Regulation 2023
Program Structure

1142 - Diploma in Medical Laboratory 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 mathematics, science and engineering fundamentals and an engineering specialization to solve the engineering 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.

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	565	20
Semester II	8	565	20
Semester III	7	625	21
Semester IV	7	625	20
Semester V	8	610	21
Semester VI	3	630	18
Total			**120**

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023

1142 - DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

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	1141233210	Human Anatomy and physiology #	4-0-0	60	4	Theory
3	Program Core	Practical	1142233320	Electronic Devices & Circuits	0-0-4	60	2	Practical
4	Program Core	Practical	1141233320	Human Anatomy and physiology #	0-0-4	60	2	Practical
5	Program Core	Practicum	1142233540	Electrical Circuits and Machines	1-0-4	75	3	Practical
6	Program Core	Practicum	1142233640	Fundamentals of Medical Laboratory Technology	1-0-4	75	3	Practical
7	Open Elective	Advanced Skill Certification	1142233760	Advanced Skill Certification – 3	1-0-2	45	2	NA
8	Humanities & Social Science	Integrated Learning Experience	1142233880	Growth Lab	-	30	0	NA
9	Audit Course	Integrated Learning Experience	1142233881	Induction Program – II	-	16	0	-
10	Audit Course	Integrated Learning Experience	1142233882	I&E/ Club Activity/ Community Initiatives	-	16	0	-
11	Audit Course	Integrated Learning Experience	1142233883	Shop Floor Immersion	-	15	0	-
12	Audit Course	Integrated Learning Experience	1142233885	Emerging Technology Seminars	-	8	0	-
13	Audit Course	Integrated Learning Experience	1142233886	Health & Wellness	-	30	1	-
Library						**15**		
Test & Revisions						**60**		
Total						**625**	**21**	

Note:

- *** Common with Electronics and Communication Engineering
- # Common with Medical Electronics

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023

1142 - DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

Semester IV

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1142234110	Analog and Digital Electronics	4-0-0	60	4	Theory
2	Program Core	Theory	1142234210	Measurements and Instruments	4-0-0	60	4	Theory
3	Program Core	Practical	1142234320	Analog and Digital Electronics	0-0-4	60	2	Practical
4	Program Core	Practical	1142234420	Measurements and Instruments	0-0-4	60	2	Practical
5	Program Core	Practicum	1142234540	Sensors and Transducer	1-0-4	75	3	Practical
6	Program Core	Practicum	1142234541	Clinical pathology	1-0-4	75	3	Practical
7	Open Elective	Advanced Skill Certification	1142234760	Advanced Skills Certification - 4	1-0-2	45	2	NA
8	Audit Course	Integrated Learning Experience	1142234882	I&E/ Club Activity/ Community Initiatives	-	15	0	-
9	Audit Course	Integrated Learning Experience	1142234883	Shop floor Immersion	-	8	0	-
10	Audit Course	Integrated Learning Experience	1142234884	Student-Led Initiative	-	24	0	-
11	Audit Course	Integrated Learning Experience	1142234885	Emerging Technology Seminars	-	8	0	-
12	Audit Course	Integrated Learning Experience	1142234886	Health & Wellness	-	30	0	-
13	Audit Course	Integrated Learning Experience	1142234887	Special Interest Groups (Placement Training)	-	30	0	-
Library						**15**		
Test & Revisions						**60**		
Total						**625**	**20**	

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF TECHNICAL EDUCATION
DIPLOMA IN ENGINEERING & TECHNOLOGY - REGULATION 2023

1142 - DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

Semester V

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Program Core	Theory	1142235110	Basics of Biochemistry	5-0-0	75	5	Theory
2	Program Elective	Theory		Elective 1	4-0-0	60	4	Theory
3	Program Core	Practical	1142235320	Basics of Bio chemistry	0-0-4	60	2	Practical
4	Program Core	Practical	1142235420	Immunology	0-0-4	60	2	Practical
5	Program Elective	Practical		Elective 2	0-0-4	60	2	Practical
6	Humanities & Social Science	Practicum	1145235652	Innovation & Startup @	1-0-2	45	2	Project
7	Project/Internship	Project/Internship	1093235773	Industrial Training* [Summer Vacation - 90 Hours]	-	-	2	Project
8	Open Elective	Advanced Skill Certification	1142235860	Advanced Skills Certification - 5	1-0-2	45	2	NA
9	Audit Course	Integrated Learning Experience	1142235981	Induction program III	-	40	0	-
10	Audit Course	Integrated Learning Experience	1142235984	Student-Led Initiative	-	30	0	-
11	Audit Course	Integrated Learning Experience	1142235986	Health & Wellness	-	30	0	-
12	Audit Course	Integrated Learning Experience	1142235987	Special Interest Groups (Placement Training)	-	30	0	-
Library						**15**		
Test & Revisions						**60**		
Total						**610**	**21**	

Note:* *Internship shall be offered in the summer break between 4th and 5th semester followed by a review and award of credits in the 5th semester*
@ Common with Bio Medical Electronics

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DEPARTMENT OF TECHNICAL EDUCATION
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1142 - DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

Semester VI

#	Course Category	Course Type	Code	Course Title	L-T-P	Period	Credit	End Exam
1	Open Elective	Theory		Elective 3 (Pathways)	3-0-0	45	3	Theory
2	Open Elective	Theory		Elective-4 (Specialization)	3-0-0	45	3	Theory
3	Industrial Training / Project	Project/Internship	1142236651	In-house Project / Internship / Fellowship	-	540	12	Project
Total						**630**	**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.

3. 1 Credit for Projects is equivalent to 45 periods for projects/internships/fellowship.

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Elective 1

#	Course Category	Course Type	Code	Course Title
1	Program Elective	Theory	1142235311	Blood Banking Technology
2	Program Elective	Theory	1093235110	Radiological Equipments**
3	Program Elective	Theory	1042235313	Embedded system design with Arduino ##
4	Program Elective	Theory	1142235312	Medical Image Processing

Note:

- **** Common with Biomedical Engineering**
- **## Common with ICE**

Elective 2

#	Course Category	Course Type	Code	Course Title
1	Program Elective	Practical	1142235621	Blood Banking Technology
2	Program Elective	Practical	1141235420	Diagnostic and Therapeutic Equipment Practical #
3	Program Elective	Practical	1042235423	Embedded system design with Arduino ##
4	Program Elective	Practical	1142235623	Medical Image Processing

Note:

- **## Common with ICE**
- **# Common with Medical Electronics**

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Elective 3 (Pathway)

#	Course Category	Course Type	Code	Course Title
1	Program Elective - Higher Education	Theory	6000236111	Advanced Engineering Mathematics ***
2	Program Elective - Entrepreneur	Theory	6000236112	Entrepreneurship ***
3	Program Elective - Technocrats	Theory	1146236113	Hospital Management @@
4	Program Elective -Technocrats	Theory	6000236114	Finance Fundamentals ***
5	Program Elective - Technologist	Theory	1146236116	Medical Instrumentation @@
6	Program Elective - Technologist	Theory	1141235312	Medical Physics #

Note:

- ***** Common with ECE**
- **@@ Common with ECG**
- **# Common with Medical Electronics**

Elective 4 (Specialization)

#	Course Category	Course Type	Code	Course Title
1	Program Special Course	Theory	1142236311	MicroBiology
2	Program Special Course	Theory	1142236312	Installation, maintenance and safety handling of Medical Equipment
3	Program Special Course	Theory	1142236313	Health care informatics
4	Program Special Course	Theory	1142236314	Medical Expert Systems

Regulation 2023
Program Structure

1142
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

DIRECTORATE OF
TECHNICAL EDUCATION
Government of Tamil Nadu

III SEMESTER

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

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-MediumCorrelation,1-LowCorrelation

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	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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

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
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.html
- https://www.gadgetronicx.com/electronic-circuits-library/

1141233210	HUMAN ANATOMY AND PHYSIOLOGY	L	T	P	C
Theory		4	0	0	4

Introduction

Medical Electronics Students have not only to maintain and keep up various biomedical instruments/equipment, they must also be able to use this instruments/equipment to check/monitor the health of the patients. In order to perform this function efficiently, they must have adequate knowledge of location, functions of various body systems, organs, their diseases and diagnostic parameters to be monitored.

Course Objectives

The objective of this course is to enable the students to know about

- Introduction to the Human body and Sensory organs.
- Nervous System, Cardiovascular System.
- Blood and Lymph.
- Respiratory System.
- Digestive System & Urinary System.

Course Outcomes

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

CO1: To gain knowledge of the human body's systems.

CO2: To learn about the Neurological connections and blood flow pathways.

CO3: To understand blood components and types

CO4: To determine the abort air flow to the lungs and lung volume.

CO5: To Know about the process of Digestion and urine formation

Pre-requisites

Basic understanding of Science (Bio – Zoology)

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	1	1	-	-	-
CO4	3	2	1	1	-	-	-
CO5	3	2	1	1	-	-	-

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of systems. Teachers should use PPT presentation of image of the systems and show the videos which are related to organs
- To go to a medical college or hospital students may know all the organs in the anatomy laboratory. This demonstration will enliven the subject and inculcate scientific spirit among the students.
- Demonstration method may be used with step-by-step procedure to test the various organs.

1141233210	HUMAN ANATOMY AND PHYSIOLOGY	L	T	P	C
Theory		4	0	0	4
Unit I	**MUSCULAR AND SKELETAL SYSTEMS**				
Basic structure of Human body - Types of Bones and function –Bone Formation – Division of Skeleton – Axial and Appendicular skeleton – Types of Joints – Types of Muscles – Neuromuscular Junction					8
Unit II	**CARDIOVASCULAR SYSTEM AND RESPIRATORY SYSTEM**				
CARDIOVASCULAR SYSTEM : Structure And Functions of Heart – Main Arteries and Veins – Blood Pressure (Systole And Diastole) – Pulse and Heart Rate – Blood : Composition – Function. RESPIRATORY SYSTEM : Structure of Respiratory organs – Lung volumes and Capacities – Mechanism of Breathing					10
Unit III	**DIGESTIVE AND LYMPHATIC SYSTEM**				
LYMPHATIC SYSTEM: Parts and Functions of Lymphatic Systems – Types of Lymphatic Organs and Vessels. DIGESTIVE SYSTEM : Organs of Digestive System – Mechanisms and Control of Digestive Secretions – Digestive Absorption - Liver , Gall Bladder and their Functions.					10
Unit IV	**INTEGUMENTARY AND URINARY SYSTEM**				
INTEGUMENTARY SYSTEM: Structure of Skin – Layers of Epidermis – Functions URINARY SYSTEM: Structure and Functions of Kidneys – Uterus – Bladder - Structure of Nephron – Mechanism of Urine formation.					9
Unit V	**NERVOUS AND SENSORY SYSTEM**				
Structure and Functions of Nervous Tissue – Brain and Spinal Cord – Functions of CNS – Synapse – Voluntary – Involuntary – Autonomic Nervous System. SENSE ORGANS: Eye – Ear – Olfactory systems.					8
	TOTAL HOURS				45

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

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

Reference Book

- "Ross & Wilson", "Anatomy and Physiology in Health and Illness", 13th edition, 2018.
- "Roger Watson, Bailliere Tindall" "Anatomy and Physiology for nurses",12 tedition July 27, 2005.
- "Jack Rudman" "Anatomy and Physiology", National Learning Corporation (2005).

Web Resources

- https://nptel.ac.in/courses/122103039/19
- https://nptel.ac.in/courses/102104058/19

1142233320	ELECTRONIC DEVICES AND CIRCUITS PRACTICAL	L	T	P	C
Practical		0	0	4	2

RATIONALE

Every Electronics Engineer should have sound knowledge about the components used in Electronics Industry. This is vital in R&D Department for chip level troubleshooting. To meet the industrial needs, diploma holders must be taught about the most fundamental subject, Electronic devices and Circuits Practical. By doing practical experience in this, they will be skilled in handling all types of electronic circuits and able to apply the skill in electronic systems.

OBJECTIVES

On completion of the following experiments, the students must be able to

- Know the Cold Checking of Active and Passive Component
- Find out the Unknown Resistance value of a Resistor using Colour Coding
- Find out the Unknown Capacitance value of a Capacitor using Colour Coding
- Find out the Unknown Inductance value of an Inductor using Colour Coding.
- Understand the concept, working principle and applications of PN Junction diode
- Understand the concept, working principle and applications of Zener diode
- Understand the concept, working principle and applications of BJT and FET
- Understand the concept, working principle and applications of UJT
- Understand the concept, working principle and applications of SCR
- Understand the concept, working principle and applications of DIAC and TRIAC
- Understand the concept, working principle and applications of Clippers and Clampers
- Understand the concept, working principle and applications of various types of Negative feedback amplifiers

COURSE OUTCOMES

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

CO1: Test the working of PN Junction diode, Zener diode, BJT, UJT, FET and SCR.

CO2: Test the working of Clippers and Clampers.

CO3: Check the performance of RC coupled amplifier, RC phase shift oscillator.

CO4: Test the working of Bidirectional Diac and Traic

Pre-requisites

Knowledge on Electronic devices and circuits

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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	

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. The best one out of two will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

Part	Description	Marks
A	Diagram	5
B	Handling of the Equipments	20
C	Explanation	20
D	Output / Result	5
	TOTAL MARKS	50

CA3 : 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.

CA4 : 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 conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1142233320	Electronic Devices and Circuits Practical	L	T	P	C
Practical		0	0	4	2

Ex. No.	Name of the Exercise	Hours
1.	Construct a circuit to test the forward and reverse bias characteristics of a PN Junction Silicon diode. Find the value of its cut-in voltage	4
2	Construct a circuit to test the forward and reverse bias characteristics of a Zener diode. Find the value of its reverse break down voltage	8
3	Construct a Full wave (Bridge) rectifier and test its input and output waveforms with and without Capacitor filter. Find its maximum voltage.	6
4	Construct a Common Emitter Transistor circuit and test its input and output characteristic curves.	8
5	Construct a Common Source Field Effect Transistor circuit and test its drain and transfer characteristic curves	6
6	Construct a circuit to test the Turning on and Turning off characteristics of SCR and find out the forward break over voltage, the value of Latching and Holding currents.	6
7	Construct a circuit to test the bidirectional characteristics of DIAC and plot its Switching characteristics.	8
8	Construct a circuit to test the bidirectional characteristics of TRIAC and plot its Switching characteristics	4
9	Construct a Common emitter amplifier circuit and test its frequency response characteristics with and without Current series feedback introduced in it.	4
10	Construct a circuit to test the negative resistance Characteristics of UJT.	6
	TOTAL	60

DETAILED ALLOCATION OF MARKS

PART	DESCRIPTION	MARKS
1	CIRCUIT DIAGRAM	30
2	CONNECTION	25
3	EXECUTION & HANDLING OF EQUIPMENT	25
4	RESULT	10
5	VIVA VOCE	10
	TOTAL MARKS	100

LIST OF EQUIPMENTS

S.NO	Name of the Equipments	Range	Required Nos.
1.	DC Regulated power supply	0-30V,1A	10
2.	High Voltage Power Supply	0-250V,1A	2
3.	Signal Generator	1MHz	4
4.	Dual trace CRO	20MHz /30MHz	5
5.	Digital Multi meter	-	10
6.	DC Voltmeter (Analog/Digital)	Different Ranges	15
7.	DC Ammeter (Analog/Digital)Different	Ranges	15

1141233320	HUMAN ANATOMY AND PHYSIOLOGY	L	T	P	C
Practical		0	0	4	2

INTRODUCTION

This subject is designed to impart fundamental knowledge of the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings.

COURSE OBJECTIVES

The objective of this course is to enable the students to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of the human body.
- Perform various experiments related to special senses and nervous system.
- Appreciate coordinated working patterns of different organs of each system.

Course Outcomes

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

CO1: Understand the functions of various organs of the body.

CO2: Understand the mechanisms of the body systems.

CO3: Identify and analyze the various types of Tissues.

CO4: Understand the role of nerves in the human body.

CO5: Understand the coordinated working pattern of different organs of each system.

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	1	1	-	-	-
CO4	3	2	1	1	-	-	-
CO5	3	2	1	1	-	-	-

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- Utilize multimedia resources, including videos and presentations, to illustrate concepts such as various systems of the human body.
- Implement an inductive teaching approach, guiding students through experiments and observations to understand the physiology of various systems, structure of internal organs and metabolic activities, thereby fostering a deeper understanding of the subject matter.

Do not let students to 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 could be the source of error, if any.

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	

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. The best one out of two will be considered for the internal assessment of 10 Marks.

CA3: 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.

CA4: 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 conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1142233320	HUMAN ANATOMY AND PHYSIOLOGY	L	T	P	C
Practical		0	0	4	2
UNIT 1 - MUSCULAR AND SKELETAL SYSTEMS					
1. Exposure to human anatomy using models of Human Skeleton. 2. Demonstration of all equipment required for testing of different systems. 3. To study the Muscular system.					12
UNIT 2 - CARDIOVASCULAR SYSTEM AND RESPIRATORY SYSTEM					
4. Exposure to human anatomy using models of Cardiovascular system. 5. Exposure to human anatomy using models of Respiratory System 6. Exposure to human anatomy using models of Blood Structure using microscope.					12
UNIT 3 - DIGESTIVE AND LYMPHATIC SYSTEM					
7. Exposure to human anatomy using models of Digestive System. 8. Recording the body temperature. 9. Waste disposal precautions in waste management.					12
UNIT 4 - INTEGUMENTARY AND URINARY SYSTEM					
10. Exposure to human anatomy using models of Excretory system. 11. Urine Pregnancy Test. 12. Microscopic Examination of Urine.					12
UNIT 5 - NERVOUS AND SENSORY SYSTEM					
13. To study the nervous system. 14. To examine the different types of taste. 15. To demonstrate the visual activity.					12
				TOTAL	60

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
1	DIAGRAM	25
2	HANDLING OF THE EQUIPMENTS	25
3	EXPLANATION	25
4	OUTPUT / RESULT	20
5	VIVA VOCE	05
	TOTAL MARKS	100

LIST OF EQUIPMENT

S.NO	Name of the Equipments	Required Nos.
1.	Desktop Computers	30
2.	Multi-Function Printer (MFP)	1
3.	High Speed Internet Connection 100 Mbps (30 Systems)	-

1142233540	ELECTRICAL CIRCUITS AND MACHINES	L	T	P	C
Practicum		1	0	4	3

RATIONALE

This course will give the outline of Electrical circuits and machines which are relevant for polytechnic DMLT branch.

COURSE OBJECTIVES

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

- Understand the DC circuit and network theorems.
- Get knowledge on AC circuits.
- Have basic knowledge on circuit analysis.
- Understand about resonance in series and parallel circuits.
- Get the knowledge of measurement
- Know the operation of 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, theorems and source transformation

CO2 : Define terms used for AC and solve AC series and parallel resonance circuits using various circuit elements.

CO3 : Define terms used in measurement and analyze the various types of bridges.

CO4 : understand the working principle and applications of transformer

CO5 : understand the working principle and applications of various electrical machines

Pre-requisites

Knowledge about of basic electrical parameters and Laws

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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. If the results are different from the expectations, students should do an analysis where they could be the source of error, if any.

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 Unit	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	

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.

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 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.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Methodology	20
C	Tabulation Calculation & 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.

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

CA4: 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	Written Test (Theory Portion)	30
B	Methodology	20
C	Presentation	20
D	Tabulation & Calculation	20
E	Result	05
F	Viva Voce	05
	TOTAL MARKS	100

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

1142233540	ELECTRICAL CIRCUITS AND MACHINES	L	T	P	C
Practicum		1	0	4	3

Unit I	**DC CIRCUITS AND NETWORK THEOREMS**	
Basic parameters of DC circuits, Series and parallel connections of resistors - Mesh analysis for DC circuits. Thevenin's theorem –Superposition theorem – Maximum power transfer theorem (Statement, Explanation)		**8**
Ex.1: Construct a circuit to verify Kirchoff's voltage and current law. **Ex.2:** Construct a circuit to verify Superposition theorem. **Ex.3:** Construct a circuit to verify Thevenin's Theorem. **Ex.4:** Construct a circuit to verify Maximum power transfer Theorem.		**10**
Unit II	**AC CIRCUITS AND RESONANCE**	
Definition for impedance, reactance, admittance and Power factor – Average and RMS value Analysis of RLC series circuits - Analysis of RLC parallel circuits Definition for resonance -Series resonance – Parallel resonance – Condition for resonance – frequency response ,Resonant frequency.		**10**
Ex.5: Construct and test the performance of series and parallel resonant circuit and obtain the resonance frequency		**4**
Unit III	**MEASUREMENTS**	
Definition for measurement, accuracy, precision, resolution, calibration - Error in measurement- construction and working principle of megger.		**7**
Ex.6: Study of Megger.		**3**

Unit IV	TRANSFORMERS	
Definition and working principle of transformer - EMF equation- OC and SC test on transformer-load test on single phase transformer-applications of transformer		9
Ex.7: Load test on single phase transformer **Ex.8:** OC and SC test on single phase transformer.		7
Unit V	**ELECTRICAL MACHINES**	
Types of DC generator - Working principle of DC generator – working principle of DC motor - types of single Phase induction motor – Three phase induction motor – capacitor start induction motor-stepper motor.		10
Ex.9 : Conduct a load test on a DC shunt motor and draw a load current versus speed curve. **Ex.10:** Conduct a load test on single phase induction motor and draw a Load current versus speed curve.		7
	TOTAL	75

LIST OF EQUIPMENTS

Sl. No.	Equipments	Quantity
1	Regulated Power supply	6
2	CRO	2
3	Resistors	Various range
4	Multi meters	6
5	Fluorescent Lamp	1
6	Energy Meter	1
7	Wattmeter	2
8	DC Shunt Generator	1
9	voltmeter	10
10	ammeter	10

1142233640	FUNDAMENTAL OF MEDICAL LABORATORY TECHNOLOGY	L	T	P	C
Practicum		1	0	4	3

Introduction

Fundamentals of MLT are an important branch of subject needed for the DMLT course. It needs a practical knowledge about the formation of clinical laboratory. The students obtain practical exposure about first aid measures to be followed for reducing laboratory accidents, preparation of various solutions use in the laboratory and different sterilization methods to be followed in clinical laboratory

Course Objectives

The objective of this course is to enable the students to

- To understand the technique of first aid to be given during emergency period.
- To get practice about the preparation of solutions
- To get knowledge about the preparation of stains
- To practice about the how sterilize materials in the laboratory before and after usage.

Course Outcomes

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

CO1: To construct and test the Organization of Laboratory and First aid techniques.

CO2: To test the First aid techniques

CO3: To Preparation of solution–Saturated, unsaturated and poly Un saturated solution, Stock solution, working and standard solution

CO4: To Preparation of solution–Normality, molarity and Percent solution, Isotonic, hypertonic and hypotonic salt solution

CO5: To Build the application Preparation of various Stains Sterilization

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn he different ares and departments of clinical laboratory. Teachers should use PPT presentation of FMLT to show video of application of the components. Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown all the basic design, sterilization, solution and first aid kit, in the lab. The demonstration can make the subject exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to Perform the experiments given in the curriculum
- Teachers are advised to follow inductive strategy to help the students to discover the working of medical laboratory technician.
- 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 could be the source of error, if any.

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 Unit	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	

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.

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 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.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Methodology	20
C	Tabulation Calculation & 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.

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

CA4: 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	Written Test (Theory Portion)	30
B	Methodology	20
C	Presentation	20
D	Tabulation & Calculation	20
E	Result	05
F	Viva Voce	05
	TOTAL MARKS	100

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

1142233640	**FUNDAMENTAL OF MEDICAL LABORATORY TECHNOLOGY**	L	T	P	C
Practicum		1	0	4	3
Unit I	**ORGANIZATION OF LABORATORY AND FIRST AID TECHNIQUES**				
Basic design of laboratory – setup of standardized clinical laboratory and functional components of the laboratory – Safety regulations in the laboratory – accidents in the laboratory –awareness on handling acids, alkalis, organic solvents, corrosive, carcinogenic and inflammable chemicals, infected materials, pathogenic microbes and first aid measures for the accidents – list of materials in the Laboratory first aid kit.					**10**
Expt.1. Construction of Basic design of Laboratory – outline drawing. **Expt.2.**First aid technique for accidents in laboratory caused by chemicals					**6**
Unit II	**FIRST AID TECHNIQUES**				
Safety regulations in the laboratory – accidents in the electrical shock – awareness on handling acids, alkalis, organic solvents, corrosive, carcinogenic and inflammable chemicals, infected materials, pathogenic microbes and first aid measures for wound and injury caused by broken					**9**

glass wares – list of materials in the Laboratory first aid kit.	
Expt.3. First aid technique for electrical shock. **Expt.4.** First aid measures for wound and injury caused by broken glass wares	**6**
Unit III	**PREPARATION OF SOLUTION -I**
Measurements - Mass, length, area, volume, SI units, temperature and other conversion factors. Preparation of solutions – stock solution, saturated, unsaturated solutions	**8**
Expt.5 Preparation of solution – Saturated, unsaturated and poly unsaturated solution **Expt.6** Preparation of solution –Stock solution, working and standard solution	**6**
Unit IV	**PREPARATION OF SOLUTION -II**
Preparation of solutions – normal solution – percent solution – molar solution – isotonic – hypotonic and hypertonic solution	**9**
Expt.7 Preparation of solution – Normality, molarity and Percent solution. **Expt.8** Preparation of solution –Isotonic, hypertonic and hypotonic salt solution.	**6**
Unit V	**PREPARATION OF VARIOUS STAINS AND STERILIZATION**
Basic knowledge of dyes – preparation of various stains - Romano sky stains, storage, stability and uses – Process of sterilization –Physical, chemical, mechanical and radiation methods of sterilization – Decontamination.	**9**
Expt.9 Preparation of stains – Romano sky stains **Expt.10** Sterilization techniques – model preparation	**6**
TOTAL	**75**

Suggested List of Students Activity (Ungraded)

- Check the web portal for Image and video of various medical ethics and habits of scientific minds – basic design of laboratory
- Periodical quizzes should be conducted on a weekly/fortnightly basis on the Sterilization and Disinfection and First aid techniques Sterilization,

First aid techniques and Solutions

- Students might be asked to find the various components in real life equipment.
- Students might be asked to types of sample collection techniques and its processing.
- Students might work the different causes of accidents in the laboratory, basic design of a clinical laboratory, First aid techniques and Preparation the various solution.

Reference

1. Kanai L.Mukherjee – Text book of Medical laboratoryTechnologyVol12&3.
2. Ramnik Sood–Hand book of Medical laboratory technology.
3. Praful B.Godkar–Text book of Med. Lab. Technology.

Web Reference:

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- https://fl.lf3.cuni.cz/studijni/Premedical%20course/Study%20materials/Chemistry/010- Chemical%20Calculations%20(VK).pdf
- https://iac-cheyyar.com/images/pdf/ematerials/biochemistry/biochemicaltechniques1.pdf

DETAILED ALLOCATION OF MARKS

Part	Description	Marks
1	Methodology	30
2	Presentation	30
3	Tabulation & Calculation	25
4	Result	10
5	Viva Voce	05
	Total Marks	100

LIST OF EQUIPMENTS

Sl. No.	Equipments
1	Autoclave
2	Hot air oven
3	First aid kit
4	Weighing balance(Digital)
5	Chemicals like NaCl, NaOH,HCl, KOH, H2SO4
6	Test tubes
7	Test tube rack
8	Beakers
9	Conical flask
10	Volumetric Pipettes (1ml,2ml,5ml,10ml)
11	Measuring cylinder
12	Other glass wares

Regulation 2023
Program Structure

1142
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

DIRECTORATE OF
TECHNICAL EDUCATION
Government of Tamil Nadu

IV SEMESTER

1142234110	ANALOG AND DIGITAL ELECTRONICS	L	T	P	C
Theory		4	0	0	4

Introduction

Digital electronics replaces the analog circuits in many fields. Using digital circuits is easier. Diploma holders must have knowledge about the fundamental laws used in digital electronics and the working principle of digital circuits. Operational amplifiers find application in timer circuits. This subject deals with both analog and digital electronic circuits.

Course Objectives

The objective of this course is to enable the students to

- Explain the characteristics and applications of operational amplifier.
- Learn the concepts of astable and Monostable Multivibrator using 555.
- Recognize the different number systems such as binary, BCD, Octal, Hexadecimal
- Familiarize the Truth Table and symbol of Logic gates
- Learn the operation of Adders and subtractor
- Distinguish between combinational Logic and Sequential Logic
- Familiarize the reduction technique using Karnaugh map (2 variable to 4 variable)
- Familiarize the concept of multiplexer, De-multiplexer, encoder and decoder
- Explain various Flip flops, registers and counters
- Study the different types of A/D and D/A converters

Course Outcomes

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

CO1: learn the working principle of OP-AMP and their applications

CO2: understand the digital signal operation using logic gate and Boolean Algebra and Reduction technique

CO3: understand the working principle of Combinational Logic Circuits and Different types of circuits

CO4: understand the working of Sequential Logic Circuits and different types of circuits.

CO5: learn the working principle of D/A, A/D converters and Memory

Pre-requisites

Basic knowledge of digital signal components, memories, counters and OP-AMP

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn digital signal and components. Teachers should use PPT presentation to show video of application. Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown all the available logic IC and OP-AMP in the lab. The demon stration can make the subject exciting and foster in the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to show the working of different types of logic IC and OP-AMP.
- Teachers are advised to follow inductive strategy to help the

students to know the working principle of special digital IC.

- 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 could be the source of error, if any

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1142234110	ANALOG AND DIGITAL ELECTRONICS	L	T	P	C
Theory		4	0	0	4
Unit I	**LINEAR ICS: OP-AMPS, TIMERS AND THEIR APPLICATIONS**				
Linear ICs : Op-amps Operational amplifier – Ideal Op-Amp –Block diagram and characteristics – Op-amp parameters – CMRR – Slew rate - Voltage follower – Virtual ground **Applications :** Inverting amplifier – Summing amplifier – Non inverting amplifier – Comparator – Zero crossing detector – Differential Amplifier – Instrumentation Amplifier – Integrator – Differentiator – V to I converter –I to V converter **IC555:Timer**– Functional Block diagram – Astable, Monostable and Schmitt Trigger – Sequence timer, 555 timer can be used as PWM.					12
Unit II	**BOOLEAN ALGEBRA AND REDUCTION TECHNIQUE**				
Number systems – Decimal – Binary – Octal – Hexadecimal – BCD – Conversion from one number system to other – Boolean Algebra –Basic laws and Demorgan's Theorems. **Logic gates**–OR–AND–NOT–NOR–NAND–EX-OR Symbols, Truth table and Boolean expression–Realization of gates using universal gates NAND, and NOR––Boolean expression for outputs. **Simplification** of Boolean expression using Karnaugh map (upto 4 variable)– Problems using 2, 3, and 4 variables – Constructing logic circuits for the Boolean expressions.					12
Unit III	**COMBINATIONAL LOGIC CIRCUITS**				
Arithmetic circuits – Binary addition – Binary Subtraction – 1'scomplement and					12

2's complement–Signed binary numbers. Design Construction and working of Half adder – Full adder – Half subtractor– Full subtractor–Parity Generator and checker Decoder–3 to 8decoder–BCD to seven segment decoder– Encoder- Multiplexer –Demultiplexer–Digital Logic families–TTL-CMOS–Fan in–Fan out – Propagation delay–Noise immunity for the above families.		
Unit IV	**SEQUENTIAL LOGIC CIRCUITS**	
Flip-flops – RS–D–T–JK–Edge triggered FF **Counter**-Ripple Up counter – Ripple Down Counter – Decade counter – Modn counter – Synchronous counter – Ring counter – Johnson counter **Design method** –State diagram – state table – Excitation table (all flip flop) **Shift register** – 4 bit shift register–Serial in Serial out– Serial in Parallel out – Parallel in serial out – Parallel in parallel out.		12
Unit V	**D/A, A/D CONVERTERS AND MEMORY**	
D/A Converter – Basic concepts – Weighted Resistor D/A converter R –2 R Ladder D/A converter–Specification of DAC IC. **A/D Converter** – Sampling and quantization –Analog to digital conversion using Ramp method – Successive approximation method –Dual slope method. **Memory** – Static Memory – Dynamic Memory – Static Memory organization in terms of address lines, control lines and data lines – SDRAM – DDRRAM		12
	TOTAL	**60**

Suggested List of Students Activity (Ungraded)

- Check the web portal to study OP-AMP and their applications, digital electronics, memories and digital circuits.
- Periodical quizzes should be conducted on a weekly / fortnightly basis to reinforce the OP-AMP and their applications and digital electronics, memories, digital circuits and their working principles.
- Students might be asked to see the demonstration video of OP-AMP and their applications, digital electronics, memories and digital circuits

Text Books

1. Linear Integrated circuits by D. Roy choudhury
2. R.P. Jain, Modern Digital Electronics.
3. Godse, digital electronics -3rd edition

Reference

1. Albert Paul Malvino and Donal dP. Leach, Digital Principles and Applications - TMH.
2. Roger L.Tokenism Macmillan, Digital Electronics – McGraw – Hill
3. William H.GothMann, Digital Electronics–An introduction to the oryand practice – PHI.
4. Satnam P. Mathur and others, Electronic devices Applications and Integrated Circuits – Umesh Publications.

Web Reference

- https://www.ablic.com/en/semicon/products/analog/opamp/intro/
- https://www.electronics-tutorials.ws/boolean/boolean-algebra-simplification.html
- https://www.tutorialspoint.com/computer_logical_organization/combinational_circuits.htm
- https://www.tutorialspoint.com/computer_logical_organization/sequential_circuits.htm
- https://www.analog.com/media/en/technical-documentation/dsp-book/dsp_book_Ch3.pdf

1142234210	MEASUREMENTS AND INSTRUMENTS	L	T	P	C
Theory		4	0	0	4

Introduction

Instrumentation and Control Engineers plays a major role in process industries. The students of MEDICAL LABORATORY TECHNOLOGY branch need a briefide a about the basic concepts of Measuring instruments and test instruments, which can be helpful to them to conduct various measurements. This subject covers the basic needs of measurements and measuring instruments and it makes the students to understand the importance of measuring instruments in industries.

Course Objectives

On completion of the Units mentioned above, the students would be able to

- Explain the construction and working of indicating instruments for measurement of D.C and A.C voltage, current Power & Energy.
- Understand the working and applications of Multimeter for Ω, V, A measurement.
- Explain range extension methods for Ammeters and Voltmeters.
- Understand the resistance measurement with voltmeter and Ammeter
- Understand the resistance measurement with ohm meter
- Understand the dynomo meter type wattmeter, single phase energy meter and DC potentiometer
- Understand the dynamometer type wattmeter, single phase energy meter and DC potentiometer
- Explain the construction and working and practical application of WB Bridge for Resistance measurement.
- Explain the construction and working of AC Bridges & measurement of L and C using three bridges.
- Explain the construction and working of AC Bridges & measurement of

frequency using Wien bridge.

- Explain the construction, working and applications of CRO.
- Explain the voltage probe and current probe with active and passive components.
- Explain the working and application of Power Supply as a test instrument.
- Understand the use of Audio signal generator, Frequency generator, and Megger for testing of electronic / electrical circuits.
- Explain the working and use of CT's and PT's
- Understand and write the working of recorders.
- Compare Digital Vs Analog Instruments.
- Explain the working of different types of DVM.
- Explain the block diagram and circuit diagram of DFM.
- Use Digital Multimeter.
- Explain the working of EC and Digital Panel meter using LCD.

Course Outcomes

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

CO1 : Understand the Terms and characteristics of measuring instruments.

CO2 : Perform Calibration of Ammeter, Voltmeter and Energy Meter.

CO3 : Demonstrate the working of Wheatstone, Anderson and Schering bridges.

CO4 : Demonstrate the working of Digital Instruments

Pre-requites

Knowledge of basic instruments

CO/PO Mapping

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

Legend: 3-High Correlation, 2-MediumCorrelation, 1-LowCorrelation

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1142234210	MEASUREMENTS AND INSTRUMENTS	L	T	P	C
Theory		4	0	0	4
Unit I	**MEASURING INSTRUMENTS**				
Construction , working and Equations of Permanent magnet and Moving coil instrument , Attraction and Repulsion type Moving iron instrument- Electrostatic Instrument – Electro dynamic instrument – Ballistic Galvanometer – Ammeter – Extending the range – Multi range ammeter, Voltmeter – Extending the range – Multi range voltmeter – Resistance measurement with voltmeter and ammeter - Construction and working of Ohm meter - rectifier type ac volt meter dynamo meter type wattmeter -1 φ induction type energy meter, 3 phase induction type energy meter, Digital energy meter					**12**
Unit II	**BRIDGES AND OSCILLOSCOPE**				
DC Bridge - Construction, working, derivation of balance equation and application of measurement of resistance by Wheatstone bridge – ACBridge – Balance equation of AC bridge in Ratio form and Product form, measurement of unknown lossy inductor using standard variable inductor, Maxwell's Bridge – Hay's bridge - Measurement of unknown capacitance by Schering bridge –					**12**

measurement of frequency using Wien bridge. Block diagram of oscilloscope – construction and working of CRT – horizontal deflection and vertical deflection – time base generator –CRO probes – voltage – current – active – passive probes – applications of CRO. Digital storage oscilloscope, mixed Storage oscilloscope.		
Unit III	**TEST INSTRUMENTS**	
Block diagram, working and applications of DC power supply–fixed and variable – Megger – Earth tester working and applications. Instrument transformer – Current Transformer(C) and Potential Transformer (PT) – Multimeters - Recorders-Diagram and working of Strip chart recorders– XY recorder–ultraviolet recorder - Analog Tape recorder and Digital tape recorder		**12**
Unit IV	**DIGITAL INSTRUMENTS – I**	
Function of measurement system (indicating, recording, controlling) inverting and non-inverting Schmitt trigger circuit - Digital Frequency Meter – Block diagram - circuit diagram for frequency measurement – Period measurement – Digital tachometer — digital panel meter using LCD		**12**
Unit V	**DIGITAL INSTRUMENTS – II**	
Digital volt meter - Linear ramp type voltmeter – Dual slope voltmeter - Digital ramp type voltmeter – successive approximation type voltmeter - Digital Multi meter– auto ranging – auto zeroing – auto polarity Function generator to generate triangular and pulse and sinusoidal wave - Block Diagram – Circuit diagram		**12**
	TOTAL	**60**

Text Books

1. A course in Electrical and electronic measurements and instrumentation – A.K.SAWHENY, DHANPATRAI & sons. 1986.(Page Nos.292-329,585-599,605,1171-1173,785-814,865-867,390-412,1303-1315,1295,825,1372)
2. Electronic Instrumentation and Measurements : David A.Bell

REFERENCE BOOKS

1. Modern electronics Instrumentation and measurement techniques – ALBERTD.HELFRICK
2. Electrical and Electronics measurements and instrumentation – UMESHSINHA, SATYA PRAKASHAN, Tech India publication 1992.

1142234320	ANALOG AND DIGITAL ELECTRONICS PRACTICAL	L	T	P	C
Practical		0	0	4	2

RATIONALE

Medical lab technology students play a major role in diagnosis of the diseases and providing the best care and treatment available for it. The students of medical lab technology branch need a brief idea about the basic concepts of analog and digital circuits which can be helpful to them to learn about conditioning of bio signals. The lab is well equipped with analog and digital electronic components, so students can fabricate their own circuit for processing the signals further. The lab also comprises of Analog and digital trainer kits so as to facilitate verification of the results obtained through the fabricated circuits.

OBJECTIVES

On completion of all the experiments mentioned below, the students would be able to

- Construct and verify the applications of operational amplifier
- Test the characteristics of IC 555 timer
- Obtain the output of IC voltage regulators
- Learn the construction of instrumentation amplifier
- Realize the V to I and I to V converters
- Familiarize the truth table of Logic gates
- Realize the logic circuit of Boolean expression
- Distinguish the operation of adder and subtractor
- Verify the truth table of multiplexer, Demultiplexer, encoder and Decoder.
- Learn the operation of shift register and counters.
- Study the operation of A/D and D/A converters.

Course Outcomes

CO1 : Ability to verify digital logic ICs, Demorgan's theorems and realize basic gates using universal gates.

CO2 : Ability to design and test combinational logic circuits such as adder, subtractor, Decoder and multiplexer

CO3 : Ability to design and test sequential logic circuits such as flip flops and counters

CO4 : Ability to construct and test operational amplifier circuits such as inverting amplifier and non-inverting amplifier

CO/PO Mapping

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

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	

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. The best one out of two will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

Part	Description	Marks
A	Diagram	5
B	Handling of the Equipments	20
C	Explanation	20
D	Output / Result	5
	TOTAL MARKS	50

CA3 : 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.

CA4 : 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 conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1142234320	ANALOG AND DIGITAL ELECTRONICS PRACTICAL	L	T	P	C
Practical		0	0	4	2

Ex. No.	Name of the Exercise	Hours
1.	Construct and test inverting amplifier and Non-inverting amplifier with D.C gain 10 and observe output voltages for the given positive and negative DC input voltages and draw the voltage transfer characteristics.	4
2	Construct the practical test Integrator and differentiator using operational amplifier with DC gain and corner frequency. Observe the input and output wave forms and frequency response	8
3	Experimentally obtain the output of IC voltage regulator power supplies using IC 7805 and 7912	6
4	Experimentally verify the Truth table of OR, AND, NOT, NOR, NAND, AND, XOR, gate using 7432, 7408, 7404, 7402 and 7486	8
5	Experimentally verify the universal property of NAND and NOR gates.	6
6	Design, Construct and test Half adder and Full adder using gates.	6
7	Design, Construct and test Half Subtractor and full Subtractor using discrete IC's	8
8	Experimentally verify the truth table of D, T and J K flip - flops	4
9	Construct and verify R-2 R ladder Digital to Analog converter using operational amplifier	4
10	Construct and verify A/D converter using ADC 0808 IC	6
	TOTAL	60

DETAILED ALLOCATION OF MARKS

PART	DESCRIPTION	MARKS
1	CIRCUIT DIAGRAM AND TRUTH TABLE	30
2	CONNECTION AND PROCEDURE	30
3	TABULATION AND GRAPH	25
4	RESULT	10
5	VIVA VOCE	05
	TOTAL MARKS	100

LIST OF EQUIPMENTS

S.NO.	ITEMDESCRIPTION	RANGE	QUANTITY
1	DC Regulated power supply	(0-30)V, 1A	5
2	IC Voltage Power Supply	0-5V,1A 15-0-15V, 1A	5
3	Signal Generator	1MHz	4
4	Dual trace CRO	20MHz/ 30MHz	5
5	Digital Trainer	-	10
6	DC Volt meter (Analog / Digital)	Different Ranges	5
7	DC Ammeter (Analog / Digital)	Different Ranges	5
8	Desk Top Computer	-	5
9	Simulation Tool	Multi sim or CAD	1

1142234420	MEASUREMENTS AND INSTRUMENTS PRACTICAL	L	T	P	C
Practical		0	0	4	2

Introduction

The students of medical lab technology branch need practical knowledge to measure various parameters such as pressure, temperature, flow etc., and they need practice to handle the measuring instrument. This subject gives practical knowledge to the students about measurements of various parameters.

Course Objectives

The objective of this course is to enable the students to

- To understand the extension of the range of meter
- To get practice to measure current voltage frequency using CRO
- To get practice to measure flow and viscosity
- To get practice to measure resistance capacitance using bridges
- To understand the characteristics of DPT experimentally

Course Outcomes

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

CO1 : Understand the Terms and characteristics of measuring instruments.

CO2 : Perform Calibration of Ammeter, Voltmeter and Energy Meter.

CO3 : Demonstrate the working of Wheatstone, Anderson and Schering bridges.

CO4 : Demonstrate the working of Digital Instruments

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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 Unit	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	

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.

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 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.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Methodology	20
C	Tabulation Calculation & 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.

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

CA4: 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	Written Test (Theory Portion)	30
B	Methodology	20
C	Presentation	20
D	Tabulation & Calculation	20
E	Result	05
F	Viva Voce	05
	TOTAL MARKS	100

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

1142234420	**MEASUREMENTS AND INSTRUMENTSPRACTICAL**	L	T	P	C
Practical		0	0	4	2

Ex. No.	Name of the Exercise	Hours
1	Conduct the experiment to extend the range of ammeter	4
2	Conduct the experiment to extend the range of voltmeter	8
3	Conduct experiment to measure resistance using ammeter and voltmeter	6
4	Conduct experiment to measure unknown resistance using wheat stone bridge	8
5	Conduct experiment to measure unknown inductance using Maxwell bridge	6
6	Conduct experiment to measure unknown capacitance using schering bridge	6
7	Conduct experiment to measure unknown frequency using lissajious patterns in CRO	8
8	Conduct experiment using digital storage oscilloscope and observe the wave form and store the waveform	4

9	Conduct experiment to measure voltage and current using digital panel meter	4
10	Conduct experiment to measure voltage, resistance, current using digital multimeter	6
	TOTAL	60

DETAILED ALLOCATION OF MARKS

Part	Description	Marks
1	Circuit Diagram / Experimental setup	25
2	Testing and Experimenting	40
3	Table and graph	20
4	Observing Result	10
5	Viva voce	05
	Total Marks	100

EQUIPMENTS REQUIRED

S. no	Item description	Range	Quantity
1	Ammeter	(0-10)A, (0-30)A (0-50)A, (0-100)A	As required
2	Voltmeter	(0-30)V, (0-50)V, (0-100)V	As required
3	Regulated power supply	(0-30)V	As required
4	Digital multimeter		1
5	Cathoderay oscilloscope		2
6	Audio oscillator		2
7	Digital panel meter		2
8	Wheatstone bridge		1
9	Schering bridge		1
10	Maxwell bridge		1

Text books

1. Hand book of Biomedical Instrumentation third edition Dr.R.S.Khandpur MS graw hill education(India) private limited
2. Dr.M. Arumuga Biomedical Instrumentation Anuradha publications Chennai
3. Linear integrated circuits, second edition D.Roy Choudhury new age international publishers

Reference

1. Lessie Cromwell fred jwibel Lerich A.P Feither Bio medical Instrumentation and measurements II Edition
2. Medical electronics Kumara doss Introduction to Medical Electronics B.R.klin Web
3. Introduction to biomedical Instrumentation Mandeep Singh Printice Hall India 2010

Web Reference

- https://www.ablic.com/en/semicon/products/analog/opamp/intro/
- https://www.electronics-tutorials.ws/boolean/boolean-algebra-simplification.html
- https://www.tutorialspoint.com/computer_logical_organization/combinational_circuits.htm
- https://www.tutorialspoint.com/computer_logical_organization/sequential_circuits.htm
- https://www.analog.com/media/en/technical-documentation/dsp-book/dsp_book_Ch3.pdf

1142234540	SENSORS AND TRANSDUCERS	L	T	P	C
Practicum		1	0	4	3

Introduction

Most of the bio medical equipments are designed with electronic circuits to process the signal sensed by sensor or electrodes. Lab technician should be well known sensors and bio electrodes. The signal picked up the sensors and electrodes need various processing to further used it Hence signal conditioning circuit using operational amplifier are included in this subject. The subjects enable the students to learn the basic principle of the different sensors and electrodes and signal processing circuit

Course Objectives

After learning this subject, the students should be able to understand about

- Construction and working of various types of sensors
- Construction and working of displacement sensors
- Construction and working of LVDT
- Construction and working of thermocouple thermistor
- Construction and working of RTD
- Construction and working of load cell, strain gauge
- Construction and working of photodiode
- Construction and working of transducers
- Construction and working of proximity sensors and flow sensors
- Construction and working of temperature sensors
- Construction and working of various types of level sensors
- Operational amplifier and it's Specification and characteristics
- Low pass high pass band pass flutters using operational amplifier
- Digital to analog converter and analog to digital converter

COURSE OUTCOMES:

After successful completion of this course the student should be able to

CO1: To construct the test of sensors, LVDT

C02: To construct and test the thermocouple, RTD, LDR, Thermistor

C03: To construct and test the level sensors, strain gauge, potentio meter

C04: To construct and test the operational and instrumentation amplifiers

C05: To construct the I to V and V to I , A to D, & D to A convertor

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn digital signal and components. Teachers should use PPT presentation to show video of application. Also, should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- Students may be shown all the available logic I C and OP – AMP in the lab. The demonstration can make the subject exciting and fostering the students a scientific mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to show the working of different types of logic IC and OP-AMP.
- Teachers are advised to follow inductive strategy to help the students to know the working principle of special digital IC.
- 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 could be the source of error, if any

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 Unit	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	

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.

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 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.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Methodology	20
C	Tabulation Calculation & 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.

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

CA4: 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	Written Test (Theory Portion)	30
B	Methodology	20
C	Presentation	20
D	Tabulation & Calculation	20
E	Result	05
F	Viva Voce	05
	TOTAL MARKS	100

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

1142234540	**SENSORS AND TRANSDUCERS**	L	T	P	C
Practicum		1	0	4	3
Unit I	**SENSORS**				
Sensors – Definition – Displacement sensor – Proximity sensors –Hall effect sensors – Piezo electric sensors - Force sensor – Potentio meters construction – working - Strain gauge element –LVDT construction and working – strain gauge load cell construction and working					**8**
Ex.1 : Conduct experiment to measure displacement using potentiometer Ex.2 : Conduct experiment to measure displacement using LVDT Conduct Ex.3 : experiment to measure force using strain gauge load cell					**9**
Unit II	**TEMPERATURE MEASUREMENTS**				
Temperature detector- Thermistor construction and working - Temperature sensor - Bimetallic strips - Resistance temperature detector- Construction and working – Thermocouple - Construction and working					**7**
Ex.4 : Conduct experiment to measure temperature using thermistor Ex.5 : Conduct experiment to measure temperature using RTD					**6**
Unit III	**TRANSDUCERS**				
Transducers – Definition – Types – Transducer for body Temperature					**8**

Measurements – Photoelectric Transducers Construction & Working – Light Sensors – LDR Construction and Working – Photo Resistor – Liquid level Sensor – Float – Bio Sensor – Smart Sensor.		
Ex.6 : Conduct experiment to measure light intensity using LDR Ex.7 : Conduct experiment to measure body temperature		**6**
Unit IV	**OPERATIONAL AMPLIFIER**	
Inverting and non-inverting amplifier-Operational amplifier-block diagram of Op-amp input and output characteristics-parameters of op-amp – CMRR - slew rate - V to I & V to I convertor- instrumentation amplifier - block diagram – characteristics		**8**
Ex.8 : Construct inverting and non-inverting amplifier using operational Amplifier and experimentally obtained input and output characteristics Ex.9 : Construct the instrumentation amplifier circuit and test it Ex.10 : Convert I to V and V to I converter circuits using operational amplifier		**9**
Unit V	**D/A, A/D CONVERTERS AND FILTERS**	
D/A–Basic concepts–Weighted Resistor D/A converter R – 2R Ladder D/A converter–Specification of DACIC**A/D-**Sampling and Quantization –using op-amp – filters - high pass - low pass - notch filters – using Operational Amplifier		**8**
Ex.11 : Construct low pass high pass notch filters using operational amplifier And test it Ex.12 : Construct R – 2 R digital to Analog Converter using operational amplifier And test it		**6**
	TOTAL	**75**

DETAILED ALLOCATION OF MARKS

PART	DESCRIPTION	MARKS
1	CIRCUIT DIAGRAM	30
2	CONNECTION	25
3	EXECUTION AND PROCEDURE	25
4	RESULT	10
5	VIVA VOCE	10
	TOTAL MARKS	100

Text books

1. Hand book of Bio medical Instrumentation third edition Dr.R.S. Khandpur M S graw hill education (India) private limited
2. Dr.M. Arumuga Bio medical Instrumentation Anuradha publications Chennai
3. Linear integrated circuits, second edition D. Roy Choudhury new age international publishers

Reference

1. Leslie Cromwell fredwibel Lerich A.P Feather Biomedical Instrumentation and measurements II Edition
2. Medical electronics Kumara doss
3. Introduction to Medical Electronics B.R. kiln Web
4. Introduction to bio medical Instrumentation Mandeep Singh Printice Hall India 2010

Web Reference

- https://www.ablic.com/en/semicon/products/analog/opamp/intro/
- https://www.electronics-tutorials.ws/boolean/boolean-algebra-simplification.html
- https://www.tutorialspoint.com/computer_logical_organization/combinational_circuits.html
- https://www.tutorialspoint.com/computer_logical_organization/sequential_circuits.html
- https://www.analog.com/media/en/technical-documentation/dsp-book/dsp_book_Ch3.pdf

1142234541	CLINICAL PATHOLOGY PRACTICAL	L	T	P	C
Practical		1	0	4	3

Rationale

1. It will improve the technician's capacity to collect samples, label them, maintain records, clean the samples, prepare different stains and reagents, and examine blood, stool, urine, sputum, and semen, among other materials.
2. It will improve the technician's capacity to perform safe lab work without endangering patients or resulting in cross-infection.
3. It will improve the technician's capacity to handle diverse biomedical waste types with its range of disposal techniques.
4. It will improve the technician's capacity to plan blood drive events, motivate and screen donors, maintain the blood bank, and ensure safety.
5. It will improve the technician's comprehension of different chemical agents, the tools utilized, and how to conduct different tests in a clinical setting.

Course Objectives

The objective of this course is to

1. Assembles and configures diverse tools and equipment in a clinical lab to carry out diverse pathological and bacteriological investigations.
2. Performs standard tests on bodily fluids such as blood, urine, and sputum to aid in illness diagnosis and for medical purposes.
3. Positions relevant machinery and equipment and connects the necessary electrical outlets.
4. Helps with routine testing of blood, sputum, urine, or stool to identify blood types, bacteria, worms, and sugar content as needed.
5. Mounts and gets ready slides containing specimens for medical professionals to examine under a microscope.
6. After usage, wash, clean, and dry the apparatus and equipment to keep them in good operating order.

Course Outcomes

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

CO1: Analyse the structure of the cell.

CO2: Identify tumor cells.

CO3: Discuss the stool analysis.

CO4: Explain the urine analysis.

CO5: Explain about the biomedical waste management.

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy:

- Focus on health science context.
- Focus on medical terminology.
- Conduct laboratory-based activities that allow students to use their own bodies.
- Explore and solve a medical mystery.

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 Unit	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	

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.

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 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.

SCHEME OF EVALUATION

Part	Description	Marks
A	Aim	5
B	Methodology	20
C	Tabulation Calculation & 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.

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

CA4: 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	Written Test (Theory Portion)	30
B	Methodology	20
C	Presentation	20
D	Tabulation & Calculation	20
E	Result	05
F	Viva Voce	05
	TOTAL MARKS	100

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

1142234541	**CLINICAL PATHOLOGY PRACTICAL**	L	T	P	C
Practicum		1	0	4	3
Unit I	**INTRODUCTION OF CLINICAL PATHOLOGY**				
Normal cell and tissue structure and function - The changes in cellular structure and function in disease - Causes of disease and its pathogenesis - Reaction of cells, tissues, organ systems. Terminology in pathology – branches of pathology.					**10**
Ex.1 : Geimsa staining Ex.2 : AFB staining					**8**
Unit II	**TUMOR MARKERS**				
Types of tumor markers- uses of tumor markers - limitations of tumors – list of tumor markers – testing of tumor markers.					**7**
Ex.3 : To study a types of tumor. Ex.4 : Identification of tumor cells.					**8**
Unit III	**STOOL ANALYSIS**				
Stool analysis - macroscopic examination - chemical examination - microscopic examination.					**6**
Ex.5 : Stool sample culture test Ex.6 : Stool microscopic examination					**8**
Unit IV	**URINE ANALYSIS**				

Urine analysis - Collection and preservation - physical examination - chemical examination- microscopic examination.		6
Ex.7 : Test for sugar in urine-benedicts test Ex.8 : Urine microscopic examination		8
Unit V	**PATHOLOGY LABORATORY**	
Levels of laboratories- infrastructure - safety in laboratories- handling biomedical waste.		6
Ex.9 : To study biomedical waste management Ex.10 : To study safety precaution of medical laboratories		8
TOTAL		75

References

- Todd and Stanford's Clinical Diagnosis and Lab Management.
- Atlas and Text of Haematology by Tejinder Singh
- Text Book on Thyroid Pathology by Geetha Jayaram
- Robbins Pathology

Regulation 2023
Program Structure

1142
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

DIRECTORATE OF
TECHNICAL EDUCATION
Government of Tamil Nadu

V SEMESTER

1142235110	BASICS OF BIOCHEMISTRY	L	T	P	C
Theory		5	0	0	5

RATIONALE

Biochemistry studies the chemical processes that take place in living organisms. The main pertinent principle of biochemistry that can be applied to ecotoxicology is the modern concept of enzymes (bio catalytic proteins) regulation by molecular-intermediates of tissue metabolism in cells .Students will understand the biological processing of proteins, carbohydrates, lipids, vitamins and minerals.

OBJECTIVES

The Objective of this course is to enable the students to

- Overview. Simple carbohydrates are broken down quickly by the body to be used as energy.
- Metabolic pathways have the following advantage: release of energy required by the body.
- Explain about the kreb's cycle, also called the tricarboxylic acid (TCA) cycle, is a crucial metabolic system that carries out the vital task of oxidising foods to sustain cellular bioenergetics.
- Learn about *blood glucose levels* and *regulation in* the human body.
- The human body's ability to produce these amino acids determines. their classification into two main categories – essential and nonessential ...
- Different amino acids and their derivatives have different *nutritional* values and physiological functions, and play different roles in the body.
- Explain the classifications of proteins and analyze the metabolism of proteins.
- Analyse the clinical importance of protein and identifies abnormalities of protein digestion.
- Understand the classification of lipids and explains the mechanism of fat metabolism.
- Explain a clinical significance of hyperlipidemia and hypolipidemia.

- Describe the classification of vitamins and elaborates roles minerals in day today life.
- Explain about the biochemical reaction of minerals and analyse disease related to minerals.
- Understand a clinical enzymology uses enzymatic reactions to measure the levels of enzymatic activity or of metabolites, mainly in serum, for the diagnosis, prognosis, monitoring and treatment of diseases.
- What's a clinical diagnosis of disease states using enzymes and proteins.

COURSE OUTCOMES

After Successful completion of this Course, the students should be able to

CO1: Explain about the classification and major pathway of carbohydrates metabolism.

CO2: To understand the structure, classification and disorder of amino acids and protein definition related to basic of biosynthesis of creatine.

CO3: Explain the emulsification & function of lipids and clinical significance of hyperlipidemia and hypolipidemia.

CO4: Explain the classification & biochemical of vitamin and dieases related to minerals.

CO5: To understand the isoenzymes definition and properties and its disorders.

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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	20	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.

Question Pattern:

- Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1142235110	BASICS OF BIOCHEMISTRY	L	T	P	C
Theory		5	0	0	5

Unit I	CARBOHYDRATES	
Carbohydrates – Introduction and general classifications of carbohydrates – major pathways of carbohydrate metabolism – (glycogenesis, glyco genolysis, gluconeogenesis, glycolysis) - TCA cycle, Regulation of blood glucose level - Abnormalities of glucose metabolism - determination of blood glucose level – Disorder of carbohydrates hypoglycemia and hyperglycemia complications.		**15**

Unit II	AMINOACIDS AND PROTEINS	
Amino acids – Structure, Classification – Essential and Non-essential amino acids- Amino acids derivatives of proteins - Metabolic fate of amino acids – (glycogenic, ketogenic, glycogenic – ketogenic amino acids) – Disorder of amino acids- Phenylketonuria, Maple syrup urine disease, Homocystinuria, Parkinson's disease. Proteins- Definition- simple, conjugated and derived proteins – Nutritional classification of Protein-Metabolism of protein – Components of plasma proteins - Functions of albumin and globulin – Abnormalities of protein digestion – Urea cycle – Bio synthesis of Creatine – Clinical importance of creatine and creatinine.		**15**

Unit III	LIPIDS	
Lipids – Classification of lipids-emulsification of lipids – functions of lipids– Saturated and unsaturated fatty acids – Essential fatty acids – Metabolism of fatty acids. Lipoproteins-Functions of glycolipids, phospholipids – Clinical significance of LDL, HDL, and VLDL – Clinical significance of hyperlipidemia and hypolipidemia – Lipid profile test.		**15**

Unit IV	VITAMINS AND MINERALS	
Vitamins- Classification of vitamins– Fat soluble and water soluble, Vitamins – dietary requirements – Biochemical functions of vitamins- Deficiency syndromes. Minerals - Biochemical function of minerals–dietary requirements–		**15**

diseases related to minerals – Hypocalcaemia, rickets, osteoporosis, Addison's disease (Cushing's syndrome), Wilson's disease.		
Unit V	**CLINICAL ENZYMOLOGY**	
Isoenzymes- Definition and properties - Enzymes of diagnostic importance in- Liver disease (ALT,AST,ALP,GGT) -Myocardial infraction (CK, Cardiac troponins, AST, LDH) - Muscle diseases – (CK, aldolase) - Bone disease-(ALP) - Prostate cancer-(PSA,ACP).		**15**
	TOTAL	75

Reference books:

1. Kanail. Mukherjee-Text book of Medical laboratory technology Vol 1, 2 & 3.
2. U.Satyanarayana and U.Chakrapani–Biochemistry– third Edition 2009.
3. PremPrakash Gupta–Text book of Biochemistry with biomedical significance 2nd edition.
4. R.C.Guptaand S. Bhargava- Practical Bio chemistry – 5thEdition.
5. T. Palmer, P . L. Bonner- enzymes : biochemistry, biotechnology, clinical chemistry- third edition.

1142235311	BLOOD BANKING TECHNOLOGY	L	T	P	C
Theory		4	0	0	4

INTRODUCTION

Blood banking technique involves typing of blood group, blood collection, pre transfusion testing, testing of infectious diseases transmitted by transfusion. Blood banking is the process in the lab to make sure that donate blood and blood products are safe before the use of transfusion. So on completion of this course the student can aware of the importance of blood donation in saving many lives.

COURSE OBJECTIVES

At the conclusion of the Units mentioned above, the students would be able to

- To understand the basic principles and concepts presented in the transfusion medicine core curriculum and development of basic knowledge in the field
- Learn the maintenance of record and documentation in blood bank and hospitals.
- Familiarize the concept of immune haematological reactions and explain the mechanism of antigen – antibody reactions
- Study the purpose of various anticoagulants used in the blood bank and explains the physical and biochemical changes in the stored blood
- Elaborate the separation of blood components from the donated blood
- Knowledge about importance of pre transfusion testing and explains the compatibility testing

COURSE OUTCOMES

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

CO1: Handling of Medical Records and documentation in blood bank

CO2: Understand the role of transfusion medicine in medical Laboratory field.

CO3: Understand the inheritance of blood group system and identifies the various techniques of blood grouping and Rh typing.

CO4: To get knowledge about the basic principles of transfusion medicine

CO5: evaluate Pre-transfusion testing protocols, compatibility tests, cross - matching procedures, and precautions, and precautions for blood component infusion.

PRE-REQUITES

Knowledge of basic science

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

INSTRUCTIONAL STRATEGY

- Engage and motivate : Instructor should be use different teaching methods to enhance the students interest in the core curriculum
- Reinforcement on fundamental of Biological sciences
- Encourage initiative: Students to actively participate in the learning process with class discussions and exercises that support the initiative.
- Simulation and Real word Practice: Conduct demonstrations and hands-on activities in basic blood banking techniques.
- Application –Based Learning: Employ a theory – demonstrate –activity Strategy throughout the course to ensure outcome-driven learning and employability.

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	20	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.

Question Pattern:

- Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1142235311	BLOOD BANKING TECHNOLOGY	L	T	P	C
Theory		4	0	0	4

Unit I	BLOOD BANK MANAGEMENT	
Reception and recording of specimen – cataloging and indexing – maintenance of records biosafety and infection control in blood bank – Medico legal-aspects- Quality control in blood bank. Principles of Immunohematology – antigen and antibody reactions.		12
Unit II	**INHERITANCE OF BLOOD GROUP SYSTEM**	
Discovery of Human blood group system- Phenotypes & Genotypes, ABO and Rh blood group system (Karl Landsteiner and Weiner's Principle).ABO grouping techniques, Testing for A1 and A2 sub groups - sources of error in grouping and Rh typing, Bombay Group. Rh (D) grouping in Haemolytic disease of New born.		12
Unit III	**PREPARATION OF ANTICOAGULANT AND STORAGE OF BLOOD**	
Preparation and uses of –Acid citrate dextrose (ACD), Citrate phosphate Dextrose (CPD-A, CPD-A1, CPD-A2), Heparin, Ethylene diamino tetra acetic acid (EDTA), Optimal additive solution (OAS), Preservation, Storage and transportation of blood- physical and biochemical changes in stored blood and blood components.		12
Unit IV	**BLOOD TRANSFUSION**	
Procedure of venipuncture - Collection of blood - Pre transfusion test - Donor selection – screening of donor - Criteria for selection and rejection of donor – post donation care – Processing of Blood – separation of blood components – blood transfusion technique Techniques of freezing and thawing of Selection of Blood - Labelling and issue of Blood.		12
Unit V	**COMPATIBILITY TESTING**	
Clinical significance of Compatibility testing – Major cross matching, Minor cross matching by Liss (Low ionic strength solution), Cross matching the patient's serum against donor red cell(Donor recipient compatibility), Antihuman globulin test(AHG) – Direct and indirect Coomb's Test.		12
	TOTAL	**60**

Suggested List of Students Activity

- Presentation/Assignments by students any innovation method to be use based on the syllabus
- Mini project based on students internship in any Hospital or Diagnostic Laboratory

Reference books:

1. Denise Harmening, Modern Blood banking and Transfusion Practices, 6th Edition 2012.
2. Makroo R.N., Compendium of Transfusion Medicine, Practice of Safe Blood Transfusion,
3. Technical Manual, American Association of Blood Banks, 2014
4. Wintrobe.M.M., Clinical Haematology, Kothari's Indian Edition.
5. Kanai L.Mukherjee - Text book of Medical laboratory Technology Vol 1,2& 3.
6. V.H.Talib - Practical Textbook of Laboratory Medicine.
7. A.B.Dutta - Blood bank and Transfusion.
8. H.B.Williams- Laboratory manual of Serology, Immunology and Blood banking
9. Dacee - Haematology and Blood banking

1093235110	RADIOLOGICAL EQUIPMENT	L	T	P	C
Theory		4	0	0	4

Introduction

This course will enable the students to acquire specific knowledge on Radiology. Radiology plays a huge role in disease management by giving physicians more options, tools, and techniques for detection and treatment. Every engineer is in need of knowledge and skill about various diagnostic equipment's which plays vital role in medical field. This subject provides the basics, construction and working of X-Ray, MRI, CT scan, fluoroscopy and radiological safety.

Course Objectives

The objective of this course is to enable the student to

1. Understand the generation of X-ray and different types of radio diagnostic instruments
2. Describe the principle of Computed Tomography.
3. Know the techniques used for visualizing various sections of the body.
4. Learn the principles of different radio diagnostic equipment in Imaging

Course Outcomes

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

CO1: Understand the generation of X-ray and its uses in imaging

CO2: Learn different types of radio diagnostic instruments and techniques

CO3: Know the techniques used for visualizing various sections of the body

CO4: Learn the principles of different radio diagnostic equipment in Imaging

CO5 Learn radiation therapy methodologies and the safety Pre-requisites

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

1. Start with an overview: Begin by providing an overview of the different types of radiological equipmentcommonly used in the field, such as X-ray machines, CT scanners, MRI machines, etc.
2. Break down the equipment: Break down each type of equipment into its components and functions. Explain how each part works and its role in the imaging process.
3. Demonstrate proper usage: Use visual aids, diagrams, or even virtual simulations to demonstrate how toproperly use each piece of equipment. Highlight safety protocols and best practices.
4. Hands-on practice: Provide opportunities for hands-on practice with the equipment. This could involve simulations, virtual labs, or even real-life practice in a controlled environment.
5. Case studies: Present case studies or scenarios where learners can apply their knowledge of radiological equipment to solve problems or make decisions.
6. Assess understanding: Use quizzes, tests, or practical assessments to gauge learners' understanding of the material and their ability to use radiological equipment effectively.

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1093235110	RADIOLOGICAL EQUIPMENTS	L	T	P	C
Theory		4	0	0	4

UNIT I	X-RAY	
Introduction - Electromagnetic spectrum - properties of electromagnetic waves, Types of rays - Quantum effects existing for Electromagnetic waves-units to measure radioactivity, Types of X-Ray radiations, X-ray , Block diagram of X-ray Tube, Block diagram of X-ray Machine,applications of X-Ray		12
UNIT II	**TOMOGRAPHY AND COMPUTER TOMOGRAPHY**	
Tomography: Basic principle – Theory of tomography - multi section radiography - Tomography equipment - subtraction, Dodging. Computed Tomography: Basic principle - Mathematical basis of image construction [back projection reconstruction] – Block diagram of a Computer Tomography (CT) scanner - Spiral CT, 3D Imaging and its application.		12
UNIT III	**FLUOROSCOPY**	
Fluoroscopic Equipment- Direct fluoroscopy-Fluoroscopic screen-Fluoroscopic image-factors affecting fluoroscopic image-Difference between radiography and fluoroscopy-,Angiography–concepts and types .		12
UNIT IV	**MRI AND MAMMOGRAPHY**	
MRI: Fundamentals of Magnetic resonance-Interaction of Nuclei with static magnetic field and Radio frequency wave-rotation and precession-Induction of magnetic resonance signals, MRI parameters-spin density, Spin lattice relaxation time t1, Spin-spin relaxation time t2, block diagram of a MRI system and its applications Mammography: Basic principles–equipment details-heel effect- compression paddle-and its advantages-viewing conditions-Magnification mammography and digital mammography.		12
UNIT V	**RADIATION THERAPY AND RADIATION SAFETY**	
Radiation Therapy-linear accelerator, Tele gamma medicine, SRS-SRT,-recent techniques in radiation therapy- 3DCRT-IMRT-IGRT and Cyber knife- radiation measuring instruments- Dosimeter, film badges, Thermo Luminescent dosimeters – electronic dosimeter- Radiation protection in medicine–radiation protection principles		12
	TOTAL	**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
- Research and create presentations on different types of radiological equipment used in medical imaging, such as X-ray machines, CT scanners, MRI machines, and ultrasound machines
- Organize a field trip to a radiology department or imaging center to observe how radiologicalequipment is used in a clinical setting.
- Conduct hands-on experiments with simulated radiological equipment to understand how differentimaging modalities work.
- Create educational posters or infographics explaining the principles of radiological equipment andhow they are used in medical diagnosis.

Reference

TEXT BOOKS:

1. Steve Webb, the Physics of Medical Imaging, Adam Hilger, Philadelpia, 1988 (Units I, II, III&IV).
2. R. Hendee and Russell Ritenour —Medical Imaging Physics‖, Fourth Edition William, Wiley-Liss,2002.

REFERENCE BOOKS:

1. Gopal B. Saha —Physics and Radiobiology of Nuclear Medicine‖- Third edition Springer,2006.
2. B.H. Brown, PV Law ford, R H Small wood , D R Hose, D C Barber, — Medical physics andbiomedical Engineering‖, - CRC Press, 1999.
3. Myer Kutz, —Standard handbook of Biomedical Engineering and design‖, McGraw Hill, 2003.
4. P.Ragunathan, —Magnetic Resonance Imaging and Spectroscopy in Medicine

Web-based/Online Resources

- https://onlinecourses.nptel.ac.in/noc21_bt50/

1042235313	Embedded System Design with Arduino	L	T	P	C
Theory		4	0	0	4

Introduction

Embedded system is inevitable in today's Industrial applications. ARDUINO is an open source based prototyping platform used to sense and control physical devices. The purpose of this subject is to become familiar with ARDUINO based embedded system design methods both in hardware and software. Embedded applications at student level are dealt to give exposure to the students to build projects using ARDUINO.

Course Objectives

The objective of this course is to enable the students to

- Acquire knowledge on Embedded system and its characteristics
- Acquire knowledge on the Arduino Board descriptions of various types of Arduino Boards
- Gain knowledge programming the Arduino through embedded c language
- Gain knowledge on various sensor modules, Actuator modules and Display devices modules to interface with Arduino
- Gain knowledge on using the Arduino for measurement applications

Course Outcomes

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

CO1: Explain about Embedded system, its characteristics, applications and design of embedded system

CO2: Work with Different types of Arduino Boards available in the market

CO3: Install the Arduino IDE and to work with that to edit, compile and download the Arduino program into Arduino Board

CO4: Interface the various sensor modules, Actuator modules and Display device modules with Arduino

CO5: Design and Develop Arduino sketch for various measurement applications and to make Digital meters

Pre-requisites

Basic knowledge of Digital logic theory, Digital electronic circuits, Analog circuits, C programming

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-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is suggested that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn fundamentals of Arduino Hardware and programming, Teachers should use PPT presentation and to show video of Arduino based student's projects.
- Demonstration method may be used with step-by-step procedure to work with ARDUINO IDE.
- Teachers are suggested to follow inductive strategy to help the students to know the Industrial applications of embedded systems.
- It is suggested to the teachers to make the students to learn Arduino Board description of One Arduino Board (Arduino UNO), sensor modules, actuator modules, LCD/LED display modules. After learning these, teacher may give their own idea of simple application and may ask the student to do the mini project to implement that application.
- It is suggested to the teachers to make use of tinker cad online portal to teach, demonstrate, simulate and to give mini project work to the students

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1042235313	Embedded System Design with Arduino	L	T	P	C
Theory		4	0	0	4

Unit I	INTRODUCTION TO EMBEDDED SYTEM	
Embedded System – Definition - Embedded System Vs General Computing Systems – Characteristics - Classification - Small Scale- Medium Scale- Sophisticated – Major Application Areas – Purpose of Embedded Systems - Quality Attributes of Embedded Systems –structure of embedded system – Processors in embedded system - Microprocessor Vs Microcontroller-Compiler- cross compiler- Assembler- Simulator.		**12**

Unit II	ARDUINO HARDWARE	
Arduino – Arduino History – Features Arduino Family: Arduino Nano - Arduino Uno - Arduino Mega - Arduino Nano Board descriptions- Arduino uno Board descriptions – Arduino Mega Board descriptions – Arduino Board installation - Digital and Analog Peripherals – Communication Models – Communication Interface.		**12**

Unit III	ARDUINO PROGRAMMING& LIBRARY FUNCTIONS	
Procedure to setup Arduino IDE – structure of Arduino sketch – Data types- constant – Variable – Boolean - Char - Unsigned char – int - unsgined int – Long - unsigned long short – float - double - Variable scope: Local variable – Global Variable–Operators: Arithmetic – Comparison - Boolean- bitwise- compound Control Statements: if –if... else- if...else if...else – switch case – While – Do while – for loop - infinite loop Functions: Function declaration-Time manipulation functions- declaring arrays Arduino Function Libraries: pin Mode() – digital Read() – digital Write() - analog Read() - analog Reference()		**12**

Unit IV	ARDUINO INTERFACE WITH DEVICES, SENSORS AND ACTUATORS	
Arduino Hardware and sketch for interfacing Devices: Blinking LED - Reading analog voltage - Reading Digital inputs - Interfacing seven segment Display - Interfacing 16 X 2 LCD display - Interfacing relays, buzzer and switches. Arduino Hardware and Sketch for interfacing		**12**

Sensors: Temperature sensor LM35, Humidity sensor DHT22, IR motion sensor(PIR) – ultrasonic sensor HC-SR04 - Light sensor(LDR) Arduino Hardware and Sketch for interfacing Actuators: DC Motor - Servo motor – Stepper Motor		
Unit V	**EMBEDDED APPLICATION DEVELOPMENT WITH ARDUINO**	
Arduino Hardware and sketch: Measurement of unknown resistance - Measurement of temperature – Measurement of light intensity – Measurement of distance in cm Measurement of angle of rotation using potentiometer – Measurement of humidity – any application to communicate with android phone through Bluetooth – any application to use wifi and local area network – any application to send data through internet.		**12**
	TOTAL	**60**

Suggested List of Students Activity (Ungraded)

- Check the web portal to study Arduino Tutorial and learn Arduino Hardware and programming
- Periodical quizzes should be conducted on a weekly basis to reinforce the knowledge on Arduino hardware and programming
- Students might be asked to work with online/offline Arduino simulator software.
- Students might be given small project type assignment and can simulate it with online simulation portal

REFERENCE BOOKS:

1. Introduction to Embedded Systems (2nd Edition) by K V Shibu, McGrawHill India
2. Embedded Systems Architecture, Programming and Design by Raj Kamal, Tata McGraw-Hill Publishing
3. Arduino Based Embedded Systems Interfacing, Simulation and LabView GUI by Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushaban Choudhury, CRC Press
4. Sams Teach Yourself Arduino Programming in 24 Hours by Richard Blu
5. Arduino for Dummies by John Nussey

6. Arduino Cookbook (3rd edition) by Michael Margolis, Brian Jepson and Nicholas Robert Weldin, O'reilly
7. Arduino Made Simple with Interactive Projects by Ashwin Pajankar, BPB Publications

LIST OF LEARNING WEBSITE:

1. https://arduino.cc
2. https://www.tutorialspoint.com/arduino

1142235312	MEDICAL IMAGE PROCESSING	L	T	P	C
Theory		4	0	0	4

RATIONALE

1. Understand DFT and picture sampling
2. Modify the provided images to improve the minimum spatial and frequency domains
3. Use frequency domain filters, such as wiener filters as well as adaptive
4. Segment and categorize an image to extract features.
5. Provide image compression methods.
6. Register pictures from several modalities to enhance diagnosis and visualization
7. Provide algorithms tailored to particular uses

OBJECTIVES

The Objective of this course is to enable the students to

1. To go over the principles of digital images and methods for improving them.
2. To learn the fundamentals of spatial and frequency domain filtering techniques for restoration and improvement.
3. To determine the segmentation strategies used for picture feature extraction and classification.

COURSE OUTCOMES

After Successful completion of this Course, the students should be able to

CO1: Explain and identify the fundamentals of medical image processing.

CO2: To understand and identify the medical image enhancement.

CO3: Explain the different types of medical image devices.

CO4: Explain the medical image analysis and segmentation`

CO5: To understand the medical image compression.

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-MediumCorrelation,1-LowCorrelation

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	20	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.

Question Pattern:

- Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1142235312	MEDICAL IMAGE PROCESSING	L	T	P	C
Theory		4	0	0	4
Unit I	**IMAGE PROCESSING FUNDAMENTALS**				
Steps in digital Image processing- components - Modulating transfer function of visual system, Digitizing an image, medical image formats, image quality and information content –his to gram, entropy, Fourier Transform and spectral contents, Signal-to-Noise Ratio					**12**
Unit II	**MEDICAL IMAGE ENHANCEMENT**				
Digital subtraction angiography, image averaging, gray scale transforms-Histogram processing, Histogram equalization, Histogram matching. Contrast enhancement, Low pass and high pass filtering in spatial and frequency domain, application to x-ray images and ultra sound images					**12**
Unit III	**MEDICAL IMAGE DEVICES**				
X-rays –film, digital, C-arm, Iso - Carm. Ultrasound-CT-MRI and protocols-Functional imaging : fMRI, SPECT, PET.					**10**
Unit IV	**MEDICAL IMAGE ANALYSIS AND SEGMENTATION**				
Image segmentation- Edge detection, line detection and point detection. Region based segmentation and basic morphological operations. Representation of shapes and contours, shape factors, statistical analysis					**13**

of texture. Feature extraction and image classification - statistical, rule based and neural network approaches.		
Unit V	**IMAGE COMPRESSION**	
Image compression models, Error free compression, Lossy Vs lossless compression, distortion measures and fidelity criteria, Direct source coding, transform coding, predictive coding, Image coding and compression standards, application to medical images		**13**
	TOTAL	**60**

Reference books:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, 2016, 3rd edition, Pearson Education, Noida
2. Rafael C. Gonzalez, Richard E. Woods, “Digital image processing”, pearson, 4th edition, 2017.
3. Anil K. Jain, “Fundamentals of Digital Image Processing”, pearson, 4th edition, 2002.

1142235320	BASICS OF BIOCHEMISTRY	L	T	P	C
Practical		0	0	4	2

RATIONALE

Biochemical approaches provide light on the fundamental changes between human health and disease, advancing our understanding of the molecular structures and processes underlying both. Finding the molecular causes of diseases has enormous ramifications.

The Objective of this course is to enable the student

- To get practice about preparation of sample for biochemical analysis.
- To get practice about the estimation of biologically important molecules.
- To know the impact of variation in the level of biomolecules.
- To understand the clinical importance of biochemical analysis and their clinical significance in the diagnosis of disease.
- Understand how the chemical properties of molecules determine the ways in which they interact and react.

Course outcomes

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

CO1: To determine whether your blood sugar levels fall within a healthy range. It is frequently employed to support diabetes diagnosis and management.

CO2: Perform the collection of blood and preparation of serum and plasma.

CO3: In the present study we find that bilirubin interfere in the estimation of creatinine by Alkaline picrate method.

CO4: Perform cholesterol related activity in biochemical reaction.

CO5: Understand the measurement of urea is an important investigation in diagnosing kidney damage.

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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	

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. The best one out of two will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

Part	Description	Marks
A	Diagram	5
B	Handling of the Equipments	20
C	Explanation	20
D	Output / Result	5
	TOTAL MARKS	50

CA3 : 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.

CA4 : 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 conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1142235320	BASICS OF BIOCHEMISTRY	L	T	P	C
Practical		0	0	4	2

Ex. No.	Name of the Exercise	Hours
1.	Collection of blood and Preparation of Serum and Plasma.	4
2	Estimation of True glucose – Glucose oxidase (GOD) method.	8
3	Estimation of Total Protein– Biuret method.	6
4	Estimation of Blood Urea – Diacetyl monoxime – Thiosemicarbazide (DAM-TSC method).	8
5	Estimation of Total Cholesterol– Modified Zak method and Sacket Method.	6
6	Estimation of Triglycerides-Enzymatic method.	6
7	Estimation of HDL/LDL cholesterol.	8
8	Estimation of serum creatinine – Alkaline picrate method.	4
9	Estimation of serum Bilirubin – Malloy & Evelyn method.	4
10	Estimation of uric acid in blood.	6
	TOTAL	60

DETAILED ALLOCATION OF MARKS

PART	DESCRIPTION	MARKS
1	METHODOLOGY	30
2	PRESENTATION / PROCEDURE	30
3	TABULATION & CALCULATION	25
4	RESULT	10
5	VIVA VOCE	05
	TOTAL MARKS	100

1142235420	IMMUNOLOGY	L	T	P	C
Practical		0	0	4	2

RATIONALE

The study of the immune system and its operations is known as immunology. It is a crucial field of study with the goal of comprehending illnesses better and creating remedies and vaccinations. Notable achievements encompass the complete eradication of smallpox and the almost complete eradication of polio via worldwide immunization campaigns.

The Objective of this course is to enable the student

- To provide students with a foundation in immunological processes.
- Students able to clearly state the role of the immune system to get knowledge about the Compatibility testing
- Students able to provide an overview of the interaction between the immune system and pathogens.
- To perform the widal test and tube agglutination.

Course outcomes

After Successful completion of this Course, the students should be able to

CO1: Identify various immune cells and enumerate them

CO2: Competently perform serological diagnostic tests such as RA, ASO, CRP

CO3: Identify blood groups and types.

CO4: Understand the fundamental concepts of immunity and cells in immune responses

CO5: Understand the separation and preservation of blood

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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	

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. The best one out of two will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

Part	Description	Marks
A	Diagram	5
B	Handling of the Equipments	20
C	Explanation	20
D	Output / Result	5
	TOTAL MARKS	50

CA3 : 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.

CA4 : 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 conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1142235420	IMMUNOLOGY	L	T	P	C
Practical		0	0	4	2

Ex. No.	Name of the Exercise	Hours
1.	Identification of various immune cells by morphology – Leishman staining, Giemsa staining.	6
2	Agglutination Reactions- Latex Agglutination reactions- RA	6
3	Agglutination Reactions- Latex Agglutination reactions- ASO	6
4	Agglutination Reactions- Latex Agglutination reactions- CRP	6
5	Hemagglutination Reactions- Blood Grouping – forward and reverse, Rh Typing	6
6	Separation and preservation of serum and plasma from blood	6
7	Widal test and tube agglutination test	6
8	Flocculation test – RPR test.	6
9	Immunodiffusion- Radial immunodiffusion and ouchterlony double diffusion.	6
10	Counter current immune electrophoresis test and rocket immuno electrophoresis	6
	TOTAL	60

DETAILED ALLOCATION OF MARKS

PART	DESCRIPTION	MARKS
1	METHODOLOGY	30
2	PRESENTATION	30
3	PROCEDURE	25
4	RESULT	10
5	VIVA VOCE	05
	TOTAL MARKS	100

1142235621	BLOOD BANKING TECHNOLOGY	L	T	P	C
Practical		0	0	4	2

INTRODUCTION

Blood banking techniques is most important in the field of blood bank and transfusion medicine. Blood banking techniques involves collection of donate blood, storage and typing of blood for transfusion and testing of infectious diseases. Students can practice about basic blood banking techniques through this subject and get fundamental knowledge.

The Objective of this course is to enable the student

- To understand the technique of blood collection.
- To get practice about the Blood grouping techniques
- To get knowledge about the Compatibility testing
- To practice about preparation of anticoagulants
- Knowledge of Anticoagulant used in blood bank

COURSE OUTCOMES

After Successful completion of this Course, the students should be able to

CO1: Understand the basic principles of medical terminology, safety measures, universal precautions, infection control and potential sources of error as they relate to standard laboratory operating procedures

CO2: developing skills on documentation, handling various equipment and instruments, maintenance of quality control, preparation of reagents and kits for various techniques in blood banking

CO3: learn the Blood components and grouping techniques.

CO4: Perform phlebotomy related activity in blood bank

CO5: Understand the basic structure and Function of blood

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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	

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. The best one out of two will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

Part	Description	Marks
A	Diagram	5
B	Handling of the Equipments	20
C	Explanation	20
D	Output / Result	5
	TOTAL MARKS	50

CA3 : 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.

CA4 : 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 conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1142235621	BLOOD BANKING TECHNOLOGY	L	T	P	C
Practical		0	0	4	2

Ex. No.	Name of the Exercise	Hours
1.	Blood Documentation - Prevention, Disinfection, Sterilization. Preservation, Storage and Transportation of blood.	6
2	ABO blood grouping- Slide method and tube method	8
3	Rh typing - Slide method and Tube method	8
4	Testing for A1 and A2 sub groups	8
5	Cross matching - Major cross matching	6
6	Cross matching - Minor cross matching	6
7	Compatibility testing - Coomb's test – Direct method	6
8	Compatibility testing - Coomb's test – Indirect method	6
9	Pre-transfusion Testing	4
10	Preparation of Anticoagulants	2
	TOTAL	60

DETAILED ALLOCATION OF MARKS

PART	DESCRIPTION	MARKS
1	METHODOLOGY	30
2	PRESENTATION / PROCEDURE	30
3	TABULATION & CALCULATION	25
4	RESULT	05
5	Record Book	05
6	VIVA VOCE	05
	TOTAL MARKS	100

EQUIPMENT REQUIRED

S. No	NAME OF THE EQUIPMENT	QUANTITY REQUIRED
1	ABD grouping kit	3
2	A1 Lectin kit	3
3	Cotton	3
4	Lancet	100
5	Disinfectant (80% ethanol or Lysol)	1000ml
6	Porcelain tiles	25
7	Microscope	10
8	Test tubes	50
9	Glass slides	100
10	Anticoagulants	As required
11	RPR Kit	2
12	Anti-Human globulin reagent	2

1141235420	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT	L	T	P	C
Practical		0	0	4	2

Introduction

Medical Electronics engineering education is in the growing stage. But every year, there is a tremendous increase in the use of modern medical equipment in the hospital and health care industry therefore it is necessary for every student to understand the functioning of various medical equipment. This course to enable the students to learn the basic principles of different biomedical instruments viz clinical measurement, Bio medical recorders, Therapeutic instruments, Biotelemetry and Modern imaging techniques instruments

Course Objectives

The objective of this course is to enable the students to

- To provide hands-on training on Measurement of physiological parameters, biochemical parameters measurement and bio signal analysis.
- Acquire signals to record the performance of physiological activity using electrodes
- Create a scenario and analyze the performance and features of ECG, EEG, EMG electrodes using biomedical instruments.
- Establish a hearing module setup using audiometer to analyze the hearing impairment levels and standards
- Check the safety of any medical equipment to provide the quality assurance safety analyzers.

Course Outcomes

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

CO1: To introduce an fundamentals of transducers as applicable to physiology

CO2: To explore the human body parameter measurements setups

CO3: To make the students understand the basic concepts of forensic techniques

CO4: To give basic ideas about how the vital parameters are useful in medical diagnosis. CO5: To learn about the procedures for various therapeutic

measurements.

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of therapeutic equipments. Teachers should use PPT presentation of image of the equipments and show the videos which are related to application of the components. Also should explain examples from daily life, realistic situations, and real-world engineering and technological applications.
- To visit the hospitals, students may be shown all the diagnostic equipment in the hospital. The demonstration can make the subject exciting and foster in the students a scientific mind set.
- Demonstration method may be used with step-by-step procedure to test the various equipment.
- Teachers are advised to follow inductive strategy to help the students to discover the working principle of various diagnostic equipment.

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 could be the source of error, if any

1141235420	DIAGNOSTIC AND THERAPEUTIC EQUIPMENT	L	T	P	C
Practical		0	0	4	2
UNIT I - PHYSIOLOGICAL & CLINICAL MEASUREMENTS					
1. Design and analysis of biological pre amplifiers 2. Measurement of blood pressure and Temperature 3. Measurement of Lung Volume and Heart Rate					12
UNIT II - BIO-MEDICAL RECORDER					
4. Recording of ECG signal 5. Recording of EEG signal 6. Recording of EMG signal					12
UNIT III - THERAPEUTIC INSTRUMENTS					
7. Recording of various physiological parameters using patient monitoring system 8. Hearing test using Audiometer 9. Measurement of pH and conductivity.					12
UNIT IV – ELECTRO THERAPY EQUIPMENT AND THERAPEUTIC LASERS					
10. Design of pacemaker circuit with bio-amplifier. 11. Study of Heart lung Machine Model 12. Measurement of stimulation current wave forms used in medical stimulator.					12
UNIT V – SPECIAL EQUIPMENT					
13. Measurement and recording of peripheral blood flow 14. Measurement of visually evoked potential. 15. Study of characteristics of optical Isolation amplifier.					12
	TOTAL				60

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	

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. The best one out of two will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

Part	Description	Marks
A	Diagram	5
B	Handling of the Equipments	20
C	Explanation	20
D	Output / Result	5
	TOTAL MARKS	50

CA3 : 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.

CA4 : 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 conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

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

SCHEME OF EVALUATION

PART	DESCRIPTION	MARKS
A	Aim	5
B	Circuit Diagram / Block diagram	25
C	Connections & Procedure	10
D	Execution & Handling of Equipments	30
E	Result / Output	20
F	Viva Voce	10
	TOTAL	100

List of the Equipment

S. No	NAME OF THE EQUIPMENT	QUANTITY REQUIRED
1	Blood Pressure Machine	1
2	Thermometer	1
3	EEG machine	1
4	ECG machine	1
5	EMG machine	1
6	Audio meter	1
7	Bread Board	As required
8	Pulse Oximeter	1
9	Patient monitoring System	1
10	pH meter	1

1042235423	Embedded System Design With ARDUINO		L	T	P	C
Practical			0	0	4	2

Introduction

The Arduino platform has become quite popular with people just starting out with electronics. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message and turn it into an output activating a motor, turning on an LED, publishing something online. Arduino is one of those Embedded System Devices (called as an Embedded Development Board), which got very famous in the maker's community due to its free and open source nature. Instrumentation Engineers must be familiar with embedded system development.

Course Objectives

The objective of this course is to enable the student to

- Gain Knowledge on Embedded system Design using ARDUINO
- Acquire skill on working with ARDUINO BOARD to embed the Arduino program into the Board to build applications
- Gain Skill on Programming the ARDUINO using C code for different applications
- Gain Skill on interfacing the various sensor and Actuator modules with ARDUINO Board
- Gain Skill on building small applications using ARDUINO BOARD and ARDUINO IDE

Course Outcomes

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

CO1: Work with ARDUINO BOARD to build embedded applications

CO2: Write C code to build small applications using ARDUINO board

CO3: Interface ARDUINO Board with various sensor modules and Actuator Modules

CO4: Design and Develop C coding for Different measurement applications

CO5: Design and Develop mini project for small applications using ARDUINO

Pre-requisite

Sensors and Transducers Theory and Practical subject

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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	

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. The best one out of two will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

Part	Description	Marks
A	Diagram	5
B	Handling of the Equipments	20
C	Explanation	20
D	Output / Result	5
	TOTAL MARKS	50

CA3 : 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.

CA4 : 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 conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1042235423	Embedded System Design With ARDUINO	L	T	P	C
Practical		0	0	4	2

Ex. No.	Name of the Exercise	Hours
1	Familiarization of ARDUINO board, ARDUINO IDE and ARDUINO sketch. Develop c program to blink LED in the ARDUINO board	5
2	Construct a circuit to interface 16 X 2 LCD to ARDUINO hardware. Write a C program to display your name in the LCD.	5
3	Construct circuit using ARDUINO hardware and develop C program to measure unknown resistance and test it	5
4	Construct circuit using ARDUINO hardware and develop C program to measure temperature using LM35 temperature sensor and test it.	5
5	Construct circuit using ARDUINO hardware and develop C program to measure light intensity using LDR and test it	5
6	Construct circuit using ARDUINO hardware and develop C program to measure distance using ultrasonic distance sensor and test it	5
7	Construct circuit using ARDUINO hardware and develop C program to measure angular displacement using potentiometer sensor and test it	5
8	Construct circuit using ARDUINO hardware and develop C program to measure humidity using Humidity sensor and test it	5
9	Construct circuit using ARDUINO hardware and develop C program to detect motion using PIR sensor and test it	5
10	Construct circuit using ARDUINO hardware and develop C program to control speed, step and direction of Bipolar stepper motor	5
11	Construct circuit using ARDUINO hardware and develop C program to control Servo motor for angular positioning	5
12	Construct circuit using ARDUINO hardware and develop C program to control DC motor.	5
	TOTAL	60

Equipment Required

Sl.No.	Name of the Equipments / Software	Quantity Required
1	ARDUINO Development Kit	As required
2	Switches, sensors, 16 X 2 LCD, LED's, POT, LDR , PIR sensor, LM35 temperature sensor, HC-SR04 ultra sonic sensor, Humidity sensor, Stepper motor, servo motor, DC motor and Bread board	As required
3	Arduino IDE Open source Software	As required

1142235623	MEDICAL IMAGE PROCESSING	L	T	P	C
Practical		0	0	4	2

RATIONALE

Medical Lab Technology students play a vital role in the hospital and medical industry. They have received training in fixing issues with medical equipment, particularly imaging devices. An essential component of medical diagnosis is medical imaging. It is imperative that the students comprehend the fundamentals of medical image processing. The fundamentals of image processing that are required for detection and classification are covered in this course.

The Objective of this course is to enable the student

1. To go over the principles of digital images and methods for improving them
2. To understand how to apply spatial and frequency domain filtering techniques for restoration &improvement.
3. To determine the segmentation methods used for picture feature extraction and classification.

COURSE OUTCOMES

After Successful completion of this Course, the students should be able to

CO1: Use medical imaging equipment, such as MATLAB software.

CO2: To guarantee patient and healthcare provider safety during medical imaging operations, comprehend and use radiation protection strategies.

CO3: Create and put into practice protocols for patient positioning and contrast agent use during medical imaging procedures.

CO4: Show an understanding of the newest developments in medical imaging trends and technology.

CO5: In the field of medical imaging technology, exhibit professionalism, moral behavior, and a dedication to lifelong learning and professional growth.

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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	

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. The best one out of two will be considered for the internal assessment of 10 Marks.

SCHEME OF EVALUATION

Part	Description	Marks
A	Diagram	5
B	Handling of the Equipments	20
C	Explanation	20
D	Output / Result	5
	TOTAL MARKS	50

CA3 : 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.

CA4 : 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 conducted as per the scheme of evaluation as below. The marks awarded should be converted to 20 Marks for the internal assessment.

1142235623	MEDICAL IMAGE PROCESSING	L	T	P	C
Practical		0	0	4	2

Ex. No.	Name of the Exercise	Hours
1	List of Experiments (Indicative) Read the given x-ray image using MATLAB software and perform contrast enhancement.	5
2	Read the given x-ray image using MATLAB software to remove the noise using spatial low pass filters. Compare the performance of filters.	6
3	Read the CT image of the given lungs image, perform intensity Enhancement, and extract the nodules in the lungs using MATLAB software	6
4	Analyze the segmentation techniques to extract the region of interest and restoration of degraded images using MATLAB.	6
5	Perform segmentation of the given image using (i) single and Multi-threshold. Compare the outputs	5
6	Perform morphological operations on the given image and Perform background subtraction	5
7	Segment the tumor from the given MRI image using MATLAB software and determine its area and perimeter	5
8	Process the given endoscopic images and extract the tumor Detected using MATLAB software.	5
9	Extract the blood vessels from the given retinal image using MATLAB software	4
10	Explain the signifance of registration of various imaging modalities and appraise the concepts of image visualization in healthcare using MATLAB.	4
11	Compress the given image using Huffman code	4
12	Perform jpeg compression on the given image. Calculate the compression ratio	5
	TOTAL	60

DETAILED ALLOCATION OF MARKS

PART	DESCRIPTION	MARKS
1	METHODOLOGY	30
2	PRESENTATION / PROCEDURE	30
3	TABULATION & CALCULATION	25
4	RESULT	10
5	VIVA VOCE	05
	TOTAL MARKS	100

EQUIPMENT REQUIRED

1. PC
2. MATLAB software

1145235652	Innovation & Startup	L	T	P	C
Practical		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

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-MediumCorrelation,1-LowCorrelation

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**

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

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**

1146235652	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
Unit V	**EXPOSURE TO INDUSTRY**	
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.		18
TOTAL HOURS		**45**

Note: Common Test and Revision periods can be used for conducting Continuous Assessment.

Reference Books :

1. Ina Goller, John Bessant, Creativity for Innovation Management, First Edition, Routledge, 2017.
2. Walter Brenne and Falk Uebernickel , Design Thinking for Innovation, Research and Practice, Springer, 2016.
3. Henri Charmasson, John Buchaca, Patents, Copyrights & Trademarks for Dummies, Second Edition, Wiley Publishing Inc.

Web-based / Online Resources:

- https://www.startupindia.gov.in/
- https://www.mudra.org.in/
- https://startuptn.in/tanseed/
- https://www.msmetamilnadu.tn.gov.in/needs.php
- https://www.kviconline.gov.in/pmegpeportal/pmegphome/index.jsp
- https://msmeonline.tn.gov.in/uyegp/

1093235773	INDUSTRIAL TRAINING	Summer Vacation	C
Practical			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.

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

CO1: Demonstrate proficiency in using industrial machinery, tools, and software.

CO2: Able to identify, analyze, and solve engineering problems using industry-standard methods and practices.

CO3: Gain a comprehensive understanding of industrial manufacturing processes, quality control, and safety practices.

CO4: Exhibit improved communication, teamwork, and professional behavior in an industrial setting.

CO5: 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.	10
B	Comprehensive report on Internship, Relevant Internship Certificate from the concerned department.	10
C	Presentation by the student at the end of the Internship.	10
D	Viva Voce	10
	Total	50

Regulation 2023
Program Structure

1142
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

DIRECTORATE OF
TECHNICAL EDUCATION
Government of Tamil Nadu

VI SEMESTER

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.

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-MediumCorrelation,1-LowCorrelation

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.

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

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 $(aD2+bD+c)y=enx$ where a,b,c and n are constants and the auxiliary equation $am2+bm+c=0$ 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	**45**

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 Geo Gebra 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

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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.

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

6000236112	Entrepreneurship	L	T	P	C
Theory		3	0	0	3

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	**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

1146236113	HOSPITAL MANAGEMENT	L	T	P	C
Theory		3	0	0	3

Introduction

A health service is one of the important and growing sectors in India. With the prospect of doubling the amount of skilled workforce as a part of this sector, it gets more significance. This elective course aims at imparting foundational theoretical knowledge about Hospital Management.

Course Objectives

1. To impart the theoretical knowledge about Hospital management.
2. To introduce the principles, practices and areas of application in Hospital management.

Course Outcomes

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

CO1: Explain the principles, practices and areas of application in Hospital Management.

CO2: Understand the biomedical waste disposal concept.

CO3: Explain the importance of supportive services.

CO4: Comprehend the quality aspect specified by the international standards.

CO5: Knowledge on Hospital safety.

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning confidence.
- Real-World Relevance: Incorporate relatable, real-life examples of hospital management to help students understand and appreciate course concepts. Case Studies can be employed.
- 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 access case studies to analyse and critique theoretical application.

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1146236113	HOSPITAL MANAGEMENT	L	T	P	C
Theory		3	0	0	3
Unit I	**Introduction to Hospital Management**				
Global and Indian scenario of Healthcare Industry—Pharmaceuticals, Medical Equipment, Biotechnology, Information Technology, Medical Tourism; Basic Concepts in Management; Hospital Management-Introduction; Managing a Service Organization; Distinction between Hospital and Industry; Challenges in Hospital Administration; Hospital Planning; Distinction between Hospital and Industry, Challenges in Hospital Administration					**9**
Unit II	**Hospital Management Support Systems**				
Introduction to Hospital Management Support Systems; Clinical Support; Information Support-- Hospital MIS; Administrative Support Systems; Medical Transcription, Medical Records Department; Central Sterilization and Supply Department; Pharmacy; Food Services; Laundry Services.					**9**
Unit III	**Human Resource Management in Hospitals**				

Principles of HRM; Functions of HRM; Profile of HRD Manager; Tools of HRD; Human Resource Inventory; Manpower Planning; Different Departments of Hospital; Recruitment, Selection, Training Guidelines; Methods of Training; Evaluation of Training; Leadership grooming and Training-Promotion and Transfer, Communication – nature, scope, barriers, styles and modes of communication.		**9**
Unit IV	**Marketing Research Process**	
Marketing information systems; Assessing information needs, developing & disseminating information; Market Research process; Other market research considerations – Consumer Markets & Consumer Buyer Behaviour; Model of consumer behaviour; The buyer decision process; Model of business buyer behavior; Major types of buying situations; WTO and its implications.		**9**
Unit V	**Quality and Safety Aspect in Hospitals**	
Quality system – Elements, implementation of quality system, Documentation, Quality auditing; International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000; Environment Management Systems; NABA, JCI, NABL Security; Loss Prevention; Fire Safety; Alarm System; Safety Rules; Health Insurance & Managing Health Care; Medical Audit; Hazard and Safety in a hospital Setup.		**9**
	TOTAL	**45**

Suggested List of Students Activity

- Periodic class quizzes shall be conducted on a weekly or fortnight basis.

Reference

1. R.C.Goyal, ―Hospital Administration and Human Resource Management‖, PHI – Fourth Edition, 2006.
2. G.D.Kunders, ―Hospitals – Facilities Planning and Management ,TMH, New Delhi, Fifth Reprint 2007.
3. Cesar A.Caceres and Albert Zara, ―The Practice of Clinical Engineering, Academic Press, New York, 1977.

4. Norman Metzger, —Handbook of Health Care Human Resources Management‖, 2nd edition, Aspen Publication Inc. Rockville, Maryland, USA, 1990.
5. Peter Berman —Health Sector Reform in Developing Countries‖ - Harvard University Press,1995.
6. William A. Reinke —Health Planning For Effective Management‖ - Oxford University Press.1988
7. Blane, David, Brunner, —Health and SOCIAL Organization: Towards a Health Policy for the 2Ist Century‖, Eric Calrendon Press 2002.
8. Arnold D. Kalcizony & Stephen M. Shortell, —Health Care Management‖, 6th Edition CengageLearning, 2011.
9. K.V. Ramani, Hospital Management: Text and Cases, Pearson,2013.

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

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-MediumCorrelation,1-LowCorrelation

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.

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

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 – Shareholders 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	**45**

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

1146236116	MEDICAL INSTRUMENTATION	L	T	P	C
Theory		3	0	0	3

Introduction

To create a bridge between the Engineering and Medical fields to make the diagnosis of disease and to analyses the medical data from instrumentation with the help of engineering applications.

Course Objectives

The objective of this course is to enable the student to

1. To gain knowledge about the basics of human physiological parameters, measurement, recording and interpreting the data.
2. To study about assist devices for health care.
3. To enhance the knowledge based information from recently developed diagnostic and therapeutic techniques.

Course Outcomes

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

CO1: Differentiate and analyses the bio medical signal sources

CO2: Elucidate cardiovascular system and related measurements.

CO3: Explain the brain, muscle, nervous systems and related measurements

CO4: Apply suitable medical image system for diagnosing the disease.

CO5: Recommend problem solving and service procedures for safety use of medical instruments as per medical standards

Pre-requisites:

Secondary Board level Human Physiology system

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-MediumCorrelation,1-LowCorrelation

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.

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1146236116	MEDICAL INSTRUMENTATION	L	T	P	C
Theory		3	0	0	3
Unit I	**BIO-POTENTIAL MEASUREMENTS**				
Functional components of a biomedical system - Cell and its Structure – Action potential – Resting potential – Half cell potential- Propagation of Action potential in cell- Bio potential measurements: Types of electrodes for different bio signal-Need of Electrolyte.					**10**
Unit II	**CARDIAC SYSTEM**				
Blood flow in Heart rooms - Origin of ECG- SV node and AV node - Normal and Abnormal ECG waveforms and heart diseases - ECG Lead systems and recording system - Basic Cardiac pacemaker - External and Implantable pacemaker - Fibrillation- Defibrillator - AC defibrillator - DC defibrillator					**10**
Unit III	**NEUROLOGICAL SYSTEM AND SKELETAL SYSTEM**				
EEG - Wave characteristics -Frequency bands - Spontaneous and evoked response - 10 -20% Lead system- EEG Recording - Analysis of EMG waveforms - muscle latent velocity					**9**
Unit IV	**THERAPEUTIC & MEDICAL IMAGING DEVICES**				
Spirometer - Heart-Lung Machine - Oxygenators - Blood Gas Analyser - Finger-tip oximeter. Medical Imaging: MRI and CT scan (Principle and Quantitative approach only).					**8**
Unit V	**MEDICAL SAFETY MANAGEMENT**				
Electrical safety Management and Maintenance: Shock hazards, LET-GO current- Leakage current- Safety of medical equipment: Protection for earth fault, short circuit, static charge and EMI.					**8**
	TOTAL				**45**

TEXT BOOKS

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 3rd Edition, 2014.

2. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2010.

REFERENCE BOOKS

1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2011.
2. Joseph J. carr and John M. Brown, "Introduction to Biomedical Equipment Technology", John Wiley and sons, New York, 2001.
3. Prof. Venkataram S.K, "Biomedical Electronics and Instrumentation", Galgotia Publications Pvt. Ltd., 2003.
4. Webb, Andrew G, “Principles of Biomedical Instrumentation. India", Cambridge University Press, 2018.

1141235312	MEDICAL PHYSICS	L	T	P	C
Theory		3	0	0	3

Introduction

Medical Physics is a branch of applied physics that utilizes physical sciences to prevent, diagnose, and treat human diseases. Medical physics can be categorized into multiple sub-groups: Medical imaging physics, Non-ionizing medical radiation physics, nuclear medicine physics, medical health physics and Physiological Measurements. Medical Physics Primarily focuses on ionizing Radiation measurement, magnetic resonance imaging, and applied physics based technologies in medicine.

Course Objectives

The objective of this course is to enable the students to

- To study principles and effects of ionizing and non-ionizing radiation in the human body.
- To discuss the physics of the senses.
- To explore the effects of radiation in matter and how isotopes are produced.
- To understand various detectors for detecting the presence of ionizing radiation.

Course Outcomes

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

CO1: Explain about non-ionizing radiation, interaction with tissue and its effects.

CO2: Define and compare intensities of sensory stimuli

CO3: Summarizes how ionizing radiation interacts with the human body, how to quantify it and its levels seen in the environment and healthcare

CO4: Explain the fundamentals of radioactivity and radioactive isotopes.

CO5: Illustrates the methods of detecting and recording the ionizing radiation and its interaction with matter

Pre-requisites

Basic Physics

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- Utilize multimedia presentations and videos for visual learning of radioactive nucleus.
- Consider an inductive teaching approach. Guide students through observations and experiments to discover the working principles of various medical equipment for a deeper understanding.

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 could be the source of error, if any.

1141235312	MEDICAL PHYSICS	L	T	P	C
Theory		3	0	0	3
Unit I	NON-IONIZINGRADIATIONANDITSMEDICALAPPLICATIONS				
Introduction and objectives – Tissue as a leaky dielectric – Relaxation processes, Debye model, Cole – Cole model, Overview of non-ionizing radiation effects - Low Frequency Effects - Higher frequency effects. Physics of light, Measurement of light and its unit – limits of vision and					**10**

color vision an over view, Ultraviolet		
Unit II	**PHYSICS OF THE SENSES**	
Introduction and objectives-Cutaneous sensation-The chemical senses Audition–Vision-Psychophysics		**7**
Unit III	**PRINCIPLES OF RADIOACTIVE NUCLIDES**	
RadioactiveDecay–SpontaneousEmission–IsometricTransition– Gammaray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology ,Decay series, Production of radionuclides – Cyclotron produced Radionuclide Reactor produced Radio – nuclide - fission and electron Capture reaction, Target and Its Processing Equation for Production of Radionuclides, radionuclide Generator-Technetium generator.		**12**
Unit IV	**RADIOACTIVE DECAY**	
Spontaneous Fission-Isomeric Transition-Alpha Decay-Beta Decay-Positron Decay – Electron Capture –Inter action of charged particles with matter – Specificionization, Linear energy transfer range, Bremsstrahlung, Annihilation,.		**8**
Unit V	**INTERACTIONS OF RADIATION WITH MATTER**	
Interaction of X and Gamma radiation with matter – Photo electric effect, Compton Scattering , Pair production, Attenuation of Gamma Radiation ,Interaction of neutron with matter and their clinical significance.		**8**
	TOTAL	**45**

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

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
- Miniproject that shall be an extension of any practical lab exercise to real-world application

Reference

1. Gopal B. Saha, “Physics and Radiobiology of Nuclear Medicine”, 4th Edition, Springer, 2013.
2. B H Brown, R H Smallwood, D C Barber, PV Lawford and DR Hose,“Medical Physics and Biomedical Engineering”, 2nd Edition, IOP Publishers.2001.
3. S.Webb“The Physics of Medical Imaging”, Taylor and Francis, 1988
4. J.P.Woodcock, “Ultrasonic, Medical Physics Handbook series 1”, Adam Hilger, Bristol, 2002.
5. HyltonB.Meire and Pat Farrant “Basic Ultrasound” John Wiley & Sons, 1995

1142236311	MICROBIOLOGY	L	T	P	C
Theory		3	0	0	3

RATIONALE

The study of microorganisms is known as microbiology, and its main objectives include the iden6nntification of illnesses brought on by germs, their clinical significance, and their composition, function, and categorization. The purpose of the microbiology course is to familiarize students with the fundamental concepts and practical implications of clinical illnesses. A wide range of etiological factors that cause diseases around the world are covered in this course. The theoretical underpinnings of pathogenic bacteria, fungi, algae and virus will be covered in this course, along with the basic mechanisms behind their pathogenicity.

OBJECTIVES

The Objective of this course is to enable the students to

- Recognize the boundaries and classifications of microbiology.
- Describe the general traits of microorganisms.
- Understand the procedure for gathering samples and moving specimens.
- Explain the sterilizing and disinfection procedures.
- Describe the methods for cultivating microorganisms and the many techniques used in this process. Recognize the significance of testing for antibiotic sensitivity.
- Describe the various staining methods used to identify microorganisms.
- Describes in detail how to identify microorganisms by their morphology and how they contribute to the pathophysiology of diseases.
- Explain the important of COVID-19 is the infectious disease caused by the most recently discovered coronavirus.
- Understand the additionally, the infection may travel through your blood to other areas of your body. We refer to this as diffuse mucormycosis.

COURSE OUTCOMES

After Successful completion of this Course, the students should be able to

CO1: Explain the history and scope of microbiology.

CO2: To understand the sterilization method and disinfection.

CO3: Explain the factor influencing microbial growth.

CO4: Explain the various staining method used as microbes.

CO5: Explain the important of microbes is the infectious disease caused by the most recently discovered coronavirus.

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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	20	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.

Question Pattern:

Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1142236311	**MICROBIOLOGY**	L	T	P	C
Theory		3	0	0	3
Unit I	**GENERAL MICROBIOLOGY**				
History and Scope of Microbiology, Prokaryotic and Eukaryotic Microorganisms. Classification of Microorganisms.-Morphology and General Characteristics of Bacteria Fungus, Algae &Virus					**7**
Unit II	**SPECIMEN PREPARATION**				
Specimen preparation- Method and collection of specimen – transport of specimen & Precaution –VR, Stuart's, Pike's transport medium and their uses in transportation of specimen; Sterilization method and disinfection – physical, chemical, mechanical.					**8**
Unit III	**CULTURE MEDIA AND CULTURE TECHNIQUES**				

Culture Media and Culture Techniques -Nutritional requirements of Microorganisms - growth cycle, Factors influencing microbial growth. Culture media - classification of media - Preparation, uses, precaution and storage of routine laboratory media -Culture techniques – Aerobic culture – liquid, stab culture, slant culture, streak culture , colony characters after growth–anaerobic culture–Candle jar technique –Antimicrobial susceptibility testing– Modified Kirby-Bauer method.		**12**
Unit IV	**STAINING TECHNIQUES AND MICROSCOPIC OBSERVATION**	
Commonly used stains – simple staining, differential staining –Gram's staining, Zihel- Neelsen staining (Hot and Cold), Albert staining, Negative staining–Indian ink preparation, Endospore staining, Visualization of the morphology and reaction to the chemical present in the stain.		**8**
Unit V	**MORPHOLOGY AND PATHOGENESIS OF MICROBES**	
Introduction, morphology, pathogenesis, symptoms, treatment, prevention and laboratory diagnosis of microbes: Bacteria- Gram positive bacteria - (Staphylococcus sp, Streptococcus sp, Mycobacterium tuberculosis)- Gram negative bacteria - (Salmonella sp, Shigella sp, E.coil), Fungus- (Mucormycosis, Penicillin, Aspergillus), Virus- (Corona virus, Rabies virus, Pox virus), Algae- (Spirullina, Cyanobacteria, Chlorophyta).		**10**
	TOTAL	**45**

Reference books:

1. Anantha narayanan R & Panicker CKJ- Text book of Microbiology. OrientLongmans.7th39ed.2006.
2. Dubey RC and Maheswari DK.A text book of Microbiology. SChand,2007.
3. Manual of Microbiology tools and techniques. Kanika Sharma. Ane's studentedition.2007.
4. KanaiL.Mukherjee-Text book of Medical laboratoryTechnologyVol1,2&3.

1142236312	INSTALLATION, MAINTENANCE AND SAFETY HANDLING OF MEDICAL EQUIPMENT	L	T	P	C
Theory		3	0	0	3

RATIONALE

Every year, there is a tremendous increase in the use of modern medical equipment in the hospital and health care industry therefore it is necessary for every student to understand the functioning of various medical equipment's. This course to enable the students to learn the basic principles of different biomedical instruments and how to install, maintain and servicing of the instruments.

Course Outcomes

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

CO1: To understand the scope of healthcare services

CO2: To familiarize the medical device working standards, maintenance procedures

CO3: To familiarize the medical device working standards, maintenance procedures

CO4: To know the need of biomedical engineers in research and development

CO5: Learn the troubleshooting of medical equipment.

CO6: Apply the tools in design, testing and developing medical equipment

CO7: To learn about the importance of patient safety and various methods of accident prevention

Pre-requisites

Basic knowledge of Electrical, Electronics and Instrumentation

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

Instructional Strategy

- It is advised that teachers have to use different teaching methods to stimulate the interest of students in learning.
- To help students to learn different types of Medical Equipment
- Teachers should use PPT presentation to show video of application of the various types of Medical Equipment. Also, should explain 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 mind set. Student activities should be planned on all the topics.
- Demonstration method may be used with step-by-step procedure to show the working of different types of sensors and transducers.
- Teachers are advised to follow inductive strategy to help the students to know the working principle of special sensors.
- 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 could be the source of error, if any

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
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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.

Question Pattern:

- Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1142236312	INSTALLATION, MAINTENANCE AND SAFETY HANDLING OF MEDICAL EQUIPMENT	L	T	P	C
Theory		2	0	2	3

Unit I	INSTALLATION OF MEDICAL EQUIPMENT	
Selection of proper site for the installation of small equipment available in institute, availability of electrical connections (sockets/switches) of proper ratings, minimal use of loose wiring. Non conducting (electrical) Lab tables for equipment installation. Space for handling of equipment.		4
Design and Fabrication of an electronic circuit, equipment, nature of Faults, troubleshooting (fault location, fault-finding) aids. Trouble-shooting techniques, procedure, component tests, Ground systems, systematic troubleshooting checks.		3
Temperature sensitive intermittent problems, corrective action preventive maintenance, service and maintenance laboratory, professional qualities and work habits		2
Unit II	**MAINTENANCE AND SERVICING OF MEDICAL EQUIPMENT**	
ECG machine – EEG Machine - X-Ray Machine – Colorimeter – Auto analyzer – Electro surgical unit – Incubator – Bed Side Monitor - Defibrillator		**9**
Unit III	**STABILIZERS, INVERTERS AND POWER SUPPLIES**	
Use and installation of stabilizers, generators in Hospital, Nursing Home, in laboratory of the institute, their ratings. Time delays of CVT, SMPS, UPS- UPS: various type, Basic principles, block diagrams of online, and off-line, systems. - Inverters: Selection of Inverter, load calculation, voltage and ampere ratings - Use and installation of above kind of equipment		**9**
Unit IV	**SERVICING OF MEDICAL EQUIPMENT**	
Use and operation of equipment, understanding of probable effects, Operation of the equipment, cold tests –visual and by use of test instruments (generally multi-meter), finding loose, broken/burnout parts and components, electrical wire, fuse etc. Live tests - testing of power leads, fuses, and power supply circuit testing (voltage measurements) tests at different points in a machine. Finding faults in a machine and its		**9**

repairs.		
Unit V	**SAFETY ASPECTS**	
Introduction - Radiation safety instrumentation - Physiological effects due to 50 Hz current passage - Micro-shock and macro-shock hazards of medical instruments - Electrical accidents in hospitals –Devices to protect against electrical hazards – Hospital architecture, hospital regulation, inspections of equipment, emergency power system, Oxygen safety, safety in the operating room, hazards of gases, pressure chambers, preventive maintenance		**9**
	TOTAL	**45**

Suggested List of Students Activity (Ungraded)

- Check the web portal to study different type Medical Equipments
- Periodical quizzes should be conducted on a weekly/fortnightly basis to reinforce the different types of Equipments and their working principles.
- Students might be asked to see the demonstration video of various Medical Equipments

REFERENCE BOOKS

1. Introduction to Biomedical Equipment Technology by Carr and Brown, Regents and Prentice Hall of India, New Delhi 2002
2. Principles of Bio-medical Instrumentation and Measurements by Leslie Cromwell, Fred J Weibell, Erich A Pfeiffer Prentice Hall of India, New Delhi I I Edition 2000
3. Principles of Biomedical Instrumentation and Measurements by Richard and Aston by MERRIL an Imprint of Macmillan Publishers Co New York. 1990
4. Modern Electronic Equipment Troubleshooting, Repair and Maintenance by RS Khandpur, Tata Mc Graw Hill Publishing House, New Delhi 1999
5. Hospitals Planning, Design and Management, by GD Kunders, S Gopinath and A Katakam, Tata Mc Graw Hill,Publishing House, New Delhi 2013 .

1142236313	HEALTH CARE INFORMATICS	L	T	P	C
Theory		2	0	2	3

RATIONALE

Enhanced quality and safety through the use of best practice standards to minimize errors and deliver high-quality care adherence to practice standards and accreditation by means of integrated recommendations inside the health record. Better instruction, supplying workers and patients with information and knowledge.

OBJECTIVES

The Objective of this course is to enable the students to

- .To Study medical informatics.
- To study medical data storage and automation.
- To study medical standard and computerized patient record.
- To study health informatics.
- To study virtual reality application in medicine.

COURSE OUTCOMES

The course will focus strongly on expert systems, but will provide scope for the examination of other areas of interest important to course participants. More specifically, the course objectives include:

- Discuss the structure of medical Informatics and functional capabilities of Hospital Information System.
- Describe the need of computers in medical imaging and automation in clinical laboratory.
- Analyze medical standards
- Identify recent trends and different ICT applications in medical Informatics.

CO/PO Mapping

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

Legend:3-High Correlation,2-MediumCorrelation,1-LowCorrelation

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	20	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.

Question Pattern:

- Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1142236313	HEALTH CARE INFORMATICS	L	T	P	C
Theory		2	0	2	3
Unit I	**INTRODUCTION TO MEDICAL INFORMATICS**				
Introduction –medical informatics – structure of medical informatics – computer based medical information retrieval - functional capabilities of a computerized hospital information system, health informatics-medical informatics - medical information, clinical information.					**8**
Unit II	**MEDICAL DATA STORAGE AND AUTOMATION**				
Representation of health Data, Relational, Hierarchical and network Approach, Data modeling for patient database development. Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computer assisted medical imaging, Radiation therapy and planning, Nuclear Magnetic Resonance					**12**
Unit III	**MEDICAL STANDARDS AND COMPUTERISED PATIENT RECORD**				

Evolution of Medical Standards – IEEE 11073 - HL7 – DICOM – IRMA - LOINC – HIPPA. Computer based Patient Records-History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, CPR in Radiology, Clinical information system, Computerized prescriptions for patients.		**9**
Unit IV	**HEALTH INFORMATICS**	
Bioinformatics Databases, Bio-information technologies, Genome Analysis, Semantic web and Bioinformatics, Genome projects. Clinical information system, data for decision making, Medical diagnostic and decision support systems, Decision analysis in health informatics.		**8**
Unit V	**RECENT TRENDS IN MEDICAL INFORMATICS**	
Virtual reality applications in medicine, Computer assisted surgical techniques-Virtual endoscopy, Computer assisted surgery, Surgical simulation. Computer assisted medical education, Computer assisted patient education and health. Telemedicine, virtual Hospitals - Smart Medical Homes – Personalized e-health services.		**8**
	TOTAL	**45**

TEXT BOOKS:

1. Mohan Bansal, “Medical informatics”, Tata McGraw Hill Publishing Ltd, 2003
2. R.D.Lele, “Computers in medicine progress in medical informatics”, Tata Mcgraw Hill, 2005

REFERENCES:

1. Alain Venot, Anita Burgun, Catherine Quantin, “Medical Informatics, e-Health: Fundamentals and Applications”, Springer Science & Business Media, 2013
2. Edward H. Shortliffe, James J. Cimino, “Biomedical Informatics: Computer Applications in Health Care and Biomedicine”, Springer Science & Business Media, 2013
3. Orpita Bosu and Simminder Kaur Thukral, “Bioinformatics Databases, Tools and Algorithms”, Oxford University press, 2007.
4. Shui Qing Ye, “Bioinformatics: A Practical Approach” , CRC Press, 2007.

1142236314	MEDICAL EXPERT SYSTEMS	L	T	P	C
Theory		2	0	2	3

RATIONALE

Knowledge systems are smaller software systems, and are usually less successful than human experts. Main reasons for expert systems development in medicine are: need for justification of decisions, need for enhancing performances in many uncertain relations; need for explaining of decision making process.

OBJECTIVES

The Objective of this course is to enable the students to

- To Study effects of problem solving.
- To study effects of predicate logic.
- To study expert system architecture.
- To study explanation based learning.
- To study MYCIN and EMYCIN

COURSE OUTCOMES

The course will focus strongly on expert systems, but will provide scope for the examination of other areas of interest important to course participants. More specifically, the course objectives include:

1. To develop informed opinions about the present and past opinion leaders in the artificial intelligence debate.
2. To develop a simple, informal expert system by performing an effort of knowledge engineering of a real, human expert.
3. To develop a series of Web pages that will serve as a current "state of the art" review of the Various AI application areas, areas which may be suggested by the instructor or brought to the course by participants.
4. To experience some actual hands-on demonstration software while accomplishing the review of current applications areas in AI.

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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.

Question Pattern:

- Answer ten questions by selecting two questions from each unit. Each question carries10 marks each. Four questions will be asked from every unit, students should write any two questions. The question may have two subdivisions only.

1142236314	MEDICAL EXPERT SYSTEMS	L	T	P	C
Theory		2	0	2	3
Unit I	**INTRODUCTION TO AI**				
Definition of AI – importance of AI – problem solving, searching, heuristic searching.					**9**
Unit II	**KNOWLEDGE REPRESENTATION**				
Preposition Logic – Clause form – Predicate logic – Resolution – Inference Rules – Unification – Semantic networks – frames – conceptual dependency – Scripts – knowledge representation using rules – rule based systems					**9**
Unit III	**EXPERT SYSTEMS**				
Expert system architecture - non-production systems architecture– knowledge acquisition and validation - Knowledge system building tools.					**9**
Unit IV	**LEARNING & DECISION MAKING**				
Types of learning – general learning model – learning by induction –					**9**

generalization & specialization – inductive bios – explanation based learning		
Unit V	**CASE STUDY**	
I Study of medical expert systems – MYCIN, EMYCIN - development of medical experts systems – sample Case studies.		**9**
	TOTAL	**45**

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Reference books

1. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Prentice Hall of India, Delhi, 2001.
2. Watterman. “Expert Systems”, Mc-Graw Hill, New York, 1991
3. George F Luger, “Artificial Intelligence, structures and strategies for complex problem solving”, Pearson Education Delhi, 2001.
4. Elain Rich and Kevin Knight, “Artificial Intelligence”, 2nd edition, Tata Mc Graw Hill,1993.
5. R.D.Lele, “Computers in Medicine,” Tata McGraw Hill, NewDelhi-1989.