E.G.S.PILLAYENGINEERINGCOLLEGE

(Autonomous)

Approved byAICTE,New Delhi|Affiliated to AnnaUniversity, Chennai Accredited byNAAC with „A"Grade|Accredited byNBA (CSE, EEE, MECH, ECE, CIVIL, IT)

NAGAPATTINAM–611002

B.E. Biomedical Engineering

FullTimeCurriculumand Syllabus

Second Year– ThirdSemester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1901MA301	Engineering Mathematics III (Transforms And Linear Algebra)	3	2	0	4	40	60	100
1902CS305	Objetct Oriented Programming and Data Structures	3	0	0	3	40	60	100
1902BM301	Fundamentals of Biochemistry	3	0	0	3	40	60	100
1902BM302	Bio medical Circuits and Networks	3	2	0	4	40	60	100
1902BM303	Bio Sensors and Measurements	3	0	0	3	40	60	100
1902BM304	Human Anatomy and Physiology	3	0	0	3	40	60	100
Laboratory Course								
1902BM351	Devices and Circuits Laboratory	0	0	4	2	50	50	100
1902BM352	Biochemistry and Human Physiology Laboratory	0	0	4	2	50	50	100
1902CS353	Data Structures and C++ Laboratory	0	0	4	2	50	50	100
1904GE351	Life Skills: Verbal Ability	0	0	2	1	100	-	100
Mandatory Course								
1901MCX02	Constitution of India	2	0	0	0	0	0	0
	Total	**18**	**4**	**12**	**27**	**490**	**510**	**1000**

L–Lecture|T–Tutorial|P–Practical|C–Credit|CA –ContinuousAssessment| ES–EndSemester

1901MA301	TRANSFORMS AND LINEAR ALGEBRA ENGINEERING MATHEMATICS - III	L	T	P	C
		3	1	0	4

PREREQUISITE :

1. Basic knowledge in Differentiation
2. Basic knowledge in Integration

COURSE OBJECTIVES:

1. To introduce solving systems of linear equations, Matrix operations.
2. To familiarize Vector spaces and subspaces; linear independence and span of a set of vectors, basis and dimension; the standard bases for common vector spaces.
3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

MODULE I	VECTOR SPACES	12 Hours

Vector spaces – Subspaces – Linear combinations and system of Linear equations – Linear independence and Linear dependence – Bases and Dimensions

MODULE II	LINEAR TRANSFORMATIONS	12 Hours

Linear combination system of linear equation – algebra of transformation – Linear transformation of matrices – Linear functional – transpose of linear transformation

MODULE III	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.

MODULE 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

MODULEV	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 / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Numerical Solution of non-homogeneous partial differential equations

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1	Use vector spaces using algebraic methods (K2)
CO2	Solve system of linear equations by matrix operations (K3)
CO3	Use Fourier series analysis which is central to many applications in engineering (K2)
CO4	Apply Fourier transform techniques used in wide variety of situations.(K3)
CO5	Apply Z transform techniques for discrete time systems (K3)

REFERENCES:

1. Friedberg, A.H., Insel, A.J. and Spence, L., ―Linear Algebra‖, Prentice - Hall of India, New Delhi, 2004.
2. Veerarajan. T., “Transforms and Partial Differential Equations”, Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012
3. Kumaresan, S., ―Linear Algebra – A geometric approach‖, Prentice – Hall of India, New Delhi, Reprint, 2010.
4. Grewal. B.S., “Higher Engineering Mathematics”, 42nd Edition, Khanna Publishers, Delhi, 2012.
5. Bali.N.P and Manish Goyal, “A Textbook of Engineering Mathematics”, 7th Edition, Laxmi Publications Pvt Ltd , 2007
6. Ramana.B.V., “Higher Engineering Mathematics”, Tata Mc-GrawHill Publishing Company Limited, New Delhi, 2008.
7. Narayanan.S.,ManicavachagomPillay.T.K and Ramanaiah.G “Advanced Mathematics for Engineering Students” Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
8. www.nptelvideos.in/2012/11/mathematics-iii.html

1902CS305	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

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.

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.

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 Enzymes‖,Ellis Horwood LTD, 4rd Edition, 1995.

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.

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.

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.

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.

3. John G. Webster, HalitEren ―Measurement, Instrumentation, and Sensors Handbook: Electromagnetic, Optical, Radiation, Chemical, and Biomedical Measurement‖, 2017
4. Jacob Fraden, ―Handbook of Modern Sensors: Physics, Designs, and Applications‖, Fourth Edition, Springer,

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.

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.

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.
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.

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

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

14	**HEPARINIZED SYRINGE**	**1**
15	**HAEMOGLOBINOMETER**	**1**
16	**ELISA READER**	**1**
17	**CAPILLARY TUBE BOX**	**1**
18	**BLOOD GROUPING KIT**	**2**
19	**OPHTHALMOSCOPE**	**1**
20	**TUNING FORK 256HZ TO 512HZ**	**5**

1902BM351	DEVICES AND CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. Be exposed to RL and RC circuits
2. Be familiar with Thevenin & Norton theorem KVL & KCL, and Super Position Theorems
3. To Know about series, parallel resonance circuits, Amplifiers and Multivibrators
4. To observe the characteristics of diodes
5. To design oscillator and multivibrator

List of Experiments:

1. Verification of ohm_s law, Kirchhoff_s law, and Thevenin_s theorem
2. Verification of superposition theorem and Maximum power transfer theorem
3. Rectifier - Half wave rectifier & Full wave rectifier
4. Forward and reverse characteristics of PN junction diode
5. Forward and reverse characteristics of zener diode
6. Characteristics of CE Bipolar Junction transistor
7. Characteristics of CB Bipolar Junction transistor
8. Characteristics of JFET & UJT
9. Design of RC Phase shift oscillator
10. Design of multivibrator

Additional Experiments:

1. Design and Analysis of Differential Amplifier
2. Design of RC Oscillators and LC Oscillators

Course Outcomes:

After completion of the course, Student will be able to

1. Design RL and RC circuits
2. Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems
3. Have a better understanding of diodes
4. Analyze different characteristics of transistor
5. Design Oscillator, rectifier and multivibrator

Text Books:

1. Electric Circuits and Networks - a text book written by Suresh Kumar K S., Published by Pearson Education ISBN:9788131713907 Pages: 840

References:

1. Muhammad H. Rashid, ―Microelectronic Circuits: Analysis and Design‖, Cengage Learning, 6th Edition, 2013.
2. Robert L. Boylestad, ―Electronic Devices and Circuit Theory‖, 11th Edition, 2015.
3. Robert B. Northrop, –Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation‖, CRC Press, 2004.