

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

Introduction

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

Course Objectives

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

Course Outcomes

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

- CO1: Summarize the basic concepts, classifications and mathematical properties of signals.
- CO2: Classify and compare continuous and discrete time systems.
- CO3: Elucidate the various signal transformation techniques.
- CO3: Explain Fourier representation of signals.
- CO4: Explain Laplace, Inverse Laplace and Z-transforms.
- CO5: Understand the concept of random signals and its response to random inputs.

Pre-requisites

Differentiation and Integration.



1146234540	Basics of Signals and 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	2	-	-	-
CO2	3	2	2	2	-	-	-
CO3	3	2	2	2	-	-	-
CO4	3	2	2	2	-	-	-
CO5	3	2	2	2	-	-	-

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

Instructional Strategy

- Teachers have to use different teaching method for easy to learn of students.
- To help the students to visualize the waveform of various signals.
- To give demo to the students by teachers using various multimedia.
- To motivate the students the importance and various applications of signals and systems.
- To familiarise the students by using interactive simulations in MATLAB / Scilab / Octave / Mathematica / LabView softwares.
- To introduce the students about the practical bio-medical signals such as ECG, EEG, EMG etc

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)	
	CA1	CA2	CA3		Written Examination	Practical Examination
Mode	Assignment	Record Writing	Written Examination	Practical Examination		



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

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

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



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

1146234540	Basics of Signals and Systems	L	T	P	C
Practicum		1	0	4	3
Unit I	Introduction to Signals and Systems				
Continuous and discrete time signals: Classification of Signals: periodic and aperiodic – even and odd – energy and power signals – deterministic and random signals –exponential and sinusoidal signals. Periodicity: unit impulse and unit step – Transformation of Independent Variable Signals: time scaling and time shifting.					3
Ex.No	Name of the Experiment				
1	Write and Execute MATLAB/Scilab/Octave program to plot the following continuous time signals <ul style="list-style-type: none"> • step function • impulse function • exponential function • ramp function • sine function • random signal 				12
2	Write and Execute a MATLAB/Scilab/Octave program to plot the following discrete time signals <ul style="list-style-type: none"> • step function • impulse function • exponential function • ramp function • sine function • random signal 				
3	Write and Execute a MATLAB/Scilab/Octave code to perform time scaling and time shifting of a given signal.				
Unit II	Signal Transformation				
Fourier transformation of continuous and discrete time signals and their properties - Laplace transformation – analysis with examples and properties – Parseval's theorem.					3
Ex.No	Name of the Experiment				



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

4	Write and Execute a MATLAB/Scilab/Octave code to calculate and plot Fourier Transform of a given signal.	
---	--	--

Unit III	The Laplace Transform		
The region of convergence for Laplace Transforms – The Inverse Laplace Transform – Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot – Properties of Laplace Transform.			3
Ex.No	Name of the Experiment		
6	Write and Execute a MATLAB/SciLab/Octave code to laplace transform and inverse laplace transform.		12
7	Write and Execute a MATLAB/SciLab/Octave code to the pole-zero plot for the given signal.		
Unit IV	Z-Transform		
Basic Principles of z-transform, z-transform definition – Relationship between z-transform and Fourier transform – region of convergence of ROC – Properties of z-transform – Poles and Zeros – Inverse z-transform using Contour integration.			3
Ex.No	Name of the Experiment		
8	Write and Execute a MATLAB/Scilab/Octave code to calculate and plot Z-Transform of a given signal.		12
9	Write MATLAB/Scilab/Octave Program to find inverse Z-transform for the given sequence.		
Unit V	Random Signals and Systems		
Definitions – distribution and density functions – mean values and moments – function of two random variables – concepts of correlation, random processes, spectral densities – response of LTI systems to random inputs.			3
Ex.No	Name of the Experiment		
10	Write and Execute MATLAB/Scilab/Octave code to find the response of LTI system to any random input.		12
TOTAL HOURS			75
5	Write and Execute a MATLAB/Scilab/Octave code to verify Parseval's theorem.		



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

Text Books

- Alan V Oppenheim, Alan S Willsky and S Hamid, Signals and Systems (2/e), 1996.
- J G Proakis and D G Manolakis, Digital Signal Processing – Principles, Algorithms and Applications (3/e), PHI, 1996.
- Hwei Sue, Outline of Signals and Systems (1/e), Schaum's Outline, McGraw Hill.
- Simon Haykin and Van Veen, Signals and Systems (2/e), Wiley.
- Robert, Signals and Systems using Transformation Methods and MATLAB 2003, TMH
- C L Phillips, J M Parr and Eve A Riskin, Signals, Systems and Transformations (3/e), Pearson Education, 2004.
- L J Nagrath, S N Sharan, R Ranjan and S Kumar, Signals and Systems, 2001.
- Luis F Chaparro, Signals and Systems using MATLAB, Elsevier.
- Richard J Tervo, Practical Signals Theory with MATLAB Applications.
- Matthew N O Sadiku and Warsame H Ali, Signals and Systems – A Primer with MATLAB, CRC Press.

Web-based/Online Resources

<https://in.mathworks.com/campaigns/products/trials.html>

<https://www.scilab.org/download/scilab-6.1.1>

<https://cloud.scilab.in/>

https://onlinecourses.nptel.ac.in/noc21_ee28/preview

https://spoken-tutorial.org/tutorial-search/?search_foss=Scilab&search_language=English

<https://script.spoken-tutorial.org/index.php/Signal-Processing>

Equipments / Facilities Required (for 30 students)

S.No	Name of the Equipment / Software	Required Quantity
1	Desktop Computers / Laptop Computers	30
2	Laser Printer (A4 size)	1
3	UPS (5 KVA) with atleast 1 hour backup	1
4	MATLAB / Octave / Scilab Software	--



1146235110	Medical Assist Devices	L	T	P	C
Theory		4	0	0	4

Introduction

Assistive technology includes systems and services that help the quality of life and independent functioning of an individual with a disability. Medical Assistive Technologies are tools or equipment that help people with activities of daily living (ADLs). ADLs include dressing and undressing, eating, continence, hygiene, and mobility.

This course includes various mechanical techniques that will help failing heart and learn the functioning of the unit which does the clearance of urea from the blood, they tests to assess the hearing loss and development of electronic devices to compensate for the loss, the various orthotic devices and prosthetic devices to overcome problems, electrical stimulation techniques used in clinical applications.

Course Objectives

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

- discuss various cardiac assist devices
- explain the function of dialysers
- familiarize the hearing tests and hearing aids
- describe the various orthotic devices and prosthetic devices
- explain the electrical stimulation techniques used in clinical applications
- understand AI techniques used in Medical Assist Devices

Course Outcomes

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

- CO1: know the role and importance of assist devices
- CO2: explain the concepts of various cardiac supporting devices
- CO3: differentiate the various hearing aids
- CO4: know the role and importance of rehabilitation and related aspects
- CO5: summarize the concepts of various stimulators



1146235110	Medical Assist Devices	L	T	P	C
Theory		4	0	0	4

Pre-requisites

Basic Electronics & Medical Instrumentation

CO/PO Mapping

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

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

Instructional Strategy

- Teachers have to use different teaching method for easy to learn of students.
- To help the students to learn different types of assist devices and their functions.
- To give demo to the students by teachers using various multimedia.
- To arrange for industrial visits manufacturing medical assist devices.
- To arrange for field visits to nearby sophisticated hospitals which prescribes such devices to patients.
- To arrange to online / offline quiz programmes



1146235110	Medical Assist Devices	L	T	P	C
Theory		4	0	0	4

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Model	Written Unit I & II (at the end of 6 th week)	Written Unit III & IV (at the end of 12 th 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 subdivisions out of 3 from each question under Part –B.	(5Q X 14 =70 Marks)(7+7)



1146235110	Medical Assist Devices	L	T	P	C
Theory		4	0	0	4

1146235110	Medical Assist Devices	L	T	P	C
Theory		4	0	0	4
Unit I	Cardiac Assist Devices				
Principle of External counter pulsation techniques, intra aortic balloon pump, Auxiliary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves. Non invasive battery techniques.					12
Unit II	Hemodialysers				
Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyzer monitoring and functional parameters. Electronic kidneys and wearable dialysis devices.					12
Unit III	Hearing Aids				
Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.					12
Unit IV	Prosthetic and Orthodic Devices				
Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical stimulation, sensory assist devices. Cortical and retinal implants- Blind mobility.					12
Unit V	Digital Instruments - II				
Transcutaneous electrical nerve stimulator, Trans cranial magnetic stimulation (TMS) and Transcranial direct current stimulation (TDCS), bio-feedback. Wheel Chair, Manual and powered wheel chair-Wheel chair transportation. Case study of AI optimized Medical Assist Devices.					12
TOTAL HOURS					60



1146235110	Medical Assist Devices	L	T	P	C
Theory		4	0	0	4

Reference Books

- Albert M Cook and Webster J G, Therapeutic Medical Devices, Prentice Hall Inc., New Jersey, 1982.
- Levine S N, Advances in Biomedical Engineering and Medical Physics, Vol I to IV, Inter University Publications, New York, 1968.
- Joseph D. Bronzino, Donald R. Peterson. Medical Devices and Human Engineering, CRC Press, New York, 2015.
- Kolff W J, Artificial Organs, John Wiley and Sons, New York, 1976.
- Peter Ogrodnik, Medical Device Design Innovation from Concept to Market (2/e), Elsevier, October 26, 2019.
- Rory A Cooper, An Introduction to Rehabilitation Engineering, Taylor and Francics , CRC Press, 2006
- Andreas F Von racum, Hand book of Bio material Evaluation, Mc.Millan Publishers, Edition 1980
- D.S. Sunder, Rehabilitation Medicine, 3rd Edition, Jaypee Medical Publication, 2010.
- A.C Anand, J F Kennedy, M.Miraftab, S.Rajendran, Wood head Medical Textiles and Biomaterials for Healthcare, Publishing Limited 2006.
- D F Williams, Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment Volume, VCH Publishers 1992.
- BD Ratner, AS Hoffmann, FJ Schoen, JE Lemmons, An introduction to Materials in Medicine, Academic Press, 1996.

Web-based/Online Resources

<https://archive.nptel.ac.in/courses/127/106/127106232>



1146235340	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS	L	T	P	C
Practicum		1	0	4	3

Introduction:

This course to enable the students to learn the basic principles of different bio medical instruments viz clinical measurement, Bio-medical recorders, therapeutic instruments, Biotelemetry and Modern imaging techniques instruments.

Course Objectives:

The objective of this course is to

- Understand the device for measurement of parameters related to cardiology
- Illustrate the measurement of recording of EEG
- Demonstrate the biotelemetry and its uses
- Explain the diagnostic and therapeutic devices related to respiratory parameters
- Understand the various sensory measurements

Course Outcomes:

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

- CO1: Describe the working and recording setup of all basic cardiac equipment.
- CO2: Understand the working and recording of all basic neurological equipment's.
- CO3: Discuss the patient safety
- CO4: Explain about measurements of parameters related to respiratory system.
- CO5: Describe the measurement techniques of sensory responses.

Pre-requisites:

Knowledge on basic medical equipment's.



1146235340	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	3	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 medical equipment's
- Focus on medical terminology
- Conduct laboratory-based activities that allow students to use their own bodies with medical equipment's
- Explore and solve a medical mystery

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



1146235340					L	T	P	C
Practicum	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS				1	0	4	3

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

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



1146235340		L	T	P	C
Practicum	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS	1	0	4	3

1146235340		L	T	P	C
Practicum	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS	1	0	4	3
Unit I	CARDIAC EQUIPMENT				
THEORY Electrocardiogram-normal waves-abnormal waves, cardiac pacemaker-external pacemaker-internal pacemaker-defibrillator-AC and DC defibrillator					3
PRACTICAL Experiment #1: Study the working of defibrillator and pacemakers Experiment #2: Recording of ECG signal					6 6
Unit II	NEUROLOGICAL EQUIPMENT				
THEORY Clinical significance of EEG-Multi channel EEG recording system-, Evoked Potential- Visual, Auditory and Somato sensory					3
PRACTICAL Experiment #3: Study of ECG,EMG,EEG electrodes Experiment #4: Measurement of Visually and auditory evoked potential					6 6
Unit III	BIOTELEMETRY AND PATIENT SAFETY				
THEORY Physiological parameters adaptable to biotelemetry-components and applications of biotelemetry-single and multi-channel telemetry system-physiological effect of electric current-leakage current					3
PRACTICAL Experiment #5: Electrical safety measurements Experiment #6: Measurement of various physiological signals using biotelemetry					6 6
Unit IV	RESPIRATORY MEASUREMENTS				



1146235340	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS	L	T	P	C
Practicum		1	0	4	3

THEORY Measurement of respiration rate-spirometer-lung volume-vital capacity-types of ventilators— pressure-volume-time controlled-humidifiers-nebulizers-inhalators-heart lung machine		3
PRACTICAL Experiment #7: Measurement of oxygen saturation and heart rate using pulse oximeter Experiment #8: Study of ventilators and ultrasound scanners		6 6
Unit V	SENSORY DIAGNOSTIC EQUIPMENT	
THEORY Galvanic skin resistance(GSR)-sensory responses-Audiometer, pure, tone, speech-Eye- tonometer-application -		3
PRACTICAL Experiment #9: Galvanic skin resistance (GSR) measurement Experiment #10: Recording of Audiogram		6 6
TOTAL HOURS		75

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 hospital to know more about equipments and hands on experience

Text Books

- John G. Webster, “Medical Instrumentation Application and Design”, 4th edition, Wiley India Pvt Ltd, New Delhi, 2015
- Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson education, 2012



1146235340	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS	L	T	P	C
Practicum		1	0	4	3

References

- L.A Geddes and L.E.Baker, “Principles of Applied Biomedical Instrumentation”, 3rd Edition, 2008.
- Khandpur. R.S., “Handbook of Biomedical Instrumentation”. Second Edition. Tata McGrawHill Pub. Co.,Ltd. 2003.
- Antony Y.K.Chan, “Biomedical Device Technology, Principles and design”, Charles Thomas Publisher Ltd, Illinois, USA, 2008.
- Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Pearson Education, New Delhi, 2007

Web-based/Online Resources

- <https://www.mddionline.com/>
- <https://www.classcentral.com/course/swayam-biomedical-instrumentation-sensors-204236>

List of Equipment's

S.No	Name of Equipment's	Quantity
1	Pacemaker	1
2	EKG	2
3	EMG Trainer kit	2
4	EEG Trainer kit	2
5	Pulse oximeter	2
6	Audiometer	2



1146235540	CLINICAL CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3

Introduction:

This course to enable the students to learn the basic principles of different clinical measurements of heart and reporting of ECG.

Course Objectives:

The objective of this course is to

- Understand the device for measurement of parameters related to cardiology
- Illustrate the measurement of recording of ECG
- Demonstrate the estimation of ECG
- Explain the various diseases caused in heart and chambers
- Understand about the ECG reporting

Course Outcomes:

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

- CO1: Describe the electrode placement of ECG
- CO2: Understand the waves and segments of ECG wave
- CO3: Understand the electrical axis estimation
- CO4: Explain about chamber enlargement and hypertrophy
- CO5: Describe the techniques of ECG reporting

Pre-requisites:

Knowledge of Cardiovascular system



1146235540	CLINICAL CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

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

Assessment Methodology

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)	
	CA1	CA2	CA3		Written Examination	Practical Examination
Mode	Assignment	Record Writing	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	



1146235540	CLINICAL CARDIOLOGY	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**.

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



1146235540	CLINICAL CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3

1146235540	CLINICAL CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3
Unit I	ECG & CARDIAC ELECTRICAL ACTIVITY				
THEORY		ECG(Electrocardiogram)-history-cardiac cycle-correct and incorrect lead placement-display of 12 standard Electrocardiogram leads-recording of cardiac axis activity			3
PRACTICAL		Experiment-1: Recording of ECG signal in Adult patient			6
		Experiment 2: Accurate positioning of electrodes			6
Unit II	ECG MEASUREMENT – I				
THEORY		Interpretation of Normal ECG, Electrocardiographic features – Rate & Regularity – P Wave – PR Interval – QRS Complex – ST Segment– T Wave – U Wave – QTC Interval- ECG Wave’s Interval & Segments			3
PRACTICAL		Experiment 3: Recording of ECG in pediatric patients			6
		Experiment 4: Recording and interpretation of blood pressure			6
Unit III	ECG MEASUREMENT – II				
THEORY		Heart rate-Introduction-Measurement of heart rate-Holter recording=stress ECG recording-Electrical axis-methods of Electrical axis Estimation-Rhythmic disorders			3
PRACTICAL		Experiment 5: Holter Recording			6
		Experiment 6: Diagnostic patterns of ECG changes during stress test			6
Unit IV	CAD, CHAMBER ENLARGEMENT & HYPERTROPHY				



1146235540	CLINICAL CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3

THEORY		
CAD (Coronary Artery Disease)- Chamber Enlargement — RAE, LAE — Hypertrophy – Right Ventricular Hypertrophy – Left Ventricular Hypertrophy – Biventricular Hypertrophy-Troubleshooting of ECG		3
PRACTICAL		
Experiment 7: Interpretation of changes in Electrocardiogram		6
Experiment 8: Study of troubleshooting methods for ECG machine		6
Unit V	CLINICAL DISORDER & ECG REPORTING	
THEORY		
Pericardial Effusion – Hyperkalemia – Hypokalemia- Hypercalcemia- Hypocalcemia-Phonocardiogram		3
PRACTICAL		
Experiment 9: Evaluation of pericardial effusion		6
Experiment 10: Measurement of heart sound using PCG		6
TOTAL HOURS		75

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 hospital to know more about equipments and hands on experience

Text Books

1. BS Cheema VSM, “Clinical Cardiology”, CBS publishers and distributors Pvt Ltd, New Delhi, 2023
2. Dr.Rajesh S.Roy, “Clinical Cardiology and Examination”, Bhalani Publishers, 2021

References

1. Michael A. Chinzer ,M.D, “Clinical Cardiology”, 4th Edition, 2011.
2. William J, Brady, Michael J. Lipinski, Wiley “Electrocardiogram in Clinical Medicine”. 2020Edition.



1146235540	CLINICAL CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3

3. Jeff Wilson "Cardiology, A Clinical Guide", Foster Academics, 2016.

E- Web-based/Online Resources

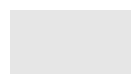
https://onlinecourses.nptel.ac.in/noc22_ge17/preview

<http://www.ecglibrary.com/>

List of Equipments

S.No	Name of Equipment's	Quantity
1	ECG	2
2	Electrodes	As required
3	Sphygmomanometer	2
4	Holter monitor	2
6	Phonocardiogram	2

DRAFT



1146235211	Medical Coding	L	T	P	C
Theory		3	0	0	3

Introduction

Medical coding is the process of transforming descriptions of medical diagnoses and procedures into universal alphanumeric codes. These codes are used for various purposes, including billing, insurance claims, statistical analysis, and research.

Course Objectives

The objective of this course is to enable the student to

- Introduce the fundamentals of medical coding, including the use of ICD and CPT code sets.
- Learn coding guidelines, documentation requirements, and ethical considerations in medical coding practices.

Course Outcomes

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

- CO1: Understand the role of medical coding as a profession within the healthcare industry.
- CO2: Conduct an anatomy review to understand the structural and functional aspects of the human body relevant to medical coding practices..
- CO3: Interpret and apply the ICD-10-CM Official Guidelines for Coding and Reporting in outpatient settings.
- CO4: Differentiate between CPT codes for procedures and HCPCS codes for supplies, equipment, and non-physician services.
- CO5: Demonstrate proficiency in diagnosis coding for E/M services in alignment with coding guidelines and documentation requirements.

Pre-requisites

- Students should have a foundational understanding of how healthcare systems operate, including roles of healthcare professionals, medical terminology, and healthcare documentation.
- Some aspects of medical coding, such as calculating codes for reimbursement or understanding numerical data in healthcare records, may require basic mathematics skills.



1146235211	Medical Coding	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

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

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Model	Written Unit I & II (at the end of 6 th week)	Written Unit III & IV (at the end of 12 th 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



1146235211	Medical Coding	L	T	P	C
Theory		3	0	0	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 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)

1146235211	Medical Coding	L	T	P	C
Theory		3	0	0	3
Unit I	INTRODUCTION TO MEDICAL CODING				
	The Business of Medicine-Coding as a Profession, The Hierarchy of Providers, The Different Types of Payers, Resource-based relative value scale (RBRVS), Medical Necessity, The Need for Privacy and Security, Fraud and Abuse, Need for Compliance Rules and Audits.				9
Unit II	MEDICAL TERMINOLOGY AND ANATOMY REVIEW				
	Introduction, Medical Terminology, Integumentary System, Musculoskeletal System, Cardiovascular System, Lymphatic System, Respiratory System (Pulmonary System), Digestive System, Urinary System, Reproductive Systems, Nervous System, Endocrine System, Hematologic (Hemic) System, Immune System.				9
Unit III	INTRODUCTION TO ICD-10-CM SYSTEM				
	Importance of ICD-10-CM (International Classification of Diseases, 10th Revision,				9



1146235211	Medical Coding	L	T	P	C
Theory		3	0	0	3

Clinical Modification, Overview of ICD-10-CM Layout, Steps to Look Up a Diagnosis Code, ICD-10-CM Official Guidelines for Coding and Reporting, Diagnosis Coding Guidelines for Outpatient Reporting, Codes for Special Purposes (U00–U85).		
Unit IV	CURRENT PROCEDURAL TERMINOLOGY(CPT) AND HEALTHCARE COMMON PROCEDURE CODING SYSTEM (HCPCS)	
Introduction to CPT, The purpose of the CPT manual, CPT manual format, CPT guidelines. Introduction to HCPCS, HCPCS format, Two levels of codes, Modifiers.		9
Unit V	EVALUATION AND MANAGEMENT (E/M) SERVICES	
Introduction and Objectives Of Evaluation and management (E/M) services, Three factors of E/M codes, CPT E/M Services Guidelines, Various levels of E/M service, Choosing the E/M Service Level, Diagnosis Coding for E/M Services.		9
TOTAL HOURS		45

Suggested List of Students Activity

1. Assignments
2. Group Activity

Reference

1. Carol J. Buck, Step-by-Step Medical Coding, Elsevier, latest edition.
2. Nelly Leon-Chisen, ICD-10-CM and ICD-10-PCS Coding Handbook, with Answers, American Hospital Association, latest edition
3. American Medical Association (AMA), CPT Professional 2024, American Medical Association, latest edition.
4. Anne B. Casto, Principles of Healthcare Reimbursement, American Health Information Management Association (AHIMA), latest edition.
5. Carol J. Buck, The Next Step: Advanced Medical Coding and Auditing, Elsevier, latest edition.

Web-based/Online Resources

- <https://www.velocityhc.com/wp-content/uploads/2019/09/Step-by-Step-Medical-Coding-2017-Edition-E-Book.pdf>
- https://cache.aapc.com/cache/pdf/cpc_study_guide_sample_pages.pdf



1146235212	Medical Informatics	L	T	P	C
Theory		3	0	0	3

Introduction

Medical Informatics combines the features of information sciences with the clinical applications.

Course Objectives

The objective of this course is to enable the student to

1. Study the application of information technology in healthcare.
2. Provide knowledge on the data collection, storage and retrieval of the medical data

Course Outcomes

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

- CO1: Explain the structure and functional capabilities of Hospital Information System.
- CO2: Describe the need of computers in medical imaging and automated clinical laboratory.
- CO3: Articulate the functioning of information storage and retrieval in computerized patient record system.
- CO4: Apply the suitable decision support system for automated clinical diagnosis.
- CO5: Discuss the application of virtual reality and telehealth technology in medical industry

Pre-requisites

NIL



1146235212	Medical Informatics	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	2	-	-	-
CO2	3	2	1	2	-	-	-
CO3	3	2	1	2	-	-	-
CO4	3	2	1	2	-	-	-
CO5	3	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 applications to help students understand and appreciate course concepts.

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

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



1146235212	Medical Informatics	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Model	Written Unit I & II (at the end of 6 th week)	Written Unit III & IV (at the end of 12 th 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	4Q X 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)



1146235212	Medical Informatics	L	T	P	C
Theory		3	0	0	3

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)
----------	---	--------------------------

1146235212		Medical Informatics			
Theory		L	T	P	C
Unit I	INTRODUCTION				
Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues , Computer based medical information retrieval, Hospital management and information system, Health Informatics – Medical Informatics, Bioinformatics					9
Unit II	COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING				
Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computerized ECG, EEG and EMG, Computer assisted medical imaging- nuclear medicine, ultrasound imaging, computed X-raytomography, Radiation therapy and planning, Nuclear Magnetic Resonance.					9
Unit III	COMPUTERISED PATIENT RECORD				
Introduction - History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.					9
Unit IV	COMPUTER ASSISTED MEDICAL DECISION-MAKING				
Neuro computers and Artificial Neural Networks application, Expert system-General model of CMD, Computer–assisted decision support system-production rule system cognitive model, decisions analysis in clinical medicine-computers in the care of critically ill patients, Computer aids for the handicapped.					9
Unit V	RECENT TRENDS IN MEDICAL INFORMATICS				
Virtual reality applications in medicine, Virtual endoscopy, Computer Assisted surgery, Surgical simulation, Telemedicine - Tele surgery, Computer assisted Patient education and health- Medical education and health care information.					9
TOTAL HOURS					45



1146235212	Medical Informatics	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

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

Reference

1. 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
3. Kathryn J. Hannah, Marion J Ball, "Health Informatics", 3rd Edition, Springer, 2006.

DRAFT



1146235213	Assist Devices	L	T	P	C
Theory		3	0	0	3

Introduction

The knowledge of assist technology is necessary to understand the functioning and usage of electromechanical units which will restore normal functional ability of particular organ which is defective temporarily or permanently.

Course Objectives

The objective of this course is to enable the student to

1. To know the hardware requirements of various assist devices.
2. To understand and know the functioning of prosthetic devices.
3. To be aware of the working of orthotic devices.
4. To know the recent trends and developments in assistive technology.

Course Outcomes

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

- CO1: Interpret the various mechanical techniques that will help in assisting the heart functions.
- CO2: Describe the underlying principles of hemodialyzer machine.
- CO3: Indicate the methodologies to assess the hearing loss.
- CO4: Evaluate the types of assist devices for mobilization.
- CO5: Explain about TENS and biofeedback system.

Pre-requisites

NIL



1146235213	Assist Devices	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

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



1146235213	Assist Devices	L	T	P	C
Theory		3	0	0	3

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Model	Written Unit I & II (at the end of 6 th week)	Written Unit III & IV (at the end of 12 th 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	4Q X 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)



1146235213	Assist Devices	L	T	P	C
Theory		3	0	0	3

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)
---	---	--------------------------

1146235213		Assist Devices			
Theory					
Unit I	CARDIAC ASSIST DEVICES				
Principle of External counter pulsation techniques, Intra aortic balloon pump, Auxillary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.					9
Unit II	HEMODIALYSERS				
Artificial kidney, Dialysis action, Hemodialyser unit, Membrane dialysis, portable dialyser monitoring and functional parameters.					9
Unit III	HEARING AIDS				
Common tests - audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids - principles, drawbacks in the conventional unit, DSP based hearing aids.					9
Unit IV	PROSTHETIC AND ORTHODIC DEVICES				
Hand and arm replacement - different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical simulation, sensory assist devices.					9
Unit V	RECENT TRENDS IN ASSISTIVE TECHNOLOGY				
Transcutaneous electrical nerve simulator, bio-feedback.					9
TOTAL HOURS					45



1146235213	Assist Devices	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

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

Reference

1. Joseph D Bronzino, “The Biomedical Engineering Handbook” , Third Edition : Three Volume Set, CRC Press, 2006
2. Marion. A. Hersh, Michael A.Johnson, “Assistive Technology for visually impaired and blind”, Springer Science and & Business Media, 1st Edition, 12-May-2010.
3. Yadin David, Wolf W. von Maltzahn , Michael R. Neuman, Joseph.D, Bronzino, “Clinical Engineering”, CRC Press, 1st Edition, 2010

Web-based/Online Resources

- NPTEL (Website): The National Programme on Technology Enhanced Learning (NPTEL) offers free online courses on Assistive Technology and on the emerging field of disability studies. [Assist Technology](#)



1146235214	Basic of Cardiac Technology and ECG	L	T	P	C
Theory		3	0	0	3

Introduction:

This course presents an introduction to heart rate measurements, rhythm of heart beat, hearts muscle cells, cardiac functions, electrical activities, types and segments of ECG waveform, electrodes for ECG measurements.

Course Objectives:

The objective of this course is to

- To provide an understanding about the human anatomy and physiology
- To explore the heart rate measurements.
- To study the medical imaging of heart rate measurements
- To offer an exposure for lab measurements and measuring devices
- To study the handling of heart rate measuring devices.

Course Outcomes:

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

- CO1: Interpret the human anatomy and physiology
- CO2: Apply the principles of heart rate measurements.
- CO3: Explain the imaging techniques in heart rate measurements.
- CO4: Identify and analyse the measurements and measuring devices.
- CO5: Handle heart rate measuring devices and its effects

Pre-requisites:

Knowledge of Basic human anatomy.



1146235214	Basic of Cardiac Technology and ECG	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping:

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

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 Unit I & II (at the end of 6 th week)	Written Unit III & IV (at the end of 12 th 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.



1146235214	Basic of Cardiac Technology and ECG	L	T	P	C
Theory		3	0	0	3

- 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 subdivisions out of 3 from each question under Part –B.	(5Q X 14 =70 Marks)(7+7)

1146235214	Basic of Cardiac Technology and ECG	L	T	P	C
Theory		3	0	0	3
Unit I	Applied Applied Anatomy and Physiology				
<p>Applied Anatomy-Structure of the heart and gross anatomy, normal position, Systemic and pulmonary circulation, coronary structure, Chest topography, Surface marking of heart, aorta, pulmonary artery, precordium, heart valves, subclavian.</p> <p>Applied Physiology- Control of heart rate, Concepts of congenital heart, Blood circulation, cardiac output, pulmonary circulation, pulmonary oedema</p>					9
Unit II	Non-invasive measurements				



1146235214	Basic of Cardiac Technology and ECG	L	T	P	C
Theory		3	0	0	3

Concepts of myocardial functions, Control of circulation, Conduction system of the heart, Technique of ECG recording, ECG Leads system, ECG waves, rate, rhythm, chambers and artifacts, Tread Mill Test (TMT),		9
UNIT III	Non-invasive echocardiography	
Exercise Testing to Diagnose Obstructive Coronary Artery Disease - Rationale and Guidelines, Pretest Probability (true positive, false positive, true negative and false negative ST-Segment Interpretation, Confounders of Stress ECG Interpretation. Result Reporting Echocardiographic views, Imaging modes - two-dimensional (2D) imaging, M-mode imaging, and Doppler imaging, color - flow mapping.		9
UNIT IV	Invasive Technologies	
Lab and biomedical equipments, Radiation safety and protocols. Vascular access - arterial in femoral, radial and ulnar, venous in femoral Catheterization left heart and right heart, Angiography - Chambers. Transducers balancing, measurement of pressures, Calculations of gradients Blood flows, cardiac output and Calculations of cardio shunts, resistances. Prerequisites of lab procedures: Maintaining sterility, PPE - Personnel protective equipments.		9
UNIT V	Gas administration devices	
Gas administration devices (reducing valves, flow meters and regulators). Simple oxygen administration devices. Methods of controlling gas flow. Reducing valve, Flow meters, restrictors and regulators, Selection of device Precautions, advantages and disadvantages		9
TOTAL		45

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

References:



1146235214	Basic of Cardiac Technology and ECG	L	T	P	C
Theory		3	0	0	3

1. Ary L. Goldberger, Zachary D. Goldberger, Alexei Shvilkin , Goldberger's Clinical Electrocardiography, A Simplified Approach, 10th Edition, Elsevier
2. Antoni Bayés, Miquel, Adrian Baranchuk, Clinical Electrocardiography: A Textbook, 5th Edition, Wiley International, 2021
3. R.S. Khandpur, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.

Web-based/Online Resources:

1. <https://archive.nptel.ac.in/courses/127/106/127106232/>

DRAFT



1146235215	BASICS OF TELEHEALTH TECHNOLOGY	L	T	P	C
Theory		3	0	0	3

Introduction

Telehealth is the use of digital information and communication technologies to access health care services remotely and manage your health care. Technologies can include computers and mobile devices, such as tablets and smartphones. This may be technology you use from home. Or a nurse or other health care professional may provide telehealth from a medical office or mobile van, such as in rural areas. Telehealth can also be technology that your health care provider uses to improve or support health care services.

Course Objectives

The objective of this course is to enable the student to

1. Learn the principles of telemedicine and health
2. Understand telemedical technology and its required infrastructure
3. Know telemedical standards and ethics, mobile telemedicine and its applications

Course Outcomes

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

- CO1: To analyze the benefits and limitations of telemedicine.
- CO2: To develop analytics for patient health monitoring.
- CO3: To apply multimedia technologies in telemedicine.
- CO4: To apply telemedicine in various healthcare domains.
- CO5: To explain the need for encryption techniques and secure transmission of data.

Pre-requisites : NIL



1146235215	BASICS OF TELEHEALTH TECHNOLOGY	L	T	P	C
Theory		3	0	0	3

CO/PO Mapping

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	3	1	-	1	2	2
CO2	1	-	1	2	1	3	3
CO3	2	4	2	3	-	2	2
CO4	3	1	3	1	3	1	1
CO5	1	2	2	-	2	-	-

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

Instructional Strategy

- Show video/animation to explain the concepts.
- Ask students (in group of three-four) to prepare a mini project on a particular Telehealth Technology and present in a Seminar/Symposium

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Model	Written Unit I & II (at the end of 6 th week)	Written Unit III & IV (at the end of 12 th 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.



1146235215	BASICS OF TELEHEALTH TECHNOLOGY	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)

1146235215	BASICS OF TELEHEALTH TECHNOLOGY	L	T	P	C
Theory		3	0	0	3
Unit I	INTRODUCTION TO TELEMEDICINE				
Definition of telemedicine, History of telemedicine and telehealth, telecare – Types of telecare, telehealth – Classification of Telehealth streams, Benefits & limitations of telemedicine.					9
Unit II	TYPES OF INFORMATION INFRASTRUCTURE FOR TELEMEDICINE				
Definition of EMR and EHR, Features of EHR, Application of EHR in telehealth, Audio, video, still images, text and data, Problems in Storage, transmission and interpretation of data, Data analytics in the context of telehealth.					9
Unit III	TYPES OF COMMUNICATION INFRASTRUCTURE FOR TELEMEDICINE				



1146235215	BASICS OF TELEHEALTH TECHNOLOGY	L	T	P	C
Theory		3	0	0	3

Telecommunication standards, Teleconsultation system components- Building blocks, Video conferencing system, Multipoint systems, Image display system, Telemonitoring devices, ISDN, Satellite, Wireless technologies, Integration and operational issues.		9
Unit IV	APPLICATIONS OF TELEMEDICINE	
Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery.		9
Unit V	ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE	
Medical ethics, Telemedicine laws, Confidentiality and privacy, Authentication, patient rights and consent, the patient-doctor relationship, access to medical records, consent treatment - data protection & security, Licensure, Jurisdiction.		9
TOTAL HOURS		45

Suggested List of Student Activity

- Visit any nearby reputed hospitals/diagnostic centers.
- 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 content.

Reference

1. IMIA Telehealth working group and Shashi Bhushan Gogia (editor), Fundamentals of telemedicine and telehealth, Academic Press, 2019.
2. Norris A C, "Essentials of Telemedicine and Telecare", John Wiley, New York, 2002
3. Khandpur R S, "TELEMEDICINE – Technology and Applications", PHI Learning Pvt Ltd., New Delhi, 2017.



1146235216	BASICS OF BIOMECHANICS	L	T	P	C
Theory		3	0	0	3

Introduction

This course will enable the students to acquire specific knowledge on the biomechanics of linear and angular kinetics of human motion, biomechanics of hard and soft tissues and joints. Students will learn orthopaedic applications of biomechanics.

Course Objectives

The objective of this course is to enable the student to

1. Study the mechanics involved with various physiological systems
2. Outline the kinetics of human motion and biomechanics of tissues
3. Analyze and apply biomechanics in real-time applications

Course Outcomes

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

- CO1: Understand the fundamental concepts of biomechanics in engineering and analyze its properties.
- CO2: Apply solid and fluid dynamics in biomechanics.
- CO3: Analyze the mechanical properties of hard and soft tissues.
- CO4: Analyze the biomechanical properties of joints.
- CO5: Design and develop the models specific to orthopaedic applications.

Pre-requisites

- Anatomy of human body
- General mechanics of rotational and linear motions

CO/PO Mapping

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

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



1146235216	BASICS OF BIOMECHANICS	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 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.

Assessment Methodology:

	Continuous Assessment (40 marks)				End Semester Examination (60 Marks)
	CA1	CA2	CA3	CA4	
Model	Written Unit I & II (at the end of 6 th week)	Written Unit III & IV (at the end of 12 th 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)



1146235216	BASICS OF BIOMECHANICS	L	T	P	C
Theory		3	0	0	3

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)

1146235216	BASICS OF BIOMECHANICS	L	T	P	C
Theory		3	0	0	3
Unit I	INTRODUCTION				
Definition , Importance of biomechanics, Kinematic concept for analyzing human motion, Linear kinetics of human movement, Equilibrium, Angular kinetics of human movement, Anthropometry.					9
Unit II	BIOMECHANICS OF SOLIDS AND FLUIDS				
Stress, strain, viscoelasticity, models of viscoelasticity, Flow properties of blood, dynamics of fluid flow in cardiovascular system, Rheology of blood in micro vessels, Bio viscoelasticsolids.					9
Unit III	BIOMECHANICS OF HARD AND SOFT TISSUE				
Bone: structure, mechanical properties, fracture mechanisms -pseudo elasticity- mechanical properties of: skin, ligaments, skeletal muscles and tendons, Constitutive equations for soft tissues.					9
Unit IV	BIOMECHANICS OF JOINTS				
Kinetics and kinematics of joints, Skeletal joints, mechanics of the elbow, mechanics of shoulder, mechanics of spinal column, mechanics of hip, mechanics of knee, mechanics of ankle					9
Unit V	ORTHOPAEDIC APPLICATIONS				
Gait analysis, Qualitative biomechanical analysis to: improve technique; understand injury development, Amputations and prosthetics, prosthetic components, Introduction to 3D printing.					9
TOTAL HOURS					45



1146235216	BASICS OF BIOMECHANICS	L	T	P	C
Theory		3	0	0	3

Suggested List of Students Activity

- Presentation/Seminars by students on any recent technological developments based on the course
- Periodic class quizzes conducted on a weekly/fortnightly based on the course
- model designing of linear and angular kinetics of human moment
- simulation of bio mechanics of joints in human body

Reference

1. Y.C.Fung, Bio-Mechanics, Mechanical Properties of Tissues, Springer-Verilog,1993.
2. C. Ross Ether and Craig A. Simmons, Introductory Biomechanics from cells to organisms, Cambridge University Press, New Delhi, 2007.
3. Susan J Hall, Basics of Biomechanics, McGraw Hill Publishing.co. New York, 8th Edition, 2019.
4. Dhanjoo N. Ghista, Orthopaedic Mechanics, Academic Press, 1990.
5. Joseph D.Bronzino, Biomedical Engineering Fundamentals, Taylor& Francis, Fourth edition,2015.

Web-based/Online Resources

- <https://archive.nptel.ac.in/courses/102/106/102106098/>



1146235441	FIBER OPTICS AND LASER IN CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3

Introduction

Fiber optics and LASER have been used in the medical industry for years. The physical characteristics of fiber make it as a natural choice for many different applications. Traditional medical fiber optic applications include light therapy, x-ray imaging, Cardiology, ophthalmic lasers, lab and clinical diagnostics, dental hand pieces, surgical and diagnostic instrumentation, endoscopy, surgical microscopy, and a wide range of equipment and instrument illumination. Laser medicine consists in the use of lasers in medical diagnosis, treatments, or therapies, such as laser photodynamic therapy, photo rejuvenation, and laser surgery. In this course students will learn optical properties of the tissues and the applications of laser in diagnosis and therapy. They get knowledge about instrumentation in photonics and understand the safety usage of laser in cardiology field.

Course Objectives

The objective of this course is to enable the student to

1. Understand the fundamentals and clinical applications of Laser and Fiber Optics.
2. Correlate the knowledge of medicine and engineering for the wellness of human being.
3. Understand the safety aspects while dealing with Laser and Fiber Optic Units in Cardiology.

Course Outcomes

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

- CO1: Discuss and understand the properties of optics fibers and relate with tissues
- CO2: Understanding the basic needs of laser in real time applications
- CO3: Applying the concepts of fiber optic lasers in clinical application
- CO4: Analyzing the fiber optic techniques with medical applications
- CO5: Evaluating the safety procedure of using laser

Pre-requisites

Fundamentals of Engineering Physics & Cardiology Techniques



1146235441	FIBER OPTICS AND LASER IN CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping

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

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

Instructional Strategy:

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



1146235441	FIBER OPTICS AND LASER IN CARDIOLOGY	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



1146235441	FIBER OPTICS AND LASER IN CARDIOLOGY	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	FIBER OPTICS AND LASER IN CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3
Unit I	OPTICAL FIBRES AND THEORY				
Theory	Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Fibre termination – Optical sources – Optical detectors - Fibre optic bio-sensors and instrumentation system.				3
Practical	Experiment #1: To Study the Structure of optical fiber and its working principle Experiment #2: To illustrate the propagation of light through straight and bend fiber.				12
Unit II	OPTICAL PROPERTIES OF THE TISSUE				
Theory	Refraction, Scattering, Absorption, Light transport inside the tissue, Tissue properties, Light interaction with tissues, opto thermal interaction, fluorescence, speckles - Laser Characteristics as applied to medicine.				3
Practical	Experiment #3: To Study the losses and dispersion in fiber optics.. Experiment #4: To design the Laser Simulation & Emission principle.				12
Unit III	CLINICAL APPLICATIONS OF FIBER OPTIC LASER SYSTEMS				
Theory	Properties and types of Laser, Clinical applications of laser, Fiber optic Laser system in - cardiovascular disease, cardiology disease, General and therapeutic surgery.				3
Practical					



1146235441	FIBER OPTICS AND LASER IN CARDIOLOGY	L	T	P	C
Practicum		1	0	4	3

Experiment #5: To Study various types of LASER used in biomedical Engineering.		12
Experiment #6: To design the structure of LASER Concept.		
Unit IV	INSTRUMENTATION IN PHOTONICS	
Theory	Instrumentation for absorption, Scattering and emission measurements, excitation light sources – high pressure arc lamp, LEDs, Lasers, Optical filters, - optical detectors – Time resolved and phase resolved detectors.	3
Practical	Experiment #7: To Design the Concept of LED with Photonic effect. Experiment #8: To Develop the LASER absorption Techniques.	12
Unit V	CARDIOLOGY ANATOMY	
Theory	Heart – Surface and gross anatomy of heart, chambers of the heart, valves of the heart, major blood Vessels of heart, pericardium, coronary arteries, pulmonary circulation and venous system ,Lead and lib configuration.	3
Practical	Experiment #9: <i>To illustrate & Inspecting the ECG Waveform</i> Experiment #10: To study the Cardiac disorder systems.	12
TOTAL HOURS		75

Suggested List of Students Activity

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



1146235442	Installation, Servicing and troubleshooting of ECG Machine	L	T	P	C
Practicum		1	0	4	3

Introduction

Clinical diagnosis depends mainly on a patient's history, and to a lesser extent on the physical examination. The ECG can provide evidence to support a diagnosis, and in some cases, it is crucial for patient management of abnormal cardiac rhythms. It helps with the diagnosis of the cause of chest pain, and the proper use of thrombolysis in treating myocardial infarction that depends upon it. It can help with the diagnosis of the cause of breathlessness. With practice, interpreting the ECG is a matter of pattern recognition.

Course Objectives

The objective of this course is to enable the student to

1. Introduce the need for ECG.
2. Understand instrumentation and the basic principles of lead theory needed for the effective and safe practice of electrocardiography.
3. Understand care and maintenance of the equipment.
4. Comprehend the faults in the equipment.
5. Visualize the analysis of solutions for faults.

Course Outcomes

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

- CO1: Identify and enumerate medical uses of ECG.
- CO2: Detect QRS in ECG signals.
- CO3: Gain adequate knowledge on caring and maintenance of ECG machine.
- CO4: Knowledge on various errors in the recorder.
- CO5: Knowledge on safety equipment.

Pre-requisites:

Basic knowledge on Human Physiology, Basic Heart Diseases, importance of ECG



1146235442	Installation, Servicing and troubleshooting of ECG Machine	L	T	P	C
Practicum		1	0	4	3

CO/PO Mapping:

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

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

Instructional Strategy

- Engage and Motivate: Instructors should actively engage students to boost their learning Confidence.
- Real-World Relevance: Incorporate relatable, real-life examples and engineering applications to help students understand and appreciate course concepts.
- Interactive Learning: Utilize demonstrations and plan interactive student activities for an engaging learning experience.
- Application-Based Learning: Employ 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.



1146235442	Installation, Servicing and troubleshooting of ECG Machine	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



1146235442	Installation, Servicing and troubleshooting of ECG Machine	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

1146235442	Installation, Servicing and troubleshooting of ECG Machine	L	T	P	C
Practicum		1	0	4	3
THEORY					
Unit I	INTRODUCTION & SAFETY INFORMATION				
Brief introduction to Electrocardiographs & its medical Uses a.Intended Uses of ECG b. Intended Users c. Indications of Use d. Contraindications for use of Electrocardiograph Safety Information - Typical symbols and markings on packaging - Equipment Identification & labels					3 Hrs
Unit II	RESTING AND STRESS ECG SYSTEM				
Types of Electrocardiograms & ECG Equipment 1. Resting ECG 2. Stress ECG or exercise ECG - Resting ECG Equipment - Typical Block diagram & Interfaces Patient Preparation-Recording a resting ECG, Stress ECG System - Typical Block diagram of stress system - Patient preparation - Monitoring stress ECG, Installing, retrieving, and viewing Holter ECG recordings					3 Hrs
Unit III	CARE AND MAINTENANCE				
Cleaning - Typical maintenance tasks - Device Storage and transport between uses - Disposal.					3 Hrs
Unit IV	TROUBLESHOOTING				
Understanding status indicators - Standard Tools and equipment used for troubleshooting - Common error conditions & troubleshooting steps					3 Hrs
Unit V	SERVICING & DEVICE REPAIR				
Understanding Responsibilities of manufacturer - Understanding warranty information – Typical Service checklist - Advanced safety equipment used					3 Hrs



1146235442	Installation, Servicing and troubleshooting of ECG Machine	L	T	P	C
Practicum		1	0	4	3

PRACTICAL	
<ul style="list-style-type: none"> Choice of appropriate leads for a particular patient category (e.g., adult / paediatric) Preparation of patient: positioning, relaxation and dignity Skin preparation - Preparation of electrode sites to give optimum electrode contact and to minimise artefact e.g. muscle tremor, AC interference etc. Accurate positioning of electrodes Setting of controls Recording a Resting ECG Recording a Stress ECG 	60 HRS
TOTAL HOURS	75 HRS

Suggested List of Students Activity

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

- Prepare Power Point presentation/Seminars by the students on any recent technological developments in the relevant fields.
- Making mini models as an extension of practical lab exercise to real time applications.
- Analyze recordings to troubleshoot faults.
- Incorporate pair and group work activities to understand the concepts.

TEXT BOOKS:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
3. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2 Edition, 2003.



1146235442	Installation, Servicing and troubleshooting of ECG Machine	L	T	P	C
Practicum		1	0	4	3

REFERENCES:

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, NewYork, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012.

Web-based/Online Resources

NPTEL VIDEO LECTURE

NOC:Electrocardiogram - Interpretation and application in clinical practice,

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

List of Equipments

S.No	Name of Equipments	Quantity
1	ECG Machine	1



1146235443	CLINICAL PATHOLOGY	L	T	P	C
Practicum		1	0	4	3

Introduction:

The goal of Clinical Pathology is the diagnosis of disease based on the laboratory analysis of bodily fluids, such as blood, urine, and tissue homogenates or extracts using the tools of chemistry, microbiology, hematology, molecular pathology, and Immunohematology.

Course Objectives:

The objective of this course is to enable the student to

1. Gain knowledge on the structural and functional aspects of living organisms.
2. Know the etiology and remedy in treating the pathological diseases.
3. Empower the importance of public health.
4. To study Antibody and its types.

Course Outcomes: □

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

CO1: Analyze structural and functional aspects of living organisms.

CO2: Discuss about the Hemostasis and bleeding disorder.

CO3: Explain the function of a microscope.

CO4: Describe methods involved in treating the pathological diseases.

CO5: Able to know Antibody and its types.

Pre-requisites:

Basic Knowledge on BioScience

CO/PO Mapping

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

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



1146235443	CLINICAL PATHOLOGY	L	T	P	C
Practicum		1	0	4	3

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			
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**.



1146235443	CLINICAL PATHOLOGY	L	T	P	C
Practicum		1	0	4	3

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

1146235443	Clinical Pathology	L	T	P	C
Practicum		1	0	4	3
UNIT 1	CELL DEGENERATION AND REPAIR				
Cell injury and adaptation- causes and mechanism of cell injury, cellular adaptation to stress. Necrosis and Apoptosis. Neoplasia - Benign and Malignant tumours - carcinogenesis.					3
Practical Exercises *					12
Experiment #1 : Histopathological slides of benign and malignant tumours Experiment #2 : Determination of cell injury using LDH(lactate dehydrogenase test)					
UNIT II	FLUID AND HEMODYNAMIC DERANGEMENTS				



1146235443	CLINICAL PATHOLOGY			L	T	P	C
Practicum				1	0	4	3
Homeostasis – normal water and electrolyte balance, pressure gradient and fluid exchange. Edema, thrombosis, embolism, shock, Bleeding disorders - vascular abnormality, platelet abnormality, disorders of coagulation factor.							3
Practical Exercises *							
Experiment #3 : Physical and chemical examination of urine (protein ketones).							12
Experiment #4 : Coagulation factor test-bleeding time.							
UNIT III	MICROSCOPES						
Light microscope - bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM & SEM). Preparation of samples for electron microscope. Staining methods - simple, gramstaining and AFB staining.							3
Practical Exercises *							
Experiment #5 : AFB staining of sputum							12
Experiment #6 : Microscopic examination of urine							
UNIT IV	SYSTEMIC PATHOLOGY						
Immunopathology - Overview of hypersensitivity reaction Type I – IV, Cardiovascular pathology – Atherosclerosis and Myocardial Infarction, Respiratory pathology - PCOD, Gastrointestinal Pathology - Reflux gastritis, Renal Pathology - Chronic Kidney Disease.							3
Practical Exercises *							
Experiment #7 : Evaluation of LH-PCOD							12
Experiment #8 : Test for albumin in urine-heat test and precipitation test							
UNIT V	IMMUNOPATHOLOGY						
Natural and artificial immunity, Types of Hypersensitivity, antibody and cell mediated tissue injury, opsonization, phagocytosis, inflammation, Secondary immunodeficiency including HIVinfection, Auto-immune disorders : Basic concepts and classification, SLE. Antibodies and its types, antigen and antibodies reactions, immunization techniques : immune diffusion, RIA and ELISA, monoclonal antibodies.							3
Practical Exercises *							
Experiment #9 : Antigen antibody reaction immuno electrophoresis.							12
Experiment #10 : Testing of antigen and antibodies- mono spot test.							
TOTAL							75

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 content.

Text and Reference Books:

1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, “Pathologic Basis of Diseases”, 2005, 7th edition, WB SaundersCo
2. Underwood JCE, “General and Systemic Pathology”,2000, 3rd edition, Churchill Livingstone
3. Jens Rietdorf, “Microscopy Techniques”, 2005, Springer
4. Parker, George, “Immunopathology in Toxicology and Drug Development: Volume 2, Organ



1146235443	CLINICAL PATHOLOGY	L	T	P	C
Practicum		1	0	4	3

Systems”, 2017, Humana Press

Web-based/Online Resources:

1. NPTEL (Website): The National Programme on Technology Enhanced Learning (NPTEL) offers free online courses on Pathology. [NPTEL Pathology Course](#)

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

S.No	Name of Equipments	Quantity
1	Microscopes	2
2	Slides with samples	10
3	Glass slides	100
4	Sample collection container	30
5	Test tubes	30
6	Latex reagents	3
7	Pipette	10
8	LH test kit	2
9	Centrifuge	2
10	Pregnancy Kit	3

