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

Introduction

This course provides fundamental knowledge on Rectifiers, Transistors, and Amplifiers, vital for Telecommunications and Consumer Electronics. It equips students with essential skills in Circuit Design, Analysis, and Troubleshooting, preparing them for real-world Engineering Challenges. Through theoretical study and hands-on experimentation, students develop a strong foundation for future careers in electronic engineering.

Course Objectives

The objective of this course is to enable the student to

- Understand the Principle and Applications of Rectifiers, and Opto-Electronic Devices in Electronic Circuits.
- Examine the Construction and Operation of Wave Shaping Circuits including Clippers, Clampers.
- Analyze the Construction, Working Principles, and Characteristics of Bipolar Junction Transistors (BJT), Field-Effect Transistors (FET), and Unipolar Junction Transistors (UJT).
- Explore the Operation and design of Amplifiers, Feedback Systems, and Oscillators using Transistor-Based Circuits.

Course Outcomes

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

CO1: Apply basic mathematics and science to analyze diode circuits.
CO2: Identify and analyze Engineering problems related to transistor circuits using standardized methods.
CO3: Analyze single stage and multistage amplifier circuits to meet specified technical requirements.
CO4: Analyze Feedback Amplifier Circuits and Oscillators to meet specified technical requirements.
CO5: Identify and analyze Engineering problems related to FET and MOSFET circuits using standardized methods.

Pre-requisites

Basics of Electrical and Electronics Engineering

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

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	3	1	3	1	1
CO2	1	2	1	2	1	1	1
CO3	3	1	3	1	1	1	1
CO4	1	1	1	2	1	1	1
CO5	3	1	3	1	3	1	1

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

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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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/

<table>
<tr><td>1040233210</td><td rowspan="2">Digital Electronics</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Theory</td><td>4</td><td>0</td><td>0</td><td>4</td></tr>
</table>

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

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	-	-	-	1
CO2	3	2	1	-	-	-	1
CO3	3	2	2	-	-	-	1
CO4	3	2	2	1	-	-	2
CO5	2	2	1	-	-	-	-

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

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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<table>
<tr><td>1040233210</td><td rowspan="2">Digital Electronics</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Theory</td><td>4</td><td>0</td><td>0</td><td>4</td></tr>
</table>

<table>
<tr><td>Unit I</td><td colspan="2">NUMBER SYSTEM AND BOOLEAN ALGEBRA</td></tr>
<tr><td colspan="2">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)</td><td>12</td></tr>
<tr><td>Unit II</td><td colspan="2">LOGIC GATES & CIRCUIT REALIZATION</td></tr>
<tr><td colspan="2">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.</td><td>12</td></tr>
<tr><td>Unit III</td><td colspan="2">COMBINATIONAL LOGIC CIRCUITS</td></tr>
<tr><td colspan="2">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)</td><td>12</td></tr>
<tr><td>Unit IV</td><td colspan="2">SEQUENTIAL LOGIC CIRCUITS</td></tr>
<tr><td colspan="2">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</td><td>12</td></tr>
</table>

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

Introduction

Digital Electronics Practical is supportive for the students to obtain the basic knowledge of digital logic levels and its application to construct digital circuits. This course will guide the students to perform the analysis and design of various digital circuits. This will improve the practical knowledge of the students to handle real time applications and working in an efficient manner.

Course Objectives

The objective of this course is to enable the student to

- Learn the basics of digital electronics, Boolean algebra, and able to design the simple logic circuits and test/verify the functionality of the logic circuits.
- Understand the working principle of various arithmetic and combinational logic circuits
- Analyze and design about different sequential logic circuits in this lab.

Course Outcomes

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

CO1: Basic knowledge on logic gate implementation and get familiar with IC.
CO2: Create digital functions using Boolean Algebraexperimentally.
CO3: Understanding different combinational circuits and design circuits.
CO4: Able to solve problem using sequential circuit and logic design.
CO5: Understand the function of simple digital circuits under real and Simulated environment.

Pre-requisites

Nil

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

CO/PO Mapping

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

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

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**

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

Equipments Required

Sl.No	Items	Quantity Required
1.	Digital Trainer Kits	10
2.	Digital ICs	--

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

Introduction

This course will provide the outline of Integrated Circuits and applications of Operational Amplifiers which are relevant for polytechnic ECE branch.

Course Objectives

The objective of this course is to

- Discuss the basic building blocks of linear integrated circuits.
- Implement the applications of Operational Amplifiers.
- Understand the waveform generators and concept of Phase Locked Loops.
- Analyze Digital to Analog converters and Analog to Digital converters.
- Learn the concept of Special function ICs

Course Outcomes

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

CO1: Calculate the gain of Operational Amplifiers
CO2: Design and implementation of Operational Amplifiers applications
CO3: Implement waveform generators using Operational Amplifiers
CO4: Analyze the Digital to Analog converters
CO5: ImplementMultivibrators using Special function ICs

Pre-requisites

Knowledge about working of basic Electronic components

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

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	3	1	1	3
CO2	3	2	2	3	1	1	3
CO3	3	2	2	3	1	1	3
CO4	3	2	2	3	1	1	3
CO5	3	2	2	3	1	1	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.

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

1040234110	Microcontroller	L	T	P	C
Theory		4	0	0	4

Introduction

The introduction of this subject will enable the students to learn about microcontroller 8051 architecture, Instruction sets, Programming and interfacing. This subject enables the students to do the project effectively. It also helps the students to choose the field of interest. If the student is aiming for higher studies, this subject is foundation.

Course Objectives

The objective of this course is to enable the student to

- To know the difference between microprocessor and microcontroller, architecture of 8051.
- To learn the Instruction set and write programs using 8051 ALP.
- To learn the programming of I/O ports, Timer, Interrupt and Serial Programming.
- To learn the interfacing techniques
- To learn the Arduino, basics, Architecture and case studies of IoT.

Course Outcomes

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

CO1: Understand the architecture of 8051
CO2: Understand and develop programs using 8051
CO3: Understand and develop applications for 8051 peripherals
CO4: Understand the interfacing techniques
CO5: Know the Arduino and basics of IoT

Pre-requisites

Knowledge of basic science and simple programming

1040234110	Microcontroller	L	T	P	C
Theory		4	0	0	4

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	2	3	-	-	2	2
CO2	2	3	3	-	-	2	2
CO3	2	2	2	-	-	2	3
CO4	2	2	3	-	-	3	3
CO5	2	2	3	-	-	2	3

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040234110	Microcontroller	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.

1040234110	Microcontroller	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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20.

1040234110	**Microcontroller**	L	T	P	C
Theory		4	0	0	4

Unit I	**ARCHITECTURE OF 8051 MICROCONTROLLER**	
	Microprocessor-Microcontroller-Comparison of Microprocessor and Microcontroller-Architecture diagram of Microcontroller 8051-Functions of each Block-Pin details of 8051-ALU-Special Function Registers-Program Counter-PSW Register-Stack I/O Ports-Timer-Interrupt-Serial Port-External memory.	12
Unit II	**8051 INSTRUCTION SET AND PROGRAMMING**	
	Instruction set of 8051-Classification of 8051 Instructions-Data Transfer Instructions-Arithmetic Instructions-Logical Instructions-Branching Instructions-Bit Manipulation Instructions - Different Addressing Modes of 8051-Time Delay routines. Assembly Language Programs - 16 Bit Addition -8 Bit Multiplication - BCD to HEX Code Conversion- Smallest number.	12
Unit III	**PERIPHERALS OF 8051**	
	I/O Ports - Bit Addresses for I/O Ports-I/O Port Programming-I/O bit Manipulation Programming. Timer/Counter - SFRS for Timer- Modes of Timers/counters-Programming 8051 Timer (Simple programs). Serial Communication - SFRs for Serial Communication-RS232 Standard-8051 Connection to RS 232-8051 Serial Port Programming Interrupts - 8051 Interrupts-SFRs for interrupt-Interrupt priority Interfacing Techniques	12
Unit IV	**INTERFACING TECHNIQUES**	
	IC 8255-Block diagram-Modes of 8255-8051 interfacing with 8255 Interfacing - Relay interfacing- Sensor interfacing -Seven Segment LED Display Interfacing - LCD Interfacing-Keyboard Interfacing-Stepper Motor interfacing-ADC Interfacing- DAC interfacing - DC motor Interfacing using PWM.	12
Unit V	**ADVANCED MICROCONTROLLERS**	
	Arduino- General Block diagram- Features-Applications IoT- Introduction to IoT-Architecture of IoT- IoT Services and Applications – IoT Ethics.	12
	TOTAL HOURS	**60**

1040234110	**Microcontroller**	L	T	P	C
Theory		4	0	0	4

Suggested List of Students Activity

- Lectures with discussions, question and answer sessions, informal quizzes, video sessions where students have an opportunity to clear concepts and doubts.
- E – Resources and E-Learning for the virtual learning environment to prepare the students ready for each and every circumstance
- Presentation / Seminars by students on any recent technological developments based on the course.

Text Books

1. AjitPal, Microcontrollers: Principles And Applications, 1stedition, PHI, 2011
2. K. Uma Rao and Andhe Pallavi, The 8051 Microcontrollers: Architecture, Programming and Applications, 2nd edition, Pearson Education India, 2011
3. Muhammad AliMazidi, Janice Gillispie Mazidi and Rolin D. Mckinley, The 8051 Microcontroller and Embedded Systems, 2nd edition, PHI, 2007

Web-based/Online Resources

- www.microchip.com
- www.raspberrypi.org
- www.arduino.org
- www.nptel.ac.in/courses/108105102

1040234210	**Data Communication and Networking**	L	T	P	C
Theory		3	0	0	3

Introduction

This course teaches the techniques essential for engineering robust networks. Topics include data communication and networking principles, Transmission Control Protocol/Internet Protocol (TCP/IP), naming and addressing (Domain Name System), data error detection and correction concepts, transport layer and application layer services. It also introduces the concept of network security.

Course Objectives

The objective of this course is to enable the student to

- Introduce the basic concepts of Data communication and networking
- Introduce the layered approach to communication architecture
- Understand various guided media and connectors used in practice
- Understand the concept of IP addressing
- Discuss various services at the application layer and network security

Course Outcomes

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

CO1: Ability to describe the basic concepts of Data communication and Networking
CO2: Ability to describe the layered approach to communication architecture
CO3: Ability to discuss various guided media and connectors used in practice
CO4: Ability to appreciate the the concept of IP addressing
CO5: Ability to discuss various services at the transport and application layer

Pre-requisites

Basics of Analog and Digital Communication

1040234210	Data Communication and Networking	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	-	2	-	2
CO2	3	1	1	-	2	-	2
CO3	3	1	1	-	2	-	2
CO4	3	2	1	-	2	-	2
CO5	3	3	1	-	2	-	2

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

Instructional Strategy

- Real life examples/demonstrations may aid in the effective learning retention of the students.
- Demonstrations using animations or any other instructional media can make the subject exciting and foster a scientific temper among the students.
- A theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome-based and employability-based.

1040234210	**Data Communication and Networking**	L	T	P	C
Theory		3	0	0	3

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.

1040234210	**Data Communication and Networking**	L	T	P	C
Theory		3	0	0	3

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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20.

1040234210	Data Communication and Networking	L	T	P	C
Theory		3	0	0	3

Unit I	**FUNDAMENTALS OF DATA COMMUNICATION**	
Data Communication: Definition of Data and Data communication, Components of Data Communication, Data Representation (Text, Image, Numbers, Audio, Video), Data Flow (Simplex, Half Duplex, Full Duplex) **Network:** Network Criteria: Performance (Throughput and Delay), Reliability, Security -Types of Network Connections (Point-to-Point and Multipoint) - Network Topologies: Star, Bus, Ring, Mesh - Network Categories (LAN, MAN, WAN) and Interconnection of networks **Network Architecture:** Layered Approach : ISO-OSI Model & TCP/IP Model – functions of each layer		8
Unit II	**PHYSICAL LAYER**	
Multiplexing: Definition of Mulitplexing - Frequency Division Multiplexing (FDM),Wavelength Division Multiplexing (WDM), Synchronous Time-Division Multiplexing (TDM) **Transmission media:** Guided Media: Twisted pair – UTP and connectors (RJ-45 Male and Female connectors), STP cables, Coaxial cable and connectors (BNC connector), Fiber-optic cables, cable sizes and connectors (SC, MT-RJ, ST, LC, FC) - Performance, and applications of UTP, Coaxial and Fiber-Optic cables - Unguided Media (Wireless Media): Radio waves, Microwaves, Infrared and their applications **Switching:** Circuit-Switched Network, Packet Switched Network (Datagram approach), Virtual Circuit network		8
Unit III	**DATA LINK LAYER**	
Framing of data: Definition, Types: Fixed Size and Variable Size framing– Flow and Error control **Flow Control:** Noiseless Channel: Definition, Stop and Wait protocol – Concepts and Flow Diagram - Noisy Channel: Definition, Stop-and-Wait ARQ protocol, Go-Back–N ARQ Protocol, Selective Repeat ARQ Protocol - Concepts and Flow Diagram only **Error Control:** Concepts of Error Detection and Error Correction – types of error detecting and error correcting codes (definition only)		8

<table>
<tr><td>1040234210</td><td rowspan="2">Data Communication and Networking</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Theory</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
</table>

<table>
<tr><td>Unit IV</td><td colspan="2">NETWORK LAYER</td></tr>
<tr><td colspan="2">Network Devices: Hub, Switch, Router, Bridge, Gateway (definition only)
Logical addressing: IP Addressing: Dot-Decimal Notation of IPv4 – Classful and Classless addressing – IPv4 datagram format - Basics of IPv6 - Need for transition from IPv4 to IPv6 – IPv6 datagram format - Subnetting (only definition and subnet masks for each IP class) – Static IP and Dynamic IP: Definition and applications
Network Layer Protocols: IGMP, ICMP, ARP, RARP (definitions and functions only)</td><td>8</td></tr>
<tr><td>Unit V</td><td colspan="2">TRANSPORT LAYER, APPLICATION LAYER AND NETWORK SECURITY</td></tr>
<tr><td colspan="2">Transport Layer: Connection-oriented and Connectionless Services - TCP Features - TCP segment format - User datagram format (UDP packet)
Application Layer: Concepts of DNS – SMTP – FTP - HTTP – WWW (World Wide Web)
Network Security: Data Encryption and Decryption</td><td>8</td></tr>
<tr><td colspan="2">REVISION</td><td>5</td></tr>
<tr><td colspan="2">TOTAL HOURS</td><td>45</td></tr>
</table>

1040234210	**Data Communication and Networking**	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

- Formative Assessment like interactive quizzes using Mentimeter etc. shall be conducted.
- Presentation/Seminars by students on any recent technological developments specific to the course.
- Group Discussions on latest trends in networking, cryptography, and hacking topics would intrigue the students to learn more.

Text Books

1. Behrouz A. Forouzan, Data Communication and Networking, 5th edition, Tata McGraw Hill, 2007
2. Andrew S. Tanenbaum, Computer Networks, 5th edition, Prentice-Hall of India, 2010
3. William Stallings, Data and Computer Communications, 8th edition, Pearson Education India, 2007

Suggested Online Resources

- https://nptel.ac.in/courses/106105082
- https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/

1040234340	**Basics of Communication Engineering**	L	T	P	C
Practicum		1	0	4	3

Introduction

The rapid growth of communication engineering demands a deep understanding of its core elements. This course equips students with the knowledge of filters, antennas, modulation, and audio/video systems, preparing them to analyze, design, troubleshoot, and adapt to the ever-evolving communication landscape.

Course Objectives

The objective of this course is to enable the student to

- Understand core concepts of electromagnetic spectrum, filters and antenna.
- Gain knowledge of modulation techniques (AM, FM, PM, pulse) used in communication systems.
- Explore principles behind audio systems such as microphone and loudspeaker.
- Develop practical skills in building, testing, and troubleshooting electronic communication circuits.

Course Outcomes

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

CO1: Understand communication systems using knowledge of Electromagnetic spectrum and filters.
CO2: Identify and solve engineering problems in amplitude modulation.
CO3: Analyze and Compare frequency and phase modulation.
CO4: Conduct standardized tests and measurements using modern Engineering tools in pulse modulation circuits.
CO5: Understand the functions of audio systems and antenna with their applications.

Pre-requisites

Knowledge about working of basic Electronic components

1040234340	**Basics of Communication Engineering**	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	1	2	1	1
CO2	2	3	2	2	2	1	1
CO3	1	2	3	1	1	1	1
CO4	2	1	1	3	1	1	1
CO5	1	1	1	1	3	1	1

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

Instructional Strategy

- Employ captivating methods to enhance students' confidence and enthusiasm for learning in communication engineering.
- Relate theoretical concepts to real-world applications in communication technology to deepen understanding.
- Conduct interactive demonstrations and experiments tailored to communication engineering principles for active engagement.
- Utilize a structured approach integrating theory, demonstrations, and hands-on activities to reinforce comprehension and practical skills.
- Foster critical thinking by encouraging students to analyze experiment outcomes and explore potential sources of error authentically.
- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome based - and employability-based.

1040234340	Basics of Communication Engineering	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.

1040234340	Basics of Communication Engineering	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

1040234340	Basics of Communication Engineering	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 & Apparatus Required	5
B	Circuit Diagram/Model based Block Diagram	20
C	Connections /Simulation	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.

<table>
<tr><td>1040234340</td><td rowspan="2">Basics of Communication Engineering</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Practicum</td><td>1</td><td>0</td><td>4</td><td>3</td></tr>
</table>

<table>
<tr><td>Unit I</td><td colspan="2">INTRODUCTION TO COMMUNICATION ENGINEERING</td></tr>
<tr><td colspan="2">Electromagnetic Frequency Spectrum: Introduction to Communication-Electromagnetic Frequency Spectrum – Relationship between Wavelength and Frequency
Filters: Definition, Types of Filters- LPF, HPF and BPF (Frequency Response Characteristics only) -applications
Introduction to Modulation: Definition- Need for Modulation - Types of modulation</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>1</td><td>Construct and Test the performance of LPF and HPF</td><td rowspan="2">6</td></tr>
<tr><td>2</td><td>Construct and Test the performance of BPF.</td></tr>
<tr><td>Unit II</td><td colspan="2">AMPLITUDE MODULATION</td></tr>
<tr><td colspan="2">Amplitude modulation (AM): Definition - Waveform representation of AM - Expression for AM and modulation index - Frequency spectrum of AM - AM sidebands: DSB, SSB and VSB
AM Transmitter and Receiver: AM Transmitter-Super Heterodyne Receiver</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>3</td><td>Construct and Test the Performance of AM Modulator.</td><td rowspan="2">6</td></tr>
<tr><td>4</td><td>Construct and Test the Performance of AM demodulation using envelope detector.</td></tr>
<tr><td>Unit III</td><td colspan="2">ANGLE MODULATION</td></tr>
<tr><td colspan="2">Frequency Modulation (FM): Concept of Angle Modulation-Waveform representation of FM - Modulation index- Modulation and Demodulation of FM: Block diagram of FM Transmitter and Receiver-Basics of Phase modulation</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>5</td><td>Construct and test the performance of FM Modulator.</td><td rowspan="2">6</td></tr>
<tr><td>6</td><td>Construct and test the performance of FM Demodulator.</td></tr>
</table>

<table>
<tr><td>1040234340</td><td rowspan="2">Basics of Communication Engineering</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Practicum</td><td>1</td><td>0</td><td>4</td><td>3</td></tr>
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<table>
<tr><td>Unit IV</td><td colspan="2">PULSE MODULATION</td></tr>
<tr><td colspan="2">Pulse Analog Modulation Techniques: Generation and detection of PAM, PWM, PPM.
Pulse Digital Modulation Techniques: PCM, DPCM and DM Transmitter and Receiver.</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>7</td><td>Construct and test the performance of Sample and Hold circuit.</td><td rowspan="2">6</td></tr>
<tr><td>8</td><td>Construct and test the performance of Pulse Width Modulator.</td></tr>
<tr><td>Unit V</td><td colspan="2">AUDIO SYSTEMS AND INTRODUCTION TO ANTENNA</td></tr>
<tr><td colspan="2">Microphones: Definition-Construction and performance of the following microphones: Carbon, Moving coil and Velocity ribbon.
Loudspeakers: Construction and working of dynamic cone type - Surround-sound systems.
Antenna: Definition-types of antenna (parabolic reflector antenna, Microstrip patch antenna)</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>9</td><td>Determine the directional characteristics of Moving Coil Microphone.</td><td rowspan="2">6</td></tr>
<tr><td>10</td><td>Determine the directional characteristics of Dynamic cone Loudspeaker.</td></tr>
<tr><td colspan="3">SIMULATION EXPERIMENTS
Note: Experiments should be designed and verified through open source simulation tools (Any five experiments)</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>1</td><td>Simulation of frequency response of LPF</td><td rowspan="5"></td></tr>
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<tr><td>4</td><td>Simulation of AM generation</td></tr>
<tr><td>5</td><td>Simulation of FM generation</td></tr>
</table>

1040234340	Basics of Communication Engineering	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
6	Simulation of PM generation.	15
7	Simulation of PAM generation.	
8	Simulation of PWM generation.	
9	Simulation of PPM generation.	
10	Simulation of Delta modulation.	
	REVISION	15
	TOTAL HOURS	**75**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course.
- Periodic class/online quizzes conducted based on the course, blended learning activities to explore the recent trends and developments in the field.

1040234340	Basics of Communication Engineering	L	T	P	C
Practicum		1	0	4	3

Text Books

1. George Kennedy, Bernard Davis and S.R.M. Prasanna, Electronic communication Systems, 5th edition, McGraw Hill Education, 2011
2. Simon Haykin, Communication Systems, 4th edition, Wiley Publications, 2006
3. Dennis Roddy and John Coolen, Electronic Communications, 4th edition, Prentice-Hall of India, 2008

Web-based/Online Resources

- https://www.scilab.org/software/xcos
- https://www.multisim.com/

List of Equipment Required for a Batch of 30 Students

Sl. No.	Equipment	Quantity
1	Regulated Power supply	6
2	CRO/DSO	6
3	Function Generator	6
5	Moving Coil Microphone	1
5	Dynamic Cone Loudspeaker	1
6	Decade Resistance Box (0-100KΩ)	5
7	Decade Inductance Box (0-10H)	5
8	Decade Capacitance Box (0-100μF)	5
9	Desk Top Computer	2
10	Bread Board and Consumables	As Required
11	Trainer Kits for above experiments (if required)	As Required

1040234440	**Measuring Instruments and Sensors**	L	T	P	C
Practicum		1	0	4	3

Introduction

A measuring instrument is a device to measure a physical quantity. In the physical sciences, quality assurance, and engineering, measurement is the activity of obtaining and comparing physical quantities of real-world objects and events. Sensors are a crucial component of instrumentation systems, providing accurate and reliable data that is used to control and optimize the process. A sensor can refer to the sensing element inside the device that measures the entire enclosure, with sensing, mounting, power, and communication elements.

Course Objectives

The objective of this course is to enable the student to

- Discuss the basic building blocks of Ammeter and Voltmeter Circuits.
- Implement the bridge circuits in Basic Applications.
- Understand the concept of CRO, DSO
- Analyze the working of multimeter and waveform generator circuits.
- Learn the concept of Sensors

Course Outcomes

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

CO1: Understand the concepts of measurement technology & basic electrical measuring instruments.
CO2: Gain knowledge on the measurement of RLC Bridges.
CO3: know the instruments of CRO and DSO in detail.
CO4: Study the working of DVM, DMM, and Signal generator.
CO5:Learn the various Sensors used to measure various physical Parameters.

Pre-requisites

Knowledge about working of basic Electronic components

1040234440	Measuring Instruments and Sensors	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	3	1	1	1
CO2	2	3	2	3	-	-	1
CO3	2	1	3	3	1	2	2
CO4	3	2	1	2	2	1	2
CO5	3	2	2	2	2	2	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040234440	Measuring Instruments and Sensors	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.

1040234440	Measuring Instruments and Sensors	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

1040234440	**Measuring Instruments and Sensors**	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 & 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.

1040234440	**Measuring Instruments and Sensors**	L	T	P	C
Practicum		1	0	4	3

Unit I	**INTRODUCTION TO MEASURING INSTRUMENTS**	
Basics of Measurement: Accuracy, Precision, Resolution, and Calibration - Principles of Operation and Construction of Permanent Magnet Moving Coil (PMMC) Instruments And Moving Iron Instruments.		3
Ex.No	Name of the Experiment	
1	Extend the Range of the Voltmeter.	9
2	Extend the Range of the Ammeter.	
3	Calibrate the given ammeter/ voltmeter.	
Unit II	**BRIDGE CIRCUITS**	
DC Bridge: Wheat Stone Bridge, AC Bridges: Maxwell's Induction Bridge, Schering Bridge.		3
Ex.No	Name of the Experiment	
4	Determine the unknown Resistance using the Wheatstone Bridge.	9
5	Determine the Self-Inductance of an unknown coil using Maxwell's Bridge.	
6	Determine the Capacitance of an unknown Capacitor using the Schering Bridge.	
Unit III	**OSCILLOSCOPE**	
Measurement of Current, Voltage, Frequency, Time Period, and Phase using CRO, Digital storage oscilloscope (DSO): Block Diagram and working principle, Measurement of current, voltage, frequency, Time Period, and Phase using DSO.		3
Ex.No	Name of the Experiment	
7	Measurement of voltage, Frequency, Time period, And Phase for any periodic waveform using CRO.	9
8	Study the Front Panel Control of 2-Channel DSO.	
9	Measurement of voltage, Frequency, Time Period, and Phase for any Periodic Waveform using DSO.	

1040234440	Measuring Instruments and Sensors	L	T	P	C
Practicum		1	0	4	3

Unit IV	**DIGITAL INSTRUMENTS AND SIGNAL GENERATORS**	
Comparison of Analog and Digital Instruments, Working Principle of Ramp Type Digital Voltmeter (DVM), Dual Slope Digital Voltmeter - Block diagram, Working Principle of a Digital Multimeter and Function Generator.		3
Ex.No	Name of the Experiment	
10	Determine the Voltage for Resistance Connected in Series and Parallel Using a Digital Voltmeter (DVM).	9
11	Generate the Sinusoidal Waveform for Different Frequencies and Amplitudes using the Function Generator, and Plot the Waveforms.	
12	Measurements of Voltage, Resistance, Continuity, and Current for a Single Loop Resistance Network using a Digital Multimeter.	
Unit V	**SENSORS AND TRANSDUCERS**	
Definition – Types of Transducers - Resistive Transducer – Strain Gauge – Capacitive Transducer – Inductive Transducer – Construction and Operation of LVDT– Thermistor - Thermocouple – Piezoelectric Transducer		3
Ex.No	Name of the Experiment	
13	Determination of Displacement using LVDT Sensor.	9
14	Measurement of Temperature using RTD/Thermistor/Thermocouple Sensors.	
15	Determination of Load/Torque/Force using Strain Gauge Sensor.	
	REVISION	15
	TOTAL HOURS	**75**

1040234440	Measuring Instruments and Sensors	L	T	P	C
Practicum		1	0	4	3

Text Books

1. Albert D.Helfrick and William D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, 1st edition, Prentice Hall of India, 2007
2. Ernest O. Doebelin, Measurement Systems: Applications and Design, 1st edition, Tata McGraw-Hill, 2019
3. A.K.Sawney and Puneet Sawney, A Course in Mechanical Measurements and Instrumentation and Control, Dhanpat Rai & Co, 12th edition, 2013

Web-based/Online Resources

- Home page:
  Analog Signals, Network and Measurement Laboratory(iitkgp.ac.in)
- Example http://vlabs.iitkgp.ac.in/asnm/exp22/index.html
- http://vlabs.iitkgp.ac.in/asnm/exp21/js-simulator/schering_bridge.html

1040234440	Measuring Instruments and Sensors	L	T	P	C
Practicum		1	0	4	3

List of Equipment Required for a Batch of 30 Students

Sl. No.	Equipment	Quantity
1	Dual Regulated Power Supplies (0 – 30V)	6
2	CRO (30 MHz)	3
3	DSO (25 MHz)	3
5	Function Generator (3 MHz)	6
5	Voltmeter (0-10)	10
6	Ammeter (0-10)	10
7	Digital Voltmeter	5
8	Digital Multimeter	5
9	LVDT Sensor	1
10	RTD/Thermistor/thermocouple Sensors.	1
11	Strain Gauge Sensor	1

1040234540	Programming in C	L	T	P	C
Practicum		1	0	4	3

Introduction

‘C’ language is the most widely used computer language. ’C’ is the general purpose high level language and is recommended for designing embedded hardware applications. Due to its flexibility, it is suitable for different development environments. Good knowledge of ‘C’ is preferable for electronics engineers in their pursuit of higher education and career.

Course Objectives

The objective of this course is to

- Familiarize with the basics of C.
- Write algorithm and flowchart for any problems.
- Know operators used in ‘C’ and Decision-making statements.
- Define and understand about arrays and functions.
- Define and understand about structure.
- Understand strings, string handling functions.
- Develop programs using C operators, decision making statements.
- Develop programs using arrays, function and structure.
- Develop programs using strings and string handling functions.

Course Outcomes

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

CO1: Understand the basics of programming and operators used in ‘C’
CO2: Solve programming problems using branching and looping statements
CO3: Develop a program using arrays and functions
CO4: Understand the concept of structure and their comparison with arrays
CO5: Understand strings and use the string handling functions

Pre-requisites

Knowledge of Digital electronics, Handling of PC and software

1040234540	Programming in C	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	1	1	-	-
CO2	3	3	2	1	1	-	-
CO3	3	3	2	1	1	-	-
CO4	3	3	2	1	1	-	-
CO5	3	3	2	1	1	-	-

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

Instructional Strategy

- Real life examples/demonstrations may aid in the effective learning retention of the students.
- Demonstrations using animations or any other instructional media can make the subject exciting and foster a scientific temper among the students.
- A theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome-based and employability-based.

1040234540	**Programming in C**	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.

1040234540	Programming in C	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	Program & Flowchart/Algorithm	30
C	Execution & Result	15
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

1040234540	**Programming in C**	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	Flowchart/ Algorithm	20
C	Program	25
D	Execution & 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.

1040234540	Programming in C	L	T	P	C
Practicum		1	0	4	3

Unit I	**BASICS OF ‘C’ LANGUAGE AND OPERATORS**	
Character set in ‘C’ – Key words and Identifiers – Data types – Variables: Declaration, Assigning values to variables – Input and Output functions [printf() and scanf()]– C Operators: Arithmetic, Logical, Assignment, Relational, Increment/Decrement, Conditional (ternary), Bitwise and Special operators		3
Unit II	**BRANCHING AND LOOPING STATEMENTS**	
Conditional Branching Statements: Simple if statement, if-else and if-else-if ladder statement – Switch Case statement **Unconditional Branching Statements:** goto, break & continue statement-Entry Controlled Loops (while loop and for loop) - Exit Controlled Loops (do-while loop)		3
Unit III	**ARRAYS AND STRINGS**	
Arrays: Definition and Need of array – syntax, declaration and initialization of One Dimensional (1D), Two Dimensional (2D) arrays **Strings:** Definition of string – syntax, declaration and initialization of string variables, String handling functions: strlen(), strcpy(),strrev(),strcat(), strcmp() – accessing strings using gets() and puts() functions		3
Unit IV	**POINTER AND STRUCTURE**	
Pointer: Definition of a pointer – Pointer variable declaration and initialization – applications of pointers **Structure:** Basic template of a structure (syntax) - Structure Variable declaration: within Structure template, after Structure template –Array within structure and Array of structure (basic concepts only) - Difference between array and structure		3
Unit V	**FUNCTIONS AND FILE MANAGEMENT USING ‘C’**	
Functions: Inbuilt functions - User Defined functions: Function Prototype, Function Definition and Function Call - Call by Value method – Call by Reference method **File management:** Opening, Reading, Writing, and closing a file using C programs		3

1040234540	Programming in C	L	T	P	C
Practicum		1	0	4	3

Ex.No	Study Experiment	Hours
1	To study the general structure of a ‘C’ program **Suggested Links:** https://www.geeksforgeeks.org/structure-of-c-program/ https://data-flair.training/blogs/basic-structure-of-c-program/	1
2	To study the execution process of a ‘C’ program **Suggested Links:** https://www.sarthaks.com/2319663/explain-program-execution-process-in-c https://www.geeksforgeeks.org/compiling-a-c-program-behind-the-scenes/	1
3	To study the basics of algorithm and flowchart **Suggested Links:** https://www.edrawsoft.com/explain-algorithm-flowchart.html https://www.tutorialspoint.com/basics_of_computer_science/basics_of_computer_science_algorithm_flowchart.htm	1
4	To study the commonly used header files in ‘C’ programming **Suggested Links:** https://www.geeksforgeeks.org/header-files-in-c-cpp-and-its-uses/ https://techvidvan.com/tutorials/header-files-in-c/	1
5	To study various ‘C’ IDE/compilers (Turbo C / gcc / Online compilers) **Suggested Links:** https://www.javatpoint.com/best-compiler-for-c-programming https://www.geeksforgeeks.org/best-ides-for-c-c-plus-plus-developers/	1

1040234540	**Programming in C**	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	Hours
1	Write and Execute a C Program to convert a given temperature in degree Celsius to Fahrenheit	45
2	Write and Execute a C program to implement Ohm’s law	
3	Write and Execute a C program to calculate the equivalent resistance of THREE resistors connected in series	
4	Write and Execute a C program to calculate the equivalent capacitance of THREE capacitors connected in series	
5	Write and Execute a C Program to find whether the given integer is even or odd	
6	Write and Execute a C Program to find whether the given number is positive or negative or zero	
7	Write and Execute a C Program to perform various arithmetic operations using switch-case statement	
8	Write and Execute a C Program to find the sum of first ten natural numbers using “while” loop	
9	Write and Execute a C Program to print a pyramid star pattern (an equilateral triangle) using “for” loop	
10	Write and Execute a C program to find the sum of elements in an 1D array	
11	Write and Execute a C program to check whether the given string is a palindrome using string handling functions	
12	Write and Execute a C Program to store a simple 2D array of four elements (2x2) and print each element using “for” loop	
13	Write and Execute a C program to calculate the resonant frequency of an RLC series circuit using sqrt() function	
14	Write and Execute a C program to prepare the total mark of each student by reading their “Name, Reg.No, Marks for four subjects” (for a class of five students) using array of structure	
15	Write and Execute a C program to find the factorial of a given number “N” using an user-defined function	
THEORY		15
STUDY EXPERIMENT		5
PRACTICAL		45
REVISION		10
TOTAL HOURS		**75**

1040234540	Programming in C	L	T	P	C
Practicum		1	0	4	3

Suggested List of Students Activity

- Apart from classroom and laboratory learning, Teachers should use the following strategies to achieve the various outcomes of the course.
- Solving programming problems from CodeChef, HackerEarth etc.
- Massive open online courses (MOOCs) may be used to gain practical knowledge on various topics/sub topics related to C programming.
- Micro-projects on topics other than the programs in the syllabus may be given to group of students for hand-on experiences.

Text Books

1. E. Balagurusamy, Programming in ANSI C, 8th edition, Tata McGraw Hill Publications, 2019
2. YashavantKanetkar, Let us C, 19th edition, BPB Publications, 2022
3. VenkateshRamasamy, ANSI C Programming Guide, 1st edition, LuLu Publishing Solutions, 2013

Web-based/Online Resources

- https://www.programiz.com/c-programming
  Compiler:https://www.programiz.com/c-programming/online-compiler/
- https://www.tutorialspoint.com/cprogramming/index.htm
- https://www.cprogramming.com
- https://www.geeksforgeeks.org/c-programming-language/
- https://www.freecodecamp.org/news/the-c-beginners-handbook/
- https://www.onlinegdb.com/online_c_compiler

List of Equipment Required for a Batch of 30 Students

Sl. No.	Equipment	Quantity
1	Desktop / Laptop Computers	15
2	Laser printer	1

Software Requirement

- OS and IDE with C-compiler

1040234652	Microcontroller Practical	L	T	P	C
Project		0	0	4	2

Introduction

The introduction of this subject will enable the students to have hands on experience in using 8051 trainer kit. The students are exposed to learn simple programs using assembly language. They can also get familiar with the c compiler programs. They also gain knowledge by using application specific interfacing boards.

Course Objectives

The objective of this course is to

- To understand the use of instruction set by writing and executing simple ALP.
- Know the connection details between microcontroller and peripherals.
- Understand the Timer/Counter and Serial Programming
- Learn the interfacing techniques
- Learn IoT basics to develop a mini project

Course Outcomes

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

CO1: Think the logic to write the given program.
CO2: Know the concepts of special function registers, different instruction sets andAddressing modes
CO3: Understand the programming of I/O ports, Timer, Interrupts and Serial Programming.
CO4: Understand the Interfacing Techniques.
CO5: Gain ability to develop to mini project using advanced microcontroller and IoT.

Pre-requisites

Knowledge of logical thinking and basic programming

1040234652	**Microcontroller Practical**	L	T	P	C
Project		0	0	4	2

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	2	3	-	-	2	2
CO2	2	2	3	-	-	2	2
CO3	2	2	2	-	-	2	3
CO4	2	2	3	-	-	3	3
CO5	2	2	3	-	-	2	3

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.

- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040234652	**Microcontroller Practical**	L	T	P	C
Project		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	Project Document	Project Examination
Portion	First Cycle / 50 % Exercises	Second Cycle / Another 50 % Exercises	All Exercises		All Exercises
Duration	2 Periods	2 Periods	Regularly		3 Hours
Exam Marks	50	50	100	100	100
Converted to	10	10	10	10	60
Marks	10	10	10	10	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 conducted as per the scheme of evaluation as below. The marks awarded will be converted to 10 Marks for each assessment test.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Program&Flowchart / Algorithm	30
C	Connection/Procedure, Observation/Reading Taken & Calculations	10
D	Result/Output	5
TOTAL MARKS		**50**

1040234652	Microcontroller Practical	L	T	P	C
Project		0	0	4	2

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.

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

Student must submit handwritten report of 10 pages containing Abstract, Introduction, Block Diagram with Description, Implementation and Result & Conclusion along with Bonafide Certificate for End Semester Examination.

PROJECT EXAMINATION - SCHEME OF EVALUATION

Part	Description	Marks
A	Model	30
B	Demonstration	40
C	Viva - Voce	30
TOTAL MARKS		**100**

1040234652	Microcontroller Practical	L	T	P	C
Project		0	0	4	2

PRACTICAL EXERCISES

PART – A

The following experiments should be written using 8051 assembly language program and should be executed in the 8051 microcontroller trainer kit

Ex.No	Name of the Experiment	Hours
1	8 / 16 bit addition	15
2	8 bit multiplication	
3	BCD to Hex code conversion	
4	Smallest number	
5	Time delay routine (Demonstrate by Blinking LEDS)	

Part B (Interfacing Application Boards)

The following experiments can be written using C compiler or 8051 assembly language and to be executed.

Ex.No	Name of the Experiment	Hours
6	Interfacing Digital I/O board	15
7	Interfacing DAC	
8	Interfacing Stepper motor	
9	Interfacing Seven segment LED display	
10	Interfacing DC motor using PWM.	
	MINI PROJECT*	30
	TOTAL HOURS	**60**

1040234652	**Microcontroller Practical**	L	T	P	C
Project		0	0	4	2

*** List of Mini Projects**

Microcontroller based Projects	**Arduino based Projects**
1. Digital Thermometer	1. Weather Station
2. Home Automation System	2. Smart Home Security System
3. Electronic Voting Machine	3. Line Following Robot
4. Wireless Weather Monitoring System	4. RFID Asset Tracking System
5. Bluetooth Controlled Robot	5. Traffic Light Controller
6. Smart Door Lock System	6. Bluetooth Controlled Car
7. Traffic Signal Controller	7. Temperature and Humidity Monitoring System
8. Heart Rate Monitor	8. Home Automation System
9. Ultrasonic Parking Sensor	9. Soil Moisture Sensor for Plant Watering
10. Gesture Recognition System	10. Obstacle Avoidance Robot
11. RFID Based Access Control System	11. Ultrasonic Distance Measurement Device
12. Automatic Plant Watering System	12. Smart Door Bell
13. GPS Tracker	13. GPS Tracker
14. Digital Clock Alarm	14. PIR Motion Sensor Alarm System
15. Breathalyzer System	15. LED Cube Display
16. Wireless Energy Meter	16. Morse Code Translator
17. Traffic Density Analyzer	17. Automated Plant Watering System
18. Obstacle Avoidance Robot	18. Heart Rate Monitoring System
19. Fire Alarm System	19. Digital Clock Temperature Display
20. Water Level Controller	20. Smart Door Lock System
21. Digital Tachometer	21. Security Surveillance System
22. Visitor Counter	22. Smart .Waste Management System
23. Biometric Attendance system	23. Automated Pet Feeder
24. Vehicle Tracking System	24. Air Quality Monitoring System
25. Smart Street Light System	25. Health Monitoring System

1040234652	Microcontroller Practical	L	T	P	C
Project		0	0	4	2

Suggested List of Students Activity

- Development of mini project by students on any recent technological developments based on the course. Blended learning activities to explore the recent trends and developments in the field.

Text Books

1. Ajit Pal, Microcontrollers: Principles And Applications, 1st edition, PHI, 2011
2. John B. Peatman, Design with PIC Microcontrollers, 2nd edition, Pearson Education, 2005
3. Samuel Greengard, Internet of Things, 2nd edition, MIT Press, 2015

Web-based/Online Resources

- www.microchip.com
- www.raspberrypi.org
- www.arduino.org
- www.nptel.ac.in/courses/108105102

1040234652	Microcontroller Practical	L	T	P	C
Project		0	0	4	2

List of Equipment Required for a Batch of 30 Students

Sl. No.	Equipment	Quantity
1	8051 Microcontroller kit	14
2	Digital I/O Interface board	2
3	Seven segment LED display interface board	2
5	8 bit DAC interface board	2
5	Stepper motor control interface board	2
6	DC motor control interface board	2
7	RS 232 Serial port cable	2
8	Laptop/ Desktop Computer	6

1040235130	**Advanced Communication Systems**	L	T	P	C
Practicum		2	0	2	3

Introduction

This course will give the outline of advanced communication systems such as optical communication, satellite communication and microwave communication. Also, the course instills practical experience and allows students to demonstrate simple experiments using advanced communication systems.

Course Objectives

The objective of this course is to

- Introduce digital modulation techniques
- Get exposed to satellite communication systems and multiple access techniques
- Get acquainted with optical communication principles and techniques
- Understand fundamentals of wave propagation and microwave communication
- Acquire the knowledge on the fundamentals of digital cellular system

Course Outcomes

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

CO1: Explain the basic digital modulation techniques such as ASK, FSK, PSK and QPSK
CO2: Recall the concepts of satellite communication systems and multiple access techniques
CO3: Compare and contrast the various optical sources and detectors
CO4: Recollect the fundamentals of wave propagation and microwave communication
CO5: Explain the concept of GSM and GPRS

Pre-requisites

Analog and digital communication

1040235130	**Advanced Communication Systems**	L	T	P	C
Practicum		2	0	2	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	1	1	1	3
CO2	3	3	2	1	1	1	3
CO3	3	3	2	1	1	1	3
CO4	3	3	2	1	1	1	3
CO5	3	3	2	1	1	1	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.

1040235130	**Advanced Communication Systems**	L	T	P	C
Practicum		2	0	2	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test Theory (Any Two Units)	Written Test Theory (Any Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Test (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. Best one will be considered for the internal assessment of 10 Marks.

CA1 and CA2, Assessment written test should be conducted for two units as below.

- Answer any Five questions. (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.

CA 3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 15 Marks for the internal mark.

1040235130	Advanced Communication Systems	L	T	P	C
Practicum		2	0	2	3

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

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

The observation and calculations 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 / printed manual / file. The reading and calculations and graph should be written by the student manually.

The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

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 - Practical Test

Part	Description	Marks
A	Aim	10
B	Circuit Diagram	20
C	Connections	20
D	Observation andOutput	10
E	Practical document (All Practicals)	30
F	Viva voce	10
TOTAL MARKS		**100**

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 15 marks for the internal assessment.

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.

1040235130	**Advanced Communication Systems**	L	T	P	C
Practicum		2	0	2	3

Unit I	**DIGITAL MODULATION TECHNIQUES**	
Digital modulation techniques – ASK, FSK, PSK, QPSK modulation and demodulation techniques (only block diagram, operation and waveforms)-Basic concept of OFDM		6
Ex.No	Name of the Experiment	
1	Test the performance of ASK modulator and demodulator & draw its input and output waveform.	3
Unit II	**SATELLITE COMMUNICATION**	
Kepler's I, II, III laws – orbits – launching orbits – types - Geostationary synchronous satellites - Advantages – Apogee – Perigee - Active and passive satellite -Satellite mobile services - Basics of DTH-Basic concept of GPS and NavIC-Multiple Access Techniques-TDMA, FDMA and CDMA		6
Ex.No	Name of the Experiment	
2	Install a DTH system and test its performance.	3
Unit III	**OPTICAL COMMUNICATION**	
Optical Sources – LED – Semiconductor LASER – Principles – Optical Detectors – PIN and APD Diodes – connectors –splices - couplers-Optical transmitter – Block diagram – Optical receiver – Block diagram – Application of optical fibers		6
Ex.No	Name of the Experiment	
3	Test the performance of a fiber optic analog link and draw its input and output waveforms.	3
Unit IV	**MICROWAVE COMMUNICATION**	
Types of propagation - Ground wave, Sky wave and Space wave propagation - Microwave frequency ranges - Simple block diagram and operation of microwave transmitter, receiver and microwave link repeater-Basic concepts of horn antenna.		6
Ex.No	Name of the Experiment	
4	Study the directional characteristics of horn antenna.	3
Unit V	**DIGITAL CELLULAR SYSTEM**	
Global system for mobile communications (GSM)–GSM services–GSM System Architecture – Basics of GPRS.		6
Ex.No	Name of the Experiment	
5	Study the working of SIM card in GSM handset and SIM card detection.	3
REVISION		15
TOTAL HOURS		**60**

1040235130	**Advanced Communication Systems**	L	T	P	C
Practicum		2	0	2	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. Dennis Roddy and John Coolen, Electronic Communications, 4th edition, Prentice-Hall of India, 2008
2. GerdKeiser, Optical Fiber Communication, 5thedition, McGraw Hill, 2017
3. Wayne Tomasi, Electronic Communication System: Fundamentals through Advanced, 5th edition, Pearson Education, 2005

Web-based/Online Resources

- https://nptel.ac.in/courses/117105131
- https://archive.nptel.ac.in/courses/108/101/108101112/
- https://ocw.mit.edu/courses/6-013-electromagnetics-and-applications-spring-2009/

1040235130	Advanced Communication Systems	L	T	P	C
Practicum		2	0	2	3

List of Equipments required for a Batch of 30 students

S. No.	Name of the Equipment	Range	Quantity
1	Dual trace CRO	100 MHz	2
2	ASK modulator and demodulator	-	1
3	DTH trainer kit	-	1
4	Fiber optic demonstration kit trainer kit	-	1
4	SIM reader trainer kit	-	1

1040235230	Mobile Communication	L	T	P	C
Practicum		2	0	2	3

Introduction

This course will explore the fundamentals of mobile radio propagation, cellular concepts and impart knowledge on capacity improvement techniques. Also, the course instills practical experience and makes the students to demonstrate simple concepts pertaining to mobile communication.

Course Objectives

The objective of this course is to

- Introduce various propagation mechanisms
- Get acquainted with cellular concepts and handoff strategies
- Get exposed to co-channel and adjacent channel interference
- Learn the various capacity improvement and equalization techniques
- Instill practical knowledge on simple concepts related to mobile communication

Course Outcomes

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

CO1: Explain various propagation mechanisms
CO2: Recall the cellular concepts and handoff strategies
CO3: Compare and contrast the co-channel and adjacent channel interference
CO4: Explain various capacity improvement and equalization techniques
CO5: Demonstrate simple concepts related to mobile communication

Pre-requisites

Analog and digital communication

1040235230	Mobile Communication	L	T	P	C
Practicum		2	0	2	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	1	1	1	3
CO2	3	3	2	1	1	1	3
CO3	3	3	2	1	1	1	3
CO4	3	3	2	1	1	1	3
CO5	3	3	2	1	1	1	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.

1040235230	**Mobile Communication**	L	T	P	C
Practicum		2	0	2	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test Theory (Any Two Units)	Written Test Theory (Any Two Units)	Practical Test (All Exercises)	Written Test (Complete Theory Portions)	Written Test (Complete Theory Portions)
Duration	2 Periods	2 Periods	3 hours	3 hours	3 hours
Exam Marks	50	50	100	100	100
Converted to	10	10	15	15	60
Marks	10		15	15	60
Tentative Schedule	6th Week	12th Week	15th Week	16th Week	

Note:

CA1 and CA2: Assessment written test should be conducted for 50 Marks. The marks scored will be converted to 10 Marks for each test. Best one will be considered for the internal assessment of 10 Marks.

CA1 and CA2, Assessment written test should be conducted for two units as below.

- Answer any Five questions. (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.

CA 3: All the exercises/experiments should be completed and kept for the practical test. The students shall be permitted to select any one experiment by lot for the test. The practical test should be conducted as per the scheme of evaluation as below. The marks awarded for 100 marks will be converted to 15 Marks for the internal mark.

1040235230	Mobile Communication	L	T	P	C
Practicum		2	0	2	3

Practical documents should be maintained for every exercise / experiment immediately after completion of the practice. The practical document should be submitted for the practical test. Each exercise/experiment should be evaluated for 10 Marks. The total marks awarded should be converted to 30 Marks for the practical test as per the scheme of evaluation as below.

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

The observation and calculations 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 / printed manual / file. The reading and calculations and graph should be written by the student manually.

The evaluated practical document should be submitted for the Practical Test (CA3). The mark scored by the students should be converted to 30 marks. The same should be included as per the allocation in the practical test.

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 - Practical Test

Part	Description	Marks
A	Aim	10
B	Circuit Diagram	20
C	Connections	20
D	Observation andOutput	10
E	Practical document (All Practicals)	30
F	Viva voce	10
TOTAL MARKS		**100**

1040235230	Mobile Communication	L	T	P	C
Practicum		2	0	2	3

CA4: Model examination should be conducted for complete theory portions as per the end semester question pattern. The marks awarded should be converted to 15 marks for the internal assessment.

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.

1040235230	**Mobile Communication**	L	T	P	C
Practicum		2	0	2	3

Unit I	**MOBILE RADIO PROPAGATION**	
1.1: PROPAGATION MECHANISMS - Introduction to radio wave propagation (scattering, reflection, diffraction), Large scale path loss, small scale fading **1.2: PROPAGATION MODELS** - Free space propagation model-Two ray model		6
Ex.No	Name of the Experiment	
1	Write a program to compute the received power by varying the transmitting power and distance using the two ray model. (Use any open source software SCILAB/OCTAVE)	3
Unit II	**CELLULAR CONCEPTS AND HANDOFF STRATEGIES**	
2.1: CELLULAR CONCEPTS- Introduction –frquency reuse, channel assignment strategies **2.2: HANDOFF STRATEGIES**- Prioritizing Handoffs-Practical Handoff Considerations		6
Ex.No	Name of the Experiment	
2	Study the effect of handover threshold margin on SINR and call drop probability using virtual laboratory	3
Unit III	**SYSTEM CAPACITY AND CAPACITY IMPROVEMENT TECHNIQUES**	
3.1: INTERFERENCE AND SYSTEM CAPACITY- Co-channel interference - Adjacent Channel Interference-Interference- System Capacity **3.2: IMPROVING COVERAGE AND CAPACITY**- Cell splitting and Cell sectoring - Repeaters for Range Extension – Micro cell Zone Concept		6
Ex.No	Name of the Experiment	
3	Study the effect of sectoring on SINR using virtual laboratory	3
Unit IV	**MULTIPATH MITIGATION TECHNIQUES**	
4.1:EQUALIZATION - Equalization – Adaptive equalization-Zero forcing and LMS algorithms **4.2:DIVERSITY** - Diversity – Micro and Macro diversity – transmitter diversity, receiver diversity		6
Ex.No	Name of the Experiment	
4	Write a program to perform zero forcing equalization. (Use any open source software SCILAB/OCTAVE)	3

1040235230	**Mobile Communication**	L	T	P	C
Practicum		2	0	2	3

Unit V	**MULTIPLE ANTENNA TECHNIQUES**	
5.1: MIMO SYSTEMS - MIMO systems – spatial multiplexing-System model-Pre-coding – Beam forming **5.2: MIMO CAPACITY** - Channel state information-capacity in fading and non-fading channels		6
Ex.No	Name of the Experiment	
5	Write a program to generate a channel matrix with M transmitters and N receivers. (Use any open source software SCILAB/OCTAVE)	3
	REVISION	15
	TOTAL HOURS	**60**

Suggested List of Students Activity

- Presentation/Seminars by students on recent technological developments based on the course
- Periodic class quizzes conducted on a weekly/fortnightly based on the course

Text Books

- Theodore S. Rappaport, Wireless Communications, Principles and Practice, 2nd edition, Pearson Education, 2010
- W.C.Y. Lee, Mobile Cellular Telecommunications, Analog and Digital Systems, 2nd Edition, McGraw Hill, 2017
- JochenSchiller, Mobile Communications, 2nd edition, Pearson Education, 2009

Web-based/Online Resources

- https://ocw.mit.edu/courses/6-450-principles-of-digital-communications-i-fall-2006/resources/lecture-20-introduction-of-wireless-communication/
- https://archive.nptel.ac.in/courses/117/102/117102062/

1040235230	Mobile Communication	L	T	P	C
Practicum		2	0	2	3

List of Equipments required for a batch of 30 students

T. No.	Name of the Equipment	Range	Quantity
1	Desktop PCs/Laptops loaded with Free open source Softwares such as SCILAB/OCTAVE and Virtual Laboratory	-	15

1030235210	**E-Vehicle Technology**	L	T	P	C
Theory		3	0	0	3

Introduction

Hybrid electric vehicles are powered by an internal combustion engine and one or more electric motors, which uses energy stored in batteries. A hybrid electric vehicle cannot be plugged in to charge the battery. Instead, the battery is charged through regenerative braking and by the internal combustion engine.

Course Objectives

The objective of this course is to enable the student to

- To understand the concept of electric vehicles.
- To study about the motors & drives for electric vehicles.
- To understand the electronics and sensors in electric vehicles
- To understand the concept of hybrid vehicles.
- To study about fuel cell for electric vehicles.

Course Outcomes

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

CO1: Describe about working principle of electric vehicles.
CO2: Explain the construction and working principle of various motors used in electric vehicles.
CO3: Understand about working principle of electronics and sensor less control in electric vehicles.
CO4: Understand about working principle of electronics and sensor less control in electric vehicles.
CO5: Illustrate the various types and working principle of fuel cells.

Pre-requisites

Knowledge of E – Vehicle Operations

1030235210	E-Vehicle Technology	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	3	-	-	1
CO2	3	2	2	3	-	-	1
CO3	3	2	2	3	-	-	1
CO4	3	2	2	3	-	-	1
CO5	3	2	2	3	-	-	1

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.

- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1030235210	**E-Vehicle Technology**	L	T	P	C
Theory		3	0	0	3

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.

1030235210	E-Vehicle Technology	L	T	P	C
Theory		3	0	0	3

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.
2.
3.
4.
II. 5.
6.
7.
8.
III. 9.
10.
11.
12.
IV. 13.
14.
15.
16.
V. 17.
18.
19.
20.

1030235210	E-Vehicle Technology	L	T	P	C
Theory		3	0	0	3

Unit I	INTRODUCTION TO ELECTRIC VEHICLES	
Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life. Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless & Solar.		9
Unit II	**ELECTRIC VEHICLE MOTORS**	
Motors (DC, Induction, BLDC) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – Series HEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS); Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling. Switched Reluctance Motors (SRM) Drives – Basic structure, Drive Convertor, Design.		9
Unit III	**ELECTRONICS AND SENSOR-LESS CONTROL IN EV**	
Basic Electronics Devices – Diodes, Thyristors, BJTs, MOSFETs, IGBTs, Convertors, Inverters. Safety – Risks and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars, Self-drive Cars, Hacking; Sensor less – Control methods- Phase Flux Linkage-Based Method, Phase Inductance- Based, Modulated Signal Injection, Mutually Induced Voltage-Based, Observer-Based.		9
Unit IV	**HYBRID VEHICLES**	
Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV. Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Propulsion systems and components. Regenerative Braking, Economy, Vibration and Noise reduction. Hybrid Electric Vehicles System – Analysis and its Types, Controls.		9
Unit V	**FUEL CELLS FOR ELECTRIC VEHICLES**	
Fuel cell – Introduction, Technologies & Types, Obstacles. Operation principles, Potential and I-V curve, Fuel and Oxidation Consumption, Fuel cell Characteristics – Efficiency, Durability, Specific power, Factors affecting, Power design of fuel Cell Vehicle and freeze capacity. Lifetime cost of Fuel cell Vehicle – System, Components, maintenance.		9
	TOTAL HOURS	**45**

1030235210	E-Vehicle Technology	L	T	P	C
Theory		3	0	0	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.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books

1. Jack Erjavec and Jeff Arias, Hybrid, Electric and Fuel Cell Vehicles, 2nd edition, Cengage Learning, 2012
2. MehrdadEhsani, YiminGao, sebastien E. Gay and Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, 3rd edition, CRC Press, 2018
3. Tom Denton and Hayley Pells, Electric and Hybrid Vehicles, 3rd edition, Routledge, 2024

Web-based/Online Resources

- NPTEL Electrical Vehicle Technology.
- https://afdc.energy.gov/vehicles/how-do-all-electric-cars-work
- https://e-amrit.niti.gov.in/types-of-electric-vehicles
- https://e-amrit.niti.gov.in/national-level-policy
- https://www.niti.gov.in/sites/default/files/2021-08/HandbookforEVChargingInfrastructureImplementation081221.pdf
- https://wattlogic.com/blog/what-is-ev-charging/

1040235312	**Medical Instrumentation**	L	T	P	C
Theory		3	0	0	3

Introduction

Every year, there is a tremendous increase in the use of Modern Electronic medical equipment in the hospital and health care industry. Therefore it is necessary for every student to understand the functioning of various medical equipments.

Course Objectives

The main objectives of the course is

- To familiarize with Human body functioning and signal conditioning of medical equipment
- To study the Diagnostic & Monitoring Instruments used in medical field
- To study the Therapeutic Instruments used in medical field
- To learn about Modern Imaging Techniques adopted in medical field
- To study telemetry ,electrical hazards and safety measures in medical field

Course Outcomes

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

CO1: Understand the parts of human body &its functioning and identify transducers and signal conditioning related to medical equipment
CO2: List the Diagnostic & Monitoring Instruments used in medical field
CO3: List the Therapeutic Instruments used in medical field
CO4: List the Modern Imaging Techniques adopted in medical field
CO5: List the various bio telemetry methods adopted in modern era in medical field. Awareness about electrical hazards while using medical instruments to patients and precautionary safety measures

Pre-requisites

- Knowledge of Human physiology
- Knowledge of telecommunication

1040235312	Medical Instrumentation	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	1	1	1	1	1
CO2	2	2	2	2	3	1	1
CO3	2	2	2	2	3	1	1
CO4	1	2	2	2	3	1	1
CO5	1	1	1	2	3	2	1

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.

- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040235312	**Medical Instrumentation**	L	T	P	C
Theory		3	0	0	3

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.

1040235312	**Medical Instrumentation**	L	T	P	C
Theory		3	0	0	3

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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1040235312	**Medical Instrumentation**	L	T	P	C
Theory		3	0	0	3

Unit I	**Introduction to Human Physiology & Biomedical Instrumentation**	
	Bio–potential and their generation(resting and action potential)- Block Diagram of Central Nervous System (CNS)- Block Diagram of the cardiovascular system - Block Diagram of the respiratory system - Block Diagram of the urinary system. **Electrodes:**Micro, Skin-Surface and Needle electrodes- Biomedical sensors and transducers – Biomedical signal conditioning and amplification.	9
Unit II	**Diagnostic & Monitoring Instruments**	
	Cardiac Monitoring: Electrocardiography (ECG) –Brain Monitoring: Electroencephalography (EEG) –Muscle Activity Monitoring: - Electromyography (EMG) –SpO2 Monitoring:Pulseoximeter- Blood Pressure monitoring: Sphygmomanometer - Basic concepts ofElectroretinography (ERG), Audiometry	9
Unit III	**Therapeutic Instruments**	
	Introduction to Electrotherapy devices – Implantable Cardioverter Devices: Pacemakers – Implantable Cardiac Defibrillators (ICD) - Therapy Devices: Dialysis machines (Haemodialysis and Peritoneal Dialysis) - Respiratory Therapy Devices: Ventilators - Heart Lung Machine (Cardio Pulmonary Bypass Machine)	9
Unit IV	**Modern Imaging Techniques**	
	Ultrasonic Imaging Techniques: Axial Echo Cardiography, applications – Xray Imaging: X-ray Machine, applications, Computerized Tomography (CT) - Positron Emission Tomography (PET) - Infrared imaging and its applications - Magnetic Resonance Imaging (MRI) technique and its applications - Laser Endoscopy imaging technique and its applications.	9
Unit V	**Biotelemetry and Patient Safety**	
	Biotelemetry: Physiological parameters adaptable to biotelemetry – Block diagram of atypical Biotelemetry System - Single Channel Telemetry technique - Multi Channel Telemetry technique - Continuous Monitoring -Chronic Disease Management-Post-discharge - Telemedicine: Definition and applications **Patient safety:** Physiological effects of electric current – Micro and Macro shock – shock hazards from electrical - Methods of Accident Prevention: Grounding - Safety aspects in electrosurgical units: Burns, High-frequency current hazards.	9
	TOTAL HOURS	**45**

1040235312	**Medical Instrumentation**	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

- Lectures with discussions, question and answer sessions, informal quizzes, video sessions where students have an opportunity to clear concepts and doubts.
- E – Resources and E-Learning for the virtual learning environment to prepare the students ready for each and every circumstance.
- Presentation / Seminars by students on any recent technological developments based on the course.

Text Books

1. R.S. Khandpur, Hand book of Biomedical Instrumentation, 3rd edition, McGraw Hill Education, 2014
2. M. Arumugam, Bio Medical Instrumentation, Anuradha Publications, 2017
3. Lesile Cromwell, Fred J. Weibell and Erich A. Pfeiffer, Bio-medicalInstrumentationandMeasurement,2nd edition, Prentice-Hall of India, 2008

1040235313	Digital Communication	L	T	P	C
Theory		3	0	0	3

Introduction

This course on Digital Communication encompasses foundational concepts and advanced techniques essential for navigating modern communication systems. From exploring the basics of digital communication and signal classification to delving into formatting, modulation, and coding techniques, each unit is designed to provide students with a comprehensive understanding of the subject. Through a structured curriculum, students will gain insights into various communication channels, modulation schemes, and spread spectrum techniques, equipping them with the knowledge and skills needed to thrive in the dynamic field of digital communication.

Course Objectives

The objective of this course is to enable the student to

- Understand digital communication fundamentals, advantages over analog, and channels like telephone, fiber optics, and satellites.
- Grasp baseband modulation principles including sampling, quantization, PCM, and M-ary pulse modulation waveforms.
- Comprehend baseband coding techniques like error control, linear block codes, and convolution codes for reliable data transmission.
- Gain knowledge of digital modulation techniques such as ASK, FSK, PSK, MSK, TDM, and OFDM for efficient signal transmission.
- Explore spread spectrum techniques including direct sequence and frequency hopping systems, with applications like WCDMA.

Course Outcomes

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

CO1: Comprehend digital communication basics, advantages over analog, and diverse channels for effective data transmission.
CO2: Apply the sampling theorem, quantization techniques, and modulation principles to design and analyze baseband communication systems.
CO3: Analyze and implement error control coding methods, including forward error correction, for reliable digital data transmission.
CO4: Demonstrate proficiency in designing and evaluating various digital modulation techniques for efficient signal transmission.
CO5: Apply spread spectrum techniques, including direct sequence and frequency hopping systems, for robust digital communication systems.

Pre-requisites

Knowledge of basic concepts of Communication Engineering

1040235313	Digital Communication	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	1	2	-	1
CO2	3	3	3	2	-	-	1
CO3	1	3	3	2	-	-	1
CO4	3	3	3	2	-	-	1
CO5	3	3	3	1	2	-	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.

- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

- Application-Based Learning: Employ atheory-demonstrate-practice-activitystrategythroughoutthecoursetoensureoutcome-drivenlearningand employability.

- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

- Encourage Critical Analysis: Foster an environment where student’s assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040235313	**Digital Communication**	L	T	P	C
Theory		3	0	0	3

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.

1040235313	**Digital Communication**	L	T	P	C
Theory		3	0	0	3

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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1040235313	**Digital Communication**	L	T	P	C
Theory		3	0	0	3

Unit I	**BASICS OF DIGITAL COMMUNICATION**	
Introduction to Digital communication- Typical Block diagram of a digital communication system - Advantages over analog communication – Channels for Digital communication- Telephone, Optical fiber, Satellite. Information capacity (Definition only) – Shannon's limit for information capacity (Definition only) - Data transmission - Serial and parallel transmission -Synchronous and asynchronous transmission		9
Unit II	**FORMATTING AND BASE BAND MODULATION**	
Base band system - The Sampling Theorem –impulse sampling- natural sampling- sample and hold operation - Spectra- Nyquist Theorem - Aliasing – signal interface for a digital system – sampling and quantizing process - Quantization noise – channel effects – channel noise – PCM - Uniform and Non-uniform Quantization, Baseband transmission - PCM waveform types- non return-to-zero(NRZ)- return-to-zero (RZ)- phase encoded – multilevel binary – spectral attributes of PCM waveforms – Bits per PCM word and Bits per symbol- PCM word size.		9
Unit III	**BASEBAND CODING TECHNIQUES**	
Rationale for coding – Types of codes – Discrete memory less channel – Error control coding methods – forward error correction – error detection with retransmission – types of errors – random error and burst error – Principles of linear block codes – Hamming code – Binary cyclic codes – Cyclic redundancy check code (CRC) – Convolution code		9
Unit IV	**DIGITAL MODULATION TECHNIQUES**	
Digital modulation techniques- Block Diagram of ASK, FSK and PSK Transmitter and Receiver - Block Diagram of QPSK Transmitter and Receiver - Minimum shift keying (MSK) - Block diagram of MSK transmitter and receiver - TDM-Frame structure. Binary differential PSK-OFDM-Block Diagram of OFDM System		9
Unit V	**SPREAD SPECTRUM TECHNIQUES**	
Definition of Spread spectrum communication- Characteristics & Advantages of spread spectrum systems – Pseudo noise sequences – Randomness properties – Balance property, Run property and Correlation property - Direct sequence spread spectrum systems – Frequency hopping systems – Frequency hopping with diversity – fast hopping versus slow hopping – Synchronization – Jamming consideration – WCDMA- Digital cellular system		9
TOTAL HOURS		**45**

1040235313	Digital Communication	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

- Presentation/Seminars bystudents on any recenttechnological 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

- Robert G. Gallager, Principles of Digital Communication, Cambridge University Press, 2008.
- B.P LathiandZhiDing,Modern Digital and Analog Communication Systems, 4th edition, Oxford Press, 2011
- Andrew J. Viterbi and Jim K. Omura, Principles of Digital Communication and Coding, Dover Publications, 2009

1040235314	**Digital Manufacturing Technology**	L	T	P	C
Theory		3	0	0	3

Introduction

This subject covers the digital manufacturing is an integrated approach to manufacturing that uses computer technologies to improve manufacturing operations. Manufacturing facilities are increasing the amount of automated tools on the ground and industries need digitized systems on the business end to monitor, analyze, and model all of the machines to optimize the process. The goals of digital manufacturing technology include efficiency, flexibility, design, and integration in the industrial environment.

Course Objectives

The objective of this course is to enable the student to

- To understand about digital manufacturing and it tools.
- To know the important of IoT in industry 4.0
- To understand the emerging trends in digital manufacturing.
- To introduce the concept of group technology, cellular manufacturing and FMS.
- To study about the smart manufacturing systems.

Course Outcomes

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

CO1: Identify appropriate tool for digital manufacturing systems.
CO2: Integrate IoT for an Industry 4.0.
CO3: Explain emerging trends in digital manufacturing.
CO4: Classify Group Technology, Cellular Manufacturing and FMS.
CO5: Describe the smart manufacturing and its various techniques.

Pre-requisites

Basics of digital Manufacturing tools, Industrial4.0 and Internet of Things

1040235314	Digital Manufacturing Technology	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	1	2	1
CO2	3	3	3	2	1	2	1
CO3	3	3	3	2	1	2	1
CO4	3	3	3	2	1	2	1
CO5	3	3	3	2	1	2	1

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.

1040235314	Digital Manufacturing Technology	L	T	P	C
Theory		3	0	0	3

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.

1040235314	Digital Manufacturing Technology	L	T	P	C
Theory		3	0	0	3

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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1040235314	**Digital Manufacturing Technology**	L	T	P	C
Theory		3	0	0	3

Unit I	**INTRODUCTION TO DIGITAL MANUFACTURING AND TOOLS**	
Digital Manufacturing : Overview of the digital manufacturing process - History of digital manufacturing and its evolution - Digital manufacturing technologies and their applications - Challenges and opportunities in digital manufacturing **Computer-Aided Design (CAD) :** Basics of CAD software and its applications, 2D and 3D modeling techniques for digital design - Design optimization using CAD tools **Computer-Aided Manufacturing (CAM) :** Basics of CAM software and its applications - CAM techniques for CNC machining, Additive manufacturing - CAM optimization techniques for process planning		9
Unit II	**INTEGRATION OF INDUSTRY 4.0 WITH IOT**	
Evolution of manufacturing: From Industry 1.0 to Industry 4.0 - Key concepts and principles of Industry 4.0 - Digital transformation in manufacturing , Cyber security, Cyber-Physical Systems (CPS) - IoT technologies, sensors, and communication protocols - Big Data and Analytics - Data acquisition - Horizontal and Vertical Integration		9
Unit III	**EMERGING TRENDS IN DIGITAL MANUFACTURING**	
Overview of cloud and edge-based solutions for smart manufacturing - Artificial Intelligence (AI) and Machine Learning (ML) in Manufacturing processes - Quality control, and predictive maintenance - Digital Twins - Virtual Reality (VR) - Augmented reality (AR)		9
Unit IV	**GROUP TECHNOLOGY, CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM**	
Group Technology(GT)– Parts Classification - Production flow Analysis – Cellular Manufacturing –Machine cell design and layout - Arranging Machines in a GT cell - Introduction to FMS – Definition - Types of FMS – FMS Components – FMS Application - Automated Guided Vehicle System (AGVS) –Types of AGVS		9
Unit V	**SMART MANUFACTURING**	
Introduction to various Smart Manufacturing Techniques - Supply chain management - Block chain of inventory management - Plant digitization -Predictive maintenance - Supply chain visibility – Warehouse - Cost reduction waste management - Automated systems - Applications		9
TOTAL HOURS		**45**

1040235314	Digital Manufacturing Technology	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

- Lectures with discussions, question and answer sessions, informal quizzes, video sessions where students have an opportunity to clear concepts and doubts.
- E – Resources and E-Learning for the virtual learning environment to prepare the students ready for each and every circumstance.
- Students enhance their knowledge in recent technological developments based on the course through presentation and seminar.

Text Books

1. Chandrakant D. Patel and Chun-Hsien Chen, Digital Manufacturing: The Industrialization of "Art to Part" 3D Additive Printing, 1st edition, Elsevier, 2022
2. Vijay RaghunathanandSantanu Deb Barma, Digital Twin: A Complete Guide for the Complete Beginner, Kindle edition, 2019
3. Lonnie Wilson, How to Implement Lean manufacturing, 2nd edition, McGraw-Hill Professional, 2015

1040235315	Signal and Image Processing	L	T	P	C
Theory		3	0	0	3

Introduction

The subject signal and image processing introduce visualization and mathematical representation of continuous time and discrete time signals and ability to analyses LTI system and give clear explanation of image compression, restoration, enhancement, segmentation. The student will have depth of knowledge about signal and image processing which will help in industries and in bio medical field.

Course Objectives

The objective of this course is to enable the student to

- Understand to describe signals mathematically and how to perform mathematical operations on signals.
- Analyze the discrete time signals and system using different transform domain techniques.
- Be able to perform the process of convolution between signals.
- Understand the basic principle of digital image fundamentals
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.

Course Outcomes

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

CO1: To understand different types of signals continuous and discrete, odd and even, periodic and aperiodic etc. Be able to classify systems based on their properties.
CO2: Recognize to familiarize the concepts of transform based continuous time analysis of signals and systems.
CO3: Review the fundamental concept of a digital image processing system.
CO4: Evaluate the techniques for image enhancement and image restoration.
CO5: Categorize various compression techniques and interpret image segmentation and representation techniques.

Pre-requisites

Knowledge of basic concepts of linear algebra, Ordinary differential equation, probability and statistics, calculus.

1040235315	**Signal and Image Processing**	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	1	2	-	2	2
CO2	3	3	1	2	-	2	2
CO3	3	3	1	3	-	2	2
CO4	2	2	1	3	-	2	2
CO5	3	3	1	3	-	2	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.

- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040235315	**Signal and Image Processing**	L	T	P	C
Theory		3	0	0	3

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.

1040235315	**Signal and Image Processing**	L	T	P	C
Theory		3	0	0	3

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.
2.
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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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<table>
<tr><td>1040235315</td><td rowspan="2">Signal and Image Processing</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Theory</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Unit I</td><td colspan="5">CLASSIFICATION OF SIGNALS AND SYSTEMS</td></tr>
<tr><td colspan="5">1.1 Signals:Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals
1.2 Systems: Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable</td><td>9</td></tr>
<tr><td>Unit II</td><td colspan="5">ANALYSIS OF CONTINUOUS TIME SIGNALS AND SYSTEMS</td></tr>
<tr><td colspan="5">2.1 Fourier Transform:Fourier series for periodic signals – Fourier Transform – properties
2.2 Laplace Transform:Laplace Transforms and properties - convolution and properties</td><td>9</td></tr>
<tr><td>Unit III</td><td colspan="5">DIGITAL IMAGE FUNDAMENTALS</td></tr>
<tr><td colspan="5">3.1 Basics of Image Processing: Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Discrete Cosine Transform
3.2 Image Sampling and Quantization: Introduction to image sampling and quantization
3.3 Color Image Fundamentals: RGB, HSI models</td><td>9</td></tr>
<tr><td>Unit IV</td><td colspan="5">IMAGE ENHANCEMENT AND IMAGE RESTORATION</td></tr>
<tr><td colspan="5">4.1 Image Enhancement: Spatial Domain: Gray level transformations-Image negative-contrast stretching - Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial filtering
4.2 Image Restoration:Image Restoration – introduction to degradation model & Noise models</td><td>9</td></tr>
<tr><td>Unit V</td><td colspan="5">IMAGE SEGMENTATION AND COMPRESSION</td></tr>
<tr><td colspan="5">5.1 Image Segmentation:Edge detection, Region based segmentation – Region growing – Region splitting and merging
5.2 Image Compression:Need for data compression, Huffman, JPEG standard, MPEG</td><td>9</td></tr>
<tr><td colspan="5">TOTAL HOURS</td><td>45</td></tr>
</table>

1040235315	**Signal and Image Processing**	L	T	P	C
Theory		3	0	0	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.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books

1. A.V. Oppenheim, A.S. willsky and S.H. Nawab, Signals and Systems, 2nd Edition, Prentice-Hall of India, 2015
2. RafelC.Gonzalez and Richard E. woods, Digital Image processing, 4thedition,PearsonInc, 2018
3. Simon Haykin and Barry Van Veen,Signals and Systems, 2nd edition, Wiley, 2007

1040235316	Electronic System Design	L	T	P	C
Theory		3	0	0	3

Introduction

This subject covers the basics design of electronic systems from the ground up will enable the students in electronic system design. It deals with the challenges any modern system designer faces: the design process and its fundamentals, such as designing power source, electronic system like amplifiers, function generators etc. Assembly of electronic automation deign and semiconductor packaging with PCB design signal integrity, power integrity and thermal analysis, power distribution and noise signaling convention requirements and environmental-friendly design principles.

Course Objectives

The objective of this course is to enable the student to

- To understand the overview of electronic system design.
- To learn the design principle of power sources.
- To interpret design of amplifiers and function generator.
- To study about electronic automation design.
- To study semiconductor package and electronic board design.

Course Outcomes

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

CO1: Explain overview of electronic system design.
CO2: Design principle of power sources.
CO3: Design of amplifiers and function generator.
CO4: Describe the function of electronic automation design
CO5: Analyse the semiconductor package and electronic board design.

Pre-requisites

Fundamental knowledge on electronic devices and circuits.

1040235316	Electronic System Design	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	1	2	1
CO2	3	3	3	2	1	2	1
CO3	3	3	3	2	1	2	1
CO4	3	3	3	2	1	2	1
CO5	3	3	3	2	1	2	1

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

1040235316	Electronic System Design	L	T	P	C
Theory		3	0	0	3

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.

1040235316	Electronic System Design	L	T	P	C
Theory		3	0	0	3

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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3.
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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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20.

1040235316	**Electronic System Design**	L	T	P	C
Theory		3	0	0	3

Unit I	**OVERVIEW ELECTRONIC SYSTEMS DESIGN**	
	Definition – Purpose and Scope – System Architecture for Electronic Product Designs – Breakdown of an electronic system design – Requirements - Electromagnetic interference in electronic systems and its impact - Concept of grounding and its significance	9
Unit II	**DESIGN OF POWER SOURCES**	
	Design of Power Sources: Introduction to low power design techniques and methodologies - Various types of power supplies - Estimation of power supply requirements and power loss in electronic products - Selection of appropriate power supplies for the given primary power sources (230VAC/Battery) - Design of power scheduler	9
Unit III	**DESIGN OF AMPLIFIERS AND FUNCTION GENERATORS**	
	Amplifiers: Emitter follower - Two stage direct coupled amplifiers - Design of audio power amplifier with drivers - Design of simple PA system - Voltage to current converter- current to voltage converter. **Function Generators:** AM signal demodulation using envelope detector - Design of FM signal using VCO (using IC NE566) - FM signal demodulation using phase discriminator.	9
Unit IV	**ELECTRONIC AUTOMATION DESIGN**	
	Circuit for Relay and motor control applications – SCADA architecture and applications – DCS architecture and applications – Block Diagram of Analog Data Acquisition System – Introduction to Transducer and types - Design of Electronic voltmeter, ammeter – and multimeter	9
Unit V	**SEMICONDUCTOR PACKAGES AND ELECTRONIC BOARD DESIGN**	
	Semiconductor Packages: Single chip packages or modules - SCM Common packages and advanced packages - Materials in packages - Current trends in Packaging - Multichip modules (MCM) – types. **Electronic Board Design:** Introduction to high speed PCB design - Signal Integrity - Power Integrity and Thermal Analysis - Power distribution and noise - Signaling convention - terminations	9
	TOTAL HOURS	**45**

1040235316	**Electronic System Design**	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

- Lectures with discussions, question and answer sessions, informal quizzes, video sessions where students have an opportunity to clear concepts and doubts.
- E – Resources and E-Learning for the virtual learning environment to prepare the students ready for each and every circumstance.
- Students enhance their knowledge in recent technological developments based on the course through presentation and seminar.

Text Books

1. John F. Wakerly,Digital Design: Principles and Practices, 5th edition, Pearson Publications, 2018
2. Charles Kitchin and Lew Counts, A Designer's Guide to Instrumentation Amplifiers,3rd edition, Analog Devices, 2006
3. Eamon Nash, Errors and Error Budget Analysis in Instrumentation Amplifier Applications, 3rd edition, Analog Devices, 2006

1040235440	Embedded Systems	L	T	P	C
Practicum		2	0	4	4

Introduction

This course attempts to make the students familiar with modern embedded system involved by understanding operating system and designing real-time embedded systems. The course begins with an introduction to ARM processor Instruction sets. Raspberry Pi, and python programming environment also discussed. At the end of the course, the learner will be able to develop real time applications.

Course Objectives

The objective of this course is to enable the student to

- Understand ARM7 processor and its instruction set.
- Understand the use of instruction set by writing simple ARM ALP and simulate to see output.
- Familiarize with the register map of on chip Timer / counter.
- Know the use of serial communication concepts using on chip UART0
- This course aims to provide students with a solid theoretical basis as well as comprehensive professional understanding of Raspberry Pi.

Course Outcomes

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

CO1: Relate the concepts of embedded systems with ARM processor
CO2: Develop assembly language and high level language programming skills to ARM based Embedded systems
CO3: Learn the architecture of LPC2148, On chip Peripherals and different ways of communication with I/O devices and standard I/O interfaces.
CO4: Design Raspberry Pi hardware and implement program.
CO5: Interpret features of Real Time Operating Systems.

Pre-requisites

Knowledge of Microprocessors and Microcontrollers

1040235440	Embedded Systems	L	T	P	C
Practicum		2	0	4	4

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	-	-	-	2
CO2	3	2	3	1	-	-	2
CO3	3	1	3	1	-	-	2
CO4	3	1	2	1	-	-	2
CO5	3	1	2	1	-	-	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to 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.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

- Throughout the course, a theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome- and employability-based.

1040235440	Embedded Systems	L	T	P	C
Practicum		2	0	4	4

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.

1040235440	Embedded Systems	L	T	P	C
Practicum		2	0	4	4

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	Program	25
C	Procedure	20
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

1040235440	Embedded Systems	L	T	P	C
Practicum		2	0	4	4

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	Program	25
C	Procedure	20
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.

1040235440	**Embedded Systems**	L	T	P	C
Practicum		2	0	4	4

Unit I	**INTRODUCTION TO EMBEDDED SYSTEMS**	
Definition of Embedded System – Features of Embedded System – Types of Embedded System – List of Embedded System Devices - Harvard and Von-Neumann architectures-RISC and CISC Processors. **ARM Processor Architecture Fundamentals**: Block diagram of ARM based embedded system with hardware components - Data Flow Model.		6
Ex.No	Name of the Experiment	
1	Study of ARM Processor Kit	3
Unit II	**ARM INSTRUCTION SET**	
Instruction Set ARM state instruction set - Data processing instructions -Branch instructions Load-store instructions - Software interrupt instruction. Simple programs: Addition, Subtraction and Multiplication using ARM processor assembly language.		6
Ex.No	Name of the Experiment	
2	Write assembly language program for addition, subtraction and simulate.	12
3	Write assembly language program for multiplication and simulate.	
4	Write assembly language program to find smallest of N numbers and simulate	
5	Write assembly language program to find largest of N numbers and simulate	
Unit III	**ARM CORE BASED MICROCONTROLLER**	
Architecture of LPC 2148, Memory Addressing, IO ports, Basics of Timers/counter, ADC, UART, Interrupts, and Embedded C programming (introduction only)		6
Ex.No	Name of the Experiment	
6	Write and execute C program to blink the LEDs using on chip TIMER/COUNTER for the delay (Using Polling method).	6
7	Write and execute C program to blink the LEDs using on chip TIMER/COUNTER for the delay (Using Interrupt method).	

1040235440	**Embedded Systems**	L	T	P	C
Practicum		2	0	4	4

Ex.No	Name of the Experiment	
8	(a) Write and execute C program for serial transmission and reception using on chip UART. Send the received character back to the PC by using polling method	6
9	(b) Write and execute C program for serial transmission and reception using on chip UART. Send the received character back to the PC by using interrupt method	
10	Write and execute C program to display a number in seven segment LED.	6
11	Write and execute C program to blink the LEDs using software delay routine.	
12	Write and execute C program for accessing an internal ADC and display the binary output in LEDs.	3
Unit IV	**EMBEDDED OS AND RTOS**	
Introduction to OS – Functions of OS – Embedded OS Foreground/background systems – Real time system concepts- Resources – Multitasking – Scheduler – Round Robin – Non Pre-emptive and Pre-emptive scheduling-task priorities- Event flag-Mutual exclusion		6
Unit V	**RASPBERRY PI**	
Introduction to the Raspberry Pi, basic functionality of the Raspberry Pi board and its processor, setting and configuring the board, programming on Raspberry Pi, python programming environment, General Purpose IO pins, Protocol pins, GPIO library, communicating with devices and sensors.		6
Ex.No	Name of the Experiment	
13	Design of Raspberry Pi Pico Based Traffic Light Control System	9
14	Design of Raspberry Pi Pico Based Temperature Monitoring System	
15	Design of Raspberry Pi Pico Based motor speed control systems	
REVISION		15
TOTAL HOURS		**90**

1040235440	Embedded Systems	L	T	P	C
Practicum		2	0	4	4

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. Lyla B. Das, Embedded systems: An Integrated Approach, 1st edition, Pearson Education, 2013
2. Steve Furbe, ARM System on chip Architecture, 2ndedition,Pearson Education, 2015
3. Eben Upton and Gareth Half acree, Raspberry Pi User Guide, 4th edition, John Wiley & Sons, 2016

Web-based/Online Resources

- https://nptel.ac.in/courses/108102045
- https://onlinecourses.nptel.ac.in/noc20_cs14/preview
- www.keil.com
- https://thonny.org/

List of Equipments required for a batch of 30 students

SI.No.	Equipments	Quantity
1	ARM7 TDMI KIT (The chip set may be TMS4701,LPC2138,LPC2148 with interface boards for the above experiments)	10
2	Desktop computer / Laptop	15
3	Raspberry Pi Pico kit with interface for the above experiments	3

1040235541	**Industrial Automation**	L	T	P	C
Practicum		1	0	4	3

Introduction

Industrial automation is a set of technologies that uses control systems and devices, such as computer software and robotics, to enable automatic operation of industrial processes and machinery without the need for human operators.

Course Objectives

The objective of this course is to enable the student to

- Understand the basic working principle of Industrial Automation.
- Learn the different control and regulating elements used in industrial automation.
- Study the circuit design for hydraulic and pneumatic circuits.
- Programme the Programmable logic controller and understand the Distributed Control System
- Know the data communication and supervisory control system .

Course Outcomes

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

CO1: Understand basics of industrial automation and control motor using electronic drives.
CO2: Realize the functions of air/ fluid regulation and control elements.
CO3: Acquire the practice on assembling the various types of pneumatic / Hydraulic circuits
CO4: learn about the fundamentals of Programmable Logic Controller & DCS
CO5: familiarize the Data Communication and Supervisory Control Systems.

Pre-requisites

Knowledge of basic digital circuits, electronic circuits and communication protocols.

1040235541	Industrial Automation	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	3	1	1	1
CO2	2	3	2	3	-	-	1
CO3	2	1	3	3	1	2	2
CO4	3	2	1	2	2	1	2
CO5	3	2	2	2	2	2	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040235541	Industrial Automation	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.

1040235541	Industrial Automation	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

1040235541	Industrial Automation	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 & 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.

<table>
<tr><td>1040235541</td><td rowspan="2">Industrial Automation</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Practicum</td><td>1</td><td>0</td><td>4</td><td>3</td></tr>
</table>

<table>
<tr><td>Unit I</td><td colspan="2">INTRODUCTION</td></tr>
<tr><td colspan="2">Automation overview, Types of Industrial automation systems, Architecture of Industrial Automation system. Introduction of DC and AC servo drives for motion control. Power electronics devices - DIAC, TRIAC, SCR, power MOSFET and IGBT</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>1</td><td>Conduct experiment to control the speed of DC motor using SCR.</td><td>3</td></tr>
<tr><td>2</td><td>Construct step down DC to DC converter using IGBT/MOSFET</td><td>3</td></tr>
<tr><td>3</td><td>Conduct experiment to control the speed of Servo drive.</td><td>3</td></tr>
<tr><td>Unit II</td><td colspan="2">CONTROL AND REGULATING ELEMENTS</td></tr>
<tr><td colspan="2">Control and Regulating Elements — Direction, Flow and Pressure Control Valves -Methods of Actuation, Types, Sizing of Ports. Spool Valves - Operating Characteristics -Electro Hydraulic Servo Valves - Types - Characteristics and Performance.</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>4</td><td>Experimental Verification of Speed Control Circuits in Pneumatic Trainer.</td><td>3</td></tr>
<tr><td>5</td><td>Experimental Verification of Speed Control Circuits in Hydraulic Trainer</td><td>3</td></tr>
<tr><td>6</td><td>Experimental Verification of Single and Double Acting Cylinder Circuits using Different Directional Control Values.</td><td>3</td></tr>
<tr><td>7</td><td>Operation of the pneumatic cylinder using AND logic control.</td><td>3</td></tr>
<tr><td>Unit III</td><td colspan="2">CIRCUIT DESIGN FOR HYDRAULIC AND PNEUMATICS</td></tr>
<tr><td colspan="2">Typical Design Methods – Sequencing Circuits Design - Combinational Logic Circuit Design -Cascade Method – KV Mapping - Electrical Control of Pneumatic and Hydraulic Circuits - Use of Relays, Timers, Counters and PLC in pneumatics and hydraulics</td><td>3</td></tr>
</table>

1040235541	**Industrial Automation**	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
8	Experimental Verification of Pneumatic Sequencing Circuits.	3
9	Experimental Verification of Logic, Metre-in and Metre-out Pneumatic Circuits.	3
10	Experimental Verification of Logic, Metre-in and Metre-out Hydraulic Circuits	3
Unit IV	**PROGRAMMABLE LOGIC CONTROLLERS & DISTRIBUTED CONTROL SYSTEM**	
Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries. Overview of DCS, DCS software configuration, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.		3
Ex.No	Name of the Experiment	
11	Design a Ladder Logic Program for various Logic Gates AND, OR, NOT, NOR, NAND, EXOR and EX-NOR.	3
12	Develop Ladder Diagram Programming to set Timer and Counter in PLC.	3
13	Develop Ladder Diagram Programming for DOL starter.	3
Unit V	**DATA COMMUNICATION AND SUPERVISORY CONTROL SYSTEMS**	
Industrial Data Communications - Modbus – HART – DeviceNet – Profibus – Fieldbus – RS232-RS485- Modbus/ Modbus TCP/IP – mechatrolink – CAN – EtherCAT - Introduction to Supervisory Control Systems – SCADA		3
Ex.No	Name of the Experiment	
14	Measure the parameters of PLC interfacing with human machine interface.	3
15	Implement the menu bar control using graphical interface.	3
REVISION		15
	TOTAL HOURS	**75**

1040235541	Industrial Automation	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
- Mini project that shall be an extension of any practical lab exercise to real-world application

Text Books

1. F.D. Petruzella, Programmable Logic Controllers, 3rdedition,TataMc-Graw Hill, 2010
2. Sawney A.K. and Puneet Sawney, A Course in Mechanical Measurements and Instrumentation and Control, 12thedition,DhanpatRai& Co, 2013
3. Antony Esposito, Fluid Power with Applications, 6th edition, Prentice-Hall, 2008

1040235542	**Robotics**	L	T	P	C
Practicum		1	0	4	3

Introduction

Robotics is a branch of engineering that involves the design, construction, operation and use of robots. The goal of robotics is to create intelligent machines that can help and assist humans in a variety of ways.Robotics addresses all the STEM fields and teaches students various skills that students need to know to be competitive in the workforce.

Course Objectives

The objective of this course is to

- Expose students to the current developments and applications in the field of robotics.
- Give students hands-on practice in building and programming an actual robot.
- Provide a challenging, highly engaging and personally satisfying learning experience.
- Learn about various sensors, actuators, robot programming.

Course Outcomes

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

CO1: Expose their knowledge of robot controllers.
CO2: Learn about the movement of robotic joints and grippers.
CO3: Understand about various types of sensory devices their working and Applications.
CO4: Demonstrate knowledge of industrial robots, characteristics, end Effectors and actuators
CO5: Understand the various power systems used in Robotics.

Pre-requisites

Basic Knowledge of Physics and C programming.

1040235542	**Robotics**	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

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

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.

1040235542	**Robotics**	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.

1040235542	**Robotics**	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	Schematic diagram& Program	30
C	Connections / Output	15
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

1040235542	**Robotics**	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	Schematic diagram& Program	30
C	Connections / Execution	15
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.

1040235542	**Robotics**	L	T	P	C
Practicum		1	0	4	3

Unit I	**ROBOTIC TERMINOLOGIES**	
Introduction to robots: Definition, need and applications of Robot – Difference between Human and the robot – Basic Terminologies (axis, Cartesian coordinates, rotate, translate, degree of freedom, home position, link and joints) – Specifications for a robot - Components of a robot system.		3
Ex.No	Name of the Experiment	
1	Switch and LEDs	9
2	Forward and backward motion control	
3	Left and right motion	
Unit II	**ROBOT HANDS**	
End effectors: need for end effector – Types of end effector – Robot gripper – mechanical and magnetic grippers - various gripping techniques – Manipulator – function of a manipulator – Robot controller – structure of a robot controller		3
Ex.No	Name of the Experiment	
4	Circular motion control	9
5	Buzzer interfacing	
6	Relayinterfacing	
Unit III	**ROBOT VISION**	
Sensors – List of sensors used in robot – Working principle of Touch sensor, Proximity Sensors, Range and tactile sensors, Vision sensor and Displacement sensor.		3
Ex.No	Name of the Experiment	
7	Velocity Control	9
8	Position Control	
9	Serial Communication (UART)	

1040235542	**Robotics**	L	T	P	C
Practicum		1	0	4	3

Unit IV	**ROBOT BRAIN**	
Robot controller – Definition - functions of a controller – structure of a robot controller- Control system - open loop and closed loop control system – feedback control system- applications of control system		3
Ex.No	Name of the Experiment	
10	ADC sensor interfacing	9
11	Servo motor interfacing	
12	Stepper motor interfacing	
Unit V	**ROBOTIC POWER SYSTEM**	
Power systems for robot – Hydraulic, pneumatic, and electric power systems (DC motor, AC motor, servo motor and stepper motor) – diagram and working principle		3
Ex.No	Name of the Experiment	
13	Gripper [pick and place]	9
14	Line follower	
15	ZigBee wireless communication	
	REVISION	15
	TOTAL HOURS	**75**

1040235542	Robotics	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
- Mini project that shall be an extension of any practical lab exercise to real-world application

Text Books

1. K.C. Jain and L.N.Agarwal, Robotics: Principles and Practice, 1st edition, Khanna Publications, 2009
2. S.R.Deb and S.Deb, Robotics Technology and Flexible Automation 2nd edition, McGraw Hill Publications, 2017
3. Ganesh S. Hegde, A Text Book on Industrial Robotics, 2nd edition, University Science Press, 2015

List of Equipments required

S.No	Name of the Equipments	Required Nos.
1	Robotic Kits (AVR / ARM / 8051)	10 Nos
2	Add on Boards for interfacing	Each 1
3	Desktop / Laptop	10

1040235543	Computer Hardware Servicing	L	T	P	C
Practicum		1	0	4	3

Introduction

Computer hardware refers to the physical devices within a computer that share resources and exchange data with each other. This subject provides the necessary core knowledge and skills regarding assembling, working, interconnecting and interfacing aspects of computer and peripherals. The students will be made aware of the know-hows of OS installation, trouble shooting, maintenance of hardware devices and Gain practical knowledge in the field of computer hardware and servicing.

Course Objectives

The objective of this course is to enable the student to

- Introduce the basic concepts of computer, motherboard and features of various processors.
- Introduce the basics of motherboard interfaces and memory slots
- Understand various input and output devices used in practice
- Understand the concept of various power supply systems in a computer
- Discuss necessity of BIOS and POST in the booting of an OS

Course Outcomes

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

CO1: Understand the basic architecture of a computer, motherboard and features of various processors.
CO2: Understand the basics of motherboard interfaces and memory slots
CO3: Understand various input and output devices used in practice
CO4: Understand the various power supply systems used in a computer
CO5: Understand the necessity of BIOS and POST in the booting of an OS

Pre-requisites

Basic knowledge of computer, peripherals, and handling of a PC

1040235543	**Computer Hardware Servicing**	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	3	1	1	1
CO2	2	3	2	3	-	-	1
CO3	2	1	3	3	1	2	2
CO4	3	2	1	2	2	1	2
CO5	3	2	2	2	2	2	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040235543	Computer Hardware Servicing	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.

1040235543	Computer Hardware Servicing	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	Block/Schematic Diagram & Troubleshooting or Connections or Setting up	35
C	Output / Result	10
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

1040235543	Computer Hardware Servicing	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 & Apparatus Required	5
B	Block/Schematic Diagram	20
C	Troubleshooting or Connections or Setting up	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.

1040235543	Computer Hardware Servicing	L	T	P	C
Practicum		1	0	4	3

Unit I	**COMPUTER HARDWARE FUNDAMENTALS**	
Definition of Hardware, Software, Firmware, Motherboard. Basic computer architecture – Schematic Diagram of a typical motherboard – Definition and comparison of motherboard form factors (Standard ATX, Micro ATX, Mini-ITX, Nano-ITX, Pico-ITX) Processor: Definitions of CPU, GPU, and multi-core processors – Block Diagram of a multi-core processor – Need for heat sink, cooling fan, and thermal paste on a motherboard		3
Ex.No	Study Experiment	
1	To study the typical architecture of a Laptop Motherboard vs Desktop Motherboard Suggested Link: https://www.scribd.com/document/526909173/CMT-pr-3#:~:text=%20Desktop%20motherboards%20are%20designed%20for,for%20high-performance%20computing%20tasks	1
Ex.No	Name of the Experiment	
1	To study, identify, and analyze the following motherboard form factors: Standard ATX, Micro ATX, Mini ITX, Nano-ITX.	9
2	To compare and tabulate the above motherboard form factors with respect to dimensions, power consumption & applications.	
3	To disassemble an assembled motherboard, identify various components and reassemble it into a working condition.	
Unit II	**MOTHERBOARD INTERFACES AND MEMORY**	
Definition of Socket, Slot, Port, Bus, Chipset – Typical Bus structure – Expansion slots: Features of PCI and PCIe Comparison between speeds of various USB connectors (Type A, B, Mini, Micro, Type C, Micro B) – 9 pin RS-232 connector, 15 pin VGA connector and HDMI connector Classification of Memory – SDRAM technologies: DDR1, DDR2, DDR3, DDR4, DDR5 (Definitions and comparison only) – Secondary Storage: Solid State Drive (SSD), Hard Disk Drive (Definitions and comparison only) – Basics of SATA and IDE connectors		3

1040235543	Computer Hardware Servicing	L	T	P	C
Practicum		1	0	4	3

Ex.No	Study Experiment	
2	To compare various features of Intel Core i3, i5, and i7 processors Suggested Links: https://www.pcworld.com/article/1475809/whats-the-difference-between-an-intel-core-i3-i5-and-i7.html https://www.expertreviews.co.uk/pcs/cpus/1400962/whats-the-difference-between-core-i3-i5-and-i7-processors	1

Ex.No	Name of the Experiment	
4	To identify various expansion slots, memory slots, sockets, chipset etc. on a given motherboard	9
5	To identify and explain about various front panel and real panel connectors in an assembled PC.	
6	A) To expand a given RAM capacity of a PC using additional RAM slots. B) To identify and connect a SATA and IDE Hard Disk Drive C) To mount and connect an additional Hard Disk Drive and expand the storage capacity.	

Unit III	**INPUT AND OUTPUT DEVICES**	
Keyboard and Mouse: Construction and working of Membrane Keyboard and Mechanical Keyboard – Construction and working of an optical mouse **WebCam and Scanners:** Basic concept of Webcam, Scanner: Document scanner and Biometric scanner (Definition only). **Printer and Display Units:** Classification of printers (Dot-matrix, Inkjet, Laser, Thermal and Multi-function printers) (Definition only) – Construction and Working Principle of Laser Printer – Comparison of Displays (LCD, LED, Plasma, TFT, OLED) and basics of Projector		3

Ex.No	Study Experiment	
3	To study various troubleshooting techniques for Keyboard, Mouse, Scanner, Printer, Display units. Suggested Links: https://edu.gcfglobal.org/en/computerbasics/basic-troubleshooting-techniques/1/ https://www.pcmag.com/how-to/how-do-i-fix-my-laptop-keyboard	1

1040235543	Computer Hardware Servicing	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
7	A) To Install and Configure a Webcam and capture a photograph. B) To Install and Configure a document Scanner and scan a physical document as image and pdf. C) To Install and Configure a biometric Scanner (fingerprint scanner) and perform authentication.	9
8	To Install and Configure a Laser printer and print a sample document on both sides of paper.	
9	To Install and Configure a projector to a system with the help of VGA /HDMI cable and project a given media from a PC onto a screen.	
Unit IV	**POWER SUPPLY COMPONENTS**	
SMPS: Block diagram and operation –ATX 24-Pin 12V power connector **UPS:**Definition –Block diagram and working of Online and Offline UPS–advantages and disadvantages - Basic concept of battery banks (Power Banks) **CMOS battery:** Importance and use of CMOS battery in a computer		3
Ex.No	Study Experiment	
4	To study various troubleshooting techniques for SMPS and UPS Suggested Link: https://www.se.com/in/en/faqs/FA279110/	1
Ex.No	Name of the Experiment	
10	A) To identify the cable colour codes and measure the output DC voltage from various power cables of SMPS using Multimeter B) To identify and connect the various output power cables of SMPS to appropriate motherboard slots	9
11	A)To Identify the CMOS battery on a motherboard and measure the output voltage B) To connect two or more cells (battery) in series and parallel connection for required voltage and current levels and measure the output using Multimeter.	
12	To troubleshoot the given faulty SMPS or UPS and identify the cause	

1040235543	Computer Hardware Servicing	L	T	P	C
Practicum		1	0	4	3

Unit V	**BIOS AND OS**	
BIOS: Definition- BIOS and its types (Legacy BIOS and UEFI) – Definitions only – BIOS Utility: Standard CMOS setup and Advanced BIOS setup POST: Definition, POST Error codes/Error Messages – IPL (Initial Program Load) Hardware OS:Definition - Introduction to Windows OS – create users, user-group - assign various permissions to access a directory - Introduction to Windows Command Prompt (CMD) - Application Software Installation using CMD		3
Ex.No	Study Experiment	
5	To study the POST test sequence Suggested Link: https://tecadmin.net/what-is-power-on-self-test/	1
Ex.No	Name of the Experiment	
13	To enter the BIOS setup Utility and demonstrate the following BIOS Setup & Configurations A) System Date & Time, Changing user passwords, Change Boot settings & priorities. B) Factory Reset, Chipset configurations	9
14	To install a Windows OS in an assembled Desktop PC	
15	To install any Application software using Windows command prompt (CMD)	
REVISION		10
TOTAL HOURS		**75**

1040235543	Computer Hardware Servicing	L	T	P	C
Practicum		1	0	4	3

Text Books

1. Albert Alan Clemets, The Principles of Computer Hardware, 4th edition, Oxford University Press, 2013
2. Ernest Ron Gilster, PC Hardware – A beginners guide, 1st edition, McGraw-Hill Education, 2005
3. D.Balasubramanian, Computer Installation and Servicing, 2nd edition, Tata Mc-Graw Hill, 2010

Suggested Web-based/Online Resources

- https://nielit.gov.in/aurangabad/content/computer-hardware-maintenance-0
- https://archive.nptel.ac.in/courses/106/105/106105214/
- https://www.buildcomputers.net/motherboard-form-factors.html
- https://softwarekeep.com/en-in/blogs/how-to/how-to-install-windows-10-81-or-7-using-a-bootable-usb
- https://www.xfurbish.com/blog/the-complete-guide-to-understanding-laptop-motherboards
- https://premioinc.com/blogs/blog/motherboard-form-factors

1040235543	Computer Hardware Servicing	L	T	P	C
Practicum		1	0	4	3

List of Hardware Required for a Batch of 30 Students

Sl. No.	Equipment	Quantity
1	Desktop Systems	30
2	Motherboard (Standard ATX, Micro ATX, Mini ITX, Nano-ITX)	01 each
3	Hard disk drive (HDD) / Solid State Drive (SSD)	05
5	Digital Multimeter	04
5	Projector with screen	02
6	Laser Printer	02
7	Document scanner / Bio Metric Scanner(Finger Print scanner)	02
8	Faulty SMPS / UPS	02
9	VGA and HDMI Cable	02 each
10	CMOS Battery	10
12	External RAM (DIMM or SODIMM)	04
13	Bootable Drive (Flash, USB, or External drive)	02
14	Other miscellaneous connectors and cables	As required

List of Software Required for a Batch of 30 Students

Sl.No.	Equipment	Quantity
1	Windows OS	As required
2	Any Open Source Application Software (setup.exe)	As required
3	Drivers for hardware and peripherals	As required

1040235544	**PCB Design & Assembly**	L	T	P	C
Practicum		1	0	4	3

Introduction

Printed Circuit Boards (PCBs) are the core component in almost all the electronic gadgets used either for domestic or industrial purposes. PCBs hold almost all electronic components necessary for a device to function. Using a PCB has many advantages such as compact design, ease of testing and repair, low noise and interference, and improved reliability. Apart from electrically connecting, it also gives mechanical support to the electrical components. Using PCBs, a highly complicated circuit can be designed in a very small package which helps in reducing the size of electronic devices. PCB design can be done either manually or using software. Electronic design automation tools are software tools used for designing the schematic and layout of PCB. Large number of PCBs can be fabricated at the same time after the layout is designed once. With consumers pushing for slimmer and faster devices, and with industries seeking improved functionality, the PCB will continue to develop in the future.

Course Objectives

The objective of this course is to enable the student to

- Understand the types of PCB and component data sheet.
- Know how to draw circuit schematics using EDA tools.
- Understand PCB layout and routing.
- Understand flow chart for PCB assembly process and importance of RoHS.
- Practice schematic PCB layout and transfer to copper clad board.

Course Outcomes

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

CO1: Identify different types of Printed Circuit Boards (PCB), list the differences between them and their adequacy for specific application. List out the menu driven items (icons) which are used for designing PCB (for any one of Electronic Design Automation tool).

CO2: Select the right components for a given analog circuit, draw the schematic and generate net list.

CO3: Draw the PCB layout for an analog circuit & verify using design rule check. Identify the problems while designing the PCB and troubleshoot them. Generate gerber file, BOM.

CO4: List out the steps involved in PCB assembly process.
CO5: Fabricate a simple analog circuit manually.

Pre-requisites

Knowledge of working of electronic components and devices.
Knowledge of Analog and Digital Electronics

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	3	1	1	1
CO2	2	3	3	3	1	1	1
CO3	2	1	1	3	1	1	1
CO4	3	2	2	3	1	1	1
CO5	3	2	2	1	1	3	1

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

1040235544	**PCB Design & Assembly**	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.

1040235544	PCB Design & Assembly	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	Program	20
C	Execution & 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

1040235544	PCB Design & Assembly	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	Program	20
C	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.

1040235544	**PCB Design & Assembly**	L	T	P	C
Practicum		1	0	4	3

Unit I	**Introduction to PCB Design**	
Basics of electronic components and circuits-Introduction to PCB design -Types -Single layer - Double layer –Multi layer - Applications-Overview of PCB design process- Electronic Components and Footprints-Understanding component data sheets- Introduction to PCB design software (e.gKiCAD or any open source EDA Software)		3
Ex.No	Name of the Experiment	
	Familiarization of any Electronic design automation (EDA) software	6
1	Solder an analog circuit (Half wave rectifier) in a PCB with plated holes	
2	Solder the given common emitter amplifier circuit in a PCB with plated holes	
Unit II	**Introduction to schematic design**	
Drawing circuit schematics using EDA (Electronic Design Automation) tools - Net-list generation and Connectivity verification - Understanding PCB layer stack up- Board materials- Materials used for multilayer PCBs - PCB thickness - Units-Aspect ratio - Importance of grounding in PCBs - Impedance matching - Reflection- Ground Bounce- SSN.		3
Ex.No	Name of the Experiment	
3	Create a schematic, generate net list and simulate an RC coupled amplifier	
4	Create a schematic, generate net list and simulate a High pass filter.	9
5	Create a schematic, generate net list and simulate basic logic gates (AND, OR, NOT) using discrete components.	
Unit III	**PCB Design**	
PCB layout and routing using software tools-Vias-Solder Mask-Silk Screen-Jumper- Design rule check-Troubleshooting and debugging common issues- Creation of accurate and comprehensive design documentation-Gerber file-Bill of Materials.		3

1040235544	**PCB Design & Assembly**	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
6	Place the components of RC coupled amplifier and route the connections between the components manually and verify using design rule check	15
7	Place the components of RC coupled amplifier and route the connections between the components using auto routing option	
8	Design a PCB layout for Astable Multivibrator circuit and verify using design rule check	
9	Design a PCB layout for regulated power supply, verify using design rule check and generate Gerber file, BOM.	
10	Design a PCB layout for a light dependent resistor (LDR) based automatic light switch and verify using design rule check.	

UNIT IV	**PCB Assembly**	
Flowchart for PCB assembly process-Steps involved in fabrication of single sided PCB, double sided PCB & multilayer PCB- Testing of PCB- Importance of RoHS(Restriction of use of Hazardous Substances)- Waste management of hazardous materials in PCB- Environment Management Standards(EMS)-RF PCB-Overview.		3

Ex.No	Name of the Experiment	
11	Create symbols and foot print for IN4007diode, IC741.	9
12	Create symbols and footprint for BC107transistor, connector.	
13	Design a double-layer PCB for a simple DC motor driver circuit with variable speed control.	

Unit V	**Manual PCB Fabrication**	
Schematic-PCB Layout-Transfer to copper clad board-Etching-Drilling-component placement-testing-Finishing.		3

Ex.No	Name of the Experiment	
14	Fabricate a low pass filter circuit manually.	6
15	Fabricate and test a power supply circuit using copper clad sheet	
	REVISION	15
	TOTAL HOURS	**75**

1040235544	**PCB Design & Assembly**	L	T	P	C
Practicum		1	0	4	3

Suggested 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

Textbook

1. R.S. Khandpur, Printed Circuit Boards: Design – Fabrication, 1st edition, McGraw Hill Education, 2017
2. Clyde F. Coombs, Printed Circuits Handbook, 6th edition, McGraw Hill, 2008
3. S.D. Mehta, Electronic Product Design, 1st edition, S Chand & Company, 2011

Web-based/Online Resources

- http://www.wikihow.com/Create-Printed-Circuit- Boards
- http://reprap.org/wiki/MakePCBInstructions#Making PCBs yourself

1040235544	**PCB Design & Assembly**	L	T	P	C
Practicum		1	0	4	3

List of Hardware required for a batch of 30 students

Sl.No.	Name of the Equipment	Quantity
1	Desktop PC	15
2	Printer	1
3	Soldering Iron	5
4	Drilling machine with drill bit for PCB hole purpose	5
5	Copper clad sheet	30

List of Software

Open Source EDA software

		L	T	P	C
1040235545	**Industrial IoT**	L	T	P	C
Practicum		1	0	4	3

Introduction

This course will give the outline of Industrial IoT and impart knowledge about the components of IIoT. Also, the course instills practical experience and makes the students to develop simple applications and appreciate real life applications of IIoT.

Course Objectives

The objective of this course is to enable the student to

- Introduce the architecture of IIoT
- Get acquainted with various types of sensors and actuators
- Understand various protocols of IIoT
- Get exposed to security aspects of IIoT
- Instill practical knowledge to develop simple applications for IIoT

Course Outcomes

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

CO1: Explain the architecture of IIoT
CO2: Identify various types of sensors and actuators used in IIoT
CO3: Select the required type of protocol for a given real life application using IIoT
CO4: Select the appropriate security mechanism for a given IIoT application
CO5: Develop simple applications for IIoT

Pre-requisites

Measuring instruments, Microcontrollers, Raspberry Pi, Computer hardware & networking and IoT.

1040235545	**Industrial IoT**	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	1	1	1	3
CO2	3	3	2	1	1	1	3
CO3	3	3	2	1	1	1	3
CO4	3	3	2	1	1	1	3
CO5	3	3	2	1	1	1	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.

1040235545	Industrial IoT	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.

1040235545	Industrial IoT	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

1040235545	**Industrial IoT**	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 & 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.

1040235545	**Industrial IoT**	L	T	P	C
Practicum		1	0	4	3

Unit I	**INTRODUCTION**	
Introduction to IoT, IoT Vs. IIoT, Overview of IoT components, Architecture of IoT and IIoT, Advantages & Disadvantages, Role of IIoT in Manufacturing Processes, Use of IIoT in plant maintenance practices, Sustainability through Business excellence tools, Challenges & Benefits in implementing IIoT.		6
Ex.No	Name of the Experiment	
1	Controlling the Light Emitting Diode (LED) with a push button using Raspberry pi	9
2	Controlling the LED blink rate with Raspberry pi	
3	Detection of the light using photo resistor and Raspberry pi	
Unit II	**SENSOR AND ACTUATORS**	
Roles of sensors in IIoT, various types of sensors-Temperature Sensor-Proximity Sensor-Accelerometer-IR Sensor-Pressure Sensor-Light Sensor-Ultrasonic Sensor-Smoke, Gas and Alcohol Sensor- sensor architecture, special requirements for IIoT sensors, Role of actuators, types of actuators-Pneumatic Actuators-Electric Actuators-Thermal Actuators-Magnetic Actuators.		6
Ex.No	Name of the Experiment	
4	Interfacing the Buzzer with Raspberry pi	9
5	Interfacing of temperature sensor with Raspberry pi	
6	Interfacing of Servo Motor with the Raspberry pi	
Unit III	**PROTOCOLS**	
Need of protocols, Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, Building Automation and Control Networks, Bluetooth Low Energy, Modbus, Serial Peripheral Interface, Inter-Integrated Circuit, Constrained Application Protocol, Message Queuing Telemetry Transport, IPv6 over Low-power Wireless Personal Area Networks, Light Weight Machine to Machine, Advanced Message Queuing Protocol.		6

1040235545	Industrial IoT	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
7	Interfacing the Relay with the Raspberry pi	9
8	Interfacing of Bluetooth with the Raspberry pi	
9	Sense and connect with the available networks using Raspberry pi	
Unit IV	**PRIVACY AND SECURITY**	
Vulnerabilities of IIoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IIoT, overview of cloud platforms.		6
Ex.No	Name of the Experiment	
10	Sense a Finger When it is Placed on Board Using Raspberry pi	9
11	Write a program to upload temperature data to cloud	
12	Write a program to download temperature data from cloud	
Unit V	**APPLICATIONS**	
Internet of Things Applications: Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IIoT in Manufacturing Sector		6
Ex.No	Name of the Experiment	
13	Directional control of DC motor using Raspberry pi	9
14	Measure the Distance using Ultrasonic Sensor and Raspberry pi	
15	Detect the Vibration of an object using Raspberry pi	
	TOTAL HOURS	**75**

1040235545	Industrial IoT	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

Text Books

1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st edition, Apress, 2017
2. Sabina Jeschke, Christian Brecher, Houbing Song and Danda B. Rawat, Industrial Internet of Things: Cybermanufacturing Systems, 1st edition, Springer, 2017
3. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry, 1st edition, Routlege Taylor & Francis, 2020

Web-based/Online Resources

- https://www.youtube.com/watch?v=LlhmzVL5bm8
- https://onlinecourses.nptel.ac.in/noc22_cs53

List of Equipments required for a batch of 30 students

S. No.	Name of the Equipment	Range	Quantity
1	Raspberry pi with necessary accessories	-	15
2	Buzzer, temperature sensor, Servo Motor, Ultrasonic Sensor and Bluetooth module	-	Each one

1040235546	Multimedia Systems	L	T	P	C
Practicum		1	0	4	3

Introduction

The research and developments are continually happening in the field of multimedia which directly or indirectly has impact on every man's daily life. As such the introduction of current and future trends and technology of multimedia systems would strengthen the knowledge and skills of Engineering community in taking one-step further the prosperity of mankind. This course focuses on building the theoretical and practical knowledge about Multimedia Systems. It emphasize on learning the architecture, techniques, tools and development phases of Multimedia Systems. Students will understand the underlying concepts of multimedia, and gain knowledge about the state-of-the-art in this field.

Course Objectives

The objective of this course is to enable the student to

- To introduce various aspects of multimedia components like Images, audio, sound and computer graphics.
- To provide hands-on training in the use of Image Editing tools with software.
- To gain knowledge about various multimedia related standards.
- To gain hands-on experience through a series of practical skill- building tasks and exercises designed to extend their knowledge
- To design and develop various multimedia applications

Course Outcomes

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

CO1: Analyze key components of multimedia technologies including text, graphics, voice, video and animation.
CO2: Create and design video and audio effects
CO3: Understand various media formats and properties
CO4: Create animated sequence with titles applying the principles of animation.
CO5: Apply acquired knowledge in the field of multimedia to design and develop various multimedia applications for good causes

Pre-requisites

Knowledge of using computer system

1040235546	Multimedia Systems	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	3	3	-	-	2	2
CO2	2	3	3	-	-	2	2
CO3	2	2	2	-	-	2	3
CO4	2	2	3	-	-	3	3
CO5	2	2	3	-	-	2	3

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040235546	**Multimedia Systems**	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.

1040235546	**Multimedia Systems**	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	Procedure	25
C	Execution	20
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

1040235546	Multimedia Systems	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	Procedure	25
C	Execution	20
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.

1040235546	Multimedia Systems	L	T	P	C
Practicum		1	0	4	3

Unit I	**INTRODUCTION TO MULTIMEDIA**	
Introduction: Definition of Multimedia, Multimedia Basics, Multimedia Elements, Multimedia Applications, Delivering Multimedia, Multimedia Workstation Architecture. **Evolving Technologies For Multimedia Systems:** Hypermedia Documents, Hypertext, Hyper Speech, 3D Technologies and Holography (Definitions only) **Multimedia Software:** Overview of Multimedia Software Tools, Open Source Replacements, Multimedia OS.		3
Ex.No	Name of the Experiment	
1	Use HTML multimedia support to play different audio and video formats in a browser using a desktop and a mobile.	9
2	Import an image from the browser / Picture folder and place it on the workspace. Click and drag the image on the work space.	
3	Using suitable software create a note book wrapper/or invitation.	
Unit II	**DEFINING OBJECTS FOR MULTIMEDIA SYSTEMS**	
Defining Objects for Multimedia System: Text, Images, Audio and Voice, Full-Motion and Live Video, Multimedia Data Interface Standards, Video Processing Standards using Text in Multimedia. **Images:** Making Still Images, Bitmaps, Vector Drawing, 3-D Drawing and Rendering, Color, Computerized Color, Color Palettes, Color Look-up table. Sound: Digital Audio, Making Digital Audio Files, MIDI Audio, Multimedia System Sounds, Adding Sound to Multimedia Project. **Animation:** Principles of Animation, Animation Techniques. **Video:** Steps in Video processing, Analog Video, Digital Video, Video Format Converters.		3
Ex.No	Name of the Experiment	
4	Use a scanner to create two or more partial scanned images of large poster/photo. Create a panoramic view of multiple photos by stitching together them using any panorama software.	6
5	Use a video processing software to perform – Trim video clips, rotate video, merge video, split video, add titles, add special effects and edit video dimensions, bit rate, frame rate, sample rate, channel.	

1040235546	Multimedia Systems	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
6	Create a 2D Animation using Motion Guide Layer and masking.	6
7	Create a moving cloud using any animation software.	

Unit III	**MULTIMEDIA DATA AND STANDARDS**
Data Compression: Definition and need for Data compression, General Non-lossy compression for images and Lossy compression (Definition) **Compression Schemes and standards:** (Only Concepts of) Binary Image Compression, JPEG, Video Image Compression, Multimedia Standards for Video, Audio compression, Fractal compression, advantages / disadvantages. **Data and File Format Standards:** Popular File Formats, RTF, RIFF, GIF, PNG, TIFF, MIDI, JPEG, JFIF, AVI, WAV, BMP, WMF, MIX, MPEG standards (List only)	3

Ex.No	Name of the Experiment	
8	Develop a web page which shows animation with sound effect using any professional HTML editor.	9
9	Use suitable software and perform a) compress / decompress audio / video files. b) Convert audio/video to different format.	
10	Create a pencil sketch of a picture using a suitable software.	

Unit IV	**MULTMEDIA DEVICES AND MAKING MULTIMEDIA**
Multimedia Input/output Technologies: Limitations of Traditional input devices, Multimedia input/output devices. **Making Multimedia:** The Stages of a Multimedia Project: Creativity, Organization, Communication, Hardware, Software: Text Editing and Word Processing Tools, OCR Software, Painting and Drawing Tools, 3-D Modeling and Animation Tools, Image-Editing Tools, Sound-Editing Tools, Animation, Video, and Digital Movie Tools, Authoring Systems, Making Instant Multimedia, Types of Authoring Tools.	3

<table>
<tr><td>1040235546</td><td rowspan="2" colspan="2">Multimedia Systems</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Practicum</td><td>1</td><td>0</td><td>4</td><td>3</td></tr>
<tr><td>Ex.No</td><td colspan="5">Name of the Experiment</td><td></td></tr>
<tr><td>11</td><td colspan="5">Import any two pictures, Morph, Merge and Overlap those two pictures.</td><td rowspan="3">9</td></tr>
<tr><td>12</td><td colspan="5">Design a certificate for sports day with different text effects using suitable software.</td></tr>
<tr><td>13</td><td colspan="5">Use a audio recording program to record audio from different sources of input such as line-in, PC speaker output etc applying different filters, encoding and compression schemes. Split the audio into pieces. Merge different pieces together. Use appropriate tools.</td></tr>
<tr><td>Unit V</td><td colspan="6">MULTIMEDIA AND INTERNET</td></tr>
<tr><td colspan="6">The Internet and Multimedia : The Bandwidth Bottleneck, Internet Services (List), Plug-ins and Delivery Vehicles, Video - Plug-ins and Players

Multimedia Communication: Multimedia Over Wireless and Mobile Networks – Wireless Network Generation, Media Entertainment

Streaming: Introduction: Applications of Streaming- The Streaming Architecture, Stream Serving: Webcasting – On-Demand Servicing – Voice and Video Conferencing</td><td>3</td></tr>
<tr><td>Ex.No</td><td colspan="5">Name of the Experiment</td><td></td></tr>
<tr><td>14</td><td colspan="5">Design a metallic text using 3D animation tool</td><td rowspan="2">6</td></tr>
<tr><td>15</td><td colspan="5">Create an innovative logo for your Institute considering all the features of your Institute.</td></tr>
<tr><td colspan="6">REVISION</td><td>15</td></tr>
<tr><td colspan="6">TOTAL HOURS</td><td>75</td></tr>
</table>

1040235546	Multimedia Systems	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/online quizzes conducted based on the course, blended learning activities to explore the recent trends and developments in the field.

Text Books

1. Ze-Nian Li and M.S. Drew, Fundamentals of Multimedia, 2nd edition, Pearson Education,2014
2. Tay Vaughan, Multimedia: Making It Work, 8th edition, Tata McGrawHill, 2017
3. Ralf Steinmetz and KlaraNahrstedt, Multimedia Computing, Communication and Applications, 1st edition, Pearson Education, 2012

Web-based/Online Resources

- https://spoken-tutorial.org/tutorial-search/?search_foss=Video+Editing+using+Blender&search_language=English
- https://www.tutorialspoint.com/

1040235546	**Multimedia Systems**	L	T	P	C
Practicum		1	0	4	3

Equipment / Facilities required for conducting the Practical Course. (Batch Strength: 30 Students)

List of Hardware

- Desktop PCs– 30 Nos
- Laser Printer Monochrome, Color – 1 Each
- Digital (Video) Camera - 1No.
- Flat bed A4 size Scanner - 1 No.

List of Software

- Operating system: Windows 7/8, Windows 10, Linux
- Software tools: Open Source Software or Commercial Software.
- GIMP later version

3D Graphics and Animation - Art of Illusion Blender

Audio Players

aTunes, Audacious, Clementine Cool Player MPH-HC Zing Audio Recorders and Editors Audacity Frinikafre:ac, BonkEnc Exact Audio Copy, Audio Convertor Studio CUERipper, Dex Exact Audio CopyMMConvert Exact Audio Copy

Multimedia Players

VLC Media Player Mplayer KODI Media Portal CinelerraOpenShot Video Editor AvidemuxKdenliveCineFX 2

Video File Conversion - DVDx, ZamzarDVD, ZamzarFFDShow, Zamzar

Video Player – Miro

CD / DVD Burners - Infrared Recorder DVD

Authoring - DVD Flick, DVDStyler, Bombono DVD

1040235752	**Innovation & Startup**	L	T	P	C
Practicum		1	0	2	2

Introduction

The integration of Innovation and Start-ups concept within the syllabus is testament to the forward thinking nature of educational institutions. By introducing this concept, students are provided with a solid foundation upon which they can build their skills in Innovation and Start-ups. This course can bridge the gap between theory and practice. It allows students to apply the knowledge they have acquired in a real world context, thereby enhancing their understanding and retention of the above concept. This experimental learning approach not only fosters a deeper level of engagement but also trains student with practical skills necessary to navigate the complexities of the business world. This also empowers students to become an Innovator or Entrepreneur. With necessary tools and knowledge, educational institutions are preparing the next generation of entrepreneurs to tackle the challenges and opportunities that lie ahead. This syllabus will explore the different facets of innovation, including its importance, types and strategies for fostering a culture of innovation within organizations.

Course Objectives

The objective of this course is to enable the student to

- To understand the concept of Innovation and Start-ups.
- To acquire knowledge of Prototype development, IPR, Patents and Copyrights.
- To have practical experience in preparing Business plan for Start-ups.
- To visit the existing nearby industry to prepare a project report about the present challenges of that industry.
- To know the different funding supports available from Government and Non-Government schemes for Start-ups.

Course Outcomes

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

CO1: Differentiate between Innovation and Start-ups
CO2: Explain the importance of IPR, Patents and Copyrights.
CO3: Describe the methodology to be adopted for preparing the Business Plan
CO4:Gain practical experience by Industrial training and visiting the nearby industry
CO5:Explore and identify various funding facilities available from Government and Non-Government Schemes for Start-ups

1040235752	Innovation & Startup	L	T	P	C
Practicum		1	0	2	2

Pre-requisites

There are no specific prerequisites for this course, although a basic understanding of business and technology concepts would be beneficial.

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	1	-	2	3	3
CO2	-	-	1	-	2	3	3
CO3	-	-	1	-	2	3	3
CO4	-	-	1	-	2	3	3
CO5	-	-	1	-	2	3	3

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

Assessment Methodology

	Continuous Assessment (40 marks)			End Semester Examination (60 marks)
	CA1	CA2	CA3	
Mode	Class Assessment (Unit I,II & Unit III)	Seminar Presentations (Unit IV)	Submission of Industry Visit Project Report (Unit V)	Practical Examination (Project)
Duration	2 hours	-	-	3 hours
Exam Marks	50	20	30	100
Converted to	10	10	20	60
Marks	**10**	**10**	**20**	**60**

1040235752	**Innovation & Startup**	L	T	P	C
Practicum		1	0	2	2

Continuous Assessment - 40 Marks

S. No	Description	Marks
CA 1	**Class Assessment (50 marks) - Unit – I,II & III** Written Examination - Theory Questions 10 questions out of 15 questions (10 x 3 marks :30 marks) 4 questions out of 6 questions (4 x 5 marks : 20 marks)	10
CA 2	**Seminar Presentations (20 marks- each topic carries 10 marks) - Unit IV** Students should present any two topics with PPTs	10
CA 3	Submission of Industry Visit Project Report - **(30 marks) - Unit V**	20
Total		**40**

Detailed Allocation of Marks - End Semester Examination - 60 Marks

S. No		Description	Marks
Part A	Written Examination – Unit –I,II & III Theory Questions		45
	i)	10 questions out of 15 questions (10 x 3 marks:30 marks)	
	ii)	3 questions either or pattern (3 x 5 marks: 15 marks)	
Part B	i)	Presentation of Industry Visit Project Report	25
	ii)	Interaction and Evaluation	30
Total			**100**

1040235752	Innovation & Startup	L	T	P	C
Practicum		1	0	2	2

Unit I	**INTRODUCTION TO INNOVATION**	
	An Introduction to Innovation and Creativity- Innovation in current Environment - Types of Innovation - Challenges of Innovation - Steps of Innovation Management - Divergent v/s Convergent thinking - Design thinking and Entrepreneurship.	6
Unit II	**INCUBATION CLUBS, IPR, PATENTS AND COPYRIGHTS**	
	Idea Generation - Incubation Clubs - Prototype Development - Marketing of Innovation - Management of Innovation - Creation of IPR -Types of IPR - Patents and Copyrights - Patents in India - Technological and Non-Technological Innovation Process.	6
Unit III	**GOVERNMENT AND NON-GOVERNMENT FUNDING SCHEMES FOR START-UPS**	
	An introduction to Start-up - Start-ups in India - Procedure for registration of Start-ups - Business Model- Business Plan - Case Studies - Opportunities and Challenges - Funding supports from Government Schemes -MUDRA, TANSEED, NEEDS, PMEGP, UYEGP – Non-Government Schemes - CSR Fund - Angel Investors - Venture Capitalist.	6
Unit IV	**TOPICS FOR PRESENTATION**	
	All the students have to select a minimum of 2 topics from the list given below. They are expected to collect the resources with the help of faculty assigned to them to prepare PPTs for presentation • Idea Generation • Innovation Management • Product Development • Business Model Innovation • Organizational Culture and Change Management • Leadership and Innovation • Barriers to Innovation • Innovation Marketing • E-Commerce success stories (any one) • Role of Start-ups in Higher Education • Professional Networking in Building Brands • How to start a start-up in India	9

<table>
<tr><td>1040235752</td><td rowspan="2">Innovation & Startup</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Practicum</td><td>1</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td>Unit V</td><td colspan="5">EXPOSURE TO INDUSTRY</td></tr>
<tr><td colspan="5">All the students should visit and study the nearby industries, incubation centres, start-ups etc., and select any one to prepare a project report which covers the Name of the Industry/Organization, Introduction of the Industry, Type of the Industry, Scope of the Industry, Plant Layout and Location, Details of Plant and Machineries, Process flow chart, Manufacturing Methods, Process of Manufacturing, Product Manufacturing, Quality Control, Marketing, Product selling - Conclusion.</td><td>18</td></tr>
<tr><td colspan="5">TOTAL HOURS</td><td>45</td></tr>
</table>

6000236111	Advanced Engineering Mathematics	L	T	P	C
Theory		3	0	0	3

Introduction

Mathematics is essential for engineering students to understand core engineering subjects. It provides the framework for engineers to solve problems in engineering domains. This course is designed to bridge the gap between diploma mathematics and B.E/B.Tech mathematics in matrix algebra, differential calculus, vector calculus, differential equations, and Laplace transforms.

Course Objectives

The objective of this course is to enable the student to

- Understand the concepts of Eigen-Values and Eigen-Vectors of matrices.
- Learn the notation of partial differentiation and determine the extremities of functions of two variables.
- Acquire knowledge in vector calculus which is significantly used to solve engineering problems.
- Formulate and solve differential equations.
- Understand Laplace transformation and its engineering applications.

Course Outcomes

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

CO1: Find eigenvalues and corresponding eigenvectors of a square matrix.
CO2: Apply the knowledge of partial differentiation to evaluate Jacobian and extremities of two variable functions.
CO3: Evaluate the gradient of a scalar field and the divergence and curl of vector fields.
CO4: Solve ordinary differential equations using various techniques.
CO5: Use Laplace transforms to solve first-order ordinary differential equations.

Pre-requisites

Matrices, Determinants, Differentiation, Integration and Vector Algebra.

6000236111	Advanced Engineering Mathematics	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	1	1	1	3
CO2	3	3	2	1	1	1	3
CO3	3	3	2	1	1	1	3
CO4	3	3	2	1	1	1	3
CO5	3	3	2	1	1	1	3

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

Instructional Strategy

- A theory-demonstrate-practice-activity strategy may be used to ensure that learning is outcome-based.
- All demonstrations/Hands-on practices might be under a simulated environment.
- Use inducto-deductive approach to achieve the desired learning objectives.
- Use open-ended questions to nurture the problem-solving and reasoning skills among students.
- Support and guide the students for self-study.
- State the need for mathematics with engineering studies and provide real-life examples.

6000236111	**Advanced Engineering Mathematics**	L	T	P	C
Theory		3	0	0	3

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.

6000236111	Advanced Engineering Mathematics	L	T	P	C
Theory		3	0	0	3

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.
10.
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12.
IV. 13.
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16.
V. 17.
18.
19.
20.

6000236111	**Advanced Engineering Mathematics**	L	T	P	C
Theory		3	0	0	3

Unit I	**EIGENVALUES AND EIGENVECTORS**	
Characteristic equation – Eigen-values of 2×2 and 3×3 real matrices – Eigen-vectors of 2×2 real matrices – Properties of eigen-values (excluding proof) – Cayley-Hamilton theorem (excluding proof) – Simple problems.		7
Unit II	**FUNCTIONS OF SEVERAL VARIABLES**	
Partial derivatives of two variable and three variable functions (up to second order) – Homogeneous functions and Euler's theorem (excluding proof) – Jacobian matrix and determinant – Maxima and minima of functions of two variables – Simple problems.		7
Unit III	**VECTOR CALCULUS**	
Scalar field and Vector field – Vector differential operator – Gradient of a scalar field – Directional derivative – Divergence and curl of a vector field (excluding properties) – Solenoidal and irrotational vector fields – Simple problems.		7
Unit IV	**DIFFERENTIAL EQUATIONS**	
Differential equation – Formation – Order and degree – Solution of a differential equation – Equations of first order and first degree – Variable separable method – Leibnitz's Linear equations – Second order equations of the form $(aD^2 + bD + c)y = e^{nx}$ where a, b, c and n are constants and the auxiliary equation $am^2 + bm + c = 0$ has only real roots) – Complementary function – Particular integral – General solution – Simple problems.		7
Unit V	**LAPLACE TRANSFORMS**	
Definition of Laplace transform – Laplace transforms of standard functions - Linearity and change of scale property (excluding proofs) – First shifting property – Laplace transforms of derivatives – Properties (excluding proofs) – Inverse Laplace transforms – Properties (excluding proofs) – Solving first order ordinary differential equation using Laplace transforms – Simple problems.		7
REVISION & TEST		10
TOTAL HOURS		**45**

6000236111	Advanced Engineering Mathematics	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

- Demonstrate the applications of Eigen-Values in stability analysis, decouple of three-phase systems and vibration analysis.
- Demonstrate maxima and minima of two variable functions using GeoGebra graphing calculator.
- Demonstrate solenoidal vector field and irrotational vector field using engineering applications.
- Demonstrate the applications of differential equations in solving engineering problems.
- Presentation /Seminars by students.
- Quizzes.

Text Books

1. John Bird, Higher Engineering Mathematics, 9th edition, Routledge, 2021
2. B.S.Grewal, Higher Engineering Mathematics, 42nd edition, Khanna Publishers, 2012
3. P.Durai pandian and Kayalal Pachaiyappa, Vector Analysis, 1st edition, S. Chand and Company Limited, 2017

Web-based/Online Resources

- https://www.khanacademy.org/math/
- https://www.mathportal.org/
- https://www.mathhelp.com/
- https://www.geogebra.org/
- https://www.desmos.com/
- https://phet.colorado.edu/

6000236112	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

Introduction

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspirations of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity of opportunity and participation and finally promote concern for excellence. In this context the course on entrepreneurship and start ups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs relevant to social prosperity and thereby ensuring good means of living for every individual, providing jobs and developing the Indian economy.

Course Objectives

After completing this subject, the student will be able to

- Acquire entrepreneurial spirit and resourcefulness
- Familiarize Acquire knowledge about the business idea and product selection
- Analyze the banking and financial institutions
- Understand the pricing policy and cost analysis
- Get knowledge about the business plan preparation

Course Outcomes

CO1: Explain the process of entrepreneurship

CO2: Analyze the importance of generation of ideas and product selection

CO3: Familiarization of various financial and non financial schemes

CO4: Acquire various cost components to arrive pricing of the product

CO5: Learn the preparation of project feasibility report

Pre-requisites

Knowledge of basics of Engineering and Industrial engineering

6000236112	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	-	-	3	1	3
CO2	-	-	-	-	3	3	3
CO3	-	-	-	1	-	3	2
CO4	-	1	3	3	2	3	2
CO5	-	2	3	3	3	3	3

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

6000236112	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

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	13-14th 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 of one will be considered for the internal assessment of 15 Marks.

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

(5 X 10 Marks = 50 Marks).

Eight questions will be asked, students should write Five questions. Each unit Four questions can be asked. Each question may have subdivisions. Maximum two subdivisions shall be permitted.

CA3: 60 MCQ can be asked by covering the entire portion. It may be conducted by Online / Offline. The answer scripts of every student (online / offline) for this assessment should be kept for records and future verification. 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.

6000236112	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

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. The question may have two subdivisions only.

Syllabus Contents

Unit I	**Entrepreneurship – Introduction and Process**	
Concept of entrepreneurship - Importance, Myths about Entrepreneurship, Pros and Cons of Entrepreneurship, Process of Entrepreneurship, Competencies and characteristics of an entrepreneur, Ethical Entrepreneurship, Entrepreneurial Values and Attitudes, Creativity, Innovation and entrepreneurship- Entrepreneurs - as problem solvers, Mindset of an employee and an entrepreneur, Risk Taking-Concepts		7
Unit II	**Business Idea**	
Types of Business: Manufacturing, Trading and Services, Stakeholders: sellers, vendors and consumers and Competitors, E-commerce Business Models, business idea generation -Types of Resources - Human, Capital and Entrepreneurial tools and resources, etc.,-setting business goals-Patent, copyright and Intellectual property rights, Customer Relations and Vendor Management, -Business Ideas vs. Business Opportunities, Opportunity – SWOT ANALYSIS of a business idea - Business Failure – causes and remedies.- Types of business risks		7
Unit III	**Banking**	
Size and capital based classification of business enterprises- Role of financial institutions, Role of Government policy, Entrepreneurial support systems, Incentive schemes for state government, and Incentive schemes for Central governments.		7

Unit IV	**Pricing and Cost Analysis**	
Types of Costs - Variable - Fixed- Operational Costs - Break Even Analysis - for single product or service, -financial Business Case Study, Understand the meaning and concept of the term Cash Inflow and Cash Outflow- Pricing- Calculate Per Unit Cost of a single product, , Understand the importance and preparation of Income Statement, Prepare a Cash Flow Projection- Factors affecting pricing.- GST.		7
Unit V	**Business Plan Preparation**	
Feasibility Report – Technical analysis, financial analysis- Market Research - Concept, Importance and Process- tools for market research- Market Sensing and Testing, Marketing and Sales strategy, Digital marketing, Branding - Business name, logo, tag line, Promotion strategy, Business Plan Preparation, -Concept and Importance, , Execution of Business Plan.		7
	Revision + Test	10
	TOTAL HOURS	45

Suggested list of Students Activity.

1. Students can explore app development or web design. They'll learn about technology, user experience, and marketing.
2. Hosting events, workshops, or conferences allows students to practice project management, networking, and marketing skills.
3. Encourage students to address social or environmental issues through innovative business solutions. This fosters empathy and creativity.
4. Part of entrepreneurship clubs or organizations provides networking opportunities, mentorship, and exposure to real-world challenges.
5. Competitions like business plan contests or pitch events allow students to showcase their ideas and receive feedback.
6. Students can create and sell handmade crafts, artwork, or other products. This teaches them about production, pricing, and customer relations.
7. Students can provide consulting services in areas they're knowledgeable about, such as social media marketing or financial planning.

8. Encourage students to create and manage their own small business or offer freelance services. This hands-on experience helps them understand various aspects of entrepreneurship.

Text and Reference Books:

1. G.K. Varshney, Fundamentals of Entrepreneurship, SahityaBhawan Publications, Agra., 2019.
2. H.Nandan, Fundamentals of Entrepreneurship, Prentice Hall India Learning Private Limited, Third Edition, 2013.
3. R.K. Singal, Entrepreneurship Development & Management, S K Kataria and Sons, 2013.

Web Reference:

- https://ocw.mit.edu/courses/15-390-new-enterprises-spring-2013/resources/lecture-1/
- https://onlinecourses.nptel.ac.in/noc20_ge08/preview

6000236112	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

END SEMESTER QUESTION PATTERN - Theory Exam

Duration: 3 Hours. **Maximum Marks: 100**

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

Instruction to the question setters.

Each unit should have four questions. Each question carries 10 Marks. Each question may have two subdivisions only.

6000236113	**Project Management**	L	T	P	C
Theory		3	0	0	3

Introduction

Project management is the systematic application of knowledge, skills, tools, and techniques to project activities to meet specific project requirements. It involves planning, organizing, and managing resources to achieve project goals within defined scope, time, and budget constraints. Project management encompasses several key processes and phases, including initiation, planning, execution, monitoring and controlling, and closing. It is essential across various industries to ensure projects are completed successfully, efficiently, and effectively, aligning with organizational objectives and stakeholder expectations. Project managers play a crucial role in leading teams, managing risks, ensuring quality, and communicating with stakeholders to drive project success.

Course Objectives

The objective of this course is to enable the student

- To understand the concept, characteristics and elements of projects.
- To understand the stages in Project Life Cycle.
- To appreciate the need for Project Portfolio Management System.
- To know the considerations in choosing appropriate project management structure.
- To understand the components of techno-economic feasibility studies.
- To know about the detailed project report
- To learn about project constraints.
- To understand the techniques of evaluation.
- To get insight into the Social Cost Benefit Analysis Method.
- To know how to construct project networks using PERT and CPM.
- To learn how to crash project networks
- To understand the meaning of project appraisal.
- To understand the meaning of project audits.
- To know the qualities of an effective project manager.
- To understand the stages in Team Development model.

Course Outcomes

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

CO 1: Understand the Project Management Principles.
CO 2: Learn to create and manage project schedules.
CO 3: Create structure and manage the project commitments.
CO 4: Gain enterprise support.
CO 5: Prepare Detailed Project Report (DPR).

6000236113	Project Management	L	T	P	C
Theory		3	0	0	3

Pre-requisites

Basic Knowledge

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	-	-	-	2	2
CO2	2	2	1	-	1	3	2
CO3	3	2	3	3	1	3	3
CO4	3	2	2		1	3	2
CO5	3	2	3	3	1	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 curiosity to learn.
- Implement task-based learning activities where students work on specific tasks or projects.
- Incorporate technology tools and resources, such as online platforms, interactive multimedia, and virtual communication tools, to enhance engagement and provide additional practice opportunities.
- All demonstrations/Hand-on practices may be followed in the real environment as far as possible.

6000236113	**Project Management**	L	T	P	C
Theory		3	0	0	3

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.

6000236113	**Project Management**	L	T	P	C
Theory		3	0	0	3

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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V. 17.
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<table>
<tr><td>6000236113</td><td rowspan="2" colspan="2">Project Management</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Theory</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Unit I</td><td colspan="6">Project Management – An Overview, Project Portfolio Management System and Structure, Steps in Defining Project and Project Delays</td></tr>
<tr><td colspan="6">Project – Classification – Importance of Project Management – An Integrated Approach – Project Portfolio Management System – The Need – Choosing the appropriate Project Management Structure: Organizational considerations and project considerations – steps in defining the project – project Rollup – Process breakdown structure – Responsibility Matrices – External causes of delay and internal constraints.</td><td>7</td></tr>
<tr><td>Unit II</td><td colspan="6">Various Stages and Components of Project Feasibility Studies, Phases of a Project, Stages in Project Life Cycle and Project Constraints</td></tr>
<tr><td colspan="6">Project feasibility studies - Opportunity studies, General opportunity studies, specific opportunity studies, pre-feasibility studies, functional studies or support studies, feasibility study – components of project feasibility studies – Managing Project resources flow – project planning to project completion: Pre-investment phase, Investment Phase and operational phase – Project Life Cycle – Project constraints</td><td>7</td></tr>
<tr><td>Unit III</td><td colspan="6">Project Evaluation Under Certainty and Uncertainty, Project Evaluation, Commercial and Social Cost Benefit Analysis</td></tr>
<tr><td colspan="6">Project Evaluation under certainty - Net Present Value (Problems - Case Study), Benefit Cost Ratio, Internal Rate of Return, Urgency, Payback Period, ARR – Project Evaluation under uncertainty – Methodology for project evaluation – Commercial vs. National Profitability – Social Cost Benefit Analysis, Commercial or National Profitability, social or national profitability</td><td>7</td></tr>
<tr><td>Unit IV</td><td colspan="6">Developing Project Network Using Pert and CPM, Project Appraisal and Control Process</td></tr>
<tr><td colspan="6">Developing a Project Plan - Developing the Project Network – Constructing a Project Network (Problems) – PERT – CPM – Crashing of Project Network (Problems - Case Study) – Resource Leveling and Resource Allocation – how to avoid cost and time overruns – Steps in Project Appraisal Process – Project Control Process – Control Issues – Project Audits – the Project Audit Process – project closure – team, team member and project manager evaluations</td><td>7</td></tr>
</table>

<table>
<tr><td>6000236113</td><td colspan="2" rowspan="2">Project Management</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Theory</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Unit V</td><td colspan="6">Project Managing Versus Leading of Project, Qualities of Project Manager and Managing Project Teams, Team Building Models and Performance Teams and Team Pitfalls</td></tr>
<tr><td colspan="6">Managing versus leading a project - managing project stakeholders – social network building (Including management by wandering around) – qualities of an effective project manager – managing project teams – Five Stage Team Development Model – Situational factors affecting team development – project team pitfalls</td><td>7</td></tr>
<tr><td colspan="6">REVISION & TEST</td><td>10</td></tr>
<tr><td colspan="6">TOTAL HOURS</td><td>45</td></tr>
</table>

Suggested List of Students Activity

Project Simulation and Role-Playing:

- Activity: Participate in simulated project scenarios where students take on different roles within a project team (e.g., project manager, team member, stake holder).
- Purpose: This helps students understand the dynamics of project management, including leadership, communication, and team collaboration.

Case Study Analysis:

- Activity: Analyze real-world case studies of successful and failed projects.
- Purpose: This activity enables students to apply theoretical knowledge to practical situations, identify best practices, and learn from the challenges and solutions implemented in real projects.

Project Plan Development:

- Activity: Develop a comprehensive project plan for a hypothetical or real project, including scope, schedule, budget, risk management, and quality management plans.
- Purpose: This allows students to practice creating detailed and structured project plans, honing their skills in planning and organizing project activities.

6000236113	Project Management	L	T	P	C
Theory		3	0	0	3

Group Project:

- Activity: Work in teams to manage a project from initiation to closure, simulating a real project environment.
- Purpose: Group projects help students learn how to work collaboratively, manage group dynamics, and apply project management tools and techniques in a team setting.

Project Management Software Training:

- Activity: Gain hands-on experience with project management software such as Microsoft Project, Asana, or Trello.
- Purpose: This activity equips students with practical skills in using technology to plan, track, and manage project tasks and resources efficiently.

Text Books

1. Clifford F. Gray and Erik W. Larson, Project Management: The Managerial Process, 6th edition, Tata Mcgraw Hill, 2017
2. Dragan Z. Milosevic, Project Management Toolbox: Tools and Techniques for the Practicing Project Manager, 2nd edition, John Wiley & Sons, 2016
3. P. Gopalakrishnan and V.E. Ramamoorthy, Textbook of Project Management, 1st edition, Laxmi Publications, 2022

6000236114	Finance Fundamentals	L	T	P	C
Theory		3	0	0	3

Introduction

This course gives a deep insight into the finance fundamentals such as money management and the process of acquiring needed funds. It also encompasses the oversight, creation, and study of money, banking, credit, investments, assets, liabilities that make up financial systems and improves overall financial literacy.

Course Objectives

The objective of this course is to enable the student to

- Identify different ways to save money for future
- Understand various techniques to raise capital
- Get acquainted with the essential terminologies used in finance language
- Get exposed to different types of budgeting
- Instill the concept of costing and its impact on profitability

Course Outcomes

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

CO1: Manage financial resources effectively to achieve personal goals
CO2: Ensure that the business has enough money to meet its obligations and that it can recover in the future
CO3: Exhibit financial literacy through the usage of different terminologies appropriate to the context
CO4: Differentiate different types of budgeting and allocate the resources
CO5: Apply the idea of marginal costing in decision making

Pre-requisites

Knowledge of basic mathematics

6000236114	Finance Fundamentals	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	1	-	1	-	2
CO2	3	1	1	-	1	-	2
CO3	3	1	1	-	1	-	2
CO4	3	2	1	-	1	-	2
CO5	3	2	1	-	1	-	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.

- Real-World Relevance: Incorporate relatable, real-life examples and applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

6000236114	Finance Fundamentals	L	T	P	C
Theory		3	0	0	3

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.

6000236114	Finance Fundamentals	L	T	P	C
Theory		3	0	0	3

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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6000236114	Finance Fundamentals	L	T	P	C
Theory		3	0	0	3

Unit I	**PERSONAL FINANCE**	
Personal Finance – Meaning, Objectives and advantages – Individual Perspective – Family Perspective – Time Value of Money – Personal Savings: Meaning, Different modes of Saving – Bank Deposit, Online Investments, Insurance, Stocks, Gold, Real Estate – Returns Vs Risk – Financial Discipline – Setting Alerts for commitments (With Real time Examples)		7
Unit II	**BUSINESS FUNDING**	
Sources: Personal Savings – Borrowings - Venture Capital – Venture Capital Process – Commercial Banks – Government Grants and Scheme		7
Unit III	**FINANCE LANGUAGE**	
Capital – Drawing – Income – Expenditure – Revenue Vs Capital Items – Assets – Fixed Assets – Current Assets – Fictitious Assets – Liabilities – Long-term Liabilities – Current Liabilities – Internal Liabilities – External Liabilities – Share holders fund: Equity Share capital, Preference Share Capital, Reserve & Surplus – Borrowings: Debentures, Bank Loan, Other Loan – Depreciation – Reserve Vs Provision.		7
Unit IV	**BUDGETING**	
Budgetary Control – Meaning – Preparation of various budgets – Purchase budget – Sales Budget – Production budget – Cash Budget – Flexible budgets. (With Problems)		7
Unit V	**MARGINAL COSTING**	
Marginal Costing – Meaning – Marginal Costing Vs Absorption Costing – Concepts of Variable Cost, Fixed Cost and Contribution – PV Ratio – Break Even Point – Margin of Safety – Key Factor – Application of Marginal Costing in decision making – Make or Buy – Shutdown or Continue – Exploring New Markets (With Problems)		7
REVISION & TEST		10
TOTAL HOURS		**45**

6000236114	**Finance Fundamentals**	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

Financial Statement Analysis:

- Activity: Analyze and interpret financial statements, including balance sheets, income statements, and cash flow statements of different companies.
- Purpose: This activity helps students understand the financial health and performance of organizations, developing skills in financial analysis and critical thinking.

Investment Portfolio Management:

- Activity: Create and manage a simulated investment portfolio, making decisions on asset allocation, stock selection, and diversification.
- Purpose: This allows students to apply theoretical concepts in a practical setting, learning how to evaluate investment opportunities and manage financial risk.

Case Study Analysis:

- Activity: Examine real-world case studies involving financial decisions made by companies, such as capital budgeting, mergers and acquisitions, and financial restructuring.
- Purpose: Case studies provide insights into the application of finance principles in business scenarios, enhancing problem-solving and decision-making skills.

Financial Modeling:

- Activity: Build financial models using spreadsheets to forecast future financial performance, conduct sensitivity analysis, and evaluate business projects.
- Purpose: Financial modeling is a critical skill in finance, enabling students to project financial outcomes and support strategic decision-making with quantitative analysis.

Classroom Discussions and Debates:

- Activity: Participate in discussions and debates on current financial issues, market trends, and economic policies.
- Purpose: Engaging in discussions helps students stay informed about the latest developments in finance, develop their communication skills, and form well-rounded opinions on financial matters.

Text Books

1. L. Natarajan, Banking Theory, Law & Practice, 1st edition, Margham Publications, 2019
2. T.S. Reddy and Dr. Y. Hariprasad Reddy, Management Accounting, 1st edition, Margham Publications, 2005
3. T.S. Reddy and Dr. Y. Hariprasad Reddy, Cost Accounting, 1st edition, Margham Publications, 2012

1040236115	Consumer Electronics	L	T	P	C
Theory		3	0	0	3

Introduction

The consumer electronics market has undergone significant growth in recent years. Looking towards the present need, in-depth knowledge for maintaining various consumer electronics appliances/equipment is necessary for diploma engineering students. This course will introduce the students with working principles, of consumer electronics appliances like audio-video systems, modern communication gadgets, home appliances, smart devices and others to develop skills to troubleshoot in systematic way. Knowledge so gained would also help the students to start their own enterprises.

Course Objectives

The objective of this course is to enable the student to

- Understand the basic principle operation behind various audio electronic instruments, recording devices and reproducing systems.
- Comprehend the core concept of video signal processing and TV standards.
- Gain a solid understanding of the fundamental principles of different digital information transmission systems.
- Understand the working principle of various consumer appliances
- Explore emerging trends and technologies highlighted in modern consumer electronic industries.

Course Outcomes

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

CO1: Identify and describe various audio electronic devices, including their key features and functionalities.

CO2: Recognize the concept of Monochrome & Colour TV principles, standards, and various types of displays used in TV signal transmission systems.

CO3: Distinguish and describe the different digital transmission mediums, including the potential use case in wireless, optical and satellite systems

CO4: Acquire a practical skill in troubleshooting, repairing, and maintaining consumer electronic appliances.

CO5: Get familiar with emerging technologies and trends in modern consumer electronics, including advancements in wearables, smart home devices, and digital assistants.

1040236115	Consumer Electronics	L	T	P	C
Theory		3	0	0	3

Pre-requisites

Knowledge of Electronic Devices and Circuits and Basic Communication Engineering

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	3	-	1	-	2
CO2	3	1	3	-	1	-	2
CO3	3	1	3	-	1	-	2
CO4	3	2	3	-	1	-	2
CO5	3	1	2	-	1	-	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040236115	**Consumer Electronics**	L	T	P	C
Theory		3	0	0	3

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.

1040236115	Consumer Electronics	L	T	P	C
Theory		3	0	0	3

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:

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1040236115	Consumer Electronics	L	T	P	C
Theory		3	0	0	3

UNIT I	AUDIO SYSTEMS	
Microphones and Loudspeakers: Carbon, Moving coil, Wireless microphone, Permanent Magnet Loudspeakers and Multi-speaker Systems. **Recording Systems:** Magnetic Recording, Digital Recording, Optical Recording, Digital sound recording on CD system, MP3. **Reproducing systems:** Monophonic, Stereophonic, Surround System, Home Theatre Systems.		9
UNIT II	**VIDEO SYSTEMS**	
Introduction to Video Signal Processing: Scanning Principles, Aspect Ratio, Resolution and Flicker. Attributes of Colour, Luminance and Chrominance Signal. **TV standards:** National Television Standards Committee (NTSC), Phase Alternating Line (PAL), Sequential Color and Memory (SECAM) System, Advanced Television Systems Committee (ATSC). **TV Displays:** Liquid crystal display (LCD), light-emitting diode (LED) display, organic light-emitting diode (OLED) display, Plasma display.		9
UNIT III	**DIGITAL TRANSMISSION SYSTEMS**	
Telecommunication System: Cordless Phones, Digital Cellular Phone, Closed-circuit television (CCTV). **Satellite System:** Direct-To-Home (DTH), Video on demand, Satellite Navigation- GPS Receiver. **Fiber Optic System:** Optical Fiber Cable and its types, Usage of Fiber in Telephone Network, Fiber to the Home (FTTH).		9
UNIT IV	**CONSUMER APPLIANCES**	
Microwave Oven: Magnetron, Working principle of Microwave Oven. **Washing Machine:** Controller for Washing Machine, Washing Cycle, Hardware and Software Development, Fuzzy Logic Washing Machines. **Air Conditioner and Refrigerators:** Components of air conditioning systems, working principle of Domestic Refrigerators, Inverter technology in AC and Refrigerator.		9

1040236115 **Theory**	**Consumer Electronics**	L	T	P	C
		3	0	0	3

Unit V	**MODERN CONSUMER ELECTRONICS**	
	Scanner and Readers: Bar coding principle, Bar-Code Scanner and Decoder, RFID Tags and Readers, Quick Response (QR) code technology. **Wearables:** Smart Watch/Fit bands, Hearing Aids, AR/VR Headsets. **Personal Digital Assistants:** Notebook PC, Smart Speakers (Voice Assistant), Digital camera.	9
	TOTAL HOURS	**45**

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. S.P.Bali, Consumer Electronics, 1st edition, Pearson Education, 2007
2. B.R. Gupta and V. Singhal, Consumer Electronics, 6th edition, S. K. Kataria& Sons, 2013
3. R.G. Gupta, Audio video systems,2nd edition, Tata McGraw Hill, 2017

Web-based/Online Resources

- https://www.explainthatstuff.com/articles_gadgets.html
- https://www.electronicsandyou.com/consumer-electronics-definition-list-of-companies.html
- https://spectrum.ieee.org/topic/consumer-electronics/

1040236116	ASIC Design	L	T	P	C
Theory		3	0	0	3

Introduction

Fundamental knowledge in the field of ASIC (Application Specific Integrated Circuit)is essential for Electronics engineers. ASIC is custom designed for a particular task or application. ASIC might be best choice for designers looking to decrease the size, perform specialized functions and improve efficiency by using less electric power. By consolidating multiple functions in a single chip, ASIC products require fewer electronic components and are easier to assemble.

Course Objectives

The objective of this course is to enable the student to

- Acquire knowledge on ASIC, Types of ASICs.
- To learn about different Programming technologies Anti fuse, SRAM, EPROM, and EEPROM Technology.
- To know the steps involved in ASIC design.
- To learn the different Programmable logic modules.
- To learn about Programmable I/O cells, Programmable interconnect.

Course Outcomes

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

CO1: Demonstrate ASIC design flow.
CO2: Get an idea about the function of partitioning and floor planning involved in ASIC design.
CO3: Understand the placement and routing steps involved in ASIC design.
CO4: Differentiate the Programming technologies Anti fuse, SRAM, EPROM, EEPROM Technology.
CO5: Describe the Programmable logic modules, Programmable I/O cells and Programmable interconnect

Pre-requisites

Knowledge of Digital Electronics

1040236116	**ASIC Design**	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	3	2	2	-	-	-	2
CO2	3	2	2	1	-	-	2
CO3	3	2	2	1	-	-	2
CO4	3	2	2	1	-		2
CO5	3	2	2	-	-	-	2

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

Instructional Strategy

- Teachers should give examples from daily routine as well as, engineering/technology applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles.
- Student activities should be planned on all the topics.
- Demonstrate/practice approach may be followed throughout the course so that learning may be employability based.

1040236116	ASIC Design	L	T	P	C
Theory		3	0	0	3

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.

1040236116	ASIC Design	L	T	P	C
Theory		3	0	0	3

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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1040236116	ASIC Design	L	T	P	C
Theory		3	0	0	3

UNIT I	**INTRODUCTION TO ASIC**	
Definition for ASIC (Application Specific Integrated Circuit) —Types of ASICs — Standard cell based ASICs —Gate array based ASICs —ASIC Design flow: Design Entry, Simulation, Synthesis, Partitioning, Floor planning, Placement and Routing.		9
UNIT II	**PARTITIONING and FLOOR PLANNING**	
Partitioning Goal and Objectives —Types of partitioning —Constructive partitioning —Iterative partitioning —Partitioning algorithm—Simple partitioning Example. Floor planning Goals and Objectives — Measurement of Delay in Floor planning —Floor planning— Optimization.		9
UNIT III	**PLACEMENT and ROUTING**	
Placement Goal and Objectives — Measurement of placement Goals and Objectives —Placement Algorithms — Simple placement Example. Types of Routing —Global Routing — Goals and Objectives — Measurement of Interconnect Delay — Global Routing Methods — Detailed Routing — Goals and Objectives — circuit extraction.		9
UNIT IV	**PROGRAMMABLE ASIC LOGIC CELLS**	
Programmable technologies — Anti fuse, SRAM, EPROM, and EEPROM technology— Actel ACT1 logic module — Actel ACT2 and ACT3 logic module — XC3000 CLB — XC4000 Logic block — XC 5200 logic block.		9
Unit V	**PROGRAMMABLE ASIC I/O CELLS AND PROGRAMMABLE INTERCONNECTS**	
XILINX I/O block —Altera MAX 5000 / 7000 interconnect scheme — Altera MAX 9000 interconnect scheme — Altera flex interconnect scheme.		9
TOTAL HOURS		**45**

1040236116	**ASIC Design**	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

Apart from classroom and 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 classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- Micro-projects may be given to group of students for hand-on experiences.

Text Books

1. Neil H.E. Weste and Kamran Esrhaghian, Principles of CMOS VLSI design, 2ndedition,Addison Wesley, 2005
2. S. Palnitkar, Verilog HDL: a guide to digital design and synthesis, 2nd edition, Pearson Education India, 2017
3. Sneh Saurabh, Introduction to VLSI Design Flow, 1st edition, Cambridge University Press, 2023

Websites

- VLSI Design Flow: RTL to GDS - Course (nptel.ac.in)
- https://youtu.be/IgxAfhW7o48

1040236241	Power Electronic Devices	L	T	P	C
Practicum		1	0	4	3

Introduction

Power Electronics Devices are crucial for improving energy efficiency, enhancing system reliability, and enabling advanced functionalities in modern electrical systems. They play a vital role in transitioning towards renewable energy sources, transportation electrification, and smart grid technologies. Understanding the principles and applications of power electronics devices is essential for engineers and researchers in electrical and electronic systems.

Course Objectives

The objective of this course is to enable the student to

- Know the Working principle of MOSFET and IGBT
- Know the Working principle of THYRISTOR
- Study the methods of Triggering SCR
- Learn about Converters, Choppers, and their types.
- Study about Inverters
- Analyze the Performance of Power Electronic Devices by Simulation and Experimentation.

Course Outcomes

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

CO1: Understand the Operation of MOSFET and IGBT
CO2: Understand the Operation of THYRISTOR
CO3: Outline the Triggering of SCR Circuits
CO4: Outline the Construction and Working of Choppers and Converters.
CO5: Outline the Working of the Inverter

Pre-requisites

Knowledge of electrical circuits and semiconductors

1040236241	**Power Electronic Devices**	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	3	2	2	-	-	1
CO2	1	3	2	2	-	-	1
CO3	1	3	2	2	-	-	1
CO4	1	3	2	2	-	-	1
CO5	1	3	2	2	-	-	1

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.

- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040236241	**Power Electronic Devices**	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.

1040236241	Power Electronic Devices	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

1040236241	**Power Electronic Devices**	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.

1040236241	Power Electronic Devices	L	T	P	C
Practicum		1	0	4	3

Unit I	**POWER TRANSISTOR DEVICES**	
Power Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-N-channel Enhancement Power MOSFET, Insulated Gate Bipolar Transistor (IGBT)- Symbol, Principle of Working, Voltage-Current (V-I) Characteristics, and its applications.		3
Ex.No	Name of the Experiment	
1	Verify the V-I Characteristics of Power MOSFET and Plot the graph.	9
2	Verify the V-I Characteristics of IGBT and Plot the graph.	
3	Study any one Application of IGBT/Power MOSFET.	
Unit II	**THYRISTOR FAMILY DEVICES**	
Silicon Controlled Rectifier (SCR), Diode for Alternating Current (DIAC), Triode for Alternating Current (TRIAC) - Symbol, Principle of Working, V-I Characteristics, and its applications.		3
Ex.No	Name of the Experiment	
4	Verify the V-I Characteristics of SCR and Plot the graph.	12
5	Verify the V-I Characteristics of DIAC and Plot the graph.	
6	Verify the V-I Characteristics of TRIAC for different values of Gate Currents and Plot the graph.	
7	Construct and Test the Lamp Dimmer Circuit using TRIAC.	
Unit III	**SCR TRIGGERING CIRCUITS**	
Triggering of SCR - Gate Triggering – Types –Concepts of DC Triggering, AC Triggering–Synchronized UJT Triggering (Ramp Triggering) Circuit and Waveform.		3
Ex.No	Name of the Experiment	
8	Construct a circuit to Trigger the given SCR using a UJT relaxation oscillator.	9
9	Construct a circuit to prevent unwanted dv/dt triggering of the SCR using a snubber circuit.	
10	Study any one Application based on SCR.	

1040236241	**Power Electronic Devices**	L	T	P	C
Practicum		1	0	4	3

Unit IV	**CONVERTERS AND CHOPPERS**	
CONVERTERS: Definition–Single Phase Full Controlled Bridge Converter with R Load and RL load. **CHOPPERS**: Definition– Principle of DC Chopper Operation – Principle and working of Single-Phase AC Chopper.		3
Ex.No	Name of the Experiment	
11	Construct and Test a Half-Wave Controlled Rectifier with R Load.	9
12	Construct and Test a Single-phase Full Controlled Bridge Rectifier with RL-Load.	
13	Study the Working of a Single-Phase AC chopper.	
Unit V	**INVERTERS**	
Inverter with Resistive Load – Single Phase Inverter with RL load – Methods to obtain Sine Wave output from an Inverter		3
Ex.No	Name of the Experiment	
14	Construct and Test the Single-Phase Inverter using MOSFET/IGBT.	6
15	Study any one method to obtain Sine Wave output from an Inverter.	
	REVISION	15
	TOTAL HOURS	**75**

1040236241	**Power Electronic Devices**	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.
- Mini project that shall be an extension of any practical lab exercise to real-world application.

Text Books

1. M.D. Singh and K.B. Khanchandhini, Power Electronics,2nd edition McGraw Hill Publishing Company, 2007
2. M.H. Rashid, Power Electronics: Circuits, Devices and Applications, 4th edition, Pearson Education India, 2017
3. Daniel W. Hart, Power Electronics, 1st edition, McGraw Hill Education, 2011

Websites / Online Resources

- NPTEL:https://archive.nptel.ac.in/courses/108/102/108102145/
- https://archive.nptel.ac.in/courses/108/101/108101126/
- https://nptel.ac.in/courses/108101038
- Laboratory:https://virtual-labs.github.io/exp-igbt-iitr/index.html
- https://falstad.com/circuit/e-index.html
- https://dcaclab.com/users_experiments

1040236241	**Power Electronic Devices**	L	T	P	C
Practicum		1	0	4	3

List of Equipment Required for a Batch of 30 Students

Sl.No.	Equipment	Quantity
1	Regulated Power supply (0-30V), (0-60V)	6
2	DSO (0-100 MHZ)	6
3	Function Generator (1-3 MHZ)	6
4	Ammeter (DC) 0-60mA	5
5	Ammeter (DC) 0-30mA	5
6	Ammeter (DC) 0-1A	5
7	Voltmeter (DC) 0-60V	5
8	Voltmeter (DC) 0-30V	5
9	Multimeter	10
10	Auto-transformer 230/0-260V, 15A	3
11	Isolation Transformer 230V	3
12	MOSFET IRF 740	10
13	SCR TYN616	10
14	IGBT BC 20S	10
15	TRAIC BTM36/BT136	10
16	DIAC DB3	10
17	UJT 2N2646	10
18	Resistor 560Ω,2.2kΩ, 1KΩ	10
19	Resistor 1kΩ/1W, 100Ω/20W	10
20	Connecting wires/Bread Board	As Required
21	TRAINER KITS – Related to Experiments SCR/IGBT/MOSFET Computer for Simulation	As Required

1040236242	VLSI using Verilog	L	T	P	C
Practicum		1	0	4	3

Introduction

Very Large Scale Integration technology, especially used for designing digital Systems. HDL can be used to describe hardware. This course is to learn the digital system design Concepts through hardware description Language. It is mainly aimed at design of combinational and sequential functions and simulates or verifies their functionality using Verilog Hardware description Language (HDL).

Course Objectives

The objective of this course is to enable the student to

- Understand the concepts of NMOS, CMOS logic.
- Acquire knowledge on VLSI design process.
- Know the different Verilog statements.
- Develop a Verilog HDL code for combinational circuit
- Develop a Verilog HDL code for sequential circuit.
- Differentiate PROM, PLA and PAL.
- Develop the circuit using PROM, PAL and PLA.
- Familiarize with CPLD and FPGA.

Course Outcomes

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

CO1: Develop a Verilog HDL code for combinational circuit.
CO2: Develop a Verilog HDL code for sequential circuit.
CO3: Simulate a Verilog HDL code of any combinational circuit.
CO4: Synthesis a Verilog HDL code of any combinational /sequential circuit.
CO5: Check the function of any combinational / sequential circuit in the FPGA kit.

Pre-requisites

Knowledge of Digital Electronics

1040236242	VLSI using Verilog	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	3	-	-	1
CO2	3	2	2	3	-	-	1
CO3	3	2	2	3	-		1
CO4	3	2	2	3	-	-	1
CO5	3	2	2	3	-	-	1

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

Instructional Strategy

- Teachers should give examples from daily routine as well as, engineering/technology applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles.
- Student activities should be planned on all the topics.
- Demonstrate/practice approach may be followed throughout the course so that learning may be employability based.

1040236242	**VLSI using Verilog**	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.

1040236242	VLSI using Verilog	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	Program & Flowchart/Algorithm	30
C	Execution & Result	15
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

1040236242	**VLSI using Verilog**	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	Flowchart/ Algorithm	20
C	Program	25
D	Execution & 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.

1040236242	**VLSI using Verilog**	L	T	P	C
Practicum		1	0	4	3

Unit I	**INTRODUCTION TO VLSI DESIGN**	
Different level of abstractions in VLSI design – Steps involved in VLSI design process: Design Entry, Simulation, Synthesis, Placement and Routing –NOT, AND, OR, NAND, and NOR Gates using NMOS – NOT, AND, OR, NAND, and NOR Gates using CMOS – Simple combinational circuit using NMOS – Simple combinational circuit using CMOS.		3
Ex.No	Name of the Experiment	
1	Simulation of Verilog code for logic gates AND gate, OR gate. (Develop code for logic gates AND gate, OR gate. Simulate the code in the software)	3
Unit II	**INTRODUCTION TO VERILOG**	
HDL – Types of HDL – Different types of modeling – Basics of Verilog language: module, Data types, Operators: Arithmetic operators, Logical shift operators, Relational operators, Logical operators – Syntax for Continuous assignment statements, Procedural assignment statement – Timing control, wait statement – Syntax for control statements.		3
Unit III	**COMBINATIONAL CIRCUIT DESIGN**	
Verilog program for half adder and Full adder –Verilog program for Half Subtractor and Full Subtractor–Verilog program for 4 to 1Mux, 1 to 4 Demux–Verilog program for 4 to 2 Encoder, 2 to 4 decoder.		3
Ex.No	Name of the Experiment	
2	Simulation of Verilog code for half adder. (Develop code for half adder. Simulate the code in the software)	18
3	Simulation of Verilog code for Full adder. (Develop code for Full adder. Simulate the code in the software)	
4	Simulation of Verilog code for half Subtractor. (Develop code for half Subtractor. Simulate the code in the software)	
5	Simulation of Verilog code for Full Subtractor. (Develop code for Full Subtractor. Simulate the code in the software)	
6	Simulation of Verilog code for 4 to 1 Mux and implement it in FPGA Kit.	
7	Simulation of Verilog code for 1 to 4 Demux and implement it in FPGA Kit.	

1040236242	VLSI using Verilog	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
8	Simulation of Verilog code for 4 to 2 Encoder and implement it in FPGA Kit.	6
9	Simulation of Verilog code for 2 to 4 Decoder and implement it in FPGA Kit.	
Unit IV	**SEQUENTIAL CIRCUIT DESIGN**	
Verilog program for D, JK and T Flip-flops – Verilog program for 3 bit Shift register – Verilog program for 3 bit up counter – Verilog program for 3 bit down counter –Verilog program for 3 bit up-down counter		3
Ex.No	Name of the Experiment	
10	Write Verilog code for D Flip Flop and T Flip Flop and implement it in FPGA kit.	15
11	Write Verilog code for JK Flip Flop and implement it in FPGA kit.	
12	Write Verilog code for 3 bit Shift Register and implement it in FPGA kit.	
13	Write Verilog code for 3 bit up counter and implement it in FPGA kit.	
14	Write Verilog code for 3 bit down counter and implement it in FPGA kit.	
Unit V	**PROGRAMMABLE LOGIC DEVICES**	
Introduction to PROM, PLA and PAL – Implementation of combinational circuits with PROM, PAL and PLA (up to 3 variables) – Introduction to CPLD–Introduction to FPGA		3
Ex.No	Study Experiment	
15	Write Verilog code for RAM / ROM	3
REVISION		15
TOTAL HOURS		**75**

1040236242	VLSI using Verilog	L	T	P	C
Practicum		1	0	4	3

Suggested List of Students Activity

Apart from classroom and 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 classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- Micro-projects may be given to group of students for hand-on experiences.

Text Books

1. M.Morris Mano and Michael D. Ciletti, Digital Design, 6th edition, Pearson Education, 2018
2. J. Bhasker, A Verilog Primer, 3rd edition, Prentice Hall India, 2005
3. Neil H.E. Weste and Kamran Esrhaghian, Principles of CMOS VLSI design, 2nd edition,Addison Wesley, 2005

List of Hardware / Software Required for a Batch of 30 Students

Sl.No.	Equipment	Quantity
1	Desktop PCs	15
2	FPGA Kit with software	10

Websites

- Hardware Modeling Using Verilog - Course (nptel.ac.in)
- https://archive.nptel.ac.in/courses/106/103/106103116

1040236243	**Virtual Instrumentation**	L	T	P	C
Practicum		1	0	4	3

Introduction

VI is a program created in the LabVIEW programming environment that simulates physical or hard instruments such as oscilloscopes and function generators. These tasks include things like understanding graphical language, recognizing patterns, learning from experience, and making decisions.

Course Objectives

The objective of this course is to enable the student to

- Understand the basics of Virtual Instrumentation
- Know the basic of Modular Programming
- Understand the 2D and multidimensional arrays and structures
- Know the data acquisition
- Understand simple applications in VI.

Course Outcomes

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

CO1: Understand Fundamentals of virtual instrumentation.
CO2: Apply various VI repetition and loops.
CO3: List out the various types of structures used in LabVIEW.
CO4: Analyze and design different type of programs based on data Acquisition.
CO5: Apply VI application for a real time system.

Pre-requisites

Knowledge of Digital Electronics

1040236243	Virtual Instrumentation	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	3	1	1	1
CO2	2	3	2	3	-	-	1
CO3	2	1	3	3	1	2	2
CO4	3	2	1	2	2	1	2
CO5	3	2	2	2	2	2	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040236243	**Virtual Instrumentation**	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
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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.

1040236243	Virtual Instrumentation	L	T	P	C
Practicum		1	0	4	3

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

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- 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.
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SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Program & Flowchart/ Algorithm	30
C	Execution & Result	15
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

1040236243	Virtual Instrumentation	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	Flowchart/ Algorithm	20
C	Program	25
D	Execution & 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.

<table>
<tr><td>1040236243</td><td rowspan="2">Virtual Instrumentation</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Practicum</td><td>1</td><td>0</td><td>4</td><td>3</td></tr>
</table>

<table>
<tr><td>Unit I</td><td colspan="2">VIRTUAL INSTRUMENTATION</td></tr>
<tr><td colspan="2">Virtual Instrumentation – Definition-Block diagram and Architecture of Virtual Instruments-Introduction to LabVIEW : Advantages, software environment, creating and saving VI, front panel and block diagram toll bar, palettes, controls and indicators, block diagram, data types, data flow program, Simple basic program.</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>1</td><td>Introduction to LabVIEW software (Study Experiment)</td><td rowspan="3">9</td></tr>
<tr><td>2</td><td>Basic arithmeticoperations</td></tr>
<tr><td>3</td><td>Boolean operations.</td></tr>
<tr><td>Unit II</td><td colspan="2">MODULAR PROGRAMMING</td></tr>
<tr><td colspan="2">Build a VI front panel and block diagram, building a connector pane, displaying sub VIs and express VIs, creating sub VIs, Repetition and loops: For loops, while loops, structure tunnels, terminal inside or outside loops, shift registers, feedback nodes, control timing, communication among multiple loops, local and global variables.</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>4</td><td>Sum of ‘n’ numbers using ‘for’ loop</td><td rowspan="3">9</td></tr>
<tr><td>5</td><td>Factorial of a given number using ‘for’ loop</td></tr>
<tr><td>6</td><td>Sum of n natural numbers using ‘while’ loop</td></tr>
<tr><td>Unit III</td><td colspan="2">ARRAYS</td></tr>
<tr><td colspan="2">Creating one dimensional, two dimensional, multi-dimensional arrays, array initialization, deleting, inserting, replacing elements within an array, array function, auto indexing. Structures: Case, sequence, customizing, timed structures, formula nodes, event structures.</td><td>3</td></tr>
<tr><td>Ex.No</td><td>Name of the Experiment</td><td></td></tr>
<tr><td>7</td><td>Sorting even numbers using while loop in an array</td><td rowspan="3">9</td></tr>
<tr><td>8</td><td>Find the maximum and minimum in an array</td></tr>
<tr><td>9</td><td>Flat and stacked sequence</td></tr>
</table>

1040236243	**Virtual Instrumentation**	L	T	P	C
Practicum		1	0	4	3

Unit IV	**DATA ACQUISITION**	
Signals, signal conditioning, DAQ hardware configuration, DAQ hardware, analog inputs, outputs, counters.		3
Ex.No	Name of the Experiment	
10	Create a sine wave using formula node.	9
11	Find the Convolution of two signals	
12	Apply Median Filter technique for a given input signal	
Unit V	**ANALYSIS TOOLS AND SIMPLE APPLICATIONS IN VI**	
Build virtual instruments like oscilloscope, FFT analyser – Windowing and filtering tools - Building autonomous embedded system using FPGA target		3
Ex.No	Name of the Experiment	
13	Apply filtering technique for a given input signal	9
14	Apply different windowing technique on the given input signal	
15	Apply FFT on the given input signal	
REVISION		15
TOTAL HOURS		**75**

1040236243	Virtual Instrumentation	L	T	P	C
Practicum		1	0	4	3

Suggested List of Students Activity:

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

- Different analyzing tools for virtual instrumentation may be discussed.
- Micro-projects may be given to group of students for hand-on experiences.

Text Books

1. G. Johnson, LabVIEW Graphical Programming, 4th edition, McGraw Hill, 2006
2. L. Sokoloft, Basic Concepts of LabVIEW 4, Prentice Hall Inc., 1st edition, 2005
3. L.K. Wells and J.Travis, LabVIEW for Everyone: Graphical Programming Made Even Easier, 4th edition, Prentice Hall, 2005

Websites

- LabVIEW tutorial videos on NI http://www.ni.com/academic/students/learn-labview/
- LabVIEW Basics http://www.ni.com/white-paper/7466/en/
- LabVIEW VISA Overview http://www.ni.com/support/visa/vintro.pdf

List of Hardware / Software Required for a Batch of 30 Students

Sl.No.	Equipment	Quantity
1	Desktop PCs	15Nos
2	Printer	1
3	NI Labview	15 users

1040236244	**Artificial Intelligence**	L	T	P	C
Practicum		1	0	4	3

Introduction

Artificial Intelligence (AI) is a branch of computer science that focuses on creating systems capable of performing tasks that typically require human intelligence. These tasks include things like understanding natural language, recognizing patterns, learning from experience, and making decisions.

Course Objectives

The objective of this course is to enable the student to

- To familiarize with fundamentals of Artificial Intelligence and Python programming.
- To acquaint with various AI search algorithms
- To study the various machine learning methods
- To study the various text processing techniques
- To implement AI application in real time system

Course Outcomes

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

CO1: Understand Fundamentals of Artificial Intelligence. Review of python programming
CO2: Apply various AI search algorithms (uninformed, informed, heuristic, Adversarial).
CO3: List out the various machine learning methods and apply algorithms
CO4: List out various text processing techniques and implement algorithms
CO5: Apply AI application for a real time system.

Pre-requisites

Knowledge of c programming language
Knowledge of probability and statistics
Knowledge of language development

1040236244	Artificial Intelligence	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	2	3	1	1	1
CO2	2	3	2	3	-	-	1
CO3	2	1	3	3	1	2	2
CO4	3	2	1	2	2	1	2
CO5	3	2	2	2	2	2	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.

- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.

- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.

- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.

- Simulation and Real-World Practice: Conduct demonstrations and hands-on activities in a simulated environment, transitioning to real-world scenarios when possible.

- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1040236244	**Artificial Intelligence**	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.

1040236244	**Artificial Intelligence**	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	Program & Flowchart/ Algorithm	30
C	Execution & Result	15
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

1040236244	Artificial Intelligence	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	Flowchart/ Algorithm	20
C	Program	25
D	Execution & 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.

1040236244	**Artificial Intelligence**	L	T	P	C
Practicum		1	0	4	3

Unit I	**FUNDAMENTALS OF AI &PYTHON BASICS**	
Introduction to AI - Evolution & Revolution of AI - Structure of AI - Intelligent Agents & Environments **Python**: Introduction-Basic Syntax: Data Types- Variables - Operators- Input/output- Flow of Control (Modules, Branching): If-If-else-Nested if-else-Looping: For – While - Nested loops – Pass - Strings - Comparison of List, Dictionary & Tuples- OOPs concept.		3
Ex.No	Name of the Experiment	
	Familiarize with various python libraries used for machine learning	9
1	Write a program using python to get a number from user and display whether it is even or odd.	
2	Write a program using python to generate random numbers	
3	Extract the data from database using python	
Unit II	**PROBLEM SOLVING BY SEARCH**	
Searching for solution- Uninformed Search-Breadth first search- Informed Search(Heuristic & Meta-heuristics)- Alpha beta pruning.		3
Ex.No	Name of the Experiment	
4	Implement uninformed search technique" Breadth first search" using python	9
5	Solve a simple knapsack problem by using heuristic algorithm in python	
6	Implement game playing algorithm (Alpha beta pruning) using python	
Unit III	**LEARNING**	
Learning -the brain and the neuron - Machine Learning- supervised- unsupervised - reinforcement learning - Find S Algorithm - Classification-Linear regression		3

1040236244	**Artificial Intelligence**	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
7	Implement Find S algorithm using python	9
8	Generate a program for unsupervised K means clustering on synthetic GPS data using python	
9	Implement the regression model for y=mx+c using the given data set	
Unit IV	**NATURAL LANGUAGE PROCESSING**	
Basics of text processing-Tokenization-Word type-Morphology-Lemmatization-Morphemes-Stemming- - Parts of speech tagging		3
Ex.No	Name of the Experiment	
10	Write a program to remove stop words from the given text using python	9
11	Implement a python program that performs tokenization on the input text.	
12	Implement noise removal on input text using python	
Unit V	**APPLICATIONS OF ARTIFICIAL INTELLIGENCE**	
Education – Healthcare – Transportation – Robotics- Data Analysis -Autonomous vehicle- Agriculture –Gaming		3
Ex.No	Name of the Experiment	
13	Generate an image for the given text description with AI image generator	9
14	Generate speedometer using TK dial using python	
15	Generate a smart watch data analysis using python	
REVISION		15
TOTAL HOURS		**75**

1040236244	Artificial Intelligence	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. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 3rdedition, Prentice Hall Series, 2010
2. Rupinder Singh, Introduction to Artificial Intelligence,1st edition, Notion Press, 2021
3. T.R. Sharikaand P.S. Archana, Introduction to Artificial Intelligence, 1st edition, Sharika T R Publisher, 2023

List of Hardware / Software Required for a Batch of 30 Students

Sl.No.	Equipment	Quantity
1	Desktop PCs	15Nos
2	Python or equivalent software package	15 users
3	Printer	1

1040236245	**Wireless Communication**	L	T	P	C
Practicum		1	0	4	3

Introduction

This course will give the outline of wireless communication such as cellular concepts, mobile radio propagation, digital modulation techniques, equalization techniques, diversity techniques and multiple access techniques. Also, the course instills practical experience and allows students to demonstrate basic concepts of wireless communication through simulations.

Course Objectives

The objective of this course is to enable the student to

- To familiarize the concepts of a Cellular System
- To study and understand Mobile Radio Propagation models
- To acquaint the students with different Digital Modulation Techniques
- To learn the fundamentals of equalization and diversity
- To study and understand the concepts of Multiple Access Techniques for wireless communication

Course Outcomes

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

CO1: Understand the concept of a Cellular System.
CO2: Derive an input-output linear time varying model for the channel, and define important physical parameters.
CO3: Explain Digital Modulation techniques for radio wave propagation.
CO4: Comprehend various types equalization and diversity techniques
CO5: Describe the concepts of Multiple Access Techniques

Pre-requisites

Signals and systems, Probability and digital communications

1040236245	Wireless Communication	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	1	3	3	-	-	3
CO2	3	1	3	3	-	-	3
CO3	3	1	3	3	-	-	3
CO4	3	1	3	3	-	-	3
CO5	3	1	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.

1040236245	**Wireless Communication**	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.

1040236245	**Wireless Communication**	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

1040236245	Wireless Communication	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.

1040236245	**Wireless Communication**	L	T	P	C
Practicum		1	0	4	3

Unit I	**CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS**	
Introduction –frequency reuse, channel strategy, handoff strategy, interference & system capacity, improving coverage and capacity in cellular system		3
Ex.No	Name of the Experiment	
1	Performance measurement of signal adjacent channel leakage ratio	9
2	Performance measurement of error vector magnitude	
3	Performance measurement of handoff	
Unit II	**MOBILE RADIO PROPAGATION**	
Large scale path, introduction to radio wave propagation(scattering, reflection, diffraction),free space propagation model- two ray Rayleigh model, small scale fading, multipath fading		3
Ex.No	Name of the Experiment	
4	Modeling of wireless communication system using any open source software like Octave, Scilab.	9
5	Modeling and simulation of Large scale path loss using any open source software like Octave, Scilab.	
6	Modeling and simulation of multipath fading channel using any open source software like Octave, Scilab.	
Unit III	**MODULATION TECHNIQUES**	
Linear Modulation Techniques-MSK, GMSK, Spread Spectrum Modulation Techniques- DS-SS, FH-SS		3
Ex.No	Name of the Experiment	
7	Modulation and demodulation of direct sequence spread spectrum	9
8	Modulation and demodulation of frequency hopping spread spectrum	
9	Modulation and demodulation of MSK and GMSK	
Unit IV	**EQUALIZATION AND DIVERSITY TECHNIQUES**	
Basics of equalization and its types, diversity techniques, space diversity, polarization diversity, frequency diversity, time diversity		3

1040236245	**Wireless Communication**	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
10	Wireless channel equalization of Zero forcing Equalizer	9
11	Wireless channel equalization of MMSE equalizer	
12	Wireless channel equalization of adaptive equalizer, Decision Feedback equalizer	
Unit V	**MULTIPLE ACCESS TECHNIQUES**	
FDMA, OFDM, TDMA and SDMA-capacity measurement, capacity of CDMA with multiple cells, capacity of cellular CDMA		3
Ex.No	Name of the Experiment	
13	Modeling and simulation of TDMA using any open source software like Octave, Scilab.	9
14	Modeling and simulation of FDMA using any open source software like Octave, Scilab.	
15	Modeling and simulation of CDMA using any open source software like Octave, Scilab.	
REVISION		15
TOTAL HOURS		**75**

1040236245	Wireless Communication	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. T.S. Rappaport, Wireless Communications, 2nd edition, Pearson Education, 2010
2. Andreas F. Molisch, Wireless Communications, 2nd edition, Wiley, 2013
3. Gordon Gow and Richard K. Smith, Mobile and Wireless Communications, 1st edition, McGraw Hill, 2006

List of Equipments Required for a Batch of 30 Students

Sl.No.	Description	Quantity
1	Desktop PC	15 Nos
2	MATLAB or scilab or equivalent software package for simulation experiments	15 Users

1040236246	VR and AR	L	T	P	C
Practicum		1	0	4	3

Introduction

This course is designed to give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

Course Objectives

The objective of this course is to enable the student to

- Learn the fundamental Computer Vision, Computer Graphics and Human-Computer interaction Techniques related to VR/AR.
- Review the Geometric Modeling Techniques.
- Review the Virtual Environment.
- Discuss and Examine VR/AR Technologies
- Use of various types of Hardware and Software in Virtual Reality systems
- Simulate and Apply Virtual/Augmented Reality to varieties of Applications

Course Outcomes

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

CO1: Understand the fundamental Computer Vision, Computer Graphics and Human-Computer interaction Techniques related to VR/AR.
CO2: Understand the physical principles of VR.
CO3: Explain the concepts of motion and tracking in VR systems.
CO4: Create a comfortable, high-performance VR application using Unity.
CO5: Understand the system of human vision and its implication on perception and rendering.

Pre-requisites

Knowledge on Engineering Graphics.

1040236246	**VR and AR**	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	3	1	1	2
CO2	3	2	3	3	1	1	2
CO3	3	3	3	3	1	3	2
CO4	3	3	3	3	2	3	2
CO5	3	3	3	3	2	3	2

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ a theory-demonstrate-practice-activity strategy throughout the course to ensure outcome-driven learning and employability.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyse potential sources of error in case of discrepancies.

1040236246	**VR and AR**	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.

1040236246	VR and AR	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	Program & Flowchart/ Algorithm	30
C	Execution & Result	15
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

1040236246	VR and AR	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	Flowchart/ Algorithm	20
C	Program	25
D	Execution & 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.

<table>
<tr><td>1040236246</td><td colspan="2" rowspan="2">VR and AR</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Practicum</td><td>1</td><td>0</td><td>4</td><td>3</td></tr>
<tr><td>Unit I</td><td colspan="6">INTRODUCTION TO VIRTUAL REALITY (VR)</td></tr>
<tr><td colspan="6">Introduction : Defining Virtual Reality, History of VR, Key Elements of Virtual Reality.
Virtual Environment: Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement,
Benefits: benefits of virtual reality, Historical development of VR, Scientific Landmark.</td><td>3</td></tr>
<tr><td>Ex.No</td><td colspan="5">Name of the Experiment</td><td></td></tr>
<tr><td>1</td><td colspan="5">Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.</td><td rowspan="3">9</td></tr>
<tr><td>2</td><td colspan="5">Implementation on Video/Feature viewing</td></tr>
<tr><td>3</td><td colspan="5">Implementation on Virtual Tool</td></tr>
<tr><td>Unit II</td><td colspan="6">COMPUTER GRAPHICS AND GEOMETRIC MODELLING</td></tr>
<tr><td colspan="6">Fundamentals of VR World: The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Color theory.
Modelling: Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modeling, 3D clipping, Illumination models, Reflection models, Shading algorithms.
Geometrical Transformations: Introduction, Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.</td><td>3</td></tr>
<tr><td>Ex.No</td><td colspan="5">Name of the Experiment</td><td></td></tr>
<tr><td>4</td><td colspan="5">Demonstration of the working of HTC Vive, Google Cardboard, Google Daydream and Samsung gear VR.</td><td rowspan="3">9</td></tr>
<tr><td>5</td><td colspan="5">Explore projects in unity 2D and 3D</td></tr>
<tr><td>6</td><td colspan="5">Create an immersive environment (living room / battlefield / tennis court) with only static game objects. 3D game objects can be created using blender or use available 3D models.</td></tr>
</table>

1040236246	**VR and AR**	L	T	P	C
Practicum		1	0	4	3

Unit III	**VIRTUAL ENVIRONMENT**	
Input/Output Devices: Input (Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner, etc.), Output (Visual/Auditory/Haptic Devices). **Generic VR system:** Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems, Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system. **Physical Simulation:** Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.		3

Ex.No	Name of the Experiment	
7	Develop a scene in Unity that includes: i. a cube, plane and sphere, apply transformations on the 3 game objects. ii. add a video and audio source.	9
8	Develop a scene in Unity that includes simple pendulum, apply any 3 transformations on the above object.	
9	Develop a scene in Unity that shows flight dynamics of an aircraft.	

Unit IV	**AUGMENTED REALITY (AR)**	
Fundamentals of Augmented Reality: Taxonomy, Technology and Features of Augmented Reality, AR Vs VR. **Challenges:** Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality. **Enhancing Environment:** Enhancing interactivity in AR Environments, Evaluating AR systems.		3

1040236246	**VR and AR**	L	T	P	C
Practicum		1	0	4	3

Ex.No	Name of the Experiment	
10	Develop a scene in Unity that includes a sphere and plane. Apply Rigid body component, material and Box collider to the game Objects.	9
11	Apply the Visualization Techniques on any object.	
12	Implement an interaction technique on any object.	
Unit V	**DEVELOPMENT TOOLS AND FRAMEWORKS**	
Human factors: Introduction, the eye, the ear, the somatic senses **Hardware:** Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems **Software:** Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML		3
Ex.No	Name of the Experiment	
13	Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects. 3D game objects can be created using Blender or use available 3D models.	9
14	Write a basic VRML code to create a simple red sphere	
15	Case Study of a single application using both VR and AR	
REVISION		15
TOTAL HOURS		**75**

1040236246	VR and AR	L	T	P	C
Practicum		1	0	4	3

Suggested List of Students Activity

- Presentation/Seminars by students on recent technological developments based on the course.
- Project based Learning in emerging application.
- Periodic class/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.
- Assignments on different types of learning.
- Tutorials on solving problems.
- Flipped classroom activities to explore application areas.

Text Books

- D. Schmalstieg and T. Höllerer, Augmented Reality: Principles & Practice, 1st edition, Pearson, 2016
- K. Norman and J. Kirakowski, Wiley Handbook of Human Computer Interaction, 1stedition, Wiley-Blackwell, 2018
- A.E. Hassanien, D.Gupta, A. Khanna and A. Slowik, Virtual and Augmented Reality for Automobile Industry: Innovation Vision and Applications, 1st edition, Springer, 2022.

Web-based / Online Resources

- Manivannan, M., (2018), "Virtual Reality Engineering," IIT Madras, https://nptel.ac.in/courses/121106013
- Misra, S., (2019), "Industry 4.0: Augmented Reality and Virtual Reality," IIT Kharagpur, https://www.youtube.com/watch?v=zLMgdYI82IE
- Dube, A., (2020), "Augmented Reality - Fundamentals and Development," NPTEL Special Lecture Series, https://www.youtube.com/watch?v=MGuSTAqIZ9Q

1040236246	VR and AR	L	T	P	C
Practicum		1	0	4	3

Equipment / Facilities required to conduct the Practical Course for a Batch of 30 Students

- Operating System recommended : 64-bit Windows OS
- Programming tools recommended: Unity, C#, Blender, VRTK.
- VR Devices: HTC Vive, Google Cardboard, Google Daydream and Samsung gear VR.

1040236351	**Internship**	Periods	C
Project		540	12

Introduction

Internships in educational institutions are designed to provide students with practical experience in their field of study and to bridge the gap between academic knowledge and professional practice.

Course Objectives

After completing Internship, Interns will be able to,

- Apply the theoretical knowledge and skill during performance of the tasks assigned in internship.
- Demonstrate soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship.
- Document the Use case on the assigned Task.
- Enable interns to apply theoretical knowledge gained in the classroom to real-world practical applications.
- Provide hands-on experience in the industrial practices.
- Develop essential skills such as communication, organization, teamwork, and problem-solving.
- Enhance specific skills related to the intern's area of focus. Offer a realistic understanding of the daily operations and responsibilities.
- Provide opportunities to work under the guidance of experienced supervisors and administrators.
- Allow interns to explore different career paths.
- Help interns make informed decisions about their future career goals based on first hand experience.
- Facilitate the establishment of professional relationships with supervisor, administrators, and other professionals in the field.
- Provide access to a network of contacts that can be beneficial for future job opportunities and professional growth.
- Foster personal growth by challenging interns to step out of their comfort zones and take on new responsibilities.
- Build confidence and self-efficacy through successful completion of internship tasks and projects.
- Give insight into the policies, regulations, and administrative practices.
- Allow interns to observe and understand the implementation of standards and policies in practice.
- Provide opportunities for constructive feedback from supervisors and mentors, aiding in the intern's professional development.
- Enable self-assessment and reflection on strengths, areas for improvement, and career aspirations.
- Encourage sensitivity to the needs and backgrounds of different groups, promoting inclusive and equitable industrial practices.

1040236351	**Internship**	Periods	C
Project		540	12

Course Outcomes

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

CO 1: Demonstrate improved skills.
CO 2: Exhibit increased professional behavior.
CO 3: Apply theoretical knowledge and principles in real-world practices.
CO 4: Develop and utilize assessment tools to evaluate the learning and practices.
CO 5: Engage in reflective practice to continually improve their learning and professional growth.

Facilitating the Interns by an Internship Provider

- Orient intern in the new workplace. Give interns an overview of the organization, Explain the intern's duties and introduce him or her to co-workers.
- Develop an internship job description with clear deliverables and timeline.
- Allow the interns in meetings and provide information, resources, and opportunities for professional development.
- The interns have never done this kind of work before, they want to know that their work is measuring up to organizational expectations, hence provide professional guidance and mentoring to the intern.
- Daily progress report of Intern is to be evaluated by industry supervisor. Examine what the intern has produced and make suggestions. Weekly supervision meetings can help to monitor the intern's work.

Duties Responsibilities of the Faculty Mentor

- To facilitate the placement of students for the internship
- To liaison between the college and the internship provider
- To assist the Industrial Training Supervisor during assessment

Instructions to the Interns

- Students shall report to the internship provider on the 1st day as per the internship schedule.
- Intern is expected to learn about the organization, its structure, product range, market performance, working philosophy etc.

1040236351	**Internship**	Periods	C
Project		540	12

- The interns shall work on live projects assigned by the internship provider.
- The Intern shall record all the activities in the daily log book and get the signature of the concerned training supervisor.
- Intern shall have 100% attendance during internship programme. In case of unavoidable circumstances students may avail leave with prior permission from the concerned training supervisor of the respective internship provider. However, the maximum leave permitted during internship shall be as per company norms where they are working and intern shall report the leave sanctioned details to their college faculty mentor.
- The interns shall abide all the Rules and Regulations of internship provider
- Intern shall follow all the safety Regulations of internship provider.
- On completion of the internship, the intern shall report to the college and submit the internship certificate mentioning duration of internship, evaluation of interns by internship provider, Student's Diary and Comprehensive Training Report.

Attendance Certification

Every month students have to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution supervisor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Training Reports

The students have to prepare two types of reports: Weekly report in the form of diary to be submitted to the concerned staff in-charge of the institution. This will be reviewed while awarding Internal.

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

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Comprehensive Training Report

In addition to the diary, students are required to submit a comprehensive report on training with details of the organization where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant/product/process/construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training.

Any data, drawings etc. should be incorporated with the consent of the Organization.

Scheme of Evaluation - Internal Assessment

Students should be assessed for 50 Marks by industry supervisor and polytechnic faculty mentor during 3rd Month and 5th Month. The total marks (50 + 50) scored shall be converted to 40 marks for the Internal Assessment.

S. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Ability to solve practical problems. Sense of responsibility	10
D	Self expression / communication skills. Interpersonal skills / Human Relation.	10
E	Report and Presentation.	10
TOTAL MARKS		**50**

1040236351	**Internship**	Periods	C
Project		540	12

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of internship period (June - May). The marks scored will be converted to 60 marks for the End Semester Examination.

S. No.	Description	Marks
A	Daily Activity Report	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department	30
C	Presentation by the student at the end of the Internship	30
D	Viva Voce	20
TOTAL MARKS		**100**

1040236353	Fellowship	Periods	C
Project		540	12

Introduction

- The Fellowship in the Diploma in Engineering program is designed to provide aspiring engineers with a comprehensive educational experience that combines theoretical knowledge with practical skills. This fellowship aims to cultivate a new generation of proficient and innovative engineers who are equipped to meet the challenges of a rapidly evolving technological landscape.
- Participants in this fellowship will benefit from a robust curriculum that covers core engineering principles, advanced technical training, and hands-on projects. The program emphasizes interdisciplinary learning, encouraging fellows to explore various branches of engineering, from mechanical and civil to electrical, electronics & communication and computer engineering. This approach ensures that graduates possess a versatile skill set, ready to adapt to diverse career opportunities in the engineering sector.
- In addition to academics, the fellowship offers numerous opportunities for professional development. Fellows will engage with industry experts through seminars, workshops, and internships, gaining valuable insights into real-world applications of their studies. Collaborative projects and research initiatives foster a culture of innovation, critical thinking, and problem-solving, essential attributes for any successful engineer.
- By offering this fellowship, participants become part of a vibrant community of learners and professionals dedicated to advancing the field of engineering. The program is committed to supporting the growth and development of each fellow, providing them with the tools and resources needed to excel both academically and professionally.
- The Fellowship in the Diploma in Engineering is more than just an educational endeavor; it is a transformative journey that equips aspiring engineers with the knowledge, skills, and experiences necessary to make significant contributions to society and the engineering profession.

Course Objectives

After completing, Students will be able to,

- Provide fellows with a solid foundation in core engineering principles and advanced technical knowledge across various engineering disciplines.
- Equip fellows with hands-on experience through laboratory work, projects, and internships, ensuring they can apply theoretical knowledge to real-world scenarios.

1040236353	**Fellowship**	Periods	C
Project		540	12

- Promote interdisciplinary understanding by encouraging exploration and integration of different engineering fields, fostering versatility and adaptability in fellows.
- Encourage innovation and creativity through research projects and collaborative initiatives, enabling fellows to develop new solutions to engineering challenges.
- Facilitate professional growth through workshops, seminars, and interactions with industry experts, preparing fellows for successful careers in engineering.
- Develop critical thinking and problem-solving skills, essential for tackling complex engineering problems and making informed decisions.
- Strengthen connections between academia and industry by providing opportunities for internships, industry visits, and guest lectures from professionals.
- Foster leadership qualities and teamwork skills through group projects and collaborative activities, preparing fellows for leadership roles in their future careers.
- Instill a sense of ethical responsibility and awareness of the social impact of engineering practices, encouraging fellows to contribute positively to society.
- Promote a culture of lifelong learning, encouraging fellows to continually update their knowledge and skills in response to technological advancements and industry trends.
- Prepare fellows to work in a global engineering environment by exposing them to international best practices, standards, and cross-cultural experiences.

Course Outcomes

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

CO 1: Demonstrate a strong understanding of core engineering principles and possess the technical skills necessary to design, analyze, and implement engineering solutions across various disciplines.

CO 2: Apply theoretical knowledge to practical scenarios, effectively solving engineering problems through hands-on projects, laboratory work, and internships.

CO 3: Exhibit the ability to conduct research, develop innovative solutions, and contribute to advancements in engineering through critical thinking and creative approaches to complex challenges.

CO4:Understand and adhere to professional and ethical standards in engineering practice, demonstrating responsibility, integrity, and a commitment to sustainable and socially responsible engineering.

CO 5: Enhance strong communication skills, both written and verbal, and be capable of working effectively in teams, demonstrating leadership and collaborative abilities in diverse and multidisciplinary environments.

Important points to consider to select the fellowship project

Selecting the right fellowship project is crucial for maximizing the educational and professional benefits of a Diploma in Engineering program.

- **Relevance to Future Plans**: Choose a project that aligns with your long-term career aspirations and interests. This alignment will ensure that the skills and knowledge you gain will be directly applicable to your desired career path.
- **Industry Relevance**: Consider the current and future relevance of the project within the industry. Opt for projects that address contemporary challenges or emerging trends in engineering.
- Access to Facilities: Ensure that the necessary facilities, equipment, and materials are available to successfully complete the project. Lack of resources can hinder the progress and quality of your work.
- **Mentorship and Guidance**: Select a project that offers strong mentorship and support from experienced faculty members or industry professionals. Effective guidance is crucial for navigating complex problems and achieving project objectives.
- **Project Scope**: Assess the scope of the project to ensure it is neither too broad nor too narrow. A well-defined project scope helps in setting clear objectives and achievable milestones.
- **Feasibility**: Evaluate the feasibility of completing the project within the given timeframe and with the available resources. Consider potential challenges and ensure you have a realistic plan to address them.
- **Technical Skills**: Choose a project that allows you to develop and enhance important technical skills relevant to your field of study. Practical experience in using specific tools, technologies, or methodologies can be highly beneficial.
- **Soft Skills**: Consider projects that also offer opportunities to develop soft skills such as teamwork, communication, problem-solving, and project management.
- **Innovative Thinking**: Select a project that encourages creativity and innovative problem-solving. Projects that push the boundaries of traditional engineering approaches can be particularly rewarding.
- **Societal Impact**: Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

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Project		540	12

Guidelines to select Fellowship

- Ensure the program is accredited by a recognized accrediting body and has a strong reputation for quality education in engineering.
- Ensure it covers core engineering principles that align with your interests and career goals.
- Investigate the qualifications and experience of the faculty mentor. Look for programs with faculty who have strong academic backgrounds, industry experience, and active involvement in research.
- Check if the program provides adequate hands-on training opportunities, such as laboratory work, workshops, and access to modern engineering facilities and equipment.
- Assess the program’s connections with industry. Strong partnerships with companies can lead to valuable internship opportunities, industry projects, and exposure to real-world engineering challenges.
- Explore the availability of research opportunities. Participation in research projects can enhance your learning experience and open doors to innovative career paths.
- Look for programs that offer professional development resources, such as workshops, seminars, and networking events with industry professionals and alumni.
- Ensure the program provides robust support services, including academic advising, career counseling, mentorship programs, and assistance with job placement after graduation.
- Consider the cost of the program and available financial aid options, such as scholarships, grants, and fellowships. Evaluate the return on investment in terms of career prospects and potential earnings.
- Research the success of the program’s alumni. High employment rates and successful careers of past graduates can indicate the program’s effectiveness in preparing students for the engineering field.

Duties Responsibilities of the Faculty Mentor

Each student should have a faculty mentor for the Institute.

- Get the approval from the Chairman Board of Examinations with the recommendations of the HOD/Principal for the topics.
- Provide comprehensive academic advising to help fellows select appropriate specializations, and research projects that align with their interests and career goals.
- Guide fellows through their research projects, offering expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.

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Project		540	12

- Assist fellows in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.
- Offer career advice and support, helping fellows explore potential career paths, prepare for job searches, and connect with industry professionals and opportunities.
- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.
- Facilitate connections between fellows and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.
- Ensure fellows have access to necessary resources, including research materials, lab equipment, software, and academic literature.
- Regularly monitor and evaluate the progress of fellows, providing constructive feedback and guidance to help them stay on track and achieve their goals.
- Instill and uphold high ethical and professional standards, encouraging fellows to practice integrity and responsibility in their work.
- Assist with administrative tasks related to the fellowship program, such as preparing progress reports, writing recommendation letters, and facilitating grant applications.
- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development of fellows.
- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the Fellowship Scholar

- Regularly meet with your faculty mentor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your mentor.
- Develop strong organizational skills. Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.
- Take advantage of opportunities to participate in research projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.
- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.

- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.
- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.
- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.
- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student to offer fellowship

- **Completed Application Form**: This is typically the standard form provided by the institution or fellowship program that includes personal information, educational background, and other relevant details.
- **Detailed CV/Resume**: A comprehensive document outlining your educational background, knowledge experience, interest in research experience, publications, presentations, awards, and other relevant achievements if any.
- **Personal Statement**: A document explaining your motivation for applying to the fellowship, your career goals, how the fellowship aligns with those goals, and what you intend to achieve through the program.
- **Recommendation Letters**: Letters from faculty mentor, employer, or professionals who can attest to your academic abilities, professional skills, and suitability for the fellowship.
- **Proposal/Description**: A detailed proposal or description of the fellowship project or study you plan to undertake during the fellowship. This should include objectives, methodology, expected outcomes, and significance of the project.
- **Enrollment Verification**: Documentation verifying your current acceptance status in the academic institution or industry where the fellowship will be conducted.
- **Funding Information**: Details about any other sources of funding or financial aid you are receiving, if applicable. Some fellowships may also require a budget proposal for the intended use of the fellowship funds.
- **Samples of Work**: Copies of the relevant work that demonstrates your capabilities and accomplishments in your field.
- **Endorsement Letter**: A letter from your current academic institution endorsing your application for the fellowship, if required.

- **Ethical Approval Documents**: If your research involves human subjects or animals, you may need to submit proof of ethical approval from the relevant ethics committee.
- **Additional Documents**: Any other documents requested by the fellowship program required by the institution.

Attendance Certification

Every month students have to get their attendance certified by the supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the faculty mentor. Regularity in attendance and submission of report will be duly considered while awarding the Internal Assessment mark.

Rubrics for Fellowship

Sl. No.	Topics	Description
1	Alignment with Objectives	Assess how well the project aligns with the stated objectives and requirements. Determine if the student has addressed the key aspects outlined in the project guidelines.
2	Depth of Research:	Evaluate the depth and thoroughness of the literature review. Assess the student's ability to identify and address gaps in existing research.
3	Clarity of Objectives:	Check if the student has clearly defined and articulated the objectives of the project. Ensure that the objectives are specific, measurable, achievable, relevant, and time-bound (SMART).
4	Methodology and Data Collection:	Evaluate the appropriateness and justification of the research methodology. Assess the methods used for data collection and their relevance to the research questions.
5	Analysis and Interpretation:	Examine the quality of data analysis techniques used. Assess the student's ability to interpret results and draw meaningful conclusions.

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Project		540	12

Sl. No.	Topics	Description
6	Project Management:	Evaluate the project management aspects, including adherence to timelines and milestones. Assess the student's ability to plan and execute the project effectively.
7	Documentation and Reporting:	Check the quality of documentation, including code, experimental details, and any other relevant materials. Evaluate the clarity, structure, and coherence of the final report.
8	Originality and Creativity:	Assess the level of originality and creativity demonstrated in the project. Determine if the student has brought a unique perspective or solution to the research problem.
9	Critical Thinking:	Evaluate the student's critical thinking skills in analyzing information and forming conclusions. Assess the ability to evaluate alternative solutions and make informed decisions.
10	Problem-Solving Skills:	Evaluate the student's ability to identify and solve problems encountered during the project. Assess adaptability and resilience in the face of challenges.

Internal Marks - 40 Marks

As per the rubrics each topic should be considered for the Review 1 and Review 2. Equal weightage should be given for all the topics. It should be assessed by a faculty mentor and the industrial professional or research guide.

Review 1 shall be conducted after 8th week and Review 2 shall be conducted after 14th week in the semester. Average marks scored in the reviews shall be considered for the internal assessment of 40 Marks.

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Project		540	12

Scheme of Evaluation

Part	Description	Marks
A	Assessment as per the rubrics	30
B	Attendance	10
TOTAL MARKS		**40**

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of fellowship. The marks scored will be converted to 60 marks for the End Semester Examination.

S. No.	Description	Marks
A	Daily Activity Report	20
B	Comprehensive report of the fellowship work	30
C	Presentation by the student	30
D	Viva Voce	20
TOTAL MARKS		**100**

1040236374	**In-house Project**	Periods	C
Project		540	12

Introduction

- Every student must do one major project in the Final year of their program. Students can do their major project in Industry or R&D Lab or in-house or a combination of any two for the partial fulfillment for the award of Diploma in Engineering.
- For the project works, the Department will constitute a three-member faculty committee to monitor the progress of the project and conduct reviews regularly.
- If the projects are done in-house, the students must obtain the bonafide certificate for project work from the Project supervisor and Head of the Department, at the end of the semester. Students who have not obtained the bonafide certificate are not permitted to appear for the Project Viva Voce examination.
- For the projects carried out in Industry, the students must submit a separate certificate from Industry apart from the regular bonafide certificate mentioned above. For Industry related projects there must be one internal faculty advisor / Supervisor from Industry (External), this is in addition to the regular faculty supervision.
- The final examination for project work will be evaluated based on the final report submitted by the project group of **not exceeding four students**, and the viva voce by an external examiner.

Course Objectives

Academic project work plays a crucial role in the education of Diploma in Engineering students, as it helps them apply theoretical knowledge to practical situations and prepares them for real-world engineering challenges.

- **Integration of Knowledge**: Consolidate and integrate theoretical knowledge acquired in coursework to solve practical engineering problems.
- **Skill Development**: Enhance technical skills related to the specific field of engineering through hands-on experience and application.
- **Problem-Solving Abilities**: Develop critical thinking and problem-solving abilities by addressing complex engineering issues within a defined scope.
- **Project Management**: Gain experience in project planning, execution, and management, including setting objectives, timelines, and resource allocation.
- **Teamwork and Collaboration**: Foster teamwork and collaboration by working in multidisciplinary teams to achieve project goals and objectives.

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- **Research Skills**: Acquire research skills by conducting literature reviews, gathering relevant data, and applying research methodologies to investigate engineering problems.
- **Innovation and Creativity**: Encourage innovation and creativity in proposing and developing engineering solutions that may be novel or improve upon existing methods.
- **Communication Skills**: Improve communication skills, both oral and written, by presenting project findings, writing technical reports, and effectively conveying ideas to stakeholders.
- **Ethical Considerations**: Consider ethical implications related to engineering practices, including safety, environmental impact, and societal concerns.
- **Professional Development**: Prepare for future professional roles by demonstrating professionalism, initiative, and responsibility throughout the project lifecycle.

Course Outcomes

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

CO 1: Demonstrate the ability to apply theoretical concepts and principles learned in coursework to solve practical engineering problems encountered during the project.

CO 2: Develop and enhance technical skills specific to the field of engineering relevant to the project, such as design, analysis, simulation, construction, testing, and implementation.

CO 3: Apply critical thinking and problem-solving skills to identify, analyze, and propose solutions to engineering challenges encountered throughout the project lifecycle.

CO 4: Acquire project management skills by effectively planning, organizing, and executing project tasks within defined timelines and resource constraints.

CO 5: Improve communication skills through the preparation and delivery of project reports, presentations, and documentation that effectively convey technical information to stakeholders.

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Project		540	12

Important points to considerto select the In-house project

- Selecting a project work in Diploma Engineering is a significant decision that can greatly influence your learning experience and future career prospects.

- Choose a project that aligns with your career aspirations and interests within the field of engineering. Consider how the project can contribute to your professional development and future opportunities.

- Ensure the project aligns with your coursework and specialization within the Diploma program. It should complement and build upon the knowledge and skills you have acquired in your studies.

- Evaluate the scope of the project to ensure it is manageable within the given timeframe, resources, and constraints. Avoid projects that are overly ambitious or impractical to complete effectively.

- Assess the availability of resources needed to conduct the project, such as equipment, materials, laboratory facilities, and access to relevant software or tools. Lack of resources can hinder project progress.

- Select a project that genuinely interests and motivates you. A project that captures your curiosity and passion will keep you engaged and committed throughout the project duration.

- Consider the availability and expertise of faculty advisors or industry mentors who can provide guidance and support throughout the project. Effective mentorship is crucial for success.

- Clearly define the learning objectives and expected outcomes of the project. Ensure that the project will help you achieve specific learning goals related to technical skills, problem-solving, and professional development.

- Look for opportunities to propose innovative solutions or explore new methodologies within your project. Projects that encourage creativity can set you apart and enhance your learning experience.

- Consider ethical implications related to the project, such as safety protocols, environmental impact, and compliance with ethical guidelines in research and engineering practices.

- Evaluate whether the project offers opportunities for collaboration with peers, experts from other disciplines, or industry partners. Interdisciplinary projects can broaden your perspective and enhance your teamwork skills.

- Consider the potential impact of your project on society or the engineering community. Projects that address significant challenges or contribute to social good can be highly fulfilling and make a meaningful difference.

By carefully considering these points, Diploma Engineering students can make informed decisions when selecting project work that not only enhances their academic learning but also prepares them for successful careers in engineering.

Duties Responsibilities of the internal faculty advisor

Each group should have an internal faculty advisor assigned by the HOD/Principal.

- The in-house project should be approved by the project monitoring committee constituted by the Chairman Board of Examinations.

- The in-house project should be selected in the fifth semester itself. Each in-house project shall have a maximum of four students in the project group.

- Provide comprehensive academic advising to help in the selection of appropriate in-house project that align with their interests and career goals.

- Offer expertise and feedback to ensure rigorous methodology, innovative approaches, and meaningful contributions to the field.

- Assist in developing technical and professional skills through hands-on projects, laboratory work, and practical applications of theoretical knowledge.

- Provide personal mentorship, fostering a supportive relationship that encourages growth, resilience, and a positive academic experience.

- Facilitate connections between students and industry professionals, alumni, and other relevant networks to enhance their professional opportunities and industry exposure.

- Ensure students have access to necessary resources, including research materials, lab equipment, software, and academic literature.

- Regularly monitor and evaluate the progress of the in-house project, providing constructive feedback and guidance to help them stay on track and achieve their goals.

- Instill and uphold high ethical and professional standards, encouraging students to practice integrity and responsibility in their work.

- Assist in preparing progress reports, writing recommendation letters, and facilitating grant applications.

- Organize and participate in workshops, seminars, and other educational events that enhance the learning experience and professional development.

- Address any issues or conflicts that arise, providing mediation and support to ensure a positive and productive academic environment.

Instructions to the students

- Regularly meet with your internal faculty advisor for guidance on academic progress, research projects, and career planning. Be proactive in seeking advice and support from your faculty advisor.

- Use planners, calendars, and task management tools to keep track of assignments, project deadlines, and study schedules. Prioritize tasks to manage your time efficiently.

- Take advantage of opportunities to participate in in-house projects and hands-on activities. These experiences are crucial for applying your theoretical knowledge and gaining practical skills.

- Focus on improving essential professional skills such as communication, teamwork, problem-solving, and leadership. Participate in workshops and seminars that enhance these competencies.

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Project		540	12

- Actively seek networking opportunities through industry events, seminars, and meetings. Establish connections with peers, alumni, and professionals in your field to build a strong professional network.

- Seek internships, co-op programs, or part-time jobs related to your field of study. Real-world experience is invaluable for understanding industry practices and enhancing your employability.

- Uphold high ethical standards in all your academic and professional activities. Practice integrity, honesty, and responsibility. Adhere to the ethical guidelines and standards set by your institution and the engineering profession.

- Adopt a mindset of lifelong learning. Stay updated with the latest developments and trends in engineering by reading industry journals, attending conferences, and taking additional courses.

Documents to be submitted by the student for an in-house project

Submit a printed report of your in-house project work along with the fabrication model / analysis report for the End Semester Examination.

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Project		540	12

Rubrics for In-House Project Work

Sl. No.	Topics	Description
1	Objectives	Clearly defined and specific objectives outlined. Objectives align with the project's scope and purpose.
2	Literature Review	Thorough review of relevant literature. Identification of gaps and justification for the project's contribution.
3	Research Design and Methodology	Clear explanation of the research design. Appropriateness and justification of chosen research methods.
4	Project Management	Adherence to project timeline and milestones. Effective organization and planning evident in the project execution.
5	Documentation	Comprehensive documentation of project details. Clarity and completeness in recording methods, results, and challenges.
6	Presentation Skills	Clear and articulate communication of project findings. Effective use of visuals, if applicable.
7	Analysis and Interpretation	In-depth analysis of data. Clear interpretation of results in the context of research questions.
8	Problem-Solving	Demonstrated ability to identify and address challenges encountered during the project. Innovative solutions considered where applicable.
9	Professionalism and Compliance	Adherence to ethical standards in research. Compliance with project guidelines and requirements.
10	Quality of Work	Overall quality and contribution of the project to the field. Demonstrated effort to produce high-quality work.

1040236374	In-house Project	Periods	C
Project		540	12

SCHEME OF EVALUATION

The mark allocation for Internal and End Semester Viva Voce are as below.

Internal Mark Split (40 Marks)*		
Review 1 (10 Marks)	Review 2 (15 Marks)	Review 3 (15 marks)
Committee: 5 Marks. Supervisor: 5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks	Committee: 7.5 Marks Supervisor: 7.5 Marks

Note: * The rubrics should be followed for the evaluation of the internal marks during reviews.

END SEMESTER EXAMINATION - Project Exam

The performance of each student in the project group would be evaluated in a viva voce examination conducted by a committee consisting of an external examiner and the Department project supervisor and an internal examiner.

End Semester (100)#		
Record (20 Marks)	Presentation (20 Marks)	Viva Voce (20 Marks)
External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5	External: 10 Internal: 5 Supervisor: 5

The marks scored will be converted to 60 Marks.

Students who are unable to complete the project work at the end of the semester can apply for an extension to the Head of the Department, with the recommendation from the project guide for a period of a maximum of two months. For those students who extend the project work for two months, Viva Voce will be carried out and results will be declared separately. If the project report is not submitted even beyond the extended time, then students are not eligible to appear for Project Viva Voce Examination.

1040235773	**Industrial Training**	Summer vacation	C
Internship			2

Introduction

Industrial training is a crucial component of the diploma engineering curriculum, designed to bridge the gap between theoretical knowledge and practical application. Typically conducted during vacation periods, this two-week training program provides students with hands-on experience in their respective engineering fields. The primary objectives are to enhance practical skills, familiarize students with industry standards, and prepare them for future employment.

Two-week industrial training during vacation periods is an invaluable part of diploma engineering education. It not only equips students with practical skills but also provides a comprehensive understanding of the industry, preparing them for successful engineering careers.

Objectives

1. Practical Exposure: Students gain direct exposure to real-world engineering practices, tools, and technologies.
2. Skill Enhancement: The training helps in developing technical and soft skills that are essential for professional growth.
3. Industry Insight: Students learn about the working environment, operational procedures, and challenges faced by industries.
4. Professional Networking: The training offers opportunities to interact with industry professionals, which can be beneficial for career prospects.
5. Application of Knowledge: It allows students to apply classroom knowledge to solve practical problems, enhancing their understanding and retention of engineering concepts.

1040235773	**Industrial Training**	Summer vacation	C
Internship			2

Structure of the Training Program

- Orientation: Introduction to the company, its operations, and safety protocols.
- Project Assignment: Students are assigned specific projects or tasks relevant to their field of study.
- Supervision and Mentorship: Industry professional's guide and mentor students throughout the training.
- Skill Development Workshops: Sessions on technical skills, software tools, and industry best practices.
- Assessment and Feedback: Performance evaluations and constructive feedback to help students improve.

Benefits for Students

- Enhanced Employability: Practical experience makes students more attractive to potential employers.
- Confidence Building: Working in a real-world setting boosts confidence and professional demeanor.
- Clarified Career Goals: Exposure to various roles and responsibilities helps students define their career paths.

Course Outcomes

CO 1: Demonstrate proficiency in using industrial machinery, tools, and software.

CO 2: Able to identify, analyze, and solve engineering problems using industry-standard methods and practices.

CO 3: Gain a comprehensive understanding of industrial manufacturing processes, quality control, and safety practices.

CO 4: Exhibit improved communication, teamwork, and professional behavior in an industrial setting.

CO 5: Apply theoretical concepts learned in their coursework to practical engineering tasks and projects.

Duties Responsibilities of the Faculty Mentor.

One faculty mentor should be assigned for every 30 students by the HOD / Principal. Faculty mentors shall play a crucial role in overseeing and guiding students during their industrial training program in Diploma engineering.

Pre-Training Responsibilities:

1. Orientation and Preparation:
   - ○ Conduct orientation sessions to familiarize students with the objectives, expectations, and guidelines of the industrial training program.
   - ○ Assist students in understanding the importance of industrial training in their academic and professional development.
2. Placement Coordination:
   - ○ Collaborate with the placement cell or industry liaison office to secure suitable training placements for students that align with their academic specialization and career interests.
   - ○ Facilitate communication between the institution and host organizations to ensure smooth coordination of training arrangements.
3. Training Plan Development:
   - ○ Help students develop a detailed training plan outlining learning objectives, tasks, and expected outcomes for the training period.
   - ○ Guide students in setting SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals for their training experience.

During Training Responsibilities:

4. Monitoring and Support:
   - ○ Regularly monitor the progress of students during their industrial training. Maintain communication with both students

and industry supervisors to track performance and address any issues that may arise.

  - Provide ongoing support and guidance to students, offering advice on technical challenges, professional conduct, and workplace etiquette.

5. Technical Guidance:
    - Offer technical guidance and mentorship related to the specific engineering discipline or specialization of the students. Help them apply theoretical knowledge to practical situations encountered in the industry.
6. Problem-Solving Assistance:
    - Assist students in overcoming obstacles or challenges encountered during their training. Encourage them to develop problem-solving skills and resilience in real-world engineering scenarios.
7. Feedback and Evaluation:
    - Provide constructive feedback on students' performance based on reports, assessments, and observations gathered from industry supervisors.
    - Evaluate students' achievements in relation to their training objectives and competencies developed during the program.

Post-Training Responsibilities:

8. Reflection and Debriefing:
    - Conduct debriefing sessions with students to reflect on their training experiences, discuss lessons learned, and identify areas for further improvement.
    - Help students articulate their learning outcomes and how these experiences contribute to their professional growth.

9. Documentation and Reporting:
    - Ensure comprehensive documentation of students' training activities, achievements, and feedback received from industry supervisors.
    - Prepare reports summarizing students' performance and submit these to relevant departments or committees for review and assessment.
10. Career Counseling:
    - Provide career guidance and counseling to students based on their industrial training experiences. Assist them in leveraging these experiences for future job applications or further academic pursuits.
11. Continuous Improvement:
    - Collaborate with industry partners to continuously improve the quality and relevance of the industrial training program.
    - Incorporate feedback from students and industry supervisors to enhance the effectiveness of future training placements.

By fulfilling these duties and responsibilities, faculty mentors contribute significantly to the overall educational experience and professional development of Diploma engineering students during their industrial training program.

Instructions to the students

Before Starting Industrial Training:

1. **Orientation and Preparation:**
    - Attend orientation sessions conducted by the institution or faculty mentors to understand the objectives, expectations, and guidelines of the industrial training program.

- ○ Familiarize yourself with the specific policies, procedures, and safety regulations of the host organization where you will be undergoing training.

2. Setting Goals:
   - ○ Set clear and specific goals for your industrial training period. Define what skills, knowledge, and experiences you aim to gain during this time.
   - ○ Discuss your goals with your faculty mentor and seek their guidance in developing a training plan that aligns with your career aspirations.
3. Professional Attire and Conduct:
   - ○ Dress appropriately and professionally according to the standards of the industry and host organization.
   - ○ Maintain a positive attitude, demonstrate punctuality, and adhere to workplace etiquette and norms.

During Industrial Training:

4. Learning and Engagement:
   - ○ Actively engage in all assigned tasks and projects. Seek opportunities to learn new skills and technologies relevant to your field of study.
   - ○ Take initiative in asking questions, seeking clarification, and participating in discussions with supervisors and colleagues.
5. Adaptability and Flexibility:
   - ○ Adapt to the work environment and demonstrate flexibility in handling various responsibilities and challenges that arise during your training.
   - ○ Be open to different roles and tasks assigned to you, as this will broaden your experience and skill set.

6. Professionalism and Communication:
    - Communicate effectively with supervisors, colleagues, and clients as required. Practice clear and concise verbal and written communication.
    - Demonstrate professionalism in all interactions, respecting confidentiality, and adhering to company policies and procedures.
7. Safety and Compliance:
    - Prioritize safety at all times. Familiarize yourself with safety protocols, procedures, and emergency exits in the workplace.
    - Follow all safety guidelines and regulations to ensure your well-being and that of others around you.

After Completing Industrial Training:

8. Reflection and Documentation:
    - Reflect on your training experience. Evaluate what you have learned, the challenges you faced, and how you have grown professionally.
    - Maintain a journal or log documenting your daily activities, achievements, and lessons learned during the training period.
9. Feedback and Evaluation:
    - Seek feedback from your industry supervisor and faculty mentor on your performance and areas for improvement.
    - Use constructive feedback to enhance your skills and competencies for future career opportunities.
10. Career Planning:
    - Use your industrial training experience to inform your career planning and decision-making process.

- ○ Discuss your career goals and aspirations with your faculty mentor or career counselor for guidance on next steps after completing your diploma.

By following these instructions, Diploma engineering students can make the most of their industrial training experience, gain valuable insights into their chosen field, and prepare themselves effectively for future professional endeavors.

Attendance Certification

Every student has to get their attendance certified by the industrial supervisor in the prescribed form supplied to them. Students have also to put their signature on the form and submit it to the institution faculty mentor.

Training Reports

The students have to prepare reports: The report in the form of a diary to be submitted to the concerned faculty mentor of the institution. This will be reviewed while awarding Internal assessment.

Industrial Training Diary

Students are required to maintain the record of day-to-day work done. Such a record is called Industrial training Diary. Students have to write this report regularly. All days for the week should be accounted for clearly giving attendance particulars (Presence, absence, Leave, Holidays etc.). The concern of the Industrial supervisor is to periodically check these progress reports.

In addition to the diary, students are required to submit a comprehensive report on training with details of the organization where the training was undergone after attestation by the supervisors. The comprehensive report should incorporate study of plant / product / process / construction along with intensive in-depth study on any one of the topics such as processes, methods, tooling, construction and

Equipment, highlighting aspects of quality, productivity and system. The comprehensive report should be completed in the last week of Industrial training. Any data, drawings etc. should be incorporated with the consent of the Organization.

Scheme of Evaluation

Internal Assessment

Students should be assessed for 40 Marks by industry supervisor and polytechnic faculty mentor for the Internal Assessment.

Sl. No.	Description	Marks
A	Punctuality and regularity. (Attendance)	10
B	Level / proficiency of practical skills acquired. Initiative in learning / working at site	10
C	Ability to solve practical problems. Sense of responsibility	10
D	Self expression / communication skills. Interpersonal skills / Human Relation.	10
E	Report and Presentation.	10
Total		50

End Semester Examination - Project Exam

Students should be assessed for 100 Marks both by the internal examiner and external examiner appointed by the Chairman Board of Examinations after the completion of industrial training. The marks scored will be converted to 60 marks for the End Semester Examination.

Sl. No.	Description	Marks
A	Daily Activity Report and Attendance certificate.	20
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department.	30
C	Presentation by the student at the end of the Internship.	30
D	Viva Voce	20
	Total	100