1901MA301	ENGINEERING MATHEMATICS III (LINEAR ALGEBRA AND VECTOR CALCULUS)	L	T	P	C	
		3	2	0	4	

COURSE OBJECTIVES:

1. To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
2. To introduce Fourier series analysis which is central to many applications in engineering.
3. To understand the classifications of Partial Different Equations and its applications.
4. To introduce the Fourier transforms and Theorem
5. To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I	PARTIAL DIFFERENTIAL EQUATIONS	12 Hours

Formation of partial differential equations – Singular integrals — Solutions of standard types of first order partial differential equations , Lagrange's linear equation — Linear partial differential equations of second order with constant coefficients of homogeneous type.

UNIT II	FOURIER SERIES	12 Hours

Dirichlet's conditions – General Fourier series , Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis.

UNIT III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	12 Hours

Classification of PDE – Solutions of one-dimensional wave equation, One dimensional equation of heat conduction, Steady state solution of two-dimensional equation of heat conduction.

UNIT IV	FOURIER TRANSFORMS	12 Hours

Statement of Fourier integral theorem – Fourier transform pair , Fourier sine and cosine transforms , Properties, Transforms of simple functions – Convolution theorem , Parseval's identity

UNIT V	Z – TRANSFORMS AND DIFFERENCE EQUATIONS	12 Hours

Z - transforms – Elementary properties, Inverse Z – transform (using partial fraction and residues), Convolution theorem – Formation of difference equations, Solution of difference equations using Z – transform.

Total:	60 Hours

FURTHER READING:

- Linear partial differential equations of higher order
- Solution of non-homogeneous partial differential equations

COURSE OUTCOMES:

After completion of the course, Student will be able to:

1. Compute the solution of partial differential equations (K2)
2. Use Fourier series analysis which is central to many applications in engineering (K2)
3. Solve boundary value problem using partial differential equation.(K3)
4. Apply Fourier transform techniques used in wide variety of situations.(K3)
5. Apply Z transform techniques for discrete time systems. (K3)

Employability

TEXT BOOK:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

REFERENCES:

1. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 7th Edition, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.
4. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2008.
5. nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html

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1902CS306	OOPs & Data Structures (Common to B.E / B.Tech-All branches)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To comprehend the fundamentals of object oriented programming, particularly in C++.
2. To use object oriented programming to implement data structures.
3. To introduce linear, non-linear data structures and their applications.

Unit I	**OBJECT ORIENTED PROGRAMMING**	9Hours

Evolution of Programming methodologies - Introduction to OOP -Basic features - Structure of C++ Program- Compiling and Executing C++ Program - Data types - Operators - Expressions - Control statements & Iteration statements in C++ - Arrays-Structures-Pointers

Unit II	**FUNCTIONS & CONSTRUCTORS**	9Hours

Functions - Passing Data to Functions - Scope and Visibility of variables in Functions - Dynamic Binding - data members - member functions - this Pointer - Friend Functions - Friend Classes - Constructors and Destructors.

Unit III	**LINEAR DATA STRUCTURES**	9 Hours

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists –Polynomial Manipulation - Stack ADT – Queue ADT - Evaluating arithmetic expressions

Unit IV	**NON-LINEAR DATA STRUCTURES**	9 Hours

Trees – Binary Tree-Binary search trees -Tree traversal -Expression manipulation -Symbol table construction - AVL trees: Rotation, Insertion, Deletion,–Red black tree – Graph and its representations – Graph Traversals – Representation of Graphs – Breadth-first search – Depth-first search - Connected components.

Unit V	**SORTING and SEARCHING**	9 Hours

Sorting Techniques-Selection, Bubble, Insertion, Merge, Heap, Quick, and Radix sort -Address calculation - Linear search -Binary search -Hash table methods.

	Total:	**45 Hours**

Further Reading:

JAVA Program

Advanced Sorting Algorithms.

Course Outcomes:

After completion of the course, Student will be able to

1. Understand the various programming methodologies and OOPs Concepts.
2. Understand the scope of Functions in Real time Problems.
3. Design algorithms to solve real life problems using data structures
4. Recognize the usage of Non-Linear Data structures such as Binary Search tree, AVL search tree and Heap tree in applications
5. Analyze various sorting and searching algorithms

Employability

References:

1. Deitel and Deitel, "C++, How To Program", Seventh Edition, Pearson Education, 2013.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Addison-Wesley, 2013.
3. Bhushan Trivedi, "Programming with ANSI C++, A Step-By-Step approach", Oxford University Press, 2010.
4. Goodrich, Michael T., Roberto Tamassia, David Mount, "Data Structures and Algorithms in C++", 7th Edition, Wiley. 2016.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, Mc Graw Hill, 2009.
6. Bjarne Stroustrup, "The C++ Programming Language", 3rd Edition, Pearson Education, 2007.
7. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, "Fundamentals of Data Structures in C++", Galgotia Publications, 2007.

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1902BM301	FUNDAMENTALS OF BIOCHEMISTRY	L	T	P	C
		3	2	0	3

COURSE OBJECTIVES:

1. To understand about the functioning of physiological system.
2. To analyse the biochemical reactions and the various methods to analyze them.
3. To know the significance of bio molecules in biological systems.
4. To give an introduction about the clinical diseases
5. To understand the concepts of Enzymes and Kinetics.

UNIT I INTRODUCTION TO BIOCHEMISTRY — **9 Hours**

Biomolecules, structure of water & its importance – Important non covalent forces – Hydrogen bonds, electrostatic, hydrophobic &vanderwaals forces – Acid, base & buffers – pH, Henderson Hassel Balch equation. Biological buffers and their significance – Principle of viscosity – surface tension, adsorption, diffusion, osmosis & their applications in biological systems.

UNIT II BIOENERGETICS — **9 Hours**

High energy compounds - electronegative potential of compounds,respiratory chain - ATP cycle,Calculation of ATP during oxidation of glucose and fatty acids. DNA-RNA,Proteins,Lipids,Carbohydrates.

UNIT III MACROMOLECULES, VITAMINS, HORMONES, ENZYMES — **9 Hours**

Physical and chemical properties- structure of hemoglobin: immunoglobulin and nucleoprotein, classification and their properties,occurrence,functions, requirements, deficiency manifestations and role of vitamins as coenzyme, chemical nature and properties, hormones, Nomenclature - enzyme kinetics- classification and their properties, mechanism of action, enzyme induction and inhibition, coenzyme significance and enzymes of clinical importance.

UNIT IV CLINICAL DISEASES — **9 Hours**

Diabetes mellitus- insulin dependent diabetes mellitus ,non-insulin dependent diabetes mellitus, measurement of HbA1c levels-atherosclerosis, fatty liver, and obesity- hormonal disorders, aging, inborn errors of metabolism organ function tests

UNIT V ENZYME AND ITS KINETICS — **9 Hours**

Classification of enzymes: apoenzyme, coenzyme, holoenzyme and cofactors. Kinetics of enzymes -Michaelis, Menten equation. Factors affecting enzymatic activity: temperature, pH, substrate concentration and enzyme concentration. Inhibitors of enzyme action- Competitive, non- competitive, irreversible. Enzyme- Mode of action, allosteric and covalent regulation. Clinical significance of enzymes. Measurement of enzyme activity and interpretation of units

Total: 45 Hours

FURTHER READING:

- Study metabolic pathways in pathological conditions.
- Assess the significance of bio molecules in biological systems.
- Analyze the etiology and biological parameters in metabolic diseases.

COURSE OUTCOMES:

After completion of the course, Student will be able to

1. Comprehend and appreciate the significance and role of this course in the present contemporary world.
2. They will generate and test hypotheses, analyze data using statistical methods where appropriate, and appreciate the limitations of conclusions drawn from experimental data.
3. Students will analyze the pathological conditions like obesity, Diabetes mellitus, atherosclerosis, fatty liver, and hormonal disorders, aging.
4. Students will be able to understand and compare the Physical and chemical properties and structure of hemoglobin, immunoglobulins and nucleo protein.
5. Students will analyze the clinical significance of enzyme activity. Skill development.

TEXT BOOKS:

1. Lehninger A.L., Nelson D.L. and Cox M.M. Principles of Biochemistry. CBS publishers and distributers,2010
2. Thomas M. Devlin. Textbook of Biochemistry with clinical correlations. Wiley Liss Publishers David L. Nelson, Michael M. Cox, Lehninger —Principles of Biochemistry Macmillan, 6th edition 2013.

REFERENCES:

1.Murray R.K., Granner D.K., Mayes P.A. and Rodwell V.W. Harpers Biochemistry. Appleton and Lange, Stanford, Conneticut,2012

2.Keith Wilson and John Walker, —Practical Biochemistry – Principles & Techniques — Oxford University press, 7th Edition, 2010.

3.Trevor palmer—Understanding Enzymesl,Ellis Horwood LTD, 4rd Edition, 1995.

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1902BM302	BIO MEDICAL CIRCUITS AND NETWORKS	L	T	P	C
		3	0	0	4

COURSE OBJECTIVES:

1. Ability in identifying passive and active circuit elements/components and basic knowledge on their operation and application.
2. To prepare the students to have a basic knowledge in the analysis of Electric Networks
3. To understand and solve the given circuit with various theorems and methods and to distinguish between tie set and cut set methods for solving various circuits.
4. To gain knowledge about coupled circuits.
5. In depth knowledge in Integral & Differential Calculus and fundamental knowledge on Laplace Theorem & its inverse.

UNIT I	MESH CURRENT AND NETWORK ANALYSIS	9 Hours

Kirchhoff's Voltage Law- Formulation of Mesh Equations- Solution of mesh equations by Cramer's rule and matrix method, Driving point impedance, Transfer impedance.

UNIT II	NODAL ANALYSIS OF CIRCUITS	9 Hours

Graph of Network: Concept of Tree Branch, Tree link, junctions, Incident matrix, Tie-set matrix, Cutset matrix, determination of loop current and node voltages.

UNIT III	RESONANT CIRCUITS	9 Hours

Series and Parallel Resonance, Impedance and Admittance Characteristics -Quality Factor, Half-Power Points, Bandwidth, Resonant voltage rise, Transform diagrams

UNIT IV	NETWORK ANALYSIS	9 Hours

.Kirchoff's Current Law- Formulation of node equations and solutions- Driving point admittance, Transfer admittance, Solutions of Problems with DC and AC sources. Definition and implications of Superposition Theorem, Thevenin's Theorem- Norton's Theorem- Reciprocity Theorem- Compensation Theorem- Maximum Power Transfer Theorem- Millman's Theorem, Star-Delta transformations, Solutions and Problems with DC and AC sources.

UNIT V	COUPLED CIRCUITS	9 Hours

Magnetic Coupling- polarity of coils, polarity of induced voltage, concept of self and mutual inductance, coefficient of coupling, Solution of Problems Circuit Transients- DC Transient in R-L & R-C circuits with and without initial charge, R-L-C circuits, AC transients in sinusoidal RL, R-C, & R-L-C circuits.

	Total:	45 Hours

FURTHER READING:

- Understand, Describe and Analyze the Transients in electrical networks and solve related problems.
- Apply Laplace Transform and form Transfer Function for different kinds of electrical networks for analyzing them and solve related problems

COURSE OUTCOMES:

After completion of the course, Student will be able to

1. Understand, Describe, Analyze and Design series and parallel RLC circuits and solve related problems.
2. Analyze circuits using Node Voltage & Mesh Current Analysis in electrical networks and solve related problems.
3. Apply and Analyze Network Theorems to electrical networks to evaluate network parameters in simplified ways.
4. Understand, Describe, Analyze and Design Graph and Trees for a given network and build network matrices and solve related problems
5. Understand Describe, Analyze and Design Coupled (Magnetic and Electromagnetic) Circuits and solve related problems.

Employability

TEXT BOOKS:

1. Electric Circuits and Networks - a text book written by Suresh Kumar K S., Published by Pearson Education ISBN:9788131713907 Pages: 840
2. Circuit Theory and Network by S.p.Ghosh and A.K. Chakraborty,2011

REFERENCES:

1. Neamen Donald A., Electronics Ckt. Analyzer & Design, 2nd ed., Tata McGraw Hill.
2. Boylestad Robert L., Nashelsky Louis, Electronics Devices & Circuits, Pearson Education.

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1902BM303	BIOSENSORS AND MEASUREMENTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To Understand the Units and Standards of measurements for various physical quantities and how to use the measurement for calibration and error analysis.
2. To analyze the Characteristics of the Transducer using their models and Responses.
3. To make an experiment on various Resistance type transducer using their principle of operation and Applications.
4. To gain knowledge about Bio Sensors and their Applications.
5. To acquire the knowledge of another special Transducer.

UNIT I	SCIENCE OF MEASUREMENT	9 Hours

Units and Standards - calibration methods, statics calibration. classification of errors- error analysis , statistical methods - odds and uncertainity

UNIT II	CHARACTERISTICS OF TRANSDUCERS	9 Hours

Static characteristics - accuracy, precision, sensitivity, linearity. mathematical model of transducers – zero, first order and second - order transducers - response to impulse step, ramp and sinsoidal inputs

UNIT III	VARIABLE RESISTANCE TRANSDUCERS	9 Hours

Resistance Potentiometer - Principle of operation, construction details, characteristics and applications - strain gauges- resistance thermometers- thermistors- hot-wire anemometer and humidity sensors.

UNIT IV	BIOSENSORS - PHYSIOLOGICAL RECEPTORS	9 Hours

Type of Bio Sensor - Chemoreceptors, Baroreceptors, Touch receptors, Biosensors - Working Principle and Applications

UNIT V	SPECIAL TRANSDUCERS	9 Hours

Piezoelectric tranducers, magnetostrictive transducer, IC sensor digital transducers - smart sensor - fibre optic transducers-
Introduction to MEMS and Nano Sensors

	Total:	45 Hours

FURTHER READING:

- Bio receptors and Bio detectors
- DNA Sequencing with nano pores

COURSE OUTCOMES:

After completion of the course, Student will be able to

1. Explain the Science of Measurementand Error Analysis
2. Identify the characteristics of transducers and its Responses
3. Experiment with Variable Resistance Transducers and their Applications.
4. Describe the working function of Different types of Bio Sensors and their applications
5. Explain the working principles of special Transducers.

Employability

TEXT BOOKS:

1. L. A Geddes and L.E.Baker , „Principles of Applied Biomedical Instrumentation" Third Edition, – John Wiley and sons, Reprint 2008.
2. Albert D.Helfrick and William D.Cooper."Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.

REFERENCES:

1. S.M. Sze, "Semiconductor Sensors," New York, 1994, John Wiley & Sons.
2. L. Ristic, "Sensor Technology and Devices," 1994, Artech House, Inc.

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1902BM304	HUMAN ANATOMY AND PHYSIOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Know basic structural and functional elements of human body.
2. Learn organs and structures involving in system formation and functions.
3. Understand all systems in the human body.
4. Gain knowledge about sensory system
5. Better understanding of fluid maintenance

UNIT I	BASIC ELEMENTS OF HUMAN BODY	9 Hours

Cell- Structure and organelles, Functions of each component in the cell. Cell membrane – transport across membrane, Origin of cell membrane potential.Tissue- Types, Specializedtissues, functions.

UNIT II	RESPIRATORY SYSTEM AND URINARY SYSTEM	9 Hours

Respiratory System- Components of respiratory system , Respiratory Mechanism, Types of respiration , Oxygen and carbon dioxide transport and acid base regulation. Urinary system: Structure of Kidney and Nephron. Mechanism of Urine formation, Urinary reflex,Homeostasis and blood pressure regulation by urinary system. Digestive system: Structure of Digestive system-Parts of Digestive system- Digestive process.

UNIT III	BLOOD AND CARDIOVASCULAR SYSTEM	9 Hours

Blood composition - functions of blood, functions of RBC, WBC types and their functions Blood groups, importance of blood groups, identification of blood groups. Blood vessels - Structure of heart – Properties of Cardiac muscle, Conducting system of heart,Cardiac cycle, Heart sound, Volume and pressure changes and regulation of heart rate, Coronary Circulation. Factors regulating Blood flow.

UNIT IV	SKELETAL AND SPECIAL SENSORY SYSTEM	9 Hours

Skeletal system: Bone types and functions, Axial Skeleton and Appendicular Skeleton. Joint - Types of Joint, Cartilage structure, types and functions. Special Sensory system- Eye, Ear and Skin - diseases and related surgery.

UNIT V	NERVOUS SYSTEM	9 Hours

Structure of a Neuron – Types of Neuron. Neuroglial Cells, Synapses and types. Brain – Divisions of brain lobes, Cross Sectional Anatomy of Brain, Cortical localizations and functions. Spinal cord – Tracts of spinal cord, Spinal Nerve,Reflex mechanism – Types of reflex, Autonomic nervous system and its functions.

	Total:	45 Hours

FURTHER READING:

- 1.To determine hemoglobin count in the blood by Sahli's method.
- In-vitro recognition of A, B, O blood groups by slide test.
- To find the total Red Blood Cell count using Neubauer's haemocytometer.
- To find the total White Blood Cell count using Neubauer's haemocytometer.
- 5. To study ECG Machine

COURSE OUTCOMES:

After completion of the course, Student will be able to

1. Describe basic structural and functional elements of human body.
2. Explain gaseous exchange and fluid maintenance in the human body.
3. Enlighten organs and structures involving in system formation and functions.
4. Identify all systems in the human body.
5. Elucidate special senses in the human body.

Skill development.

TEXT BOOKS:

1. Eldra Pearl Solomon. "Introduction to Human Anatomy and Physiology", W.B.Saunders Company, 2003.
2. Frank H.Netter,"Atlas of human anatomy",Netter basic science, 7th edition 2019.

REFERENCES:

1. William F. Ganong,"Review of Medical Physiology", Mc Graw Hill, New Delhi, 25th Edition, 2015.
2. Arthur C. Guyton, "Text book of Medical Physiology", Elsevier Saunders, 11th Edition, 2006
3. Elaine.N. Marieb, "Essential of Human Anatomy and Physiology", Pearson Education New Delhi, 8th Edition, 2007.
4. Gillian Pocock, Christopher D. Richards, "The Human Body An introduction for Biomedical and Health Sciences", Oxford University Press, USA, 2009.

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1902CS353	DATA STRUCTURES AND C++ LABORATORY	L	T	P	C
		0	0	2	2

Course Objectives:

1. Learn C++ programming language.
2. Be exposed to the different data structures
3. Be familiar with applications using different data structures
4. Learn to implement stack application
5. To learn about abstract data type

List of Experiments:

1. Basic Programs for C++ Concepts
2. Array implementation of List Abstract Data Type (ADT)
3. Linked list implementation of List ADT
4. Cursor implementation of List ADT
5. Stack ADT - Array and linked list implementations
6. The next two exercises are to be done by implementing the following source files
   i. Program source files for Stack Application 1
   ii. Array implementation of Stack ADT
   iii. Linked list implementation of Stack ADT
   iv. Program source files for Stack Application 2
   v. An appropriate header file for the Stack ADT should be included in (i) and (iv)
7. Implement any Stack Application using array implementation of Stack ADT (by implementing files (i) and (ii) given above) and then using linked list
8. Implementation of Stack ADT (by using files (i) and implementing file (iii))
9. Implement another Stack Application using array and linked list implementations of Stack ADT (by implementing files (iv) and using file (ii), and then by using files (iii) and (iv)
10. Queue ADT – Array and linked list implementations

Total: 45 Hours

Additional Experiments:

1. Hash table implementation
2. Graph traversals

Course Outcomes:

After completion of the course, Student will be able to

1. Identify the model of Abstract Data Type. Skill development.
2. Calculation of algorithm efficiency and designing of recursive algorithms.
3. Recognize the usage of Non-Linear Data structures such as Binary Search tree, AVL search tree and Heap tree in applications.
4. To implement ADT for any stack application
5. To learn about queue ADT

Text Book:

1. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, "Fundamentals of Data Structures in C++", Galgotia Publications, 2007.

References:

1. F.RichardGilberg, A.Behrouz. Forouzan, Data Structures, A Pseudocode Approach with C. Thomson, 2007.
2. M. A. Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education, 2009.
3. Y.Langsam, M. J.Augenstein and A. M.Tenenbaum, Data Structures using C+, Pearson Education,2004.
4. A. M.AhoHopcroft and J.D. Ullman, Data Structures and Algorithms, Pearson education, 2000.

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1902BM352	BIOCHEMISTRY AND HUMAN PHYSIOLOGY LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. Estimation and quantification of bio molecules.
2. Separation of macromolecules.
3. Interpreting the metabolic changes in pathological conditions.
4. To learn about Hemoglobin
5. Study of anatomy using software

List of Experiments:

1. Study of Human anatomy with A.D.A.M interactive online software
2. Absorption Spectrum of Hemoglobin
3. Bleeding time and clotting time
4. Preparation of serum and plasma from blood
5. Estimation of ESR , PCV, MCH , MCV total count of RBCs and hemoglobin estimation
6. Estimation of creatinine
7. Estimation of urea
8. Estimation of cholesterol
9. Separation of amino acids by thin layer chromatography
10. Separation of DNA by agarose gel electrophoresis

11. Total: 45 Hours

Additional Experiments:

1. Measurement of pH of solutions using pH meter. Weber‟s and Rinne —s test for auditory conduction.
2. Ishihara chart for color blindness and Snellen‖s chart for myopia and hyperopia - by letters reading and ophthalmoscope to view retina

Course Outcomes:

After completion of the course, Student will be able to

1. Use basic laboratory skills and apparatus to obtain reproducible data from biochemical experiments.
2. Separate and analyze the importance of macromolecules.
3. To gain knowledge about Hemoglobin estimation
4. Estimation of cholesterol , urea, blood glucose levels
5. Separation of amino acids and DNA using different methods

Employability / Entrepreneurship

Text Book:

1. Keith Wilson and John Walker, —Practical Biochemistry – Principles & Techniques — Oxford University press, 7th Edition, 2010.

References:

1. Pamela.C.Champe and Richard. A. Harvey —Biochemistry Lippincott‟s Illustrated Reviews‖. Lippincott-Raven publishers, 6th Edition, 2013.
2. Arthur C. Guyton, "Text book of Medical Physiology", Elsevier Saunders, 11th Edition, 2006

S.NO	Name of the Equipment	Quantity Available (A)
1	COLORIMETER	2
2	SPECTROPHOTOMETER	1
3	PH METER	1
4	ELECTRONIC WEIGHING BALANCE	1
5	REFRIGERATOR	1
6	SDS GEL ELECTRODE	1
7	TLC PLATE 20 20CM	1
8	WINTROBES TUBE	4
9	CLINICAL CENTRIFUGE	1
10	MICROSLIDES PACKETS	10
11	LANCET BOXES	10
12	MICROSCOPE	2
13	NEUBAURS CHAMBER	2

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1901MA401	PROBABILITY AND STOCHASTIC PROCESSES	L	T	P	C
		3	2	0	4

Course Objectives:

1. To analyze the concepts of probability, random variables and distribution functions.
2. To acquire skill in handling situation with more than one random variable with time function.
3. To understand the concepts of Covariance and correlation.
4. To analyze the concept of Markov process.
5. To acquire skills in Linear systems with random inputs.

UNIT I	**PROBABILITY**	**12 Hours**

Probability- Theorems on Probability, Conditional Probability ,Baye's Theorem- Discrete and continuous random variables ,Moments – Moment generating functions ,Real Time Problems

UNIT II	**ONE DIMENSIONAL RANDOM VARIABLE**	**12 Hours**

Discrete Distributions- Binomial, Poisson, Geometric - Continuous Distributions- Uniform, Exponential, Normal distributions- Application of Distribution in Engineering Problems

UNIT III	**TWO - DIMENSIONAL RANDOM VARIABLES**	**12 Hours**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression

UNIT IV	**MARKOV PROCESSES AND MARKOV CHAINS**	**12 Hours**

Classification – Stationary process – Markov process – Markov chains, transition probabilities – Limiting distributions – Poisson process.

UNIT V	**SPECTRAL DENSITIES AND LINEAR SYSTEMS WITH RANDOM INPUTS**	**12 Hours**

Auto correlation-cross correlation, power spectral density, cross spectral density, Properties-Wiener-Khintchine relation-relationship between cross power spectrum and correlation function. Linear time invariant system- system transfer function, Linear system with random inputs, White noise.

Total:	**45+15 Hours**

Further Reading:

Probabilistic manner which evolve with time

- Discrete time Markov chains in modeling Electronic systems.

Course Outcomes:

After completion of the course, Student will be able to:

1. To apply basic probability techniques to analyze the performance of Electronic systems.(K3)
2. To apply standard distributions in describing real life phenomena.(K3)
3. To solve problems involving more than one random variable.(K3)
4. To apply probability technique which evolve with respect to time.(K3)
5. To interpret the response of random input to linear time invariant systems. (K3)

Employability

Text Books:

1. O.C. Ibe, Fundamentals of Applied Probability and Random Processes, Elsevier, 1st Indian Reprint, 2007
2. H. Pishro-Nik, "Introduction to probability, statistics, and random processes",2014.

References:

1. D. Gross and C.M. Harris, Probability and random processes, WileyStudent edition, 2004.
2. Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
3. Stark. H., and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition,Pearson Education, Asia, 2002.
4. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press, 2004.

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1902BM401	Bio Mechanics	L	T	P	C
		3	0	0	3
	(For B.E, BME)				

Course Objectives: The student should be made to:

- To explain the principle of mechanics.
- Discuss the mechanics of physiological systems.
- Explain the mechanics of joints.
- Illustrate the mathematical models used in the analysis of biomechanical systems.
- Tounderstand about Kinetics and kinematics.

UNIT I **INTRODUCTION TO MECHANICS** **9 Hours**

Introduction – Scalars and vectors, Statics – Force types, Resolution and composition of forces, Moments of force and couple, Resultant force determination, parallel forces in space, equilibrium of coplanar forces, Dynamics, Basic principles – Linear motion, Newton's laws of motion, Impulse and Momentum, Work and Energy Kinetics – Velocity and acceleration, Kinematics – Link segment models, Force transducers, Force plates, Introduction to Constitutive equations – Constitutive equations of Nonviscous fluid, Newtonian Viscous fluid and Hookean Elastic solid

UNIT II **BIOFLUID MECHANICS** **9 Hours**

Intrinsic fluid properties – Density, Viscosity, Compressibility and Surface Tension, Viscometers – Capillary, Coaxial cylinder and cone and plate, Rheological properties of blood, Pressure-flow relationship for Non-Newtonian Fluids, Fluid mechanics in straight tube – Steady Laminar flow, Turbulent flow, Flow development, Viscous and Turbulent Sheer Stress, Effect of pulsatility, Boundary Layer Separation, Structure of blood vessels, Material properties and modeling of Blood vessels, Heart –Cardiac muscle characterisation, Native heart valves – Mechanical properties and valve dynamics, Prosthetic heart valve fluid dynamics.

UNIT III **BIOSOLID MECHANICS** **9 Hours**

Constitutive equation of viscoelasticity – Maxwell &Voight models, anisotropy, Hard Tissues – Structure, blood circulation, elasticity and strength, viscoelastic properties, functional adaptation, Soft Tissues – Structure, functions, material properties and modeling of Soft Tissues – Cartilage, Tendons and Ligaments Skeletal Muscle – Muscle action, Hill's models, mathematical modeling, Bone fracture mechanics, Implants for bone fractures.

UNIT IV **BIOMECHANICS OF JOINTS** **9 Hours**

Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, Free body diagrams, Structure of joints, Types of joints, Biomechanical analysis of elbow, shoulder, spinal column, hip, knee and ankle, Lubrication of synovial joints, Gait analysis, Motion analysis using video.

UNIT V **MODELING AND ERGONOMICS** **9 Hours**

Introduction to Finite Element Analysis, finite element analysis of lumbar spine; Ergonomics – Musculoskeletal disorders, Ergonomic principles contributing to good workplace design, Design of a Computer work station, Whole body vibrations, Hand transmitted vibrations. T

Total: 45 Hours

Further Readings:

Basic orthopaedic biomechanics & mechano-biology, Mechanical tribology : materials, characterization, and applications

Course Outcomes:

After completion of the course, Student will be able to

1. Understand the principles of mechanics.
2. Outline the principles of biofluid dynamics.
3. Explain the fundamentals of bio-solid mechanics.
4. Apply the knowledge of joint mechanics.
5. Give Examples of computational mathematical modelling applied in biomechanics.

Skill development.

TextBooks:

1. Y.C. Fung, —Bio-Mechanics- Mechanical Properties of Tissues‖, Springer-Verlag, 1998.
2. Subrata Pal, —Textbook of Biomechanics‖, Viva Books Private Limited, 2009.

References:

1. Krishna B. Chandran, Ajit P. Yoganathan and Stanley E. Rittgers, —Biofluid Mechanics: The Human Circulation‖, Taylor and Francis, 2007.
2. Sheraz S. Malik and Shahbaz S. Malik, —Orthopaedic Biomechanics Made Easy‖, Cambridge University Press, 2015
3. Jay D. Humphrey, Sherry De Lange, —An Introduction to Biomechanics: Solids and Fluids, Analysis and Design‖, Springer Science Business Media, 2004.

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1902BM402	BASICS OF PATHOLOGY AND MICROBIOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the structural and functional aspects of living organisms.
2. To know the etiology and remedy in treating the pathological diseases.
3. To practice on chemical and structural examinations.
4. To know about the microbial cultures.
5. To learn about the antibody reactions and diseases caused by microbes.

UNIT I	CELL DEGENERATION, REPAIR AND NEOPLASIA	9 Hours

Cellinjury and Necrosis- Apoptosis, Intracellular accumulations, Pathological calcification- cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia- Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours. Autopsy and biopsy.

UNIT II	FLUID AND HEMODYNAMIC DERRANGEMENTS	9 Hours

Edema- normal hemostasis- thrombosis, disseminated intravascular coagulation, embolism, infarction, shock. Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas.

UNIT III	MICROSCOPES	9 Hours

Light microscope – bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM& SEM). Preparation of samples for electron microscope. Staining methods – simple, gram staining and AFB staining. Parts of compound microscope- Flow cytometry and its applications.

UNIT IV	MICROBIAL CULTURES	9 Hours

Morphological features and structural organization of bacteria- growth curve, Sterilization techniques – physical and chemical methods, identification of bacteria, culture media and its types, culture techniques and observation of culture.

UNIT V	IMMUNOLOGY	9 Hours

Natural and artificial immunity- opsonization- phagocytosis, inflammation, Immune deficiency syndrome, antibodies and its types, antigen and antibody reactors, immunological techniques-immune diffusion, immuno electrophoresis, radioimmunoassay and enzyme linked immune sorbent assay, monoclonal antibodies. Disease caused by bacteria, fungi, protozoal, virus and helminths.

	Total:	45 Hours

Further Reading:

- Comprehend and appreciate the significance and role of this course in the present contemporary world.
- Analyze structural and functional aspects of living organisms.
- Explain the function of microscopes.
- Discuss on the importance of public health.
- Describe treatment methods involved in curing the pathological diseases.

Course Outcomes:

After completion of the course, Student will be able to

1. Analyze structural and functional aspects of living organisms
2. Explain the function of microscopes.
3. Discuss on the importance of public health.
4. Describe treatment methods involved in curing the pathological diseases.
5. Perform practical experiments on tissue processing, sterilization techniques and staining processes

Skill Development / Entrepreneurship.

Text Books:

1. Harsh Mohan, "Text book of Pathology". Jaypee Brothers Medical publishers private Limited, 7th Edition, 2014.
2. Anantha Narayanan, "Text Book of Microbiology",Orient Longman,6th edition,2012.

References:

1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, "Pathologic Basis of diseases", WB Saunders Co. 7th Edition, 2005.
2. Underwood JCE, "General and Systematic Pathology", Churchill Livingstone, 3rd, Edition, 2000.
3. Ananthanarayanan, "Microbiology", Panicker University press. 9th Edition, 2013
4. Prescott, Harley,Klein, "Microbiology", Mc Graw Hill, 9th Edition, 2013.

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1902BM403	CONTROL SYSTEMS	L	T	P	C
		3	0	0	4

Course Objectives:

1. In this course it is aimed to introduce to the students the principles and applications of control systems.
2. To the basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems.
3. In deals with the different aspects of stability analysis of systems in frequency domain and time domain.
4. To understand the application of control system.
5. In this course it is aimed to introduce to the students the principles and applications of control systems.

UNIT I	**INTRODUCTION OF CONTROL SYSTEMS**	**9 Hours**

Basic concept of control systems - Open loop, closed loop control systems and their differences,Block diagram algebra, Representation by signal flow graph - Reduction using Mason's gain formula - Feedback characteristics and effect of feedback

UNIT II	**TIME RESPONSE ANALYSIS**	**9 Hours**

Time response analysis - Time response of first order system, Transient response of second order system, Time domain specification - steady state response, Steady state error,Effect of proportional, derivatives, Proportionalintegral system

UNIT III	**FREQUENCY RESPONSE ANALYSIS**	**9 Hours**

Frequency response - Frequency domain specification,stability analysis frombode plot, polar plot, Nyquist plot - Compensation techniques - Lag,Lead, lead-lag controllers design in frequency domain.

UNIT IV	**STABILITY ANALSIS AND ROOT LOCUS TECHNIQUES**	**9 Hours**

Concept of stability - Routh Hurwitz criterion,Nyquist stability criterion - Routh locus concept - construction of root locus

UNIT V	**APPLICATIONS OF CONTROL SYSTEMS**	**9 Hours**

Aircraft flight control systems - Director(military) , Embedded instrumentation - Fire control system - Guidance navigation and control - Laser ignition - Weight shift control

Total:	**45 Hours**

Further Reading:

- Biocontrol and disease modelling

Course Outcomes:

After completion of the course, Student will be able to

1. Have a better understanding on open loop and closed loop control system, concept of feedback in control systems.
2. Transfer function representation through block diagram algebra and signal flow graph, time response analysis.
3. Frequency response analysis through bode plot, polar plot, Nyquist plot and basics of state space analysis.
4. Better understanding on root locus techniques.
5. Apply control system concepts on real time applications.

Employability.

Text Books:

1. I.J.Nagrath,Madan Gopal "Text book of control system Engineering" by,New Age International, 2008
2. B.S.Manke, "Control system design",Stylus publishing,2017.

References:

1. Automatic control systems, third edition, Benjamin C.Kuo.
2. Control and Dynamical Systems,Karl Johan Aström ˚ Richard M. Murray, Version v2.10c (March 4, 2010),princeton university press.
3. Modern Control Systems, twelfth edition, Richard C. Dorf University of California, Davis, Robert H. Bishop Marquette University.
4. Katshuikoogata, "Modern Control engineering", 5th edition, 2012

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1902BM404	BIOMEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the basic theory of Bio potential Electrodes and Bio potential measurement.
2. To Understand the design of Bio potential amplifiers.
3. To know about bioelectric signals and amplifiers
4. To analyse the biomedical recording systems
5. Study the various non-electrical physiological measurement and bio chemical measurements.

UNIT I	BIOPOTENTIAL ELECTRODES	9 Hours

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half-cell potential, Contact impedance, polarization effects of electrode – non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - motion artifacts, measurement with two electrodes.

UNIT II	BIOPOTENTIAL MEASUREMENTS	9 Hours

Bio signals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system, Principles of vector cardiography.EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. Recording of ERG, EOG and EGG

UNIT III	BIOELECTRIC AMPLIFIERS	9 Hours

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier, Impedance matching circuit, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier., Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT IV	MEASUREMENT OF NON-ELECTRICAL PARAMETERS	9 Hours

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods -Auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers, Systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT V	PATIENT MONITORING SYSTEMS	9 Hours

System concepts- Cardiac monitor-selection of system parameters, Bedside monitors, Central monitors, Heart rate meter, Pulse rate meter, sphygmomanometers- Holtermonitor and Cardiac stress test, Cardiac cauterization instrumentation-Organization and equipment used in ICCU & ITU.

Total:	45 Hours

Further Reading:

- Medical Imaging,Biomedical Image Processing.

Course Outcomes:

After completion of the course, Student will be able to

1. Comprehend and appreciate the significance and role of this course in the present contemporary world.
2. Describe the fundamentals of Bio potential recording.
3. Design various bio amplifiers.
4. Measure various physiological and bio chemical parameters.
5. Understand the concepts of patient monitoring systems.

Employability / Entrepreneurship.

Text Books:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical equipment technology", Pearson Education, 4th Edition, 2014.
2. R.S.Khandphur, " Handbook on Biomedical Instrumentation", 2014

References:

1. John G.Webster, "Medical Instrumentation Application and Design", John Wiley and Sons, New York, 4th Edition, 2009.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 3rd Edition, 2014.
3. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", John Wiley and Sons, 3rd Edition, Reprint 2008.
4. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Pearson Education India, 2nd Edition, 2015.
5. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design", McGraw-Hill Publisher, 2003.

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1902BM405		DIGITAL ELECTRONICS AND INTEGRATED CIRCUITS	L	T	P	C
			3	0	0	4

Course Objectives:

1. To study the circuit configuration and introduce practical applications of linear integrated circuits.
2. To introduce the concept of application of ADC and DAC in real time systems and Phase Locked loop with applications.
3. To introduce the number systems and Logic gates.
4. To analyse combinational logic circuits.
5. To bring out the analysis and design procedures for sequential circuits.

UNIT I	**INTRODUCTION TO OPERATIONAL AMPLIFIER AND ITS APPLICATIONS**	**9 Hours**

Operational amplifier –ideal characteristics, Performance Parameters, Linear and Nonlinear Circuits and their analysis- voltage follower, Inverting amplifier, Noninverting Amplifiers, Differentiator, Integrator, Voltage to Current converter, Instrumentation amplifier- Low pass, High pass filter and band pass filters, Comparator-Multivibrator and Schmitt trigger- Triangular wave generator.

UNIT II	**DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS**	**9 Hours**

Analog switches- High speed sample and hold circuit and IC's,-Types of D/A converter -Weighted resistor, R-2R ladder DAC, D/A Accuracy and Resolution. A/D converter - Flash, Dual slope, Successive approximation, A/D Accuracy and Resolution. Voltage controlled oscillator -Voltage to Frequency converters.

UNIT III	**THE BASIC GATES ANDCOMBINATIONAL LOGIC CIRCUITS**	**9 Hours**

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, 84-2-1, 2421, Excess 3, Biquinary, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map and Tabulation methods.

UNIT IV	**COMBINATIONAL LOGIC CIRCUITS**	**9 Hours**

Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Implementation of combinational logic using standard ICs- ROM, PLA and PAL.

UNIT V	**SEQUENTIAL LOGIC CIRCUITS**	**9 Hours**

Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – state minimization, state assignment, circuit implementation. Counters, Ripple Counters, Ring Counters.

	Total:	**45 Hours**

Further Reading:

- Study aboutTimer IC 555,Monolithic PLL IC 565, IC 723 general purpose regulator

Course Outcomes:

After completion of the course, Student will be able to

1. Ability to design new analog linear circuits and develop linear IC based Systems.
2. Understand the concept of application of ADC and DAC in real time systems and Phase Locked Loop with applications.
3. Use Boolean algebra and apply it to digital systems.
4. Design various combinational digital circuits using logic gates.
5. Bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.

Employability / skill development.

Text Books:

1. ChoudaryD.Roy, Linear integrated circuits, New age international Publishers, 2018
2. Ken Martin, "Digital Integrated circuit design", Oxford University press,2012.

References:

1. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", Mc Graw Hill Education, 3rd Edition, 2017.
2. M. Morris Mano and Michael D.Ciletti, "Digital Design", Pearson, 5th Edition, 2013.
3. Charles H.Roth, Jr, "Fundamentals of Logic Design", Jaico Books, 7th Edition, 2013.
4. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 2009.

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1901MCX01		ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
			3	0	0	3
		(For B.E.,BME)				

Course Objectives:	The student should be made to:
	1. To study the nature and facts about environment.
	2. To finding and implementing scientific, technological, economic and political solutions to environmental problems
	3. To study the interrelationship between living organism and environment.
	4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
	5. To study the dynamic processes and understand the features of the earth"s interior and surface

UNIT I	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY	9 Hours

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc

UNIT II	ENVIRONMENTAL POLLUTION	9 Hours

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III	NATURAL RESOURCES	9 Hours

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV	SOCIAL ISSUES AND THE ENVIRONMENT	9 Hours

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V	HUMAN POPULATION AND THE ENVIRONMENT	9 Hours

, Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies

	Total:	45 Hours

Further Reading:	
	Analyze the continuous pollution signals & systems and its biosignal applications.

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Course Outcomes:	
	After completion of the course, Student will be able to
	1. Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection.
	2. Public awareness of environmental is at infant stage.
	3. Development and improvement in std. of living has lead to serious environmental disasters
	4. Ignorance and incomplete knowledge has lead to misconceptions
Text Book:	
1. Benny Joseph, _Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.	
2. Gilbert M.Masters, _Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.	
References:	
1. Benny Joseph, _Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.	
2. Dharmendra S. Sengar, _Environmental law', Prentice hall of India PVT LTD,New Delhi, 2007.	
3. 2. Erach Bharucha, —Textbook of Environmental Studies‖, Universities Press(I) PVT, LTD, Hydrabad, 2015	
4. Rajagopalan, R, _Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.	
5. G. Tyler Miller and Scott E. Spoolman, —Environmental Science‖, Cengage Learning India PVT, LTD, Delhi, 2014.	

skill development

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1902BM451	PATHOLOGY AND MICROBIOLOGY LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. The student should learn how to use Compound microscope, Practice on chemical examinations
2. To learn how to use Cryoprocessing, Histopathological examinations
3. To understand the concepts of staining
4. Microscopic visualisation of the microorganisms for disease determination.
5. Practical explanation of techniques used in tissue processing

List of Experiments:

1. Study of bone marrow charts.
2. Steam Sterilization using Autoclave
3. Manual paraffin tissue processing and section cutting
4. Cryo processing of tissue and cryosectioning
5. Basic staining – Hematoxylin and eosin staining.
6. Special stains – Cresyl Fast Blue (CFV)- Trichrome – oil red O – PAS
7. Simple stain, Gram stain, AFB stain.
8. Slides of malarial parasites, micro filaria and leishmania donovani.
9. Haematology slides of anemia and leukemia.
10. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)

Additional Experiments:

1. Histopathological slides of benign and malignant tumours.
2. Differential count of different WBCs and blood group identification.

Course Outcomes:

After completion of the course, Student will be able to

1. List the laboratory tests performed for urine analysis.
2. Staining procedures are explained completely for the identification of microorganisms.
3. Practical knowledge about microscopes.
4. Explains the bleeding and clotting time for analysis of the fluid in the body.
5. Practical description about the structure and organisation of microorganisms andpathogens.

Employability Entrepreneurship

Text book:

1. Harsh Mohan, "Text book of Pathology". Jaypee Brothers Medical publishers private Limited, 7th Edition, 2014.

References:

1. "Molecular Pathology: The Molecular Basis of Human Disease" by William B Coleman and Gregory J Tsongalis
2. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, "Pathologic Basis of diseases", WB Saunders Co. 7th Edition, 2005.
3. Underwood JCE, "General and Systematic Pathology", Churchill Livingstone, 3rd, Edition, 2000.

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1902BM452	BIO MEDICAL INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To study and design Bio amplifiers.
2. To provide hands on training on Measurement of physiological parameters.
3. To study about blood flow and blood measurement
4. To understand about patient monitoring system
5. To study about pH meter

List of Experiments:

1. Design of low noise pre-amplifier
2. Recording of ECG signal and analysis using Simulation
3. Simulation and analysis of EMG amplifier.
4. Simulation and analysis of EEG with Simulation
5. Measurement of respiration rate.
6. Measurement of blood flow velocity using ultrasound transducer.
7. Measurement of blood pressure using sphygmomanometer.
8. Study of characteristics of Baby Ventilator.
9. Measurement of vital parameters using Patient Monitoring System
10. Measurement of Hydrogen Ion using pH Meter

Additional Experiments:

1. Understand & Implement Isolation Techniques in designing Biomedical Instruments
2. Measurement of vital parameters using patient Monitoring Systems

Course Outcomes:

After completion of the course, Student will be able to

1. Design the amplifier for Bio signal measurements .
2. Measure heart rate and heart sounds.
3. Record and analyze pulse rate and respiration rate.
4. Measure blood pressure and blood flow.
5. Design isolation amplifier.

Employability / Entrepreneurship

Text Book:

1. "Principles of Biomedical Instrumentation and Measurement" by Richard Aston

References:

1. Medical Instrumentation – Application and Design" by John G Webster
2. "Transducers for Biomedical Measurements: Principles and Applications" by Richard S C Cobbold
3. Measurement Systems, Application and Design" by Ernest O Doeblin

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1902BM453	ANALOG AND DIGITAL AND INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To design digital logic and circuits
2. To learn the function of different ICs
3. To understand the applications of operation amplifier.
4. To learn the working of multivibrators
5. To design circuits for generating waveforms using ICs.

List of Experiments:

1. Inverting, non-inverting amplifier and comparator
2. Integrator and Differentiator
3. Design and analysis of active filters using op-amp
4. Schmitt trigger using operational amplifier
5. Instrumentation amplifier using operational amplifier
6. Phase shift oscillators
7. Multivibrators using IC555 Timer
8. Study of logic gates, Half adder and Full adder
9. Universal shift register using flip flops
10. Multiplexer and demultiplexer using digital ICs

Additional Experiments:

1. Design of mod-N counter
2. Simulation and analysis of circuits using software

Course Outcomes:

After completion of the course, Student will be able to :

1. Design Combinational Circuits using logic gates CO2: CO3: CO4: CO5:
2. Design and implement arithmetic circuits for different applications using opamp
3. Design Sequential Circuits using logic gates
4. Design wave form generators and analyse their characteristics
5. Simulate and analyse circuits using ICs

Employability/ Entrepreneurship

Text Book:

1. M.MorrisMano,"DigitalDesign",4th Edition,PrenticeHallofIndiaPvt.Ltd.,2008/Pearson Education (Singapore)Pvt.Ltd., NewDelhi,2003

References:

1. Ronald J. Tocci, Neal S. Widmer & Gregory L. Moss, "Digital Systems: Principles and Applications", 10th Edition, Pearson Prentice Hall, 2007
2. Joseph Cavanagh, "Verilog HDL: Digital Design and Modeling", Taylor & Francis, 2007
3. John F.Wakerly, "DigitalDesign",FourthEdition,Pearson/PHI,2008

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