Regulation 2023
Program Structure

Diploma in ECG Technology

Program Outcomes (PO's)

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 science, mathematics and engineering fundamentals and an engineering specialization to solve the engineering and medical problems.

PO2: Problem analysis: Identify and analyse 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 for medical purposes.

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: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Credit Distribution

Semester	No of Courses	Periods	Credits
Semester I	8	640	20
Semester II	8	625	20
Semester III	8	640	21
Semester IV	7	625	19
Semester V	8	640	22
Semester VI	3	685	18
Total			**120**

Semester III

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1146233110	Human Physiology	3-0-0	45	3	Theory
2	Program Core	Theory	1030233210	Electrical Circuit Theory$^{\$\$\$}$	3-0-0	45	3	Theory
3	Program Core	Practical	1146233320	Human Physiology 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	1146233540	Electronic circuits	2-0-4	90	4	Practical
6	Engineering Science	Practicum	1146233640	Sensor and Signal Conditioning	2-0-4	90	4	Practical
7	Open Elective	Advanced Skill Certification	1146233760	Advanced Skills Certification - 3	1-0-2	45	2	NA
8	Humanities & Social Science	Integrated Learning Experience	1146233880	Growth Lab	0-0-2	30	1	NA
9	Audit Course	Integrated Learning Experience	1146233881	Induction Program - II	-	16	0	-
10	Audit Course	Integrated Learning Experience	1146233882	I&E/ Club Activity/ Community Initiatives	-	16	0	-
11	Audit Course	Integrated Learning Experience	1146233883	Shop floor Immersion	-	6	0	-
12	Audit Course	Integrated Learning Experience	1146233884	Student-Led Initiative	-	24	0	-
13	Audit Course	Integrated Learning Experience	1146233885	Emerging Technology Seminars	-	8	0	-
14	Audit Course	Integrated Learning Experience	1146233886	Health & Wellness	-	30	0	-
	Test & Revisions					60	0	-
	Library Hours					15	0	-
	Total					**565**	**21**	**-**

*** Common with ECE Department ; $$$ Common with EEE Department

Semester IV

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1146234110	Bio-Materials and Artificial Organs	3-0-0	45	3	Theory
2	Program Core	Theory	1146234210	Operational Amplifier and Linear Integrated Circuits	3-0-0	45	3	Theory
3	Program Core	Practicum	1146234340	Microbiology	1-0-4	75	3	Practical
4	Engineering Science	Practicum	1146234440	Microcontroller and its applications	1-0-4	75	3	Practical
5	Program Core	Practicum	1146234540	Basics of Signals and Systems	1-0-4	75	3	Practical
6	Program Core	Project/ Internship	1146234652	Industrial Training [Summer Vacation]	0-0-4	60	2	Project
7	Open Elective	Advanced Skill Certification	1146234760	Advanced Skills Certification - 3	1-0-2	45	2	NA
8	Audit Course	Integrated Learning Experience	1146234882	I&E / Club Activity / Community Initiatives	-	30	0	-
9	Audit Course	Integrated Learning Experience	1146234883	Shop Floor Immersion	-	8	0	-
10	Audit Course	Integrated Learning Experience	1146234884	Student Led Initiative	-	24	0	-
11	Audit Course	Integrated Learning Experience	1146234885	Emerging technology seminars	-	8	0	-
12	Audit Course	Integrated Learning Experience	1146234886	Health & Wellness	-	30	0	-
13	Audit Course	Integrated Learning Experience	1146234887	Special Interest groups (Placement training)	-	30	0	-
	Test & Revisions				-	60	0	-
	Library Hours				-	15	0	-
	Total				**-**	**550**	**19**	**-**

Semester V

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1146235110	Medical Assist Device	4-0-0	60	4	Theory
2	Program Elective	Theory		Elective - 1	3-0-0	45	3	Theory
3	Program Core	Practicum	1146235340	Diagnostic and Therapeutic Equipments	1-0-4	75	3	Practical
4	Program Elective	Practicum		Elective - 2	1-0-4	75	3	Practical
5	Program Core	Practicum	1146235540	Clinical Cardiology	1-0-4	75	3	Practical
6	Humanities & Social Science	Practicum	1146235652	Innovation & Startup	1-0-2	45	2	Project
7	Project/ Internship	Project/ Internship	1146235751	Hospital Training	0-0-4	60	2	Project
8	Open Elective	Advanced Skill Certification	1146235860	Advanced Skills Certification - 5	1-0-2	45	2	NA
9	Audit Course	Integrated Learning Experience	1146235981	Induction program III	-	16	0	-
10	Audit Course	Integrated Learning Experience	1146235984	Student-Led Initiative	-	24	0	-
11	Audit Course	Integrated Learning Experience	1146235986	Health & Wellness	-	30	0	-
12	Audit Course	Integrated Learning Experience	1146235987	Special Interest Groups (Placement Training)	-	30	0	-
	Test & Revision				-	60	0	-
	Total				**-**	**580**	**22**	**-**

Semester VI

#	Course Category	Course Type	Course Code	Course Title	L-T-P	Period	Credit	End Semester Exam
1	Program Elective	Theory		Elective-3(Pathway)	3-0-0	45	3	Theory
2	Program Elective	Practicum		Elective-4 (Specialisation)	2-0-2	60	3	Theory
3	Project / Internship	Project / Internship	1146236352/ 1146236351/ 1146236353	In-house Project / Internship / Fellowship	-	540	12	Project
				Test & Revisions	-	40	-	-
				Total		**645**	**18**	

Note:

1. For all semesters, the type of End Semester examination for practicum subjects is based on the higher credits towards the theory or practical component of the respective course.

2. Some of the audit courses are non-credited but compulsory courses that are a part of the program initiative and the implementation process has to be recorded.

Elective 1

#	Course Category	Course Type	Course Code	Course Title
1	Program Elective	Theory	1146235211	Medical Coding
2	Program Elective	Theory	1146235212	Medical Informatics
3	Program Elective	Theory	1146235213	Assist Devices
4	Program Elective	Theory	1146235214	Basic of Cardiac Technology and ECG
5	Program Elective	Theory	1146235215	Basics of Telehealth Technology
6	Program Elective	Theory	1146235216	Basics of Biomechanics

Elective 2

#	Course Category	Course Type	Course Code	Course Title
1	Program Elective	Practicum	1146235441	Fiber Optics and Laser in Cardiology
2	Program Elective	Practicum	1146235442	Installation, Servicing and troubleshooting of ECG Machine
3	Program Elective	Practicum	1146235443	Clinical Pathology
4	Program Elective	Practicum	1146235444	Medical Imaging Techniques
5	Program Elective	Practicum	1146235445	Basics of VLSI Design
6	Program Elective	Practicum	1146235446	Fundamentals of Embedded Systems

Elective 3 (Pathway)

#	Course Category	Course Type	Course Type	Course Title
1	Program Elective | Higher Education	Theory	XXXX236111	Advanced Engineering Mathematics***
2	Program Elective | Entrepreneurship	Theory	XXXX236112	Entrepreneurship***
3	Program Elective| Technocrats	Theory	1146236113	Hospital Management
4	Program Elective| Technocrats	Theory	XXXX236114	Finance Fundamentals***
5	Program Elective| Technologists	Theory	1146236115	IOT in Health care
6	Program Elective| Technologists	Theory	1146236116	Medical Instrumentation

*** Common with ECE Department

Elective 4 (Specialisation)

#	Course Category	Course Type	Course Type	Course Title
1	Program Elective	Practicum	1146236231	Interpretation of ECG
2	Program Elective	Practicum	1146236232	Radiology
3	Program Elective	Practicum	1146236233	Medical Device Design
4	Program Elective	Practicum	1146236234	Basics of Bio-Chemistry
5	Program Elective	Practicum	1146236235	Blood Banking Techniques
6	Program Elective	Practicum	1146236236	Cardiovascular Investigation

1146233110	HUMAN PHYSIOLOGY	L	T	P	C
Theory		3	0	0	3

Introduction

Physiology is the study of the characteristics and mechanisms of the human body. It is a sub-section of biology, covering a range of topics that include organs, anatomy, and biological compounds, among others. It incorporates functions and processes that create life which split into many disciplines covering topics as exercise & evolution about the internal workings of organisms and their interaction through recent medical devices. In this course students will learn about cell structure, cardiovascular, central nervous system, respiratory system, digestive and reproductive system and understand about the structural and functional process of human physiology.

Course Objectives

The objective of this course is to enable the student to

1. To integrate the individual functions of all the cells and tissues and organs into functional whole, the human body.
2. To Emphasizes on the cardiovascular, respiratory and nervous system and their interrelatedness.
3. To understand the functional anatomy of digestive and reproductive organs

Course Outcomes

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

CO1: Identify and explain basic elements of human cell structure

CO2: Describe the structure, function of cardiovascular system

CO3: Describe the structure, function of central nervous system

CO4: Discuss the structure of respiratory system

CO5: Describe the physiological process of digestive & reproductive system

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Pre-requisites

Fundamentals of biology, structural & functional human parts

1146233110	HUMAN PHYSIOLOGY	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	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.

1146233110	HUMAN PHYSIOLOGY	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Model	Written Unit I & II (at the end of 6th week)	Written Unit III & IV (at the end of 12th week)	Written Model Exam Units I to V	Quiz/MCQ/ Activity/ Assignment	Written Examination
Duration	2 hours	2 hours	3 hours	2 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	20	20	10	10	60
Marks	20		20		60

Note:

- CA1 and CA2 Assessment test should be conducted as per the question pattern. Best of one will be considered for 20 Marks.
- CA3 Model examination should be conducted as per the question pattern.
- CA4 Online quiz examination (MCQ) should be conducted covering the complete syllabus.

Question pattern:

CA1 & CA2 Assessment		
Part	**Description**	**Marks**
A	16 Questions to be answered out of 20 Questions	16Q X 2 = 32 Marks(Each question carries 2 marks)
B	4 Questions to be answered out of 6 Questions	4QX 7 = 28 Marks (Each question carries 7 Marks)
CA3 Assessment		
Part	**Description**	**Marks**
A	15 Questions to be answered out of 20 Questions	15Q X 2 = 30 Marks(Each question carries 2 marks)
B	Answer all 5 questions, choosing any 2 sub-divisions out of 3 from each question under Part –B.	(5Q X 14 =70 Marks)(7+7)

1146233110	HUMAN PHYSIOLOGY	L	T	P	C
Theory		3	0	0	3

1146233110	HUMAN PHYSIOLOGY	L	T	P	C
Theory		3	0	0	3

Unit I	**CELL STRUCTURE**	
Theory Structure of Cell – structure- Cell Membrane- function and regulation of intracellular transport- electrical properties of membrane- Action Potential -Mitosis and meiosis, their regulation - steps in cell cycle, and control of cell cycle- Cell Division- Types of Specialized tissues – Functions		9
Unit II	**CARDIOVASCULAR SYSTEMS**	
Theory Cardiovascular: Components of Blood and functions. - Blood Groups and importance – Structure of Heart – Conducting System of Heart – Properties of Cardiac Muscle - Cardiac Cycle - Heart Beat regulation of cardiac function; cardiac output – regulation in normal and abnormal conditions, – Types of Blood vessel – Regulation of Heart rate and Blood pressure.		9
Unit III	**CENTRAL NERVOUS SYSTEM**	
Theory Nervous: Cells of Nervous systems – Types of Neuron and Synapses – Neurotransmitters - Mechanisms of Nerve impulse – Brain : Parts of Brain – Reflex - Spinal Cord – Tract and Pathways of Spines – Reflex Mechanism – Classification of Nerves - Autonomic Nervous systems and its functions Cerebro - Spinal Fluid - Autonomic Nervous System		9
Unit IV	**RESPIRATORY SYSTEM**	
Theory Respiratory: Parts of Respiratory Systems – Types of respiration - Mechanisms of Breathing – Regulation of Respiration cells of airways and alveoli – ciliated cells, cells for mucous production-origin of respiratory rhythm, central and peripheral chemoreceptors-respiratory problems - pulmonary embolism, respiratory distress syndrome		9
Unit V	**DIGESTIVE & REPRODUCTIVE SYSTEM**	
Introduction to digestive system - Composition and functions of digestive juices -Physiological anatomy of stomach, pancreas, liver and gall bladder, small intestine, large intestine. Male reproductive system - testis and its hormones, seminal vesicles, prostate gland, semen - Introduction to female reproductive system- Menstrual cycle- Ovulation		9
TOTAL HOURS		45

Suggested List of Students Activity

1. Assignments.
2. Hospital Field Visit
3. Group Discussion with Doctor`s and Students.

Reference

1. Guyton and Hall Textbook of Medical Physiology - 11th Edition
2. Animal Physiology. Third Edition. By Richard W. Hill, Gordon A. Wyse, and Margaret Anderson

1146233110	HUMAN PHYSIOLOGY	L	T	P	C
Theory		3	0	0	3

3. Physiology 6th edition LINDA S. COSTANZO, Ph.D.
4. Berne & Levy Physiology - 7th Edition

Web-based/Online Resources

1. https://learn.careers360.com/biology/human-physiology-chapter/

2. https://www.coursera.org/learn/physiology/

1030233210	ELECTRICAL CIRCUIT THEORY	L	T	P	C
THEORY		3	0	0	3

Introduction:

Electrical circuits are very important to all engineering disciplines either because there are electric circuits in those disciplines or because the underlying physical ideas are easily translated to other disciplines. The two most important laws in circuit analysis are the two Kirchhoff's Laws which are just another form of the conservation laws of physics. These laws are ALWAYS valid in every situation. Circuit theory is the cornerstone of electrical engineering, providing the rules and methods for analyzing electrical circuits. Electric circuit theory is one of the most vital aspects of electrical engineering.

Course Objectives:

The objective of this course is to enable the student to

- Maintain electrical systems applying AC and DC circuit fundamentals
- Impart knowledge on solving circuit equations using network theorems
- Learn the concept of single phase AC Series Circuits for different load condition.
- Learn the phenomenon of single phase AC Parallel circuit and resonance circuits.
- Introduce Phase diagrams and analysis of three phase circuit.

Course Outcomes:

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

CO1 : Apply principles of circuit analysis to solve electric circuits.

CO2 : Apply network theorems to solve electric circuits.

CO3 : Solve the problems related to single phase A.C Series circuits.

CO4 : Solve the problems related to single phase A.C Parallel circuits and Resonance circuits.

CO5 : Solve the problems related to three phase circuits.

Pre-requisites: Knowledge of Mathematics.

1030233210	ELECTRICAL CIRCUIT THEORY	L	T	P	C
THEORY		3	0	0	3

CO/PO Mapping:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	-	-	-	3
CO2	3	2	3	-	-	-	3
CO3	3	3	3	-	-		3
CO4	3	3	2	-	-	-	3
CO5	2	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.
- Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyze potential sources of error in case of discrepancies.

1030233210	**ELECTRICAL CIRCUIT THEORY**	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 1	Written Test 2	Quiz/ MCQ	Model Examination	Written Examination
Portion	Unit I & II	Unit III & IV	All Units	All Units	All Units
Duration	2 Hours	2 Hours	1 Hour	3 Hours	3 Hours
Exam Marks	60	60	40	100	100
Converted to Marks	20	20	10	10	60
Internal Marks	40				60

Note:

- CA1 and CA2 Assessment test should be conducted. Best of one will be considered for the internal assessment of 20 Marks.
- CA3 Online quiz examination (MCQ) should be conducted covering the complete syllabus. The marks should be converted to 10 marks for the internal assessment.
- CA4 Model examination should be conducted as per the end semester question pattern. The marks should be converted to 10 marks for the internal assessment.

1030233210	**ELECTRICAL CIRCUIT THEORY**	L	T	P	C
THEORY		3	0	0	3

Theory Portion :		
UNIT I	BASIC CIRCUITS ANALYSIS	Period
Resistive elements - Ohm's Law - Kirchhoff's laws - Resistors in series and parallel circuits - Source transformation - Star/delta and delta/star transformation - Mesh Analysis - Node Analysis - Problems on all the above topics.		9
UNIT II	NETWORK THEOREMS	Period
Superposition Theorem - Thevenin's Theorem - Norton's Theorem - Maximum Power Transfer Theorem - Problems on all the above topics.		9
UNIT III	SINGLE PHASE A.C SERIES CIRCUITS	Period
Sinusoidal voltage and current – Instantaneous, peak, average and effective values – Form Factor - Peak factor - Pure resistive, inductive and capacitive circuits – RL, RC, and RLC series circuits – Impedance – Phase angle – Phasor diagram – Power and Power factor – Power triangle – Apparent power – Active Power - Reactive power - Problems using RL, RC, and RLC series circuits.		9
UNIT IV	SINGLE PHASE A.C PARALLEL CIRCUITS & RESONANCE	Period
J Notations – Rectangular and polar coordinates - Parallel circuits (two branches only) – Conductance - Susceptance – Admittance - Problems using two branch parallel circuits. Series Resonance: Effects of varying inductance and capacitance in series RLC circuit – Selectivity – 'Q' factor - Resonance Frequency – Bandwidth – Half power frequencies- Problems on all the above topics. Parallel Resonance : Two branch parallel circuits, Q Factor – Resonance Frequency – Band width – problems on all the above topics.		9

1030233210	ELECTRICAL CIRCUIT THEORY	L	T	P	C
THEORY		3	0	0	3

UNIT V	THREE PHASE CIRCUITS	Period
Significance of 3 phase circuits – Star, Delta connections – Phase sequence – Balanced load – Relation between voltages, currents of line and phase values in star and delta connection – Problems in balanced loads of star and delta connections – Measurement of 3 phase power using two wattmeter method (Derivation and Problems) - Star and Delta connected unbalanced loads (No problems) – Symmetrical components (No problems).		9
TOTAL PERIODS		**45**

Suggested List of Students Activity:

- Prepare power point presentation on source transformation, star delta transformation, mesh and nodal analysis and give presentation in the class room.
- Select suitable components for the given circuit and prepare the same on bread board to verify the following theorems practically and theoretically: Superposition theorem, thevenin's theorem, maximum power transfer theorem and Norton theorem.
- Design different kinds of circuits that you will study in your class and assemble them using the relevant components, for example:
  - Circuit to measure the value of an unknown resistance using a meter bridge
  - Circuit to compare e.m.f. of two cells using a potentiometer, etc.
- Measure the voltmeter and ammeter readings for different rheostat settings and verify if the ratio of potential difference across the resistor to the current through it is constant. Modify the circuit using two resistors which may either be connected in series or in parallel.
- Compare the connecting wires used in household circuits and those used in the laboratory.

1030233210	ELECTRICAL CIRCUIT THEORY	L	T	P	C
THEORY		3	0	0	3

- Make a study of different battery eliminators, dc sources (cells, batteries) in the laboratories.
- Assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse and a power source.
- Draw a circuit diagram consisting of two light points, one fan point and one plug point.

Text and Reference Books:

1. Electric circuit theory by Dr. M. Arumugam & N. Prem kumar, Khanna Publishers New Delhi
2. A Text Book of Electrical Technology Vol-I, Theraja, BL, Theraja, A. K , S Chand & Co. Ram Nagar, New Delhi, ISBN : 9788121924405
3. Circuit theory, by Saliva hanan, S.; Pravin kumar, S;, Vikas Publishing House Pvt. Ltd, Noida; ISBN: 978-93259-7418-0
4. Networks and Systems, Asfaq Husain, Hanna Publishing House, Delhi
5. Networks and systems, D. Roy Choudhary, New Age International Publishers
6. Problems and Solutions of Electrical Circuit Analysis, R.K. Mehta & A.K. Mal, CBS Publishers
7. Circuit Theory by A. Chakra barti for Electronics & Electrical Engineering
8. Circuit Theory by A. Nagoor Kani - -McGraw-Hill Education (2018)
9. Schaum's Outline of Electric Circuits, 7th Edition

Web-based/Online Resources:

- Circuit Theory free e book by Jackd ·published 03/12/2017 updated 31/03/2018
- Electric circuits and network by Dr. Jamuna K.and Dr. Nilanjan Tewari
- II Year diploma level book as per aicte model curriculum (based upon outcome based education as per new education policy 2020) available in AICTE website.

1030233210	ELECTRICAL CIRCUIT THEORY	L	T	P	C
THEORY		3	0	0	3

- https://ekumbh.aicte-india.org/userdiplomabook.php
- https://upload.wikimedia.org/wikipedia/commons/f/f8/Circuit_Theory.pdf
- https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis- topic/circuit-elements/v/ee-ideal-sources
- https://onlinecourses.nptel.ac.in/noc20_ee64/preview
- https://www.electrical4u.com/electrical-engineering-articles/circuit-theory/

1146233320	HUMAN PHYSIOLOGY PRACTICAL	L	T	P	C
Practical		0	0	4	2

Introduction

Human Physiology course is designed to impart a fundamental knowledge on the structure and functions of the human body. It also helps in understanding of how the entire body works, responds to changing internal and external conditions, and fulfils a function.

Course Objectives

The objective of this course is to enable the student to

- Interpret and draw inferences from experimental measures of our body.

Course Outcomes

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

CO1: To record the blood pressure, heart rate.

CO2: To record the pulse rate and to perform haematological test.

CO3: To explain about breathing rate and galvanic skin response.

CO4: To prepare serum and plasma from blood and to Perform urine analysis

CO5: To analysis and estimate blood glucose and to explain about cardiac disorder system

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Pre-requisites

Fundamentals of biology, structural & functional human parts

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

1146233320	HUMAN PHYSIOLOGY PRACTICAL	L	T	P	C
Practical		0	0	4	2

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.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test (Expt 1 to 5)	Practical Test (Expt 6 to10)	Model Practical Exam.	Record of Work Done	Practical Examination
Duration	2	2	3	Regularly	3 hours
Exam Marks	60	60	100	20	100
Converted to	15	15	15	10	60
Marks	15		15	10	60
Internal Marks	40				60

Note:

- CA1 and CA2: It should be conducted as per the end semester question pattern for 60 Marks. The 60 marks awarded will be converted to 15 Marks. The best one will be considered for the Internal Assessment of **15 Marks**.

1146233320	HUMAN PHYSIOLOGY PRACTICAL	L	T	P	C
Practical		0	0	4	2

- CA 3: After completion of all the exercises, model examination should be conducted as per end semester question pattern. The marks awarded should be converted to **15 Marks** for the internal assessment.
- CA 4: Record of work done should be maintained and the same have to be evaluated after completion of each practical exercise before the commencement of the next exercise for **20** Marks. The marks awarded should be converted to **10 Marks** for the internal assessment.

Allocation of Marks for Model Examination and End Semester Examination

Part	Description	Marks
A	Circuit Diagram / Experimental set up	25
B	Testing/Experimenting	40
C	Tables/Graph	20
D	Observing Result	10
E	Viva-voce	5
TOTAL MARKS		**100**

1146233320	HUMAN PHYSIOLOGY PRACTICAL	L	T	P	C
Practical		0	0	4	2

Ex. No	Name of the Exercise	Hours
1	To determine the heart rate in sitting and standing posture	6
2	To determine blood pressure before and after exercise	6
3	To determine the pulse rate	6
4	To determine Hb before and after exercise	6

1146233320	HUMAN PHYSIOLOGY PRACTICAL	L	T	P	C
Practical		0	0	4	2

5	Study of breathing rate with the change of postures.	6
6	Study of Galvanic skin response (GSR).	6
7	To Prepare serum and plasma from blood.	6
8	To Estimate of urea	6
9	Estimation of blood glucose.	6
10	To study the Cardiac disorder systems.	6
TOTAL HOUR		**60**

Equipment Required:

Sl. No	Item Description	Range	Quantity Required
1.	Heart rate monitor	-	4
2.	Sphygmomanometer	-	2
3.	Hemoglobinometer	-	4
4	EDTA tubes	-	1 box
5	Urea Kit	-	2
6	Breathing exercise charts	-	As required
7.	Body Postures charts	-	As required

1146233320	HUMAN PHYSIOLOGY PRACTICAL	L	T	P	C
Practical		0	0	4	2

Web-based/Online Resources:

1. https://www.gdcb.iastate.edu/laboratory-experiences-human-physiology
2. https://physiologylab.unl.edu/human-physiology-labs-1-6
3. https://iastate.pressbooks.pub/curehumanphysiology/front-matter/introduction-to-the-human-physiology-laboratory/

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
- Analyse 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 Algebra and verify experimentally.

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

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

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

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.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Practical Test (Ex: 1 to 6)	Practical Test (Ex: 7 to 12)	Model Examination	Record Work	Practical Examination
Duration	2 hours			--	3 hours
Exam Marks	20	20	20	20	100
Converted to	10	10	10	10	60
Marks	40				60

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

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

Ex.No	Name of the Exercise	Hours
1	Verification of truth table of OR, AND, NOT, NOR, NAND, EX- OR gates.	4
2	Realization of logic gates using NAND & NOR gates.	4
3	Verification of Demorgan's theorems.	4
4	Half adder, Full adder using logic gates.	4
5	Half subtractor, full subtractor using logic gates.	4
6	Construction and verification of truth table for Decoder and Encoder.	4
7	Construction and verification of truth table Multiplexer and De-multiplexer.	4
8	Construction and verification of truth table one digit digital comparator	4
9	Construction and verification of truth table for SR Latch using NAND and NOR gates	4
10	Construction and verification of truth table for JK, D and T flip- flops.	4
11	Construct and test the performance of a 4- bit asynchronous up counter.	4
12	Construct and test the performance of a decade counter.	4
13	Construct and test the performance of Parity generator and checker.	4
14	Construct and test shift register in SIPO	4
15	Construct and test shift register in PISO	4
Total Hours		**60**

Note: For the Semester Examinations, there is no need to do the Simulation. It is only for the learning purpose. Students must do the experiments only using Trainer Kits and ICs.

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

Allocation of Marks

Part	Description	Marks
A	Circuit Diagram	30
B	Truth Table	20
C	Connection and Execution	35
D	Tabulation and Result	10
E	Viva Voce	05
Total Marks		**100**

Equipments Required

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

1146233540	ELECTRONIC CIRCUITS	L	T	P	C
Practicum		2	0	4	4

Introduction

This course is intended to introduce students to the fascinating world of analog electronics. The emphasis of the course is to build intuition behind the operation of circuits. To do this, we derive circuits ground-up, from first principles. Electronic Circuits, with the simple explanation presents a single comprehensive syllabus covering all aspects of semiconductor devices and circuits with an aim to satisfy the requirements of polytechnic students and teachers. With each topic organized in a sequential manner, explanations are provided for every concept to enhance the understanding of the students.

Course Objectives

The objective of this course is to enable the student to

1. Introduce the concept of rectifiers and filters.
2. Know the types of biasing and stability factor.
3. Comprehend the fundamental concepts in feedback amplifier circuits.
4. Analyze the characteristics of RC & LC oscillators.
5. Understand the concept of Multivibrators and IC voltage regulators. .

Course Outcomes

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

CO1: Categorize the filters and rectifiers.

CO2: Demonstrate the BJT biasing circuits.

CO3: Explain the negative feedback concept and analyze frequency response characteristics of amplifiers.

CO4: Construct and test the characteristics of RC/LC oscillators.

CO5: Design regulated power supplies & multivibrators.

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Pre-requisites:

Prior knowledge on basic Electronic Devices and components.

1146233540	ELECTRONIC CIRCUITS	L	T	P	C
Practicum		2	0	4	4

CO/PO Mapping

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

1146233540	ELECTRONIC CIRCUITS	L	T	P	C
Practicum		2	0	4	4

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)	
	CA1	CA2	CA3			
Mode	Assignment	Record Writing	Written Examination	Practical Examination	Written Examination	Practical Examination
Duration	-	-	1 Hour	2 Hours	1 Hour	2 Hours
Exam Marks	20	10	20	80	20	80
Converted to	10	10	20		60	
Marks	40				60	

Note:

- CA 3 Model Examination shall be conducted similar to End Semester Examination which comprises of 100 Marks in which **80 Marks are allocated for Practical** and **20 Marks are allocated for Theory Question pattern**

Allocation of Marks for End Semester Board Practical Examination and Model Practical Examination

Practical part (All Experiments)

Part	Description	Marks
A	Circuit Diagram	35
B	Procedure/Algorithm	10
C	Connections/Execution	20
D	Output/Result	10
E	Viva voce	5
TOTAL MARKS		**80**

1146233540	ELECTRONIC CIRCUITS	L	T	P	C
Practicum		2	0	4	4

Model Examination /End Semester Examination		
Part	**Description**	**Marks**
Theory	10 Questions to be answered out of 15 Questions, Each Question carries 2 Marks**(10Q X 2=20 Marks)**	20
Practical	As per Allocation of marks in Practical Part	80
Total		**100**

1146233540	ELECTRONIC CIRCUITS	L	T	P	C
Practicum		2	0	4	4

Unit I	**Diode and its Application circuits**	
Theory: PN Junction Diode – Rectifier - Classification of Rectifiers-Half wave rectifier- Full wave rectifier with two Diodes, Bridge Rectifier – Filters: Definition - Types - Capacitor filter - Inductor filter, Zener Diode: Zener breakdown – Zener diode as a Voltage regulator		6 Hrs
Practical: Experiment #1: Construct a circuit to test the forward and reverse bias characteristics of a PN Junction Silicon diode. Experiment #2: Construct a circuit to test the forward and reverse bias characteristics of a Zener diode Experiment #3: Construct a Full wave (center tapped) rectifier and test its input and output waveforms with and without Capacitor filter.		12 Hrs
Unit II	**BJT AMPLIFIERS**	
Theory: Transistor biasing: Need for biasing - Types- Fixed bias, Collector to base bias and Self bias (Operation only, no derivation of circuit elements and parameters)– Define: Stability factor - Operation of Common Emitter Transistor as an Amplifier and as a switch - RC coupled amplifier circuit		6 Hrs
Practical: Experiment #4: Construct a Common Emitter Transistor circuit and test its input and output Characteristic curves. Experiment #5: Construct and test the frequency response characteristics of RC coupled amplifier		12 Hrs
Unit III	**FEEDBACK AMPLIFIERS**	

1146233540	ELECTRONIC CIRCUITS	L	T	P	C
Practicum		2	0	4	4

Theory: Block diagram – Loop gain – Gain with feedback – Effects of negative feedback –Sensitivity and desensitivity of gain – Cut-off frequencies – Distortion – Noise – Input impedance and output impedance with feedback – Four types of negative feedback connections.	6 Hrs
Practical: Experiment #6: Construct a Common emitter amplifier circuit and test its frequency response characteristics with and without Current series feedback introduced in it using any electronic simulation software like Multisim/Tina/Pspice. Experiment #7: Shunt feedback amplifiers using any Electronic simulation software like Multisim/Tina/Pspice.	12 Hrs
Unit IV **OSCILLATORS**	
Theory: Classification – Barhausen criterion – Mechanism for start of oscillation and stabilization of amplitude – General form of an oscillator – Analysis of LC oscillators – Hartley – Colpitts - RC oscillators – Phase Shift - Frequency response of RC and LC oscillators	6 Hrs
Practical: Experiment #8: Construct RC Phase shift oscillator circuit using NPN transistor BC107 and Observe the output waveform in CRO Experiment #9: construct and test the characteristics OF Hartley oscillator	12 Hrs
Unit V **MULTIVIBRATORS & REGULATORS**	
Theory: Multivibrators: Definition, Types, Astable and Monostable Multivibrator, Schmitt trigger using Transistors - Need for voltage regulator, IC Voltage regulator-series and shunt voltage regulator, Comparison, Design of power supply	6 Hrs
Practical: Experiment #10: Design multivibrators (Astable, Monostable) using any Electronic simulation Software like Multisim/Tina/Pspice. Experiment #11: Design Schmitt trigger using Transistor using any Electronic simulation software like Multisim/Tina/Pspice. Experiment #12: Test the performance of IC Voltage Regulator Power Supplies using IC 7805, IC 7912.	12 Hrs
TOTAL HOURS	90 Hrs

Suggested List of Students Activity

Other than classroom learning, following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course.

- Prepare Power Point presentation/Seminars by the students on any recent technological developments in the relevant fields.
- Analyze circuit response to troubleshoot faults in the electronic circuits.
- Practice Multisim/Matlab to analyze circuit response.
- Micro projects can be an extension of any practical lab exercise to real time applications.
- Incorporate pair and group work activities to understand the concepts.

1146233540	ELECTRONIC CIRCUITS	L	T	P	C
Practicum		2	0	4	4

Text Books:

1) S. Salivahanan, N.Suresh Kumar-"Electronic Devices and Circuits",4th edition-2017,McGraw Hill Education.
2) Robert L.Boylestad, Louis Nashelsky-"Electronic Devices and Circuits Theory",8th edition-2021, Shree Hari Publications.

Reference Books:

1) Dr.Albert Paul Malvino, David J. Bates-"Electronic Principles (ENGINEERING TECHNOLOGIES & THE TRADES) " 4th edition-2015,McGraw Hill Education.
2) Jacob Millman-"Millman's Electronic Devices and Circuits (SIE) ", 4th Edition-2010, McGraw Hill Education.
3) Jacob Millman, Christos Halkias-"Integrated Electronics", 2nd edition-2017,McGraw Hill Education.

WEB-BASED/ONLINE RESOURCES:

- NPTEL video lecture on Analog Electronic Circuits https://archive.nptel.ac.in/courses/108/105/108105158/
- NPTEL video lecture on Introduction to Electronic Circuits https://archive.nptel.ac.in/courses/108/102/108102097/

For Quiz / MCQ Questions:

- **https://www.indiabix.com/**
- **https://www.sanfoundry.com/**

List of Equipment's:

S. No	Name of Equipment	Quantity
1.	Regulated Power Supply	10
2.	Signal Generator 1MHz	4
3.	Dual trace CRO30MHz	5
4.	Digital Multimeter	10
5.	DC Voltmeter (Different Ranges)	15
6.	DC Ammeter (Different Ranges)	15
7.	Decade Resistance Box	1
8.	Decade Capacitance Box	1
9.	Decade Inductance Box	1
10	PC with simulation software	5

1146233640	SENSOR AND SIGNAL CONDITIONING	L	T	P	C
Practicum		2	0	4	4

Introduction

Most of the Bio medical equipment's are designed with Electronic circuit to process the signal sensed by sensors or electrodes. Lab technician should be well-known with the sensors and bio electrodes. The signals picked up by sensors and electrodes need various processing to further use it. The students need practical knowledge to measure various parameters such as Temperature, pressure, Flow, etc. This subject gives practical exposure to the students about measurement of process variables and enables the students to learn the basic principles of different sensors and Electrodes and signal processing circuits.

Course Objectives

The objective of this course is to enable the student to

1. Discuss the working of various types of sensors like displacement sensors, motion sensors, proximity sensors, flow sensors, temperature sensors, pressure sensors etc.
2. Operational amplifiers and its specification, characteristics
3. Implement Operational Amplifiers in basic applications
4. Understanding of signal conditioning circuits like amplifier and filters.
5. Analyses of Digital to Analog converters and Analog to Digital converters.
6. Learn the concept of instrumentation amplifier, V to I and I to V converter.

Course Outcomes

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

CO1: Construction and working of various types of Displacement sensors

CO2: Construction and working of Force sensors

CO3: Construction and working of various types of temperature sensors

CO4: Construction and working of various types of light sensors

CO5: Construction and working of various types' amplifiers (inverting, non-inverting, Instrumentation amplifier) and filters using operational amplifiers and DAC Converters.

Pre-requisites

Knowledge about working of basic Electronic components.

1146233640	SENSOR AND SIGNAL CONDITIONING	L	T	P	C
Practicum		2	0	4	4

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 stimulate 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.

1146233640	SENSOR AND SIGNAL CONDITIONING	L	T	P	C
Practicum		2	0	4	4

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)	
	CA1	CA2	CA3			
Mode	Assignment	Record Writing	Written Examination	Practical Examination	Written Examination	Practical Examination
Duration	-	-	1 Hour	2 Hours	1 Hour	2 Hours
Exam Marks	20	10	20	80	20	80
Converted to	10	10	20		60	
Marks	40				60	

Note:

- CA 3 Model Examination shall be conducted similar to End Semester Examination which comprises of 100 Marks in which **80 Marks are allocated for Practical** and **20 Marks are allocated for Theory Question pattern:**

Allocation of Marks for End Semester Board Practical Examination and Model Practical Examination

Practical part (All Experiments)

Part	Description	Marks
A	Circuit Diagram	35
B	Procedure/Algorithm	10
C	Connections/Execution	20
D	Output/Result	10
E	Viva voce	5
TOTAL MARKS		**80**

1146233640	SENSOR AND SIGNAL CONDITIONING	L	T	P	C
Practicum		2	0	4	4

Model Examination /End Semester Examination		
Part	**Description**	**Marks**
Theory	10 Questions to be answered out of 15 Questions, Each Question carries 2 Marks**(10Q X 2=20 Marks)**	20
Practical	As per Allocation of marks in Practical Part	80
Total		**100**

1146233640	SENSOR AND SIGNAL CONDITIONING	L	T	P	C
Practicum		2	0	4	4

Unit I	**DISPLACEMENT, PROXIMITY AND FORCE SENSOR**	
Sensors and Transducers – Definition **Displacement Sensor**- Potentiometer, strain gauged element, Capacitive element, LVDT **Proximity Sensor**- Eddy current proximity sensor, Inductive proximity sensor, proximity switches **Force Sensor**- strain gauge Load cell		6
Ex. No	Name of the Experiment	
1	Conduct experiment to measure the displacement using potentiometer	12
2	Conduct experiment to measure the displacement using LVDT	
3	Conduct experiment to measure the force using strain gauge load cell	
Unit II	**TEMPERATURE, PRESSURE AND LIGHT SENSORS**	
Temperature sensor - Bimetallic strips –Resistance temperature detectors(RTD)–Thermistor-Thermo-diodes and transistors Pressure sensors-Diaphragm pressure gauge, capsules, Bellows, piezoelectric sensor Light sensors –Photodiodes ,Photo resistors, LDR		6
Ex. No	Name of the Experiment	
4	Conduct experiment to measure the temperature using Thermistor	12
5	Conduct experiment to measure the temperature using RTD	
Unit III	**BIO ELECTRODES AND BIO SENSORS**	

Bio Electrodes-Origin of Bio-Electric signal–Bio potential - Resting and Action potential, ECG Electrodes–EEG Electrodes–EMG Electrodes- Recording Electrodes- types of Electrodes- Micro- skin and Needle electrodes - Silver-Silver chloride electrodes- Electrical conductivity of Electrode jellies and creams Bio Sensors- Transducers for body temperature measurement–Photoelectric transducer–Smart sensors		6
Ex. No	Name of the Experiment	
6	Conduct experiment to measure light intensity using LDR	12
7	Conduct experiment to measure the body temperature	
Unit IV	**OPERATIONAL AMPLIFIERS**	
Operational amplifier IC 741-Schematic symbol for opamp-pin diagram of IC 741-Block diagram of an opamp- Characteristics of an ideal opamp-CMRR-Slew Rate. Basic circuits-Inverting Amplifier, Non Inverting Amplifier, Instrumentational Amplifier		6
Ex. No	Name of the Experiment	
8	Construct and test the performance of Inverting and Non-inverting amplifier using operational amplifier with waveforms for input and output signals	12
9	Construct the instrumentation amplifier circuit and test it	
Unit V	**SIGNAL CONDITIONING CIRCUITS USING OP-AMP**	
comparator – Zero crossing detector- Differential Amplifier- ECG amplifier Adder–subtractor-Integrator–Differentiator-Voltage to current converter-Current to voltage converter- low pass filter-High pass filter Band pass filter –Notch filter- Non-inverting Schmitt trigger-Inverting Schmitt trigger- Digital to analog converter		6
Ex. No	Name of the Experiment	
10	Construct V to I and I to V converter circuit using operational amplifier	12
11	Construct Low pass , High pass and Notch filter using operational amplifier and test it	
12	Construct R- 2R digital to analog converter circuit using operational amplifier and test it	
Total Hours		**90**

Suggested List of Students Activity

- https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering
- https://ndl.iitkgp.ac.in
- Check the web portal to study different types of sensors and transducers.
- Periodic class quizzes conducted on weekly based on the course

- Students might be asked to see the demonstration video of various sensors and transducer in YouTube and other online source

Text Book:

1. Hand book of Bio-Medical instrumentation- Third Edition, Dr.R.S.Khandpur, McGraw Hill Education (India)Private Limited
2. Dr.M.Arumugam–Biomedical Instrumentation, Anuradha publications, Chennai.
3. Linear Integrated Circuits, Second Edition, D.Roy Choudhury, New age international publishers

Reference Books

1. Leslie Cromwell–Fredj. Wibell, Erich A.P Feither–Biomedical Instrumentation and measurements, II Edition.
2. Medical Electronics- Kumaradoss
3. Introduction to Medical Electronics. B.R.Klin
4. Introduction to Biomedical Instrumentation Mandeep Singh Printice HallIndia2010

List of Equipment required

S. No	NAME OF THE EQUIPMENT	QUANTITY REQUIRED
1.	Potentiometer	4
2.	LVDT	2
3.	Strain gauge Load cell	2
4.	Thermistor, RTD, LDR	Each 2
5.	Analog IC trainer board with bread board and power supply	4
6.	IC741,Resistors, capacitors	As required
7.	Digital Multimeter	5
8.	Cathode ray oscilloscope	4
9.	Function generator	4
10.	Connecting wires	As required

1146234110	BIO-MATERIALS AND ARTIFICIAL ORGANS	L	T	P	C
Theory		3	0	0	3

Introduction

This course introduces the bio-materials that are compatible with the human body. Artificial organ developments are important in this scientific world. Hence, it becomes necessary to learn the materials involved in the development of these organs.

Course Objectives

The objective of this course is to enable the student to imparting the knowledge of material science, chemistry and characteristics and classification of biomaterials. It is useful to learn about different metals and ceramics used as biomaterials, polymeric materials and combinations for mechanism of tissue replacement implants and also gives knowledge of the artificial organ development.

Course Outcomes

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

CO1: Identify and classify the different type of biomaterials in the field of biomedical engineering.

CO2: Apply recent trends of different biomaterials in drug delivery systems

CO3: Develop a polymeric materials and combinations for implanting materials.

CO4: Understand the concepts of different dental implants.

CO5: Design tissues for replacement of organ.

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Pre-requisites

NIL

CO/PO Mapping

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

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

Instructional Strategy

1146234110	BIO-MATERIALS AND ARTIFICIAL ORGANS	L	T	P	C
Theory		3	0	0	3

- 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 for the applicable topics to ensure outcome-driven learning and employability.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Model	Written Unit I & II (at the end of 6th week)	Written Unit III & IV (at the end of 12th week)	Written Model Exam Units I to V	Quiz/MCQ/ Activity/ Assignment	Written Examination
Duration	2 hours	2 hours	3 hours	2 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	20	20	10	10	60
Marks	20		20		60

Note:

- CA1 and CA2 Assessment test should be conducted as per the question pattern. Best of one will be considered for 20 Marks.
- CA3 Model examination should be conducted as per the question pattern.
- CA4 Online quiz examination (MCQ) should be conducted covering the complete syllabus.

Question pattern:

1146234110	BIO-MATERIALS AND ARTIFICIAL ORGANS	L	T	P	C
Theory		3	0	0	3

CA1 & CA2 Assessment		
Part	**Description**	**Marks**
A	16 Questions to be answered out of 20 Questions	16Q X 2 = 32 Marks(Each question carries 2 marks)
B	4 Questions to be answered out of 6 Questions	4QX 7 = 28 Marks (Each question carries 7 Marks)
CA3 Assessment		
Part	**Description**	**Marks**
A	15 Questions to be answered out of 20 Questions	15Q X 2 = 30 Marks(Each question carries 2 marks)
B	Answer all 5 questions, choosing any 2 sub-divisions out of 3 from each question under Part –B.	(5Q X 14 =70 Marks)(7+7)

1146234110	BIO-MATERIALS AND ARTIFICIAL ORGANS	L	T	P	C
Theory		3	0	0	3

Unit I	**STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY**	
Definition and classification of biomaterials, Mechanical properties, Viscoelasticity, Wound healing process, Body response to implants, Blood compatibility		9
Unit II	**IMPLANT MATERIALS**	
Metallic implant materials, Stainless steels, Co-based alloys, Ti-based alloys, Ceramic implant materials, Aluminum oxides, Hydroxyapatite, Glass ceramics, Carbons, Medical applications.		9
Unit III	**POLYMERIC IMPLANT MATERIALS**	
Polymerization, Polyamides, Acryrilic polymers, Rubbers, High strength thermoplastics, Medical applications, Biopolymers - collagen and elastin; Medical textiles silica, Chitosan, PLA composites, Sutures, Wound dressings; Materials for ophthalmology - contact lens, intraocular lens, membranes for plasma separation and blood oxygenation		9
Unit IV	**TISSUE REPLACEMENT IMPLANTS**	
Small intestinal submucosa and other decellarized matrix biomaterials for tissue repair; Soft tissue replacements, Sutures, Surgical tapes, Adhesive, Percutaneous and skin implants, Maxillofacial augmentation, Vascular grafts, Hard tissue replacement Implants, Joint replacements, Pancreas replacement..		9
Unit V	**ARTIFICIAL ORGANS**	
Artificial blood, Artificial skin, Artificial heart, Prosthetic cardiac valves, Artificial lung (oxygenator), Artificial kidney (Dialyser membrane), Artificial pancreas, Dental implants		9
TOTAL HOURS		**45**

1146234110	BIO-MATERIALS AND ARTIFICIAL ORGANS	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/online quizzes conducted based on the course.
- Blended learning activities to explore the recent trends and developments in the field.

Reference

1. Joseph D. Bronzino,"The Biomedical Engineering Hand Book, 2nd Edition Boca Raton: CRC Press LLC, 2000.
2. Sujata V. Bhatt, "Biomaterials", 2nd edition, Narosa Publishing House, 2005
3. Park J.B., "Biomaterials Science and Engineering", 1st edition, Plenum Press, 1984.
4. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design", Mc Graw Hill, 2003.
5. John Enderle, Joseph D. Bronzino, Susan M.Blanchard, "Introduction to Biomedical Engineering", 2nd edition, Elsevier, 2005.
6. A.C Anand, J F Kennedy, M.Miraftab, S.Rajendran, "Woodhead Medical Textiles and Biomaterials for Healthcare", 2nd edition, Publishing Limited, 2006.
7. D F Williams, "Materials Science and Technology: Vol 14, Medical and Dental Materials: A comprehensive Treatment Volume", VCH Publishers, 1992.
8. B D Ratner, AS Hoffmann, FJ Schoen and JE Lemmons, "An introduction to Materials in Medicine", Academic Press, 1996.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc19_mm24/preview

1146234210	Operational Amplifier and Linear Integrated Circuits	L	T	P	C
Theory		3	0	0	3

Introduction

An operational amplifier is an integrated circuit that can amplify weak electric signals. An operational amplifier is not normally used alone but is designed to be connected to other circuits to perform a great variety of operations.

Op-amps usually have high open-loop gain, and differential inputs are used most in the medical area, especially in the monitoring area, which can use the characteristic of the op-amps to magnify the signal from biology signals and increase it for better monitoring.

Basically all medical equipment that uses sensors will use Op Amps to amplify and condition the signals that the sensors pick up. In medical devices and equipment, op-amps may be used in various ways, such as in signal conditioning, filtering, and amplification within electronic medical instruments. This includes EKGs, ECGs, pulse and BP monitors, temperature monitors, etc. Op-amps help process and amplify the small electrical signals generated by the body for further analysis and diagnosis.

In addition, chemistry analyzers and blood counters that are used to perform tests on blood and urine use Op Amps to perform the tests themselves.

Hence an in-depth knowledge of the operation and application of Operational Amplifier and Linear Integrated Circuits is essential for Biomedical Electronics.

Course Objectives

At the end of the course, the students would be able to

- study in detail constructional & basic operational aspects of various analog and Digital electronic devices used in industry.
- study in detail the concepts of ICs Like op-amp, 555 Timer IC , Voltage Regulator ICs, Multiplier ICs, ADC-DAC etc.
- focus on the application of Integrated circuits for practical designing aspects.
- aware the applications of different digital devices for designing the different type of circuits.

1146234210	Operational Amplifier and Linear Integrated Circuits	L	T	P	C
Theory		3	0	0	3

Course Outcomes

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

CO1: have a thorough understanding of IC fabrication techniques and advantages of ICs over discrete components.

CO2: comprehend the operational features of Operational Amplifiers

CO3: describe the working of various applications of Operational Amplifiers
interpret the working of analog multipliers and PLLs

CO4: understand the working and applications of ADC and DAC

CO5: illustrate the working of wave form generators and special function ICs

CO6: engage in self-study to demonstrate the various applications of Operational Amplifiers.

Pre-requisites

Basic Electronics

CO/PO Mapping

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

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

Instructional Strategy

- Teachers have to use different teaching methods for easy understanding.
- Teachers have to explore the various simulation methods to explain the operation of Operational Amplifiers and its applications.
- Teachers have to encourage the students to visit various online resources on Operational Amplifiers.

1146234210	Operational Amplifier and Linear Integrated Circuits	L	T	P	C
Theory		3	0	0	3

- Teachers have to motivate the students to explore various MOOC courses on Operational Amplfiers.
- Teachers have to illustate the application of Operational Amplifiers as building blocks in various Bio-Medical Applications.
- Teachers have to arrange industrial visits on circuit designing and fabrication.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Model	Written Unit I & II (at the end of 6th week)	Written Unit III & IV (at the end of 12th week)	Written Model Exam Units I to V	Quiz/MCQ/ Activity/ Assignment	Written Examination
Duration	2 hours	2 hours	3 hours	2 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	20	20	10	10	60
Marks	20		20		60

Note:

- CA1 and CA2 Assessment test should be conducted as per the question pattern. Best of one will be considered for 20 Marks.
- CA3 Model examination should be conducted as per the question pattern.
- CA4 Online quiz examination (MCQ) should be conducted covering the complete syllabus.

1146234210	Operational Amplifier and Linear Integrated Circuits	L	T	P	C
Theory		3	0	0	3

Question pattern:

CA1 & CA2 Assessment		
Part	**Description**	**Marks**
A	16 Questions to be answered out of 20 Questions	16Q X 2 = 32 Marks(Each question carries 2 marks)
B	4 Questions to be answered out of 6 Questions	4QX 7 = 28 Marks (Each question carries 7 Marks)
CA3 Assessment		
Part	**Description**	**Marks**
A	15 Questions to be answered out of 20 Questions	15Q X 2 = 30 Marks(Each question carries 2 marks)
B	Answer all 5 questions, choosing any 2 sub-divisions out of 3 from each question under Part –B.	(5Q X 14 =70 Marks)(7+7)

1146234210	Operational Amplifier and Linear Integrated Circuits	L	T	P	C
Theory		3	0	0	3

Unit I	**IC Fabrication and Circuit Configuration for Linear Integrated Circuit**	
Advantages of ICs over discrete components – Manufacturing process of monolithic IC's, Construction of monolithic bipolar transistor – Monolithic diodes – Integrated Resistors, Monolithic Capacitors – Inductors. Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.		9
Unit II	**Application of Operational Amplifiers**	
Applications of Operational Amplifiers: Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.		9
Unit III	**Analog Multiplier and PLL**	
Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications,		9

Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.		
Unit IV	**ADC and DAC**	
Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R2R Ladder types switches for D/A converters, high speed sample-and-hold circuits, A/D Converters specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to- Time Conversion - Over-sampling A/D Converters.		9
Unit V	**Waveform Generators and Special Function ICs**	
Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL 8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjust- able voltage regulators - IC 723 general purpose regulator Monolithic switching regulator, Switched 46 capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.		9
TOTAL HOURS		**45**

Reference Books

- Integrated Electronics by Millman & Halkias, Tata McGraw Hill
- Design with Operational Amplifiers and Analog Integrated Circuits, Tata McGraw Hill
- Electronic Circuit, Discrete & Integrated by Schilling & Belove,,Tata McGraw Hill
- Operational Amplifiers and Linear Integrated Circuits by Gayakwad R A, Pearson
- Operational Amplifier and Linear Integrated Circuits by Coughlin and Driscoll, Pearson Education Asia.
- Design with Oerational Amplifiers and Analog Integrated Circuits (3/e), Sergio Franco, Tata McGraw-Hill, 2007
- Linear Integrated Circuits by D Roy Choudhry, Shail Jain New Age International
- System design using Integrated Circuits (2/e) by B S Sonde, New Age Publishers
- Analysis and Design of Analog Integrated Circuits by Gray and Meyer, Wiley International Operational Amplifier and Linear Integrated Circuits by K Lal Kishore, Pearson Education

1146234340	MICROBIOLOGY	L	T	P	C
Practicum		1	0	4	3

Introduction

Introduces the core concepts and basic principles in microbiology, examining microorganisms and how they interact with humans and the environment. Demonstrate the knowledge and skills in the common microbiology laboratory procedures. The scope on this field is immense due to the involvement and microbiology in many fields like medicine, pharmacy, industry clinical research, Nano technology etc.

Course Objectives

The objective of this course is to enable the student to

1. Get acquainted to the laboratory precautions and techniques to be followed in general microbiology laboratory.
2. Identify microorganisms microscopically.
3. Train the students in culturing techniques.
4. Acquire skills to isolate and quantify microorganisms

Course Outcomes

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

CO1: Understand basic microbiology, various micro-organisms and working of microscope.
CO2: Identify characteristics of various microorganisms and its growth.
CO3: Analyse culturing techniques.
CO4: Understand Immunology and blood grouping.
CO5: Understand microbial growth within a laboratory

.

Pre-requisites

Knowledge of basic science

1146234340	MICROBIOLOGY	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

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

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

Instructional Strategy

- It is advised that teachers take steps to stimulate 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

1146234340	MICROBIOLOGY	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)	
	CA1	CA2	CA3			
Mode	Assignment	Record Writing	Written Examination	Practical Examination	Written Examination	Practical Examination
Duration	-	-	1 Hour	2 Hours	1 Hour	2 Hours
Exam Marks	20	10	20	80	20	80
Converted to	10	10	20		60	
Marks	40				60	

Note:

- CA 3 Model Examination shall be conducted similar to End Semester Examination which comprises of 100 Marks in which **80 Marks are allocated for Practical** and **20 Marks are allocated for Theory**.

Allocation of Marks for End Semester Board Practical Examination and Model Practical Examination

Practical part (All Experiments)

Part	Description	Marks
A	Circuit Diagram	35
B	Procedure/Algorithm	10
C	Connections/Execution	20
D	Output/Result	10
E	Viva voce	5
TOTAL MARKS		**80**

1146234340	MICROBIOLOGY	L	T	P	C
Practicum		1	0	4	3

Model Examination /End Semester Examination		
Part	**Description**	**Marks**
Theory	10 Questions to be answered out of 15 Questions, Each Question carries 2 Marks **(10Q X 2=20 Marks)**	20
Practical	As per Allocation of marks in Practical Part	80
Total		**100**

1146234340	MICROBIOLOGY	L	T	P	C
Practicum		1	0	4	3

Unit I	**Basics of microbiology**
Theory History and Scope of Microbiology, Prokaryotic and Eukaryotic Microorganisms. Classification of Microorganisms.-Morphology and General Characteristics of Bacteria Fungus, Algae &Virus	3
Practical Experiment #1: Safety measures and Good Laboratory Practices in microbiology Laboratory. Experiment #2: Introduction, operation, precautions and use of common microbiology laboratory instruments: Incubator, pH meter, Hot air oven, Autoclave, Colorimeter, Laminar air flow hood, Clinical centrifuge.	12
Unit II	**Microscope and culture media**
Theory Microscope - Principles, working Mechanism and Application - Simple and Compound Microscope Culture media preparation - Types of media - Pure culture techniques Anti-microbial susceptibility testing–Modified Kirby-Bauemethod	3

1146234340	MICROBIOLOGY	L	T	P	C
Practicum		1	0	4	3

Practical Experiment #3: Microscopic examination of – Bacteria, Fungi and Protozoa. Experiment #4: Culture media preparation – Liquid and Solid medium Experiment #5: Motility of bacteria by -Hanging drop method Experiment #6: Antimicrobial susceptibility testing–Modified Kirby-Bauer method	12
Unit III	**Staining Methods**
Theory Staining method – simple staining, differential staining – Gram's staining, Zileh-Neelsen staining (Hot and Cold), Albert staining, Negative staining–India ink preparation	3
Practical Experiment #7: Simple staining–Methylene blue staining Experiment #8: Grams Staining Experiment #9: Acid fast staining	12
Unit IV	**Immunology**
Theory Immune Cells - Immune Hematology, Blood grouping, Properties of Antigen – Structure and functions of Immunoglobulin.	3
Practical Experiment #10: Motility of bacteria-Hanging drop preparation Experiment #11: Blood Collection and grouping Experiment #12: Counting of RBCs and WBCs through microscope.	12
Unit V	**Morphology**
Theory Morphology, Pathogenicity, symptoms, laboratory diagnosis, treatment, control & preventive measures of E.coli, Mycobacterium tuberculosis, Salmonella typhi.	3
Practical Experiment #13: Identification of pathogenic microorganisms by using high medium Experiment #14: Water quality test by Most Propable Number method(MPN)	12
TOTAL HOURS	**75**

Reference

- Pelezar TR M J chan ECS and Kreig NR" "Microbiology", Fifth edition, TataMc Graw-Hill INC. New York (2006).
- "Anathanarayan R and Jayaram Paniker CK" "Text book of Microbiology", Seventh edition, Orient Longmam Limited, Hyderabad (2005).
- "Dubey RC and Maheswari DK" "A text of microbiology", Revised edition, S.Chand and Company Ltd., New Delhi (2012).
- "Dubey RC and Maheswari DK" "A text of microbiology", Revised edition, S.Chand andCompany

Ltd., New Delhi (2012).

Web-based/Online Resources

- https://mvi-au.vlabs.ac.in/#
- https://onlinecourses.swayam2.ac.in/cec24_bt03/preview
- https://microbiologysociety.org/static/uploaded/23cbf9c5-f8c8-4f91-b092a4ad819e6357.pdf

List of Equipments

S. No	Name of Equipments	Quantity
1	Auto clave	**1**
2	Hot air oven	**1**
3	Microscope	**10**
4	Weighing balance(Digital)	**1**
5	Media for Culture	
6	Test tubes	**50**
7	Test tube rack	**25**
8	Beakers	**10**
9	Conical flask	**10**
10	Petridishes	**50**
11	Measuring cylinder	**5**
12	Incubator	**1**
13	Staining Rack	**1**
14	Spreader rod	**1**
15	Glass rod	**10**
16	Glass slides	**50**
17	All the stains	
18	Colony counter	**1**
19	Slide box	**2**

1146234440	MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C
Practicum		1	0	4	3

Introduction

A microcontroller is an electronic device belonging to the microcomputer family. These are fabricated using the VLSI (Very Large Scale Integration) technology on a single chip. Microcontroller is also known as “Computer-on-a-Chip”. It is named so, because not only the CPU, but RAM, ROM, I/O ports, Timer/ Counter, Serial I/Os all are put together on a single microcontroller chip. A microcontroller also called an embedded controller because the microcontroller and its support circuits are often built into, or embedded in, the devices they control. A microcontroller is available in different word lengths like microprocessors(4bit, 8bit, 16bit, 32bit, 64bit, 128bit microcontrollers are available today).

Course Objectives

On completion of the following units of syllabus contents, the students must be able to

- Explain the Architecture of 8051 Microcontroller.
- Explain the functions of various registers.
- Understand the interrupt structure of 8051.
- Understand the serial data communication concepts.
- Understand the programming techniques.
- Explain various addressing modes.
- Write simple programs using 8051.
- Understand the block diagrams and control word formats for peripheral devices.
- Understand how to interface with RS232C.
- Understand how to interface with 8255.
- Understand various application of 8051 Microcontroller.

Course Outcomes

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

CO1: Design the architecture of 8051 Microcontroller

CO2: Learn about the Assembly language programs of 8051

CO3: Explain the peripherals on Input out ports and Timer

CO4: Explain the serial communication and interrupts

CO5: Realize how to interface with 8255

1146234440	MICROCONTROLLER AND ITS APPLICATIONS	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 stimulate 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.

1146234440	MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)	
	CA1	CA2	CA3			
Mode	Assignment	Record Writing	Written Examination	Practical Examination	Written Examination	Practical Examination
Duration	-	-	1 Hour	2 Hours	1 Hour	2 Hours
Exam Marks	20	10	20	80	20	80
Converted to	10	10	20		60	
Marks	40				60	

Note:

- CA 3 Model Examination shall be conducted similar to End Semester Examination which comprises of 100 Marks in which **80 Marks are allocated for Practical** and **20 Marks are allocated for Theory Question pattern:**

Allocation of Marks for End Semester Board Practical Examination and Model Practical Examination

Practical part (All Experiments)

Part	Description	Marks
A	Circuit Diagram	35
B	Procedure/Algorithm	10
C	Connections/Execution	20
D	Output/Result	10
E	Viva voce	5
TOTAL MARKS		**80**

1146234440	MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C
Practicum		1	0	4	3

Model Examination /End Semester Examination		
Part	**Description**	**Marks**
Theory	10 Questions to be answered out of 15 Questions, Each Question carries 2 Marks**(10Q X 2=20 Marks)**	20
Practical	As per Allocation of marks in Practical Part	80
Total		**100**

1146234440	MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C
Practicum		1	0	4	3
UNIT - 1	**ARCHITECTURE AND INSTRUCTION SET OF 8051 MICROCONTROLLER**	**15 Hours**			
1.1	**Architecture:** Architecture diagram of microcontroller 8051 - Functions of each block - Pin details of 8051 – ALU –ROM – RAM				
1.2	Special function registers - Program counter - PSW register – Stack - I/O ports – Timer – Interrupt - serial port	**3 Hrs.**			
1.3	**Instruction Set of 8051** Instruction set of 8051 - Classification of 8051 instructions - data transfer instructions - Arithmetic instructions - Logical instructions - Branching instructions - Bit manipulation instructions.				
EX.NO.	**NAME OF THE EXPERIMENTS**				
1.	Write an assembly language program for adding two 8 bit / 16 bit numbers and execute the sameusing 8051 trainer kit.	**12 Hrs.**			
2.	Write an assembly language program for subtraction two 8 bit / 16 bit numbers and execute thesame using 8051 trainer kit.				
UNIT - 2	**8051 INSTRUCTION SET AND PROGRAMMING**	**15 Hours**			
2.1	**Assembler** Assembling and running an 8051 program - Structure of Assembly language - Assembler directives -Different Addressing modes of 8051 - Time delay routines.	**3 Hrs.**			

2.2	**Assembly language programs** 16 bit addition and 16 bit subtraction - 8 bit multiplication and 8 bit division - BCD to HEX code conversion - HEX to BCD code conversion - Smallest number / Biggest number	
EX.NO.	**NAME OF THE EXPERIMENTS**	
1.	Write an assembly language program for multiplication of two 8 bit numbers and execute thesame using 8051 trainer kit.	**12 Hrs.**
2.	Write an assembly language program for division of two 8 bit numbers and execute the sameusing 8051 trainer kit.	
3.	Write an Assembly Language Programme for BCD to Hex code Conversion and execute using 8051kit.	
4.	Write an Assembly Language Programme for Hex to BCD code Conversion and execute using 8051kit.	
UNIT - 3	**I/O AND TIMER**	**15 Hours**
3.1	**I/O Ports** Bit addresses for I/O and RAM – I/O programming – I/O bit manipulation programming.	**3 Hrs.**
3.2	**Timer/Counter** SFRS for Timer - Modes of Timers/counters - Programming 8051.	
EX.NO.	**NAME OF THE EXPERIMENTS**	
1.	Write a 8051 Assembly language program to generate 1 second time delay using Time delayroutine.(Demonstrate by blinking LEDs)	**12 Hrs.**
2.	Write a 8051 Assembly Language program to use Timer/ Counter of 8051 microcontroller togenerate time delay.	
UNIT - 4	**SERIAL COMMUNICATION AND INTERRUPTS**	**15 Hours**
4.1	**Serial Communication** Basics of serial communication - SFRs for serial communication - RS232 standard - 8051 connection to RS 232 - 8051 serial port programming.	**3 Hrs**

4.2	**Interrupts** 8051 interrupts - SFRs for interrupt - Interrupt priority.	
EX.NO.	**NAME OF THE EXPERIMENTS**	
1	Write a program to perform serial communication between two 8051 microcontroller kits andverify the output.	**12 Hrs.**
UNIT - 5	**INTERFACING TECHNIQUES**	**15 Hours**
5.1	**IC 8255** IC 8255 - Block diagram - Modes of 8255 - 8051 interfacing with 8255	**3 Hrs**
5.2	**Interfacing** Seven segments LED display interfacing - Stepper motor interfacing - DAC interfacing - DC motor -Interfacing using PWM	
EX.NO.	**NAME OF THE EXPERIMENTS**	
1	Write a program to interface Digital I /O board with microcontroller 8051.	**12 Hrs**
2	Write a program to interface DAC interface board with microcontroller 8051.	
3	Write a program to interface stepper motor with microcontroller 8051.	
4	Write a program to interface seven segment LED interface with microcontroller 8051.	
5	Write a program to interface a DC motor with microcontroller and verify the rotation of motor in both directions using PWM method	
	Total Hours	**75 hrs**

TEXT BOOK

S. No	Title	Author	Publisher	Year of Publishing /Edition
1.	Microcontrollers - Principleand Applications	Ajit pal	Prentice Hall of India	2011/15th Edition

2.	Microprocessor and Microcontroller	R.Theagarajan	Sci Tech Publication	2011/1st Edition
3.	Microprocessor Architecture, Programming and Applications with the 8085	Ramesh S.Goankar	Prentice Hall of India	2002/5st Edition

REFERENCE BOOKS

S.no	Title	Author	Publisher	Year of publishing / Edition
1.	8051 Microcontroller and Embedded Systems using Assembly and C	Muhammed Ali Mazidi,Janice Gillispe Mazidi and D.MacKinlay	Pearson Education Low Price Edition	2007/2nd Edition
2.	Microprocessor and Microcontrollers based system design	Mohammed Rafiquzzman	Universal Bookstall	2002/1st Edition

LIST OF PROPOSED STUDENT ACTIVITIES

REFERENCE LINKS	
Refer Web link : https://www.youtube.com/watch?v=qTZaE2lcYTo for I/O Ports	Refer Web link : https://www.youtube.com/watch?v=5kdK8f2ObVUfor instruction set of 8051
Refer Web link : https://www.youtube.com/watch?v=smh6jDORknU for Assembler Directives	Refer Web link : https://www.youtube.com/watch?v=huI5N02AHKMfor ASCII to Binary Conversion
Refer Web link : https://www.youtube.com/watch?v=WCjWIRdYNmI forTIMER	Refer Web link : https://www.youtube.com/watch?v=0SZPr4iGAC for Programming 8051 Timer

1146234440	MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C
Practicum		1	0	4	3

Refer Web link : https://www.youtube.com/watch?v=oIt-8XQxWKI for serial communication	Refer Web link : https://www.youtube.com/watch?v=nuGsQBlbx6Mfor8051 interrupts
Refer Web link : https://www.youtube.com/watch?v=QgcGmKt4jXU for 8255 interface	Refer Web link : https://www.youtube.com/watch?v=LlpQuaQEQ8A for Stepper Motor Interfacing

LIST OF EQUIPMENTS

SI. No	Name of the item	Quantity
1.	8051 Microcontroller Kit	14 Nos.
2.	Digital I/O Interface Board	2 Nos.
3.	Seven segment LED display Interface Board	2 Nos.
4.	8 bit DAC Interface Board	2 Nos.
5.	Stepper Motor Control Interface Board	2 Nos.
6.	DC motor control Interface Board	2 Nos.
7.	RS232 serial port cable	2 Nos.

1146234540	Basics of Signals and Systems	L	T	P	C
Practicum		1	0	4	3

Introduction

Signals and Systems is an essential subject that forms the backbone of modern technology. It encompasses the study of how information is captured, manipulated, and transmitted in various systems. From audio and image processing to telecommunications and control systems, Signals and Systems underlies the design and analysis of a wide range of technologies that shape our world.

Course Objectives

- To introduce the students to the idea of signals and systems, their characteristics in time and frequency domain.
- To provide the basic knowledge on Fourier representation and Laplace transform and its applications on signals and systems.
- To impart foundations of Z-transforms and its applications on signals and systems.
- To familiarise the students to the concept of random signals and random inputs.

Course Outcomes

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

CO1: Summarize the basic concepts, classfications and mathematical properties of signals.

CO2: Classify and compare continuous and discrete time systems.

CO3: Elucidate the various signal transformation techniques.

CO3: Explain Fourier representation of signals.

CO4: Explain Laplace, Inverse Laplace and Z-transforms.

CO5: Understand the concept of random signals and its response to random inputs.

Pre-requisites

Differentiation and Integration.