1146235444	MEDICAL IMAGING TECHNIQUES	L	T	P	C
Practicum		1	0	4	3

Introduction:

The goal of medical imaging is to diagnose and treat patients using images. A number of technologies are used in medical imaging, including fluoroscopy, endoscopy, magnetic resonance imaging (MRI), X-ray cardiography, elastography, and tactile imaging. Internal structures hidden by the skin and bones are revealed by medical imaging. It generates an anatomy and physiology report on the human body that is used to diagnose diseases. To track down a process of a troubling illness, medical imaging is highly necessary. With the use of MRIs and CT scans, medical professionals may assess the efficacy of a patient's care and make necessary adjustments. Patients receive better care through the information provided by medical imaging.

Course Objectives:

- To discuss the fundamentals of digital images and image processing methods.
- To study the various image transforms and filtering techniques in spatial domain and frequency domain for enhancement.
- To discover the principles filtering techniques for image restoration.
- To identify the segmentation techniques for feature extraction from images and classification.
- To study different image compression techniques for medical images.

Course Outcomes:

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

CO1: Understand the basics of digital images and image processing methods.
CO2: Examine image enhancement techniques in medical images such as X-ray and CT- images.
CO3: Apply different filtering techniques to restore the blurred image.
CO4: Execute segmentation and classification techniques in medical images.
CO5: Demonstrate the image coding and compression techniques in medical images.

Pre-requisites:

Programming in MATLAB

1146235444	MEDICAL IMAGING TECHNIQUES	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

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

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

Instructional Strategy:

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

1146235444	MEDICAL IMAGING TECHNIQUES	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

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

Note:

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

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

Practical part (All Experiments)

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

1146235444	MEDICAL IMAGING TECHNIQUES	L	T	P	C
Practicum		1	0	4	3

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

1146235444	MEDICAL IMAGING TECHNIQUES	L	T	P	C
Practicum		1	0	4	3

UNIT 1	**IMAGE PROCESSING FUNDAMENTALS**	
Fundamental steps in image processing- Digitizing an image, medical image formats, image quality and information content –histogram, entropy		3
Experiments 1. Read the given colour image and display the corresponding the gray scale image and histogram of that image in MATLAB. 2. Read the given input image and find the entropy of that image in MATLAB.		12
UNIT II	**MEDICAL IMAGE ENHANCEMENT**	
Digital subtraction angiography, image averaging, gray scale transforms, Histogram transformation, Contrast enhancement, Low pass and high pass filtering in spatial and frequency domain, application to x-ray images and ultra sound images.		3
Experiments 3. Read the given x-ray image using MATLAB software and perform contrast enhancement. 4. Read the given x-ray image using MATLAB software to remove the noise using spatial low pass filters. Compare the performance of filters. 5. Read the CT image of the given lungs image, perform intensity Enhancement, and extract the nodules in the lungs using MATLAB software.		12
UNIT III	**MODELING IMAGE DEGRADATION**	
Inverse filtering, Wiener filtering, motion de blurring, blinded blurring.		3
Experiments 6. Restore the given blurred imaged using inverse filter 7. Restore the given blurred imaged using Wiener filter		12
UNIT IV	**MEDICAL IMAGE ANALYSIS AND CLASSIFICATION**	
Image segmentation –pixel based, edge based, and region based morphological operations. Representation of shapes and contours, shape factors, statistical analysis of texture. Feature extraction and image classification ,CT and MRI images.		3

1146235444	MEDICAL IMAGING TECHNIQUES	L	T	P	C
Practicum		1	0	4	3

Experiments 8. Perform segmentation of the given image using (i) single and Multi-threshold. Compare the outputs. 9. Perform morphological operations on the given image and Perform background subtraction. 10. Segment the tumour from the given MRI image using MATLAB software and determine its area and perimeter. 11. Process the given endoscopic images and extract the tumor detected using MATLAB software. 12. Extract the blood vessels from the given retinal image using MATLAB software. Classify the given images using simple neural network classification.	12
UNIT V **IMAGE 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.	3
Experiments 13. Compress the given image using Huffman code. 14. Perform jpeg compression on the given image. Calculate the compression ratio.	12
Total	**75**

Reference

1. Rafael C. Gonzales, Richard E.Woods, "Digital Image Processing", 2016, 3rd edition, Pearson Education, Noida.
2. Birkfellner, W., 2015. Applied medical image processing: a basic course. CRC Press.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata McGraw Hill Pvt. Ltd., 2011.
4. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
5. William K Pratt, "Digital Image Processing", John Willey, 2002.
6. Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.
7. Geoff Dougherty, Medical Image Processing: Techniques and Applications, Springer Science & Business Media, 25-Jul-2011.
8. Isaac N. Bankman, Handbook of Medical Image Processing and Analysis, Science Direct, 2nd Edition -2009.

Web-based/Online Resources:

1. https://in.mathworks.com/learn/training/image-processing-with-matlab.html
2. https://www.youtube.com/playlist?list=PL9be9JpeQ7IN3dsbnAMyDmgpVmrt6WJWR
3. https://www.javatpoint.com/digital-image-processing-tutorial
4. https://www.electronicsforu.com/electronics-projects/image-processing-using-matlab-part-1

1146235444	MEDICAL IMAGING TECHNIQUES	L	T	P	C
Practicum		1	0	4	3

Equipment / Facilities required to conduct the Practical Course. (Batch Strength: 30 Students)

1. Windows 10 or higher operating system / Linux Ubuntu 20 or higher
2. MATLAB or Python
3. Open CV

1146235445	Basics of VLSI Design	L	T	P	C
Practicum		1	0	4	3

Introduction

Very Large-Scale Integration technology, when especially used for designing digital systems, it is mandatory that the behavior of the required system to be described (modeled) and verified (simulated)before synthesis, translate the design into real hardware fabrication in the foundry (gates and wires). Hardware Description Language (HDL) allows designs to be described using any methodology-top down, bottom-up approach. VHDL can be used to describe hardware at the gate level or in a more abstract way. This course is to introduce the digital system design concepts through hardware description Language, VHDL programming, design flow of VLSI and architectures of CPLD, FPGA. It is mainly aimed at design of combinational and sequential functions simulate or verify their functionality using Hardware Description Language (HDL).

Course Objectives

The objective of this course is to enable the student to

1. Understand the concepts of VLSI design process.
2. Develop a VHDL code for combinational circuit.
3. Develop a VHDL code for sequential circuit.
4. Develop a VHDL code for any digital circuits.
5. Understand the concepts of digital circuits / logic function by simulating VHDL programs through XILINX software.
6. Understand the concepts of digital circuits by using FPGA kit.
7. To know the usage of input switches, output LEDs and seven segment display in FPGA kit

Course Outcomes

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

CO1: To learn CMOS concepts of VLSI design process logic design.

CO2: To prepare the student to understand the VHDL language feature to realize the complex digital systems.

1146235445	Basics of VLSI Design	L	T	P	C
Practicum		1	0	4	3

CO3: To design and simulate sequential and concurrent techniques in VHDL.

CO4: To explain modeling of digital systems using VHDL and design methodology

CO5: To Understand behavioural, non-synthesizable VHDL and its role in modern design.

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Pre-requisites: Digital Electronics

CO/PO Mapping

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

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

Instructional Strategy

- It is advised that teachers take steps to stimulate pupils' attention and boost their learning confidence.
- To help students learn and appreciate numerous concepts and principles in each area, teachers should provide examples from daily life, realistic situations, and real-world engineering and technological applications.

1146235445	Basics of VLSI Design	L	T	P	C
Practicum		1	0	4	3

Assessment Methodology

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

Note:

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

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

Practical part (All Experiments)

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

1146235445	Basics of VLSI Design	L	T	P	C
Practicum		1	0	4	3

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

1146235441	Basics of VLSI Design	L	T	P	C
Practicum		1	0	4	3

Unit I	**INTRODUCTION TO VLSI and VHDL**	
Theory **1.1 NMOS, CMOS logic:** NOT, AND, OR, NAND, and NOR Gates using NMOS – NOT, AND, OR, NAND, and NOR Gates using CMOS – Implementation of logic function (SOP, POS) in CMOS. **1.2 INTRODUCTION TO VHDL:** HDL – Different types of modeling – General format for VHDL program. **1.2.1 VHDL statements:** Syntax for process statement, if statement, if else statement, if else if else statement, case statement –Syntax for signal declaration and signal assignment statement –Syntax for variable declaration and variable assignment statement, component declaration.		3
Practical Experiment #1: ***To Study the VLSI Design Process.***		6
Experiment #2: ***Simulation of VHDL Code for Logic gates (NOT, AND, OR).*** Develop code for logic gates. Simulate the code in the software.		6
Unit II	**COMBINATIONAL CIRCUIT DESIGN - I**	
Theory Half adder, Full adder, Half subtractor and Full subtractor - VHDL program for Half adder, Full adder – VHDL program for Hall subtractor and Full subtractor.		3
Practical		6

Experiment #3: ***Simulation of VHDL Code for Adder (Half Adder and Full Adder).*** Develop code for half adder and full adder. Simulate the code in the software. Experiment #4: ***Simulation of VHDL Code for Subtractor (Half Subtractor and Full Subtractor).*** Develop code for half subtractor and full subtractor. Simulate the code in the software.	6
Unit III	**COMBINATIONAL CIRCUIT DESIGN - II**
Theory 4 to 1 and 8 to 1 Mux, 1 to 4 and 8 to 1 Demux, 4 to 2 and 8 to 3 Encoder, 2 to 4 and 3 to 8 decoder. VHDL program for 4 to 1 and 8 to 1 Mux, 1 to 4 and 8 to 1 Demux, 4 to 2 and 8 to 3 Encoder, 2 to 4 and 3 to 8 decoder	3
Practical Experiment #5: ***VHDL Implementation of 1 to 8 Demultiplexer.*** Develop the code for a 1 to 8 Demultiplexer and implement it in FPGA kit in which Switches are connected for select inputs and a data input, Eight LEDs are connected to the output of the circuit. Experiment #6: ***VHDL Implementation of 8 to 3 Encoder.*** Develop code for 8 to 3 encoder. There will be 8 switches and 3 LEDs in the FPGA kit. The input given from switches and it is noted that any one of the switch is active. The binary equivalent for the corresponding input switch will be glowing in the LED as output.	6 6
Unit IV	**SEQUENTIAL CIRCUIT DESIGN - I**
Theory Flip-flops- JK, D and T Flip-flops. VHDL program for JK, D and T Flip-flops	3
Practical Experiment #5: ***VHDL Code for JK Flipflop (by Simulation or Implementation).*** Develop the code for JK flipflop and simulate using software or implement it in FPGA kit. Experiment #6: ***VHDL Code for D Flipflop (by Simulation or Implementation).*** Develop the code for D flipflop and simulate using software or implement it in FPGA kit.	6 6
Unit V	**SEQUENTIAL CIRCUIT DESIGN - II**
Theory Counters: 3 Bit Up Counter, 3 Bit DownCounter And 3 Bit Up/Down Counter, Decade counter, Ring Counter and Johnson counter. VHDL program for 3 Bit Up Counter, 3 Bit DownCounter And 3 Bit Up/Down Counter, Decade counter, Ring Counter and Johnson counter.	3

1146235445	Basics of VLSI Design	L	T	P	C
Practicum		1	0	4	3

Practical Experiment #5: ***VHDL Implementation of Blinking an Array of LEDs.*** Design and develop a VHDL Code for 4 bit binary up counter. Four LEDs are connected at the output of the counter. The counter should up for every one second.	6
Experiment #6: ***VHDL Implementation of a Speller with an array of LEDs*** Design and develop VHDL Code for a 5 bit Johnson ring counter 4 bit The LEDs are connected at the output of the counter. The speller should work for every one second.	6
TOTAL HOURS	**75**

Suggested List of Students Activity

1. *Assignments*
2. *Group Activity*
3. Quiz related to VHDL program

Reference

1. M. Morris Mano, Michael D. Ciletti, **Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog**, Pearson Education,2018.
2. J Bhasker , **A VHDL Primer**, Pearson Education India,2015.
3. Neil H. E. Weste, **CMOS VLSI Design: A Circuits and Systems Perspective**, Pearson Education India,2015.
4. Lizy Kurian John , Charles H. Roth, **Digital System Design Using VHDL,** Cengage,2012.

Web-based/Online Resources

- **https://www.ece.tufts.edu/es/4/**
- **https://nptel.ac.in/courses/117108040**
- **https://archive.nptel.ac.in/courses/106/105/106105161/#**

List of Equipment's

- FPGA KIT with atleast 10 switches for input, 8 LEDs for output, a 7-segment display, debounced push switch (2 Nos) for manual clock input and external clock source – 10Nos with software.

1146235446	FUNDAMENTALS OF EMBEDDED SYSTEMS	L	T	P	C
Practicum		1	0	4	3

Introduction:

This subject makes the students to understand the definition for Embedded Systems. It also enables the students to have the knowledge about the different architectures, RISC and CISC processors. This subject makes the students to understand about RTOS. To specific, the subject deals with ARM7 RISC processor and the on chip peripherals of LPC 2148.

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Course Objectives:

The objective of this course is to Students will able to know

- On completion of the syllabus, the students must be able to
- Understand ARM7 Processor.
- Understand the architecture of LPC 2148.
- Understand ARM7 instruction set.
- Understand the types of buses.
- Explain On chip peripherals.
- Have clear knowledge about RTOS concepts.

Course Outcomes:

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

CO1: Student can perform practical experiments on embedded systems.

CO2: Understand the properties of ARM7.

CO3: Have a sound knowledge of buses and peripherals.

CO4: Understand the application of on chip peripherals.

CO5: The application of RTOS Concepts.

Pre-requisites:

Knowledge of microcontroller and microprocessor.

1146235446	FUNDAMENTALS OF EMBEDDED SYSTEMS	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

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

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

Instructional Strategy:

- Focus on controllers and peripherals.
- Focus on LPC2148.
- Conduct laboratory-based activities.

Assessment Methodology

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

1146235446	FUNDAMENTALS OF EMBEDDED SYSTEMS	L	T	P	C
Practicum		1	0	4	3

Note:

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

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

Practical part (All Experiments)

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

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

1146235446	FUNDAMENTALS OF EMBEDDED SYSTEMS	L	T	P	C
Practicum		1	0	4	3

1146235446	EMBEDDED SYSTEMS	L	T	P	C
Practicum		1	0	4	3

Unit I	Introduction to Embedded Systems and ARM Processor	
THEORY Definition of Embedded System – Features of Embedded System – Types of Embedded System – List of Embedded System Devices- Harvard and Von-Neumann architectures-RISC and CISC Processors.		**6**
PRACTICAL Experiment #1: Study of ARM Processor kit.(Example LPC 2148 kit) Experiment #2: Write assembly language program for addition, subtraction and Multiplication and simulate..		**12**
Unit II	**ARM Instruction Set**	
THEORY ARM state instruction set- Data processing instructions-Branch instructions- Load-store instructions - Program status register instructions - stack instructions-Conditional execution.		**6**
PRACTICAL Experiment #3: Write and execute C program to blink the LEDs using software delay routine. Experiment #4: Write and execute C program to blink the LEDs using on chip TIMER//COUNTER for the delay (Using Polling method).		**12**
Unit III	**LPC 2148 Controller**	
THEORY LPC 2148 ARM Controller – Features-Block diagram – Memory and on chip peripheral devices – ARM 7 TDMI-S Nomenclature– Memory Map – Memory re-map and boot block-Types of buses.		**6**

1146235446	FUNDAMENTALS OF EMBEDDED SYSTEMS	L	T	P	C
Practicum		1	0	4	3

PRACTICAL Experiment #5: Write and execute C program to read the switch and display in the LEDs Experiment #6: Write and execute C program to display a number in seven segments LED.	**12**
Unit IV **LPC 2148 Peripherals**	
THEORY Pin connect block-Features-pin connect block register description-GPIO (Slow)- Features-register description. UART features – UART0 Block diagram—UART0 register description.	**6**
PRACTICAL Experiment #7: Write and execute C program for serial transmission and reception using on chip UART. Send the received character back to the PC by Polling method. Experiment #8: Write and execute C program for PWM generation & View the output in CRO.	**12**
Unit V **Operating System**	
THEORY **Embedded OS and RTOS** Introduction to OS-Functions of OS-Embedded OS- Foreground/background systems -Real time system concepts- Resources-shared resources-Critical section- multitasking-Tasks-kernel- Scheduler-Round Robin-Non Pre-emptive and Pre-emptive scheduling.	**6**
PRACTICAL Experiment #9: Write and execute C program to interface Stepper motor. Experiment #10: Write and execute C program for PWM generation & View the output in CRO..	**12**
TOTAL HOURS	**75**

Suggested List of Students Activity

- Presentation by students on any recent technological developments based on the course
- Periodic quizzes conducted on a weekly based on the course
- Students can visit nearby hospital to know more about equipment and hands on experience

1146235446	FUNDAMENTALS OF EMBEDDED SYSTEMS	L	T	P	C
Practicum		1	0	4	3

Reference

1. Pelezar TR M J chan ECS and Kreig NR" "Microbiology", Fifth edition, Tata Mc Graw-HillINC.New York (2006).
2. "Anathanarayan R and Jayaram Paniker CK" "Text book of Microbiology", Seventh edition, Orient Longmam Limited,Hyderabad (2005).
3. "Dubey RC and MaheswariDK" "A text of microbiology", Revised edition, S.Chand andCompany Ltd., New Delhi (2012).

Note

1. Manual for the ARM instruction sets and manual for the trainer kit (Excluding sample program) can be allowed for their board exam.
2. Definition for built in function for the board can be given to students for their board function.
3. Manual containing procedure for program down loading through boot loader or JTAG can be given to students for their board exam.
4. Bit details of Registers of on chip peripheral devices can be given for the board practical examination.

LIST OF EQUIPMENTS

1. RM7 TDMI KIT – 15 numbers with interface boards for the above experiments The chip set may be TMS4701,LPC2138, LPC2148 or STR7 etc.
2. Desktop computer / Laptop -15 Nos
3. Interfaces: Seven segment display. LEDS, switches and stepper motor.
4. Manual for the trainer kit and Interfaces.
5. Manual for the built in function for the board.
6. Bit details of registers of on chip peripherals.

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-Medium Correlation, 1-Low Correlation

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

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 Unit I & II (at the end of 6th week)	Written Unit III & IV (at the end of 12th week)	Written Model Exam Units I to V	Quiz/MCQ/ Activity/ Assignment	Written Examination
Duration	2 hours	2 hours	3 hours	2 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	20	20	10	10	60
Marks	20		20		60

Note:

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

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

Question pattern:

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

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**	

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

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 HOURS	**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.

1146236115	IoT IN HEALTHCARE	L	T	P	C
Theory		3	0	0	3

Introduction

In the current scenario, advanced information technologies have opened a new door to innovation in our daily lives. Out of these technologies, the Internet of Things (IoT) is an emerging technology that provides enhancement and better solutions in the healthcare field by connecting medical tools, devices, and machines to create intelligent information systems as per the individual patient requirements. So, IoT in healthcare is important to be a part of learning which aids the students to learn then use the healthcare applications of IoT and develop new IoT systems and applications in healthcare.

Course Objectives

The objective of this course is to enable the student to

1. Acquire knowledge on the core concepts of Internet of Things
2. Understand the working of an IoT system
3. Develop a new IoT system or application
4. Examine the recent trends of IoT in day-to-day life
5. Recognize the importance of IoT in healthcare applications

Course Outcomes

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

CO1: Understand the concepts of IoT and its architecture

CO2: Identify various protocols for IoT

CO3: Design a PoC of an IoT system using Raspberry Pi /Arduino

CO4: Identify and summarize the concepts of IoT based health care.

CO5: Analyse applications of IoT in real time scenario. .

Pre-requisites

Relevant background in basic electronics, digital systems, computer organization/architecture is favourable.

CO/PO Mapping

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

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

Instructional Strategy

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

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

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

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

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

● Encourage Critical Analysis: Foster an environment where students can honestly assess experiment outcomes and analyse 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 Unit I & II (at the end of 6th week)	Written Unit III & IV (at the end of 12th week)	Written Model Exam Units I to V	Quiz/MCQ/ Activity/ Assignment	Written Examination
Duration	2 hours	2 hours	3 hours	2 hours	3 hours
Exam Marks	60	60	100	100	100
Converted to	20	20	10	10	60
Marks	20		20		60

Note:

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

Question pattern:

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

1146236115	IoT IN HEALTH CARE	L	T	P	C
Theory		3	0	0	3

Unit I	**FUNDAMENTALS OF IoT**	
Definition and Characteristics of IOT-Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack –- Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem –Sensors, Actuators, Smart Objects and Connecting Smart Objects		9
Unit II	**INTEROPERABILITY IN IoT**	
IoT protocols -Bluetooth and BLE-Zigbee-Wi-Fi-LoRaWAN-MQTT-CoAP, Wireless sensor network (WSN)-Interfacing of Zigbee module to create WSN-M2M, IoT Platform, IoT Sensors-Biomedical sensors -Wearable sensors, IoT Gateway -Principle of operation -Application -IoT Gateway Using Wi-Fi and Ethernet		9
Unit III	**DESIGN AND DEVELOPMENT**	
Design Methodology - Embedded computing logic - Microcontroller, System on Chips-loT system building blocks -Arduino Programming, Integration of Sensors and Actuators with Arduino, Raspberry Pi-Interfaces, Implementation of IoT with Raspberry Pi		9
Unit IV	**IoT BASED HEALTHCARE**	
Tele-Health, Tele-Medicine, Tele-care, Tele-Monitoring-Patient Health Monitoring System (PHMS) Mobile Health Things (m-health), Internet of Medical Things - IMoT Devices- IMoT Architecture- Benefits and impact of IoMT. Cybersecurity – vulnerability, penetration & encryption technologies.		8
Unit V	**APPLICATIONS OF IoT**	
NSUM Technique for Diabetes Patients, Healthcare Monitoring system through Cyber-physical system, An loT Model for Neuro sensors, AdaBoost with feature selection using loT for somatic mutations evaluation in Cancer, A Fuzzy-Based expert System to diagnose Alzheimer's Disease, Secured architecture for loT enabled Personalized Healthcare Systems, Healthcare Application Development in Mobile and Cloud Environments, Approach to predict Diabetic Retinopathy through data analytics, Diagnosis of chest diseases using artificial neural networks		10
TOTAL HOURS		**45**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course.

References

1. Venkata Krishna, Sasikumar Gurumoorthy, Mohammad S. Obaidat, "lnternet of Things and Personalized Healthcare Systems", Springer Briefs in Applied Sciences, and Technology, Forensic and Medical Bioinformatics, 2019.

2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017.
3. Arshdeep Bahga, Vijay Madisetti, “lnternet of Things – A hands-on approach”, Universities Press, 2015
4. Ayan Kumar Panja, Amartya Mukherjee, Nilanjan Dey “Biomedical Sensors and Smart Sensing” 2022
5. Donald Norris, “The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black”, 2014.
6. Agnivesh Pandey, Amrit Gupta ,Rajiv Pandey “The Internet of Medical Things (IoMT) and Telemedicine Frameworks and Applications”, 2022
7. Khandpur R S, “TELEMEDICINE – Technology and Applications”, PHI Learning Pvt Ltd., New Delhi, 2017.
8. Michael Margolis, Arduino Cookbook, “Recipes to Begin, Expand, and Enhance Your Projects”, O'Reilly Media, 2nd Edition
9. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.Jan Holler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand.
10. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
11. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

Web-based/Online Resources

- Internet of Things : https://onlinecourses.nptel.ac.in/noc22_cs53/preview
- Internet of Medical Things (IoMT)-Based Smart Healthcare System: Trends and Progress: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9308524/
- Telemedicine: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2782224/

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 asper medical standards

Pre-requisites: Secondary Board level Human Physiology system

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

CO/PO Mapping

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

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

Instructional Strategy

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

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

Assessment Methodology:

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

Note:

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

Question pattern:

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

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

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 HOURS	**45**

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

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.

1146236231	Interpretation of ECG	L	T	P	C
Practicum		2	0	2	3

Introduction

Interpretation of ECG course reviews basic cardiac anatomy, physiology, and electro physiology and teaches ECG rhythm, acquisition, and identification.

Course Objectives

The objective of this course is to enable the student to

1. To integrate knowledge of the basic anatomy and physiology of the heart
2. To demonstrate the steps in analyzing an ECG rhythm strip.
3. To Explain ECG findings and nursing actions for a variety of atrial, ventricular, and junctional dysrhythmias.

Course Outcomes

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

CO1: Describe the anatomy and electrophysiology of the heart

CO2: Maintain ECG equipment and demonstrate lead placement

CO3: Identify ECG medical emergencies

Pre-requisites

-> Basic knowledge of anatomy of the heart to interpret ECG.

CO/PO Mapping

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

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

1146236231	Interpretation of ECG	L	T	P	C
Practicum		2	0	2	3

Instructional Strategy

- Hands-on Laboratory Sessions: Provide students with practical experience in utilizing different recording techniques and equipment to record and analyze bio-signals and non-electrical parameters. This hands-on approach will enhance their proficiency and understanding of the subject matter.

- Case Studies and Problem-Solving Exercises: Present real-world case studies and problem-solving exercises to challenge students to apply theoretical concepts to practical scenarios. This will help them develop critical thinking and problem-solving skills essential for recording and interpreting bio-signals accurately.

- Group Projects and Collaborative Learning: Encourage collaborative learning through group projects that require students to work together to record and analyze bio-signals and non-electrical parameters. This will foster teamwork and communication skills while deepening their comprehension of the course material.

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Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test 1 (Units 1 & II)	Written Test 2 (Units III & IV)	Model Written Examination	Record Work	Written Examination
Duration	2 hours	2 hours	3 hours	-	3 hours
Exam Marks	60	60	100	20	100
Converted to	20	20	10	10	60
Internal Marks	20		10	10	60

1146236231	Interpretation of ECG	L	T	P	C
Practicum		2	0	2	3

Note:

- CA1 and CA2 Assessment test should be conducted as per the question pattern. Best of one will be considered for 20 Marks.
- CA3 Model examination should be conducted as per the end exam question pattern.
- CA4: Record for the experiments should be maintained and the same have to be evaluated after completion of each practical exercise before the commencement of the next exercise for **20** Marks. The marks awarded should be converted to **10 Marks** for the internal assessment.

Question pattern:

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

1146236231	Interpretation of ECG	L	T	P	C
Practicum		2	0	2	3
Unit I	**INTRODUCTION**				
History of ECG – Physiology of Conduction System of Heart – Rates of Pacemakers – Normal Spread of Electrical Activity in the Heart – Basics of ECG – ECG Leads – Placement of Leads – Normal ECG Morphology – Parts of ECG Strip – Normal ECG Pattern – Normal R Wave Progression in Chest Leads		5			

1146236231	Interpretation of ECG	L	T	P	C
Practicum		2	0	2	3

Experiment #1: Relationship between electrocardiogram to the electrical events of the heart. Experiment #2: Relationship between electrical events to the mechanical events of the cardiac cycle. Experiment #3: The electrocardiogram associated with an artificial cardiac pacemaker - Identification of pacemaker stimulus on the electrocardiogram - Differentiation between atrial and ventricular pacing.	7
Unit II	**SYSTEMATIC INTERPRETATION OF ECG**
Systematic interpretation guidelines for electrocardiogram - Look for standardization and lead aVR - Rate - Rhythm - Axis - P wave morphology - P-R interval - Hypertrophy - Bundle branch block	5
Experiment #4: Calculation of the heart rate from the electrocardiogram. Experiment #5: Normal variations of the electrocardiogram in relation to (i) age, (ii) state of activity, (iii) body build and (iv) ethnic origin Experiment #6: Normal cardiogram and some common abnormalities.	7
Unit III	**DIFFERENTIAL DIAGNOSIS**
P wave - P-R interval - Q wave - R wave - QRS complex - ST segment - T wave - U wave - Q-T interval	5
Experiment #7:Waveform components of (P, Q, R, S, T and U) Experiment #8: Definitions of normal ranges of PR interval and QRS duration. Experiment #9:Measurement of QT interval and calculation of corrected QU interval (QTc) by Bazett's formula.	7
Unit IV	**ARRHYTHMIAS - I**
Disorders of impulse formation - Disorders of impulse conduction - Premature beats/Ectopic beats/Extrasystole - Nodal rhythm or junctional rhythm - SA node block - Abnormalities of rhythms - Sinus arrhythmia - Sinus bradycardia - Sinus tachycardia	4
Experiment #10: Rhythms arising from the sinus node i. Normal sinus rhythm ii. Sinus arrhythmia iii. Sinus tachcadria iv. Sinus bradycardia v. Sinus arrest	4
Unit V	**ARRHYTHMIAS - II**
Atrial Rhythms - Paroxysmal supraventricular tachycardia (PSVT) - Atrial fibrillation - Atrial flutter - Differences between atrial tachycardia, flutter and fibrillation -Ventricular rhythms - Ventricular tachycardia - Torsades De Pointes - Ventricular fibrillation - Idioventricular rhythm - Differences between ventricular tachycardia and ventricular fibrillation - Wolf-Parkinson-White (WPW) syndrome – Syste,matic Interpretation of Arrhythmias	6
Experiment# 11: Supraventricular tachyarrhythmiass i. Atrial premature contractions (ectopics) ii. Atrial tachycardia	

1146236231	Interpretation of ECG	L	T	P	C
Practicum		2	0	2	3

iii. Atrial flutter iv. Atrial fibrillation v. Supraventricular tachycardia vi. Accelerated AV noda (junctional rhythm) Experiment #12 : Conduction abnormalities i. Ventricular pre-excitation ii. Left and right bundle branch block iii. 1st degree AV block iv. 2nd degree AV block: Mobitz l (Wenckebach), II and 2:1 block v. 3rd degree (complete) AV block Experiment #13: Rhythms arising from the ventricles: i. Ventricular escape beats ii. Ventricular premature beats (ectopics) iii. Ventricular tachycardia iv. Ventricular flutter v. Ventricular fibrillation vi. Ventricular standstill (asystole) Experiment #14: Interpretation of changes in the electrocardiogram arising from abnormal cardiac conditions i. Myocardial ischaemia ii. Myocardial infarction iii. Left ventricular hypertrophy iv. Pericarditis v. Dextrocardia Experiment #15: Essential ECG Interpretation (12- lead ECG's taken from the following list) i. Complete heat block ii. Left bundle branch block iii. Right bundle branch block iv. Ventricular fibrillation v. Atrial fibrillation vi. Ventricular tachycardia vii. Narrow complex tachycardia viii. Acute ST elevation myocardial infarct	10
TOTAL HOURS	60

1146236231	Interpretation of ECG	L	T	P	C
Practicum		2	0	2	3

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course
- Periodic lab quizzes conducted on a weekly/fortnightly based on the course
- Organize a workshop where students can practice using different bio-signal recording devices and techniques to gain practical experience in capturing bio-signals accurately.
- Provide students with simulation exercises that simulate practical scenarios where they must apply theoretical concepts to accurately record and analyze bio-signals and non-electrical parameters.

1146236232	RADIOLOGY	L	T	P	C
Practicum		2	0	2	3

Introduction:

Radiology plays a huge role in disease management by giving physicians more options, tools, and techniques for detection and treatment. Every DMLT engineer is in need of knowledge and skill about various diagnostic equipments 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

- Understand the generation of X-ray and its uses in imaging
- Learn different types of radio diagnostic instruments and techniques
- Describe the principle of Computed Tomography
- Know the techniques used for visualizing various sections of the body.
- Learn radiation therapy methodologies and the safety.

Course Outcomes:

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

CO1: Describe the working principle of X ray machine and its application.

CO2: Illustrate the principle computed tomography.

CO3: Describe the principle of fluoroscopy

CO4: Explain the principle of MRI and mammography

CO5: Outline the methods of radiation safety.

Pre-requisites:

Basic knowledge on medical equipments

1146236232	RADIOLOGY	L	T	P	C
Practicum		2	0	2	3

CO/PO Mapping

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

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

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	Written Test 1 (Units 1 & II)	Written Test 2 (Units III & IV)	Model Written Examination	Record Work	Written Examination
Duration	2 hours	2 hours	3 hours	-	3 hours
Exam Marks	60	60	100	20	100
Converted to	20	20	10	10	60
Internal Marks	20		10	10	60

Note:

- CA1 and CA2 Assessment test should be conducted as per the question pattern. Best of one will be considered for 20 Marks.
- CA3 Model examination should be conducted as per the end exam question pattern.

1146236232	RADIOLOGY	L	T	P	C
Practicum		2	0	2	3

- CA4: Record for the experiments should be maintained and the same have to be evaluated after completion of each practical exercise before the commencement of the next exercise for **20** Marks. The marks awarded should be converted to **10 Marks** for the internal assessment.

Question pattern:

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

1146236232	RADIOLOGY	L	T	P	C
Practicum		2	0	2	3

Unit I	**X-RAY**	
THEORY 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		6
PRACTICAL **Experiment-1**: Study the working of X-ray **Experiment 2**: Maintenance of X-ray		3 3

1146236232	RADIOLOGY	L	T	P	C
Practicum		2	0	2	3

UNIT II	**COMPUTED TOMOGRAPHY**	
THEORY Basic principle-Mathematical basis of image construction(back projection reconstruction)-block diagram of computed tomography(CT)-scanner-spiral CT -3D Imaging and its applications		6
PRACTICAL **Experiment-3**: Visit the hospital and study the working of CT		3
UNIT III	**FLUOROSCOPY**	
THEORY Fluoroscopic Equipment- Direct fluoroscopy-Fluoroscopic screen-Fluoroscopic image- factors affecting fluoroscopic image-Difference between radiography and fluoroscopy ,Angiography–concepts and types		6
PRACTICAL **Experiment-4**: Preparation of patient for fluoroscopy imaging **Experiment-5**: Study of working principle of fluoroscopy		3 3 3
UNIT IV	**MRI AND MAMMOGRAPHY**	
THEORY **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-spindensity,Spin lattice relaxation time t_1, Spin-spin relaxation time t_2, blockdiagram of a MRI system and its applications **Mammography:** Basic principles–equipment details-heel effect-compression paddle-and its advantages-viewing conditions-Magnificationmammography and digital mammography		6

1146236232	RADIOLOGY	L	T	P	C
Practicum		2	0	2	3

PRACTICAL **Experiment-6**: Preparation of patient for digital mammography **Experiment-7**: Study of working principle of MRI	3 3
UNIT-V **RADIATION THERAPY AND RADIATION SAFETY**	
THEORY 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	6
PRACTICAL **Experiment-8**: Visit the hospital and study about various radiological equipments and its safety measures	9
Total Hours	**60**

STUDENT ACTIVITY:

- Visit the hospital and submit the report.

TEXT BOOKS:

- B.H. Brown, R.H. Smallwood, D.C. Barber, P.V. Lawford, D.R. Hose, "Medical Physics and Biomedical Engineering", Institute of physics publishing, Bristol and Philadelphia, 1999.
- Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine" Fourth edition Springer, 2006.

REFERENCES

- W.J. Meredith and J.B. Massey "Fundamental Physics of Radiology" Varghese Publishing house, Third Edition, 2013.
- Steve Webb, The Physics of Medical Imaging, Taylor & Francis, Newyork, Second Edition, 2012.
- R.S. Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003.

E- **Web-based/Online Resources**

- http://www.nptel.ac.in/courses/115102017/ , "Nuclear science and Engineering", Dr. Santanu Gosh, Department of Physics, IIT, Delhi.
- http://www.uthgsbsmedphys.org/GS02-0093/ ," Introduction to Medical Physics", Dr George Starkschall, The University of Texas at Houston.

1146236233	Medical Device Design	L	T	P	C
Practicum		2	0	2	3

Introduction

A medical device design course is specialized to equip students with the knowledge and skills needed to create innovative medical devices. This course typically covers a range of topics related to designing, prototyping, and developing medical technologies. It helps to describe about the design realization and understand the validation and verification of various medical devices.

Course Objectives

The objective of this course is to enable the student to

1. Understand about basic design processes of medical devices
2. Illustrate the design procedure of medical devices
3. Outline the quality assessment in design

Course Outcomes

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

CO1: Define the problem statement from a database of new medical device requirements

CO2: Explain the concept generation and concept selection methods.

CO3: Summarize the concept of medical device development.

CO4: Develop operating plan and business plan.

CO5: Demonstrate the testing and validation of medical equipment.

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Pre-requisites

Basics of medical science

1146236233	Medical Device Design	L	T	P	C
Practicum		2	0	2	3

CO/PO Mapping

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

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

Instructional Strategy

- Instructors should actively engage students to enhance their learning capability.
- The fundamental concepts in medical device design are to be taught with real life examples using theory and demonstrative classes.
- The concepts learnt are to be applied step by step to real world scenarios in laboratory sessions. In depth reading in related area is required to prepare a report on any chosen topic.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test 1 (Units 1 & II)	Written Test 2 (Units III & IV)	Model Written Examination	Record Work	Written Examination
Duration	2 hours	2 hours	3 hours	-	3 hours
Exam Marks	60	60	100	20	100
Converted to	20	20	10	10	60
Internal Marks	20		10	10	60

Note:

- CA1 and CA2 Assessment test should be conducted as per the question pattern. Best of one will be considered for 20 Marks.
- CA3 Model examination should be conducted as per the end exam question pattern.

1146236233	Medical Device Design	L	T	P	C
Practicum		2	0	2	3

- CA4: Record for the experiments should be maintained and the same have to be evaluated after completion of each practical exercise before the commencement of the next exercise for **20** Marks. The marks awarded should be converted to **10 Marks** for the internal assessment.

Question pattern:

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

1146236233	Medical Device Design	L	T	P	C
Practicum		2	0	2	3

Unit I	**NEED FINDING AND SCREENING**	
Strategic Focus – observation and problem identification – Need statement development.		6
Experiment #1: Problem selection from a database of new medical device requirements given by doctors		6
Unit II	**CONCEPT GENERATION AND SELECTION**	
Concept Generation: Ideation and Brainstorming – concept screening, Concept selection: intellectual property basics – reimbursement basics – business models – prototyping – final concept selection.		6
Experiment #2: Concept generation for the identified problem		6
Unit III	**DEVELOPMENT STRATEGY AND PLANNING**	
Intellectual property strategy – research and development strategy – clinical strategy – regulatory strategy – quality and process management – reimbursement strategy –		6

marketing and stakeholder strategy – sales and distribution strategy – competitive advantage and business strategy.	
Experiment #3: Planning and Modular Implementation for the identified problem	6
Unit IV	**INTEGRATION**
Operating plan and financial model- business plan development- funding sources- licensing and alternate pathways.	6
Experiment #4: Integration of modules	6
Unit V	**TESTING AND VALIDATION**
Basis and Types of Testing, Hardware Verification and Data Analysis, Software Verification and Data Analysis.	6
Experiment #5: Testing and Validation	6
TOTAL HOURS	**60**

Suggested List of Students Activity

- In this course students are expected to form a group of 4 to 5 members and formulate a new medical device requirement.
- The details like its background, problem definition, state-of-art technology in that area are to be prepared from literature review.
- The development strategy, integration, testing and formal conclusion are expected in a report form which is to be submitted at the end of the semester.

Reference

1. Matthew Bret Weinger, Michael E. Wiklund, Daryle Jean Gardner-Bonneau'Handbook of Human Factors in Medical Device Design',CRC press,2010
2. Peter J. Ogrodnik, "Medical Device Design: Innovation from Concept to Market", Academic Press Inc; 1st Edition, 2012
3. Paul H. King, Richard C. Fries, Arthur T. Johnson, "Design of Biomedical Devices and Systems", Third Edition, 2014
4. StefanosZenios , Josh Makower , Paul Yock , Todd J. Brinton , Uday N. Kumar , Lyn Denend, Thomas M. Krummel, "Biodesign: The Process of Innovating Medical Technologies", Cambridge University Press; 1 edition, 2009.

Web-based/Online Resources

- https://www.taylorfrancis.com/books/mono/10.1201/b10439/

1146236234	Basics of Bio-Chemistry	L	T	P	C
Practicum		2	0	2	3

Introduction

Basics of Biochemistry explore the fundamental principles of biomolecules and cellular processes essential for understanding life at a molecular level.

Course Objectives

1. Gain foundational understanding of biomolecules and cellular processes.
2. Develop skills in analyzing and applying biochemical principles.

Course Outcomes

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

CO1: Demonstrate a thorough grasp of the structure and function of bio molecules, as well as key cellular processes in biochemistry.

CO2: Exhibit the ability to analyze biochemical principles and apply them to solve problems in various biological contexts.

Pre-requisites

-> Basic knowledge of cellular biology and general chemistry.

CO/PO Mapping

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

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

Instructional Strategy

- Hands-on Laboratory Sessions: Provide students with practical experience in utilizing different recording techniques and equipment to record and analyze bio-signals and non-electrical parameters. This hands-on approach will enhance their proficiency and understanding of the subject matter.

1146236234	Basics of Bio-Chemistry	L	T	P	C
Practicum		2	0	2	3

- Case Studies and Problem-Solving Exercises: Present real-world case studies and problem-solving exercises to challenge students to apply theoretical concepts to practical scenarios. This will help them develop critical thinking and problem-solving skills essential for recording and interpreting bio-signals accurately.

- Group Projects and Collaborative Learning: Encourage collaborative learning through group projects that require students to work together to record and analyze bio-signals and non-electrical parameters. This will foster teamwork and communication skills while deepening their comprehension of the course material.

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Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test 1 (Units 1 & II)	Written Test 2 (Units III & IV)	Model Written Examination	Record Work	Written Examination
Duration	2 hours	2 hours	3 hours	-	3 hours
Exam Marks	60	60	100	20	100
Converted to	20	20	10	10	60
Internal Marks	20		10	10	60

Note:

- CA1 and CA2 Assessment test should be conducted as per the question pattern. Best of one will be considered for 20 Marks.
- CA3 Model examination should be conducted as per the end exam question pattern.
- CA4: Record for the experiments should be maintained and the same have to be evaluated after completion of each practical exercise before the commencement of the next exercise for **20** Marks. The marks awarded should be converted to **10 Marks** for the internal assessment.

1146236234	Basics of Bio-Chemistry	L	T	P	C
Practicum		2	0	2	3

Question pattern:

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

1146236234	Basics of Bio-Chemistry	L	T	P	C
Practicum		2	0	2	3

Unit I	**Water and Electrolytes**
Water – water balance – distribution of water in body – water intake (Exogenous and Endogenous)– water output (Urine, Skin, Lungs, Faces). Electrolyte – composition of electrolyte in the body fluids (Extracellular and Intracellular fluids)–Regulation of Electrolyte balance (Aldosterone, ADH & Renin-angiotensin).	8
Experiment #1: Collection of blood and Preparation of Serum and Plasma	2
Unit II	**Carbohydrates**
Carbohydrates – definition, classifications of Carbohydrates – major pathways of carbohydrate metabolism–Glycolysis, glycogenesis, glycogenolysis, gluconeogensis, TCA cycle, electron transport system – Regulation of blood glucose level- abnormalities of glucose metabolism determination of blood glucose level – clinical significance- hypoglycemia and hyperglycemia complications. Effect of insulin–Role of horm one	8

in blood glucose homeostasis-IDDM,NIDDM.		
Experiment #2: Estimation of True glucose – Glucose oxidase (GOD)method		2
Unit III	**Proteins and Amino acids**	
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. Amino acids – classification of amino acids – Essential and Non-essential amino acids- amino acids derivatives of proteins - Metabolic fate of amino acids–(glycogenic, Ketogenic and Glycogenic – ketogenic amino acids)– –clinical features of Phenylketonuria, albinism, Proteinuria, Micro albuminuria, Parkinson's disease.		8
Experiment #3: Estimation of Total Protein–Biuret method Experiment #4: Estimation of Blood Urea – Diacetyl monoxime – Thiosemicarbazide (DAMTSC) method		4
Unit IV	**Lipids and Lipoproteins**	
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, VLDL – clinical significance of Hyperlipidemia and hypolipidemia – Lipid profile test – Estimation of Serum total cholesterol, HDL cholesterol, total Cholesterol /HDL cholesterol ratio, serum triglycerides.		8
Experiment #5: Estimation of Total Cholesterol–Modified Zak method and Sacket Method Experiment #6: Estimation of Triglycerides-Enzymatic method Experiment #7:Estimation of HDL/LDL cholesterol		6
Unit V	**Vitamins and Minerals**	

1146236234	Basics of Bio-Chemistry	L	T	P	C
Practicum		2	0	2	3

Vitamins- classification of vitamins– fat soluble and water soluble vitamins – distary requirements – biochemical functions of vitaminsDeficiency syndromes. Minerals-Biochemical function of minerals– dietary requirements–diseases related to minerals – Hypocalcemia, rickets, osteoporosis, Addison's disease (Cushing's syndrome), Wilson's disease.	8
Experiment #8: Estimation of serum creatinine – Alkaline picrate method Experiment #9: Estimation of serum Bilirubin–Malloy & Evelyn method	6
TOTAL HOURS	60

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course
- Periodic lab quizzes conducted on a weekly/fortnightly based on the course
- Organize a workshop where students can practice using different bio-signal recording devices and techniques to gain practical experience in capturing bio-signals accurately.
- Provide students with simulation exercises that simulate practical scenarios where they must apply theoretical concepts to accurately record and analyze bio-signals and non-electrical parameters.

Reference Books :

1. KanaiL. Mukherjee-Text book of Medical laboratoryTechnologyVol1,2 & 3.
2. U.Satyanarayana and U.Chakrapani–Biochemistry–third Edition 2009
3. Prem Prakash Gupta–Text book of Biochemistry with biomedicalsignificance-2ndedition
4. R.C.Guptaand S.Bhargava-Practical Bio chemistry – 5thEdition

1146236235	BLOOD BANKING TECHNIQUES	L	T	P	C
Practicum		2	0	2	3

Introduction:

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:

The objective of this course is to

- Know about blood banking method
- Know about blood groups and antigens
- Get knowledge about anticoagulants
- Know about blood transfusion
- Know about compatibility testing

Course Outcomes:

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

CO1: Describe the maintenance record and documentation blood bank

CO2: Explain the mechanism of antigen antibody reactions

CO3: Identify the various techniques of blood grouping

CO4: Understand the purpose of anticoagulants used in blood banks

CO5: Understand the importance of pretransfusion testing.

Pre-requisites:

Knowledge on Human anatomy and physiology

CO/PO Mapping

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

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

1146236235	BLOOD BANKING TECHNIQUES	L	T	P	C
Practicum		2	0	2	3

Instructional Strategy:

- Focus on body fluids..
- Focus on medical terminology.
- Conduct laboratory-based activities that allow students to use their own blood samples
- Explore and solve a medical mystery with laboratory equipments.

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test 1 (Units 1 & II)	Written Test 2 (Units III & IV)	Model Written Examination	Record Work	Written Examination
Duration	2 hours	2 hours	3 hours	-	3 hours
Exam Marks	60	60	100	20	100
Converted to	20	20	10	10	60
Internal Marks	20		10	10	60

Note:

- CA1 and CA2 Assessment test should be conducted as per the question pattern. Best of one will be considered for 20 Marks.
- CA3 Model examination should be conducted as per the end exam question pattern.
- CA4: Record for the experiments should be maintained and the same have to be evaluated after completion of each practical exercise before the commencement of the next exercise for **20** Marks. The marks awarded should be converted to **10 Marks** for the internal assessment.

Question pattern:

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

1146236235	BLOOD BANKING TECHNIQUES	L	T	P	C
Practicum		2	0	2	3

1146236235	BLOOD BANKING TECHNIQUES	L	T	P	C
Practicum		2	0	2	3

Unit I	BLOOD BANK MANAGEMENT	
THEORY Reception and recording of specimen — cataloging and indexing- maintenance of records-bio safety and infection control in blood bank—Medico legal — aspects – antigen and antibody reactions.		6
PRACTICAL **Experiment-1**: Testing of antigens and antibodies **Experiment 2**: Study of Maintenance of medical records in blood bank		3 3
Unit II	**INHERITANCE OF BLOOD GROUP SYSTEM**	
THEORY Blood group antigensandantibodies—ABO & H antigens — Rh blood group system-testing for A_1 and A_2 subgroups-Technique of Blood grouping and Rh typing Sources of error in grouping and Rh typing.		6
PRACTICAL **Experiment 3**: ABO Blood grouping -slide method and tube method **Experiment 4**: Rh typing slide method and tube method		3 3
Unit III	**PREPARATION OF ANTICOAGULANTS**	
THEORY Preparation and uses of –Acid citrate dextrose (ACD), Citrate phosphate Dextrose (CPD-A, CPD-A1, CPD-A2), heparin, ethylene diaminete traacetic acid (EDTA), Optimal additive solution(OAS), Storage and transportation of blood-physical and biochemical changes in stored blood and blood components.		6

1146236235	BLOOD BANKING TECHNIQUES	L	T	P	C
Practicum		2	0	2	3

PRACTICAL **Experiment 5**: Preparation of anticoagulants **Experiment 6**: Testing for A1 and A2 subgroups	 3 3
Unit IV	**BLOOD TRANSFUSION**
THEORY Collection of blood-Pre transfusion Clinical significance of Compatibility testing—— Major cross Matching, Minor cross matching- separation of blood components— blood transfusion technique.	6
PRACTICAL **Experiment 7**: Cross matching-Major cross matching **Experiment 8**: Cross matching-Minor cross matching	 3 3
Unit V	**COMPATIBILITY TESTING**
THEORY LISS(Low ionic strength solution) method, Coomb's Test or Antihuman globul in test–Direct and indirect methods	6
PRACTICAL **Experiment 9**: Compatibility testing-Coomb's test-direct method **Experiment 10**: Compatibility testing-Coomb's test-indirect method	 3 3
TOTAL HOURS	**60**

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course
- Periodic quizzes conducted on a weekly/fortnightly based on the course
- Students can visit nearby Laboratory to know more about various blood tests.

Text Books:

- S R Mehdi. Text "Essentials of blood banking". Jaypee brothers medical publishers 2013.
- Ganga S Pilli "Blood banking and transfusion medicine", second Edition,CBS publishers 2021

1146236235	BLOOD BANKING TECHNIQUES	L	T	P	C
Practicum		2	0	2	3

References:

1. Kanai L. Mukherjee-Text book of Medical laboratoryTechnologyVol1,2&3.
2. V.H. Talib - Practical Textbook of Laboratory Medicine.
3. A.B. Dutta – Blood bank and Transfusion.
4. H.B. Williams- Laboratory manual of Serology, Immunology and Bloodbanking
5. Dacee-Haematology and Blood banking

E- **Web-based/Online Resources**

- https://www.researchgate.net/publication/277935782_A_Novel_Technique_for_Online_Blood_Bank_Management
- https://www.gihsonline.com/blood-banking-management/

List of Equipments

S.No	Name of Equipments	Quantity
1	Test tube	30
2	Chemical reagents	As required
3	Burners	2
4	Centrifuge	2
5	Microscope	2
6	Test tube holders	15
7	Beakers	20
8	Incubator	2
9	Glass slides	100
10	Syringes	As required
11	Cotton	As required
12	Lancet	As required

1146236236	CARDIOVASCULAR INVESTIGATION	L	T	P	C
Practicum		2	0	2	3

Introduction

This Course deals with the methods of identifying heart conditions associated with unhealthy, pathologic heart function.

Course Objectives

The objective of this course is to enable the student to

1. Define an ECG and state the fundamental principles of electrocardiography.
2. Calculate the heart rate from an ECG tracing.
3. Identify the various planes and Axis of an ECG.
4. Comprehend the steps of ECG interpretation including the properties of a normal sinus rhythm.
5. Describe the need for a holter monitor
6. Conduct independently a tread mill test.
7. List the various emergencies that can be expected during a tread mill test.

Course Outcomes

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

CO1: Enumerate on the working of an ECG machine, the various parts and the maintenance of the same.

CO2: Describe the properties and characteristics of each type of arrhythmia

CO3: Interpret sinus node arrhythmias, atrial and ventricular arrhythmias on an ECG.

CO4: Enumerate the technologist's role in maintaining a holter monitor.

CO5: Explain the physiology of exercise testing the indications, contraindications and the precautions to be taken for the tread mill test.

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Pre-requisites

Knowledge of basic science

1146236236	CARDIOVASCULAR INVESTIGATION	L	T	P	C
Practicum		2	0	2	3

CO/PO Mapping

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

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

Instructional Strategy

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

1146236236	CARDIOVASCULAR INVESTIGATION	L	T	P	C
Practicum		2	0	2	3

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 marks)
	CA1	CA2	CA3	CA4	
Mode	Written Test 1 (Units 1 & II)	Written Test 2 (Units III & IV)	Model Written Examination	Record Work	Written Examination
Duration	2 hours	2 hours	3 hours	-	3 hours
Exam Marks	60	60	100	20	100
Converted to	20	20	10	10	60
Internal Marks	20		10	10	60

Note:

- CA1 and CA2 Assessment test should be conducted as per the question pattern. Best of one will be considered for 20 Marks.
- CA3 Model examination should be conducted as per the end exam question pattern.
- CA4: Record for the experiments should be maintained and the same have to be evaluated after completion of each practical exercise before the commencement of the next exercise for **20** Marks. The marks awarded should be converted to **10 Marks** for the internal assessment.

Question pattern:

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

1146236236	CARDIOVASCULAR INVESTIGATION	L	T	P	C
Practicum		2	0	2	3

1146236236	CARDIOVASCULAR INVESTIGATION	L	T	P	C
Practicum		2	0	2	3

Unit I	**BASIC ELECTROCARDIOGRAPHY (ECG)**	
Theory Fundamental principles of electrocardiography - Cardiac electrical field generation during activation - Cardiac electrical field generation during ventricular recovery - Leads and their position - Standard limb leads - Precordial leads and the Wilson central terminal - Augmented limb leads - The hexaxial reference frame and electrical axis - Recording adult and pediatric ECGs - Normal electrocardiogram-explaining PQRST - Normal timings - Heart rate calculations - Sinus tachycardia - Sinus bradycardia - Sinus arrhythmia- Removal of leads		6
Practical Experiment #1: Recording a 12 lead ECG and a rhythm strip		6
Unit II	**ADVANCED ELECTROCARDIOGRAPHY (ECG)-I**	
Theory Interpretation of and ECG strip - Steps involved - ECG abnormalities - Atrial arrhythmias - Left atrial abnormality - Right atrial abnormality - Ventricular arrhythmias - Left ventricular hypertrophy and enlargement - Right ventricular hypertrophy and enlargement - Intraventricular conduction delays - Left anterior fascicular block - Left posterior fascicular block - Left bundle branch block - Right bundle branch block - Myocardial ischemia and infarction		6
Practical Experiment #2: Steps in interpretation of an ECG ▪ Atrial premature contractions (ectopics) ▪ Atrial tachycardia ▪ Ventricular pre-excitation ▪ Left and right bundle branch block ▪ Ventricular escape beats ▪ Ventricular premature beats (ectopics).		9
Unit III	**ADVANCED ELECTROCARDIOGRAPHY (ECG)-II**	
Theory		6

Cardiac arrhythmias - Premature atrial contraction - Supra-ventricular tachycardias - Atrial flutter/fibrillation - Junctional rhythm - Accelerated junctional rhythm - Ventricular premature beats - Ventricular Tachycardia/Ventricular fibrillation - Torsedes de pointes - Idioventricular rhythm - Accelerated idioventricular rhythm - Atrio Ventricular block - Atrio Ventricular block - First degree - Second degree Mobitz type 1 and 2 block - Complete heart block - A technologist's role in ECG interpretation - Maintenance and Care of the ECG Machine.	
Practical Experiment #3: Maintenance and care of ECG machines. ▪ Atrial flutter ▪ Atrial fibrillation ▪ Supraventricular tachycardia ▪ Accelerated AV noda (junctional rhythm)	6
Unit IV **HOLTER**	
Theory Introduction to the Holter test - Indications for a holter test - Precautions to be taken during holter testing - Principles of Holter Recording - Connections of the Holter recorder - Holter Analysis - Guidelines for ambulatory electrocardiography - Procedure for a Holter test	6
Practical Experiment #4: Interpretation of a Holter test	6
Unit V **TREADMILL EXERCISE STRESS TESTING**	
Theory History Taking- Exercise physiology - Exercise protocols - Lead systems - Patient preparation - ST segment displacement – types and measurement – Non electro cardiographic observations - Exercise test indications, contra-indications and precautions- Recognition of patient risk factors associated with exercise tolerance - Cardiac arrhythmias and conduction disturbances during stress testing	6
Practical Experiment #5: Conducting a Stress Test.	3
TOTAL HOURS	**60**

Suggested List of Students Activity

- Presentation by students on recent trends on the relevant topics
- Periodic quizzes can be conducted

1146236236	CARDIOVASCULAR INVESTIGATION	L	T	P	C
Practicum		2	0	2	3

Reference

1. Dhanjoo N. Ghista Noninvasive Cardiac assessment technology

2. Alberto Benchimol - Non-invasive diagnostic techniques in cardiology Williams & Wilkins, 1981

3. Atul Luthra ECG Made Easy JP Medical Ltd, 2012

4. Malcolm S. Thaler The Only EKG Book You'll Ever Need, Volume 365 Lippincott Williams & Wilkins, 2009

Web-based/Online Resources

https://nptel.ac.in/courses/127106232

https://www.primescholars.com/cardiovascular-investigations-open-access.html

List of Equipment's

S.No	Equipments	Quantity Required
1	ECG machine	2
2	Holter Monitor	2
3	Electrodes	As required