program Core	Practical	1040233320	Electronic Devices and Circuits Practical	0-0-4	60	2	Practical
4	Program Core	Practical	1040233420	Digital Electronics Practical	0-0-4	60	2	Practical
5	Program Core	Practicum	1040233540	Linear Integrated Circuits	1-0-4	75	3	Practical
6	Engineering Science	Practicum	1040233640	Electrical Circuits and Machines	1-0-2	45	2	Practical
7	Open Elective	Advanced Skill Certification	1040233760	Advanced Skills Certification-3	2-0-2	60	2	NA
8	Humanities & Social Science	Integrated Learning Experience	1040233880	Growth Lab	0-0-3	45	0	-
9	Audit Course	Integrated Learning Experience	1040233981	Induction Program–II	-	16	0	-
10	Audit Course	Integrated Learning Experience	1040233982	I&E/ Club Activity / Community Initiatives	-	16	0	-
11	Audit Course	Integrated Learning Experience	1040233985	Emerging Technology Seminars	-	8	0	-
12	Audit Course	Integrated Learning Experience	1040233983	Shop floor Immersion	-	8	0	-
13	Audit Course	Integrated Learning Experience	1040233986	Health & Wellness	0-0-2	30	1	NA
14	Audit Course	Integrated Learning Experience	1040233984	Student-Led Initiative	-	22	0	-
	Test & Revision					60		
	Library					15		
	Total					**640**	**20**	

Semester IV

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1040234110	Microcontroller	4-0-0	60	4	Theory
2	Program Core	Theory	1040234210	Data Communication and Networking	3-0-0	45	3	Theory
3	Program Core	Practicum	1040234340	Basics of Communication Engineering	1-0-4	75	3	Practical
4	Program Core	Practicum	1040234440	Measuring Instruments and sensors	1-0-4	75	3	Practical
5	Engineering Science	Practicum	1040234540	Programming in C	1-0-4	75	3	Practical
6	Program Core	Project	1040234652	Microcontroller Practical	0-0-4	60	2	Project
7	Open Elective	Advanced Skill Certification	1040234760	Advanced Skills Certification–4	2-0-2	60	2	NA
9	Audit Course	Integrated Learning Experience	1040234882	I&E/Club Activity/Community Initiatives	-	30	0	-
10	Audit Course	Integrated Learning Experience	1040234887	Special Interest groups*(Placement training)*	-	30	0	-
11	Audit Course	Integrated Learning Experience	1040234885	Emerging technology seminars	-	8	0	-
12	Audit Course	Integrated Learning Experience	1040234883	Shop Floor Immersion	-	8	0	-
13	Audit Course	Integrated Learning Experience	1040234886	Health & Wellness	-	30	0	-
14	Audit Course	Integrated Learning Experience	1040234884	Student Led Initiative	-	24	0	-
	Test & Revision					60		
	Total					**640**	**20**	

Semester V

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Practicum	1040235130	Advanced Communication Systems	2-0-2	60	3	Theory
2	Program Core	Practicum	1040235230	Mobile Communication	2-0-2	60	3	Theory
3	Program Elective	Theory	104023531X	Elective – 1	3-0-0	45	3	Theory
4	Program Core	Practicum	1040235440	Embedded Systems	2-0-4	90	4	Practical
5	Program Elective	Practicum	104023554X	Elective – 2	1-0-4	75	3	Practical
6	Open Elective	Advanced Skill Certification	1040235660	Advanced Skills Certification – 5	2-0-2	60	2	NA
7	Humanities & Social Science	Practicum	1040235752	Innovation & Startup	1-0-2	45	2	Project
8	Project/Internship	Internship	1040235873	Industrial Training [Summer Vacation - 90 Hours]	-	-	2	Project
9	Audit Course	Integrated Learning Experience	1040235981	Induction program III	-	40	0	-
10	Audit Course	Integrated Learning Experience	1040235987	Special Interest Groups (Placement Training)	-	40	0	-
11	Audit Course	Integrated Learning Experience	1040235986	Health & Wellness	-	30	0	-
12	Audit Course	Integrated Learning Experience	1040235984	Student-Led Initiative	-	30	0	-
	Test & Revision					60		
	Total					**635**	**22**	

Elective 1

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective	Theory	1030235210	E-Vehicle Technology	3-0-0	45	3	Theory
2	Program Elective	Theory	1040235312	Medical Instrumentation	3-0-0	45	3	Theory
3	Program Elective	Theory	1040235313	Digital Communication	3-0-0	45	3	Theory
4	Program Elective	Theory	1040235314	Digital Manufacturing Technology	3-0-0	45	3	Theory
5	Program Elective	Theory	1040235315	Signal & Image Processing	3-0-0	45	3	Theory
6	Program Elective	Theory	1040235316	Electronic System Design	3-0-0	45	3	Theory
7	Program Elective	Theory		Inter discipline course #	3-0-0	45	3	Theory
# Courses from other programmes with the same credit can be considered after proper approval from the Chairman, Board of Examinations.								

Elective 2

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Elective	Practicum	1040235541	Industrial automation	1-0-4	75	3	Practical
2	Program Elective	Practicum	1040235542	Robotics	1-0-4	75	3	Practical
3	Program Elective	Practicum	1040235543	Computer Hardware Servicing	1-0-4	75	3	Practical
4	Program Elective	Practicum	1040235544	PCB Design & Assembly	1-0-4	75	3	Practical
5	Program Elective	Practicum	1040235545	Industrial IoT	1-0-4	75	3	Practical
6	Program Elective	Practicum	1040235546	Multimedia Systems	1-0-4	75	3	Practical

Semester VI

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Open Elective	Theory	600023611X	Elective-3 (Pathway)	3-0-0	45	3	Theory
2	Open Elective	Practicum	104023624X	Elective-4 (Specialization)	1-0-4	75	3	Practical
3	Project / Internship	Project / Internship		Internship / Fellowship / In-house Project / Industrial Training (SW)	-	540	12	Project
	Total					**660**	**18**	
3	Project / Internship	Project / Internship	1040236351	Internship	-	540	12	Project
3	Project / Internship	Project / Internship	1040236353	Fellowship	-	540	12	Project
3	Project / Internship	Project / Internship	1040236374	In-house Project	-	540	12	Project
3	Project / Internship	Project / Internship	2040236374	Industrial Training (SW)	-	540	12	Project

Elective 3 (Pathway)

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Elective |Higher Education	Theory	6000236111	Advanced Engineering Mathematics	3-0-0	45	3	Theory
2	Elective | Entrepreneurship	Theory	6000236112	Entrepreneurship	3-0-0	45	3	Theory
3	Elective | Technocrats	Theory	6000236113	Project Management	3-0-0	45	3	Theory
4	Elective | Technocrats	Theory	6000236114	Finance Fundamentals	3-0-0	45	3	Theory
5	Elective | Technologists	Theory	1040236115	Consumer Electronics	3-0-0	45	3	Theory
6	Elective | Technologists	Theory	1040236116	ASIC Design	3-0-0	45	3	Theory
7	Elective | Open Elective	Theory		Online Elective Course $	3-0-0	45	3	Theory
$ Online Courses with the same credit available in AICTE / NPTEL and reputed Institutions with proper evaluation system and certification can be considered after proper approval from the Chairman, Board of Examinations.								

Elective 4 (Specialization)

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Elective	Practicum	1040236241	Power Electronic Devices	1-0-4	75	3	Practical
2	Elective	Practicum	1040236242	VLSI Using Verilog	1-0-4	75	3	Practical
3	Elective	Practicum	1040236243	Virtual Instrumentation [Lab view]	1-0-4	75	3	Practical
4	Elective	Practicum	1040236244	Artificial Intelligence	1-0-4	75	3	Practical
5	Elective	Practicum	1040236245	Wireless Communication	1-0-4	75	3	Practical
6	Elective	Practicum	1040236246	VR and AR	1-0-4	75	3	Practical

1040233110	Electronic Devices and Circuits	L	T	P	C
Theory		4	0	0	4

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13th -14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best one out of two will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write five questions. Four questions can be asked from each unit. Each question may have subdivisions. Maximum of two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

1040233110	Electronic Devices and Circuits	L	T	P	C
Theory		4	0	0	4

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions. Each question may have two subdivisions only.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X 20 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I. 1.
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III. 9.
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IV. 13.
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V. 17.
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1040233110	Electronic Devices and Circuits	L	T	P	C
Theory		4	0	0	4

Unit I	DIODE CIRCUITS	
Rectifiers: Definition – Operation of Half Wave, Full Wave, and Bridge Rectifiers **Clippers and Clampers:** Construction & Working Principle of Positive, Negative, and Biased Clippers - Construction & Working Principle of Positive and Negative Clampers **Opto-Electronic Devices:** Definition -Symbol, Working principle, Characteristics and Applications of LED and Photo-Diode		12

Unit II	BIPOLAR JUNCTION TRANSISTOR	
Working Principle: Construction and Working principles of NPN and PNP transistors - modes of BJT (Active, Saturation and Cut Off) **Configurations:** CE, CB, and CC and their I/O characteristics. **Transistor Biasing:** Need for Biasing- Stability Factor – Types of Biasing – Fixed Bias – Collector to Base Bias -Voltage Divider Bias		12

Unit III	AMPLIFIERS	
Single Stage Amplifiers: Transistor as an Amplifier and as a switch-Working Principle of Common Emitter Amplifier- Working Principle and Frequency Response characteristics of RC Coupled Amplifier **Power Amplifiers:** Construction, Working Principle, Operation and Characteristics of Class A, Class B, Class C, and Class B push pull Amplifier **Multistage Amplifiers**: Cascade, Cascode and Darlington pair Configuration (Basic concepts only) - Differential Amplifier: Construction and operation – CMRR (definition only).		12

Unit IV	FEEDBACK AMPLIFIERS AND OSCILLATORS	
Feedback Amplifiers: Concept –Types of feedback - Positive feedback and Negative feedback- Types of negative feedback amplifiers- Effects of Negative feedback **Theory of Oscillation:** Tank Circuit-Conditions for Oscillation (Barkhausen Criterion) - Classifications **Oscillator Circuits**: Construction, Working Principle and Operation of Hartley Oscillator, Colpitts Oscillator, Wien bridge Oscillator, RC Phase Shift Oscillator and Crystal Oscillator		12

1040233110	Electronic Devices and Circuits	L	T	P	C
Theory		4	0	0	4

Unit V	FIELD EFFECT TRANSISTORS & UNI JUNCTION TRANSISTOR	
	FET: Definition and Types - Comparison between FET and BJT- Construction and Working principle of N Channel JFET- Drain and Transfer Characteristics of JFET. **MOSFET (N Channel Enhancement and Depletion Mode):** Construction, Working Principle, Operation and Characteristics. **UJT:** Construction-Equivalent circuit -Operation-Characteristics- UJT as a Relaxation Oscillator.	12
	TOTAL HOURS	**60**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books

1. R.S.Sedha, A Textbook of Applied Electronics, 3rd edition, S.Chand Publications, 2012
2. Thomas L. Floyd, Electronic Device, 10th edition, Pearson Education, 2018
3. Boylestad&Nashlesky, Electronic Devices and Circuit Theory, 10th edition, PHI, 2009

Suggested links for Students activities

- https://www.tinkercad.com/
- https://www.multisim.com/

Web-based/Online Resources

- https://onlinecourses.nptel.ac.in/noc21_ee80/preview
- https://learn.sparkfun.com/
- https://www.allaboutcircuits.com/textbook/digital/
- http://electronicstheory.com/COURSES/ELECTRONICS/e101-1.htm
- https://www.gadgetronicx.com/electronic-circuits-library/

1040233210	Digital Electronics	L	T	P	C
Theory		4	0	0	4

Introduction

Digital Electronics is the Branch of Electronics that deals with the representation and manipulation of data in digital form. Digital systems have become an integral part of our daily lives, and there are countless examples of their applications in various fields. The main objective of this course is to introduce and provide basic idea about binary number system, digital logic gates, arithmetic operations, combinational and sequential logics and memory devices.

Course Objectives

The objective of this course is to enable the student to

- Familiarize with the different number systems and binary operations
- Build simple logic circuits using basic gates and able to simplify Boolean functions
- Know and design simple combinational logics using basic gates and to optimize Boolean logic using Karnaugh maps.
- Understand the basic sequential logic components: SR Latch, D Flip-Flop and their usage and make the students able to understand the sequential logic circuits.

Course Outcomes

On successful completion of this course, the student will be able to

CO1: Understand different number systems and their conversion from one to others, codes used in digital computers and communication systems.
CO2: Know the positive and negative logic, logic gates, logical Variables, Truth Table and construction of logic circuits using logic gates.
CO3. Learn the basic properties of Boolean algebra and minimize the Boolean Functions using Boolean laws and K–Map to construct circuits.
CO4: Understand the working mechanism of different Combinational, Sequential circuits and their role in the digital system design.
CO5: Know the technology and organization of different memory devices used in digital circuits for real world application.

Pre-requisites

Knowledge of Basic Science

1040233210	Digital Electronics	L	T	P	C
Theory		4	0	0	4

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written test (Two units)	Written test (Another Two units)	Quiz MCQ (Online / Offline)	Model Examination	Written Examination
Duration	2 Periods	2 Periods	1 Hour	3 Hours	3 Hours
Exam Marks	50	50	60	100	100
Converted to	15	15	5	20	60
Marks	15		5	20	60
Tentative Schedule	6th Week	12th Week	13th -14th Week	16th Week	

CA1 and CA2: Assessment written test should be conducted for 50 Marks for two units. The marks scored will be converted to 15 Marks. Best one out of two will be considered for the internal assessment of 15 Marks.

CA1and CA2, Assessment test should be conducted for two units as below

- PART A: (5 X 10 Marks = 50 Marks).
- Eight questions will be asked, students should write Five questions. Four questions can be asked from each unit. Each question may have subdivisions. Maximum of two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The marks scored should be converted to 5 marks for the internal assessment.

CA4: Model examination should be conducted as per the end semester question pattern. The marks should be converted to 20 marks for the internal assessment.

1040233210	Digital Electronics	L	T	P	C
Theory		4	0	0	4

Question Pattern:

- Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.
- Four questions will be asked from every unit. Students should write any two questions. Each question may have two subdivisions only.

Question Pattern - Model Examination and End Semester Examination Theory Exam

PART- A (5 X 20 Marks = 100 Marks)

Note: Answer Ten questions by selecting two questions from each unit. Each question carries 10 marks.

Sample:

I. 1.
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II. 5.
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III. 9.
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IV. 13.
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V. 17.
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1040233210	Digital Electronics	L	T	P	C
Theory		4	0	0	4

Unit I	NUMBER SYSTEM AND BOOLEAN ALGEBRA	
	Number system and Codes: Decimal, Binary, Octal and Hexa Decimal – conversion between the number systems – 1's and 2's Complement - Binary addition and subtraction - Special Codes**:** BCD, ASCII code, Gray code **Boolean Algebra:** Basic Boolean laws – Demorgan's Theorems – SOP and POS representation– Karnaugh Map: Simplification of Boolean expression using K-Map (up to 4 variables in SOP form)	12
Unit II	**LOGIC GATES & CIRCUIT REALIZATION**	
	Logic Gates: Symbol, Logical Expression, and Truth Table for AND, OR, NOT, NAND, NOR, Ex-OR and Ex-NOR gates - Universal Gates: NAND and NOR. **Logic Circuit Realization:** Realization of logic gates using Universal gates - Implementation of Boolean expression using Logic Gates.	12
Unit III	**COMBINATIONAL LOGIC CIRCUITS**	
	Arithmetic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor: Operation, Truth table, Logical expression, and diagram. **Data Processing Circuits:** Operation, Truth table, Logical expression, and diagram of Encoder (4 to 2 and 8 to 3) - Decoder (2 to 4 and 3 to 8) - Multiplexer (4 to 1) -Demultiplexer (1 to 4) - Parity generator and checker (3 bits)	12
Unit IV	**SEQUENTIAL LOGIC CIRCUITS**	
	Flip Flops – Basic Latches using NAND and NOR gates –Triggering: Types of Triggering (Definitions only) – Logic diagram, Truth table and operation of Clocked SR Flip-Flop using NAND gates –Preset and Clear (Need and Concept only) – Logic diagram, Truth table and Operation of D, JK, T Flip-Flop and Master Slave Flip-Flop – Applications of Flip-Flops **Counters:** Definition and types - Difference between Synchronous and Asynchronous Counters – Logic diagram, truth table and operation of 4-bit Asynchronous and Synchronous Counters - Decade Counter - Applications of Counter	12

1040233210	Digital Electronics	L	T	P	C
Theory		4	0	0	4

Unit V	SHIFT REGISTERS AND STORAGE DEVICES	
	Shift Registers: Definition – Logic diagram and Operation of Serial in Serial out, Parallel in Serial Out, Serial in Parallel Out and Parallel in Parallel Out – Applications of Registers **Memory**: ROM – types of ROM (PROM, EPROM, EEPROM and Flash (Simple description only) – RAM: Simple structure of SRAM and DRAMs – Comparison between RAM and ROM – comparison between SRAM and DRAM-Principles of Cache memory and associative memory (Basic Concepts only)	12
	TOTAL HOURS	**60**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

1040233210	Digital Electronics	L	T	P	C
Theory		4	0	0	4

Text Books

1. Thomas L. Floyd, Digital Fundamentals, 11th edition, Pearson Education, 2017
2. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 5th edition, Vikas Publishing House Pvt. Ltd, 2019
3. Anil K. Maini, Digital Electronics principles and integrated circuits, 1st edition, Wiley Publications, 2007

Web-based/Online Resources

- https://www.electronics-tutorials.ws/
- https://learn.sparkfun.com/
- https://www.allaboutcircuits.com/textbook/digital/
- http://electronicstheory.com/COURSES/ELECTRONICS/e101-1.htm
- https://www.gadgetronicx.com/electronic-circuits-library/
- https://www.electronics-lab.com/
- https://learn.adafruit.com/
- https://www.instructables.com/circuits/
- https://www.digitalelectronicsdeeds.com/
- https://www.electrical4u.com/digital-electronics/
- https://www.tutorialspoint.com/digital circuits/index.htm

1040233320	Electronic Devices and Circuits Practical	L	T	P	C
Practical		0	0	4	2

Introduction

Every Electronics Engineer should have knowledge about the components used in Electronics. By doing practical experiments in this course,they will be skilled in handling electronic circuits and able to apply the skill in Electronic Systems.

Course Objectives

The objective of this course is to

- Familiarize with basic Electronic Devices PN Junction Diode, Zener Diode, BJT and UJT.
- Understand the working of FET and MOSFET.
- Know the working of Clippers and Clampers.
- Acquire knowledge on RC coupled Amplifier, RC Phase Shift Oscillator.
- Understand the working of Astable Multivibrator

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Test the working of PN Junction Diode, Zener Diode.
CO2: Test the working of BJT, UJT and FET.
CO3: Test the working of Clippers and Clampers.
CO4: Check the performance of RC Coupled Amplifier, RC phase shift Oscillator.
CO5: Test the working of Astable Multivibrator.

Pre-requisites

Knowledge on Electronic Devices and Circuits

1040233320	Electronic Devices and Circuits Practical	L	T	P	C
Practical		0	0	4	2

Instructional Strategy

- Practice approach may be followed throughout the course so that students are able to understand and grasp the concepts and principles.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	First Cycle / 50 % Exercises	Second Cycle / Another 50 % Exercises	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conductedas per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test. The best one out of two will be considered for the internal assessment of 10 Marks.

1040233320	Electronic Devices and Circuits Practical	L	T	P	C
Practical		0	0	4	2

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Circuit Diagram & Tabular Column	20
C	Connection/Procedure, Observation/Reading Taken & Calculations	20
D	Result/Output	5
TOTAL MARKS		**50**

CA 3: Practical document should be maintained for every exercise immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate

The details of the documents to be prepared as per the instruction below

- The exercise should be completed on the day of practice.
- The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.
- This documentation can be carried out in a separate notebook / file. The procedure and sketch should be written by the student manually.
- The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

CA 4: All the exercises should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conductedas per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1040233320	Electronic Devices and Circuits Practical	L	T	P	C
Practical		0	0	4	2

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Circuit Diagram	25
C	Tabular Column& Model Graph	10
D	Connection/Procedure, Observation/Reading Taken & Calculations	30
E	Result/Output	20
F	Viva Voce	10
TOTAL MARKS		**100**

1040233320	**Electronic Devices and Circuits Practical**	L	T	P	C
Practical		0	0	4	2

Ex.No	Name of the Experiment	Hours
1	Test a PN Junction diode and construct a circuit using it to verify the Forward and Reverse Bias Characteristics. Find the value of its cut-in voltage.	3
2	Test a Zener Diode and construct a circuit using it to verify the Forward and Reverse Bias Characteristics. Find the value of its Reverse Breakdown Voltage.	3
3	Construct a Half Wave Rectifier and Test its input and output waveforms.	3
4	Construct a Full Wave (Bridge) Rectifier and Test its input and output waveforms.	3
5	Construct a Common Emitter Transistor Circuit and Test its input and Output Characteristic curves.	3
6	Construct a Common Base Transistor circuit and test its input and output Characteristic curves.	3
7	Construct a Common Source Field Effect Transistor circuit and test its Characteristic curves.	3
8	Construct a circuit and test the Negative Resistance Characteristics of UJT.	3
9	Construct and test the working of Positive Clipper and Negative Clipper.	3
10	Construct and test the working of positive clamper and Negative Clamper.	3
11	Using open source Software tool, find the Frequency response of RC coupled amplifier.	3
12	Test the working of Colpitts circuit using open source software tool.	3
13	Test the working of Astable Multivibrator using open source software tool.	3
14	Test the working of Hartley oscillator using open source software tool.	3
15	Test the working of RC Phase Shift Oscillator using open source Software Tool.	3
Revision		15
TOTAL HOURS		**60**

1040233320	Electronic Devices and Circuits Practical	L	T	P	C
Practical		0	0	4	2

Suggested Activity

Apart from laboratory learning, Teachers should use the following strategies to achieve the various outcomes of the course.

- Different methods of teaching and media to be used to attain attention.
- Micro-projects may be given to group of students for hand-on experiences.

Reference Books

1. S.Salivahanan, N. Suresh Kumar and A.Vallavaraj, Electronic Devices& Circuits, 3rd edition, Tata McGraw Publication,2016
2. BoylestadandNashlesky, Electronic Devices and Circuit Theory, 10th edition, PHI, 2009
3. Albert Malvinoand David J. Bates, Electronic Principles, 7th edition, Tata McGraw Hill Publication, 2017

List of Equipments

S.No	Name of the Equipments	Range	Required Nos.
1	DC Regulated power supply	0-30V,1A	10
2	Signal Generator	1MHz	4
3	Dual trace CRO	20MHz/ 30MHz	5
4	Digital Multimeter	-	10
5	DC Voltmeter (Analog/Digital)	-	10
6	DC Ammeter (Analog/Digital)	-	15
7	Open source software : Multisim	-	-

1040233420	Digital Electronics Practical	L	T	P	C
Practical		0	0	4	2

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Practical Document	Practical Test	Practical Examination
Portion	First Cycle / 50 % Exercises	Second Cycle / Another 50 % Exercises	All Exercises	All Exercises	All Exercises
Duration	2 Periods	2 Periods	Regularly	3 Hours	3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	20	60
Marks	10		10	20	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments as per the portions mentioned above should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conductedas per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test. The best one out of two will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Circuit Diagram & Tabular Column	20
C	Connection/Procedure, Observation/Reading Taken & Calculations	20
D	Result/Output	5
TOTAL MARKS		**50**

1040233420	Digital Electronics Practical	L	T	P	C
Practical		0	0	4	2

CA 3: Practical document should be maintained for every exercise immediately after completion of the practice. The same should be evaluated for 10 Marks. The total marks awarded should be converted to 10 Marks for the internal assessment. The practical document should be submitted for the Practical Test and End Semester Examination with a bonafide certificate

The details of the documents to be prepared as per the instruction below

- The exercise should be completed on the day of practice.
- The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next exercise.
- This documentation can be carried out in a separate notebook / file. The procedure and sketch should be written by the student manually.
- The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

CA 4: All the exercises should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conductedas per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Circuit Diagram	30
C	Truth Table	15
D	Connection/Procedure, Observation/Reading Taken & Calculations	20
E	Result/Output	20
F	Viva Voce	10
TOTAL MARKS		**100**

1040233420	Digital Electronics Practical	L	T	P	C
Practical		0	0	4	2

Ex.No	Name of the Experiment	Hours
1	Verification of truth table of OR, AND, NOT, NOR, NAND, EX-OR gates.	3
2	Realization of Logic Gates using NAND gates.	3
3	Verification of Demorgan's theorems.	3
4	Full adder using Logic Gates.	3
5	Full Subtractor using Logic Gates.	3
6	Construction and Verification of Truth Table for Multiplexer.	3
7	Construction and Verification of truth table for De-multiplexer.	3
8	Construction and Verification of truth table one digit digital comparator.	3
9	Construction and Verification of truth table for SR Latch using NAND gates.	3
10	Construct and test the performance of Parity Generator.	3
11	Construction and verification of Truth Table for JK and T Flip-Flops.	3
12	Construct and test the performance of a 4-bit Asynchronous up counter.	3
13	Construct and test the performance of a Decade Counter.	3
14	Construct and test Shift Register in SIPO using D flip-flops.	3
15	Construct and test Shift Register in PISO using D flip-flops.	3
Revision		15
TOTAL HOURS		**60**

1040233540	Linear Integrated Circuits	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. The best one out of two will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

1040233540	Linear Integrated Circuits	L	T	P	C
Practicum		1	0	4	3

The details of the documents to be prepared as per the instruction below

- The experiment should be completed on the day of practice.
- The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.
- This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.
- The detailed date of the practices and its evaluations should be maintained in the course logbook. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Circuit Diagram	20
C	Connections / Output	25
D	Practical document (All Practicals)	10
TOTAL MARKS		**60**

CA 3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks

1040233540	Linear Integrated Circuits	L	T	P	C
Practicum		1	0	4	3

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

Part	Description	Marks
A	Aim	5
B	Circuit Diagram	20
C	Connections / Execution	25
D	Output / Result	10
E	Written Test	30
F	Viva Voce	10
TOTAL MARKS		**100**

Note: For the written test 30 MCQ shall be asked from the theory portions.

1040233540	Linear Integrated Circuits	L	T	P	C
Practicum		1	0	4	3

Unit I	INTRODUCTION TO OPERATIONAL AMPLIFIERS	
Integrated Circuit- Classification of IC- Operational Amplifier IC 741-Schematic symbol for Op-Amp-pin diagram of IC 741-Block diagram of an Op-Amp, Characteristics of an ideal Op-Amp, CMRR, Slew Rate-Basic Linear Circuits-Inverting Amplifier, Non-Inverting Amplifier (Qualitative treatment only)		3
Ex.No	Name of the Experiment	
1	Test the performance of Inverting Amplifier with waveforms for input and output signals.	6
2	Test the performance of Non-Inverting Amplifier with waveforms for input and output signals.	

Unit II	OPAMP APPLICATIONS	
Summing amplifier-Multiplier-Divider-Voltage follower-Comparator-zero crossing detector-Integrator-Differentiator.		3
Ex.No	Name of the Experiment	
3	Test the performance of Summing amplifierusing Op-Amp IC741.	15
4	Test the performance of Voltage followerusing Op-Amp IC741.	
5	Test the performance of Zero crossing detectorusing Op-Amp IC741.	
6	Test the performance of Integratorusing Op-Amp IC741.	
7	Test the performance of Differentiatorusing Op-Amp IC741.	

Unit III	WAVEFORM GENERATORS AND PLL	
Waveform generators-Square wave, Triangular wave, Sine wave, Saw Tooth Wave Generators.Phase Locked Loops -Basic principles of PLL.		3
Ex.No	Name of the Experiment	
8	Generate Square wave using Op-Amp IC741.	6
9	Generate Triangular wave using Op-Amp IC741.	

1040233540	Linear Integrated Circuits	L	T	P	C
Practicum		1	0	4	3

Unit IV	D/A AND A/D CONVERTERS	
D/A CONVERTERS: Digital to Analog converter-Basics of D/A conversion-Weighted Resistor D/A Converter – R-2R Ladder D/A. **A/D CONVERTERS:** Analog to Digital Converter-Basics of A/D conversion-Types of A/D converter-Block diagram of Flash type ADC,Successive approximation ADC.		3
Ex.No	Name of the Experiment	
10	Design and implement the Binary Weighted Resistor DAC by using Op-Amp IC741.	6
11	Design and implement the R-2R Ladder DAC by using Op-Amp IC741.	
Unit V	**SPECIAL FUNCTION ICs**	
IC 555 Timer – Pin diagram of IC 555 -Functional Block diagram of IC555-Applications-AstableMultivibrator-Mono stable Multivibrator-Schmitt trigger. **IC voltage regulators**-Linear fixed voltage regulator-Positive voltage regulator using IC 78XX, negative voltage regulator using IC 79XX-LDO regulators.		3
Ex.No	Name of the Experiment	
12	Test the performance of Astable Multivibrator using IC 555 Timer.	12
13	Test the performance of Mono stable Multivibrator using IC 555 Timer.	
14	Test the performance of Schmitt trigger using IC 555Timer.	
15	Test the line regulation for anyone positive voltage regulator using IC 78xx and anyone negative voltage regulator using IC 79xx.	
	REVISION	15
	TOTAL HOURS	**75**

1040233540	Linear Integrated Circuits	L	T	P	C
Practicum		1	0	4	3

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class quizzes conducted on a weekly/fortnightly based on the course
- Micro project that shall be an extension of any practical lab exercise to real-world application

Text Books

1. D. Roy Choudhry and Shail Bala Jain, Linear Integrated Circuits, 6th edition, New Age International Pvt.Ltd., 2021
2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3rd edition, Tata McGrawHill, 2017
3. S. Salivahanan and V.S. Kanchana Bhaskaran, Linear Integrated Circuits, 1st edition, Tata McGraw Hill, 2018

List of Equipments required for a Batchof 30 students

Sl.No.	Equipments	Quantity
1	Dual Regulated Power supply	6
2	CRO/DSO	6
3	Function Generator	6

1040233640	Electrical Circuits and Machines	L	T	P	C
Practicum		1	0	2	2

Introduction

This course will provide an outline of Electrical Circuits and Machines that are relevant to the ECE branch.

Course Objectives

On successful completion of the course, the students must be able to

- Understand the fundamentals of DC circuits.
- Know the basic concepts of Network theorems.
- Know the basic concepts of AC circuit behavior.
- Understand resonance in series and parallel circuits.
- Know the operation of the Transformer.
- Know the operation of different Electrical machines.

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Reduce the complex circuits using Reduction Techniques.
CO2: Apply Network Theorems in DC Circuits.
CO3: Analyze AC circuits.
CO4: Analyze AC series and parallel resonance networks.
CO5: Understand the working principle and Applications of Electrical Machines.

Pre-requisites

Knowledge about basic electronic concepts and Laws

1040233640	Electrical Circuits and Machines	L	T	P	C
Practicum		1	0	2	2

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	3	-	-	3
CO2	3	2	3	3	-	-	3
CO3	3	2	3	3	-	-	3
CO4	3	2	3	3	-	-	3
CO5	3	2	3	3	-	-	3

Legend: 3-High Correlation, 2-Medium Correlation, 1-Low Correlation

Instructional Strategy

- It is advised that teachers take steps to pique pupils' attention and boost their learning confidence.
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.
- The demonstration can make the subject exciting and foster in the students a scientific mindset. Student activities should be planned on all the topics.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.
- Do not let students work on an activity or an experiment with the expected outcome, rather allow students to be honest about whatever the results of the experiment are. If the results are different from the expectations, students should do an analysis where they could be the source of error, if any.

1040233640	Electrical Circuits and Machines	L	T	P	C
Practicum		1	0	2	2

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test	Practical Test	Written Test Theory	Practical Test	Practical Examination
Portion	Cycle I Experiments/ 50% Experiments	Cycle II Experiments/ Another 50% Experiments	All Units	All Experiments	All Experiments
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	7th Week	14th Week	15th Week	16th Week	

Note:

CA1 and CA2: All the exercises/experiments should be completed as per the portions above and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded shall be converted to 10 Marks for each assessment test. The best one out of two will be considered for the internal assessment of 10 Marks.

Practical documents should be maintained for every experiment immediately after completion of the practice. The practical document should be submitted for the practical test. The same should be evaluated for 10 Marks for each exercise/experiment. The total marks awarded should be converted to 10 Marks for the practical test as per the scheme of evaluation as below.

1040233640	Electrical Circuits and Machines	L	T	P	C
Practicum		1	0	2	2

The details of the documents to be prepared as per the instruction below

- The experiment should be completed on the day of practice.
- The same shall be evaluated for 10 marks on the day or next day of practice before commencement of the next experiment.
- This documentation can be carried out in a separate notebook / printed manual / file. The Circuit Diagram, Readings, Calculations and Graph/Result should be written by the student manually.
- The detailed date of the practices and its evaluations should be maintained in the course log book. The log book and the practical documents should be submitted for the verification by the Flying Squad and DOTE Official.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Circuit Diagram	20
C	Connections / Output	25
D	Practical document (All Practicals)	10
TOTAL MARKS		**60**

CA 3: Written Test for complete theory portions should be conducted for 100 Marks as per the question pattern below. The marks scored will be converted to 15 Marks for internal assessment.

Question pattern – Written Test Theory

Description		**Marks**	
Part – A	30 MCQ Questions.	30 X 1 Mark	30 Marks
Part – B	7 Questions to be answered out of 10 Questions.	7 X 10 Marks	70 Marks

1040233640	Electrical Circuits and Machines	L	T	P	C
Practicum		1	0	2	2

CA 4: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one by lot for the test. The practical test should be conducted as per the scheme of evaluation below. After completion of all the exercises the practical test should be conducted as per End Semester Examination question pattern scheme of evaluation. The marks awarded should be converted to 15 Marks for the internal assessment.

SCHEME OF EVALUATION

Model Practical Examination and End Semester Examination - Practical Exam

Part	Description	Marks
A	Aim & Apparatus Required	5
B	Circuit Diagram	20
C	Connections / Execution	25
D	Output / Result	10
E	Written Test	30
F	Viva Voce	10
TOTAL MARKS		**100**

Note: For the written test 30 MCQ shall be asked from the theory portions.

1040233640	Electrical Circuits and Machines	L	T	P	C
Practicum		1	0	2	2

Unit I	BASIC ELECTRICAL CIRCUITS	
Ohm's law, Kirchhoff's Current Law, and Kirchhoff's Voltage Law, Equivalent Resistance of Resistors Connected in Series and Parallel- Voltage Division Rule - Current Division Rule for two Branch Parallel Resistive Network - Mesh Analysis and Node Analysis.		3
Ex.No	Name of the Experiment	
1	Construct a Resistive Network to Verify Kirchhoff's Voltage Law.	6
2	Construct a Resistive Network to Verify Kirchhoff'sCurrent Law.	
Unit II	**NETWORK THEOREMS**	
Thevenin's Theorem – Superposition Theorem – Maximum Power Transfer Theorem - Simple Problems.		3
Ex.No	Name of the Experiment	
3	Construct a Resistive Network to Verify the Superposition Theorem.	6
4	Construct a Resistive Network to Verify Thevenin's Theorem.	
Unit III	**AC CIRCUITS**	
Sinusoidal AC voltage Characteristics, AC Response of Basic Resistance, Inductance, and Capacitance - Definition for Impedance, Reactance, Admittance and Power Factor.		3
Ex.No	Name of the Experiment	
5	Analysis of the sinusoidal waveform (Measurement of Peak Voltage, Time Period, Frequency and Phase difference between two waveforms)	6
6	Analysis of the AC Response to sinusoidal inputs across R, L, and C.	
Unit IV	**RESONANCE IN RLC CIRCUITS**	
Series Resonance Circuit – Parallel Resonance Circuit – Condition for Resonance, Quality Factor (Q), Band Width, Resonance Frequency and Frequency Response Curve.		3
Ex.No	Name of the Experiment	
7	Construct and test the performance of Series Resonant Circuit and obtain the Resonance Frequency.	6
8	Construct and test the performance of parallel resonant circuit and obtain the Resonance frequency.	

1040233640	Electrical Circuits and Machines	L	T	P	C
Practicum		1	0	2	2

Unit V	ELECTRICAL MACHINES	
Working Principle of DC Generator and DC Motor – Transformer - Applications of Transformer-Specifications of Transformer, Single Phase Induction Motor.		3
Ex.No	Name of the Experiment	
9	Measure the output voltage in step up / step down Transformer.	6
10	Case study: Study the performance of Single-Phase Induction Motor	
	TOTAL HOURS	**45**

Suggested List of Student Activity

- Presentation/Seminars by students on any recent technological developments based on the course
- Periodic class quizzes conducted on a weekly/fortnightly based on the course
- Micro project that shall be an extension of any practical lab exercise to real-world application

TextBooks

1. Robert L. Boylestad, Introductory Circuit Analysis, 13th edition, Pearson Education India, 2015
2. B.L. Theraja and A.K. Theraja, A Textbook of Electrical Technology, 4th edition, S. Chand and company Ltd., 2005
3. Charles K.Alexander and Mathew N.O.Sadiku, Fundamentals of Electric Circuits, McGraw Hill, 5th edition, 2013

Web link for online simulation

- Home page Analog Signals, Network and Measurement Laboratory (iitkgp.ac.in)
- Example JS Simulator Superposition (iitkgp.ac.in)

1040233640	Electrical Circuits and Machines	L	T	P	C
Practicum		1	0	2	2

List of Equipment Required for a Batch of 30 Students

Sl.No.	Equipment	Quantity
1	Dual Regulated Power Supplies (0 – 30V)	10
2	CRO (30 MHz)	3
3	Function Generator (3 MHz)	6
4	Bread Boards	15
5	Resistors, Capacitors, Inductors - sufficient quantities	30
6	Voltmeter (0-10 V)	10
7	Ammeter (0-10 mA)	10
8	Transformer	1
9	Auto Transformer	1
10	Single-Phase Induction Motor	1