VINAYAKA MISSION'S RESEARCH FOUNDATION, SALEM
(Deemed to be University)

AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, CHENNAI
&
VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE, SALEM

FACULTY OF ENGINEERING AND TECHNOLOGY

STRUCTURED CHOICE BASED CREDIT SYSTEM

BOARD : BIOTECHNOLOGY
REGULATION : 2017
PROGRAM : B.Tech., – BIOTECHNOLOGY (FULL TIME – REGULAR)

CURRICULUM AND SYLLABUS

SEMESTER – II								
S.NO	**COURSE CODE**	**COURSE TITLE**	**OFFERING DEPARTMENT**	**CATEGORY**	**L**	**T**	**P**	**C**
THEORY								
1		BIOSTATISTICS	MATHEMATICS	FC(BS)	2	2	0	**3**
2		PROGRAMMING IN C	CSE	FC(ES)	3	0	0	**3**
3		CELL BIOLOGY	BTE	CC	3	0	0	**3**
4		SMART MATERIALS	PHYSICS	FC(BS)	3	0	0	**3**
5		ESSENTIALS OF BIOCHEMISTRY	BTE	CC	3	0	0	**3**
PRACTICAL								
6		PROGRAMMING IN C LAB	CSE	FC(ES)	0	0	4	**2**
7		CELL BIOLOGY LAB	BTE	CC	0	0	4	**2**
8		BIOCHEMISTRY LAB	BTE	CC	0	0	4	**2**
TOTAL					**14**	**2**	**12**	**21**

L – LECTURE HOUR T – TUTORIAL HOUR P – PRACTICAL HOUR C – CREDIT

HSS	HUMANITIES AND SOCIAL SCIENCES	CC	CORE COURSES
BS	BASIC SCIENCES	EC	ELECTIVE COURSES
ES	ENGINEERING SCIENCES	EEC	EMPLOYABILITY ENHANCEMENT COURSES + EXTRA CURRICULAR COURSES + CO - CURRICULAR COURSES
PII	PROJECT + INTERNSHIP + INDUSTRY ELECTIVES		

COURSE CODE	SEMESTER – II				
	NAME OF THE COURSE : **BIOSTATISTICS** **(Statistical table permitted for Examination)**	**L**	**T**	**P**	**C**
	TOTAL HOURS : **60**	**2**	**2**	**0**	**3**
	PREREQUISITE : **MATHEMATICS FOR BIO-ENGINEERING**				

PURPOSE:

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES:

1.	Biological study needs collection of data in the lab and classification of the same. Then depict pictorially and interpret.
2.	For the purpose of studying a population one cannot go for complete enumeration. Hence sampling techniques are to be learnt.
3.	For comparison of populations we need tests of significance. Large population generally follow normal distribution and hence essential to deal with Biological data as well.
4.	To design effective solutions to meet social needs.
5.	To understand the concept of Quality control, Control charts for variables.

UNIT – I	INTRODUCTION TO BIOSTATISTICS	12

Statistics – Definition, Scope, Limitation – Collection of data – Primary & Secondary Data; Classification & Tabulation of data – Type of Classification & Tabulation – Diagrammatic and Graphical representation of data – Types and significance.

UNIT – II	PROBABILITY AND SAMPLING	12

Probability – Definition – Measurement & Law of Probability – Conditional Probability – Baye's Theorem – Probability Distributions – Application of Probability. Sampling: Method of Sampling – Random and Non-Random Sampling – Merits and Demerits, Limitation of sampling.

UNIT – III	TESTING OF HYPOTHESIS	12

Sampling distributions – Statistical hypothesis – Testing of hypothesis for mean, variance, proportions using Normal, t and F distributions. Chi-square Tests for independence of attributes and Goodness of fit.

UNIT – IV	DESIGN OF EXPERIMENTS	12

Analysis of variance – One way and Two way classifications – Completely randomized design – Randomized block design.

UNIT – V	STATISTICAL QUALITY CONTROL	12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

TEXT BOOKS:

1. S.P. Gupta, "Statistical Methods", 34th Edition, Sultan Chand & Sons Publishers (2006).
2. P.N.Arora, P.K.Malhan, "Biostatistics", Himalaya Publishing House (2010).

REFERENCES:

1. Milton.J.S, "Statistical Methods in Biological & Health Science", McGraw Hill, New York (1992).
2. S.S.Sundar Rao, J.Richard, "Introduction to Biostatistics and Research Methods", 5th Edition, Prentice-Hall of India Pvt. Ltd (2016).

COURSE CODE : **NAME OF THE COURSE : BIOSTATISTICS**												
COURSE DESIGNED BY		**DEPARTMENT OF MATHEMATICS**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
		√				√						√
2	Mapping of instructional objectives with student outcome	3,4				1,2						5
3	Category	HSS	BS	ES	CC	EC	EEC	PII				
			√									

COURSE CODE	SEMESTER – II				
	NAME OF THE COURSE : **PROGRAMMING IN C**	**L**	**T**	**P**	**C**
	TOTAL HOURS : **45**	**3**	**0**	**0**	**3**
	PREREQUISITE : **NIL**				

PURPOSE:

To study basics of programming, control structures, arrays, string processing and files.

INSTRUCTIONAL OBJECTIVES:

1.	To introduce Basics of C.
2.	To understand Control Structures & Arrays.
3.	To learn about String concept, Structure and Union in C.
4.	To introduce the concepts of Functions and Pointers.
5.	To introduce Memory and File management concepts in C.

UNIT – I	**BASICS OF C**	**9**

Identifiers, variables, expression, keywords, data types, constants, scope of variables. Operators: arithmetic, logical, relational, conditional and bitwise operators – Special operators: size of ( ) & comma (,) operator – Precedence and associatively of operators – Type conversion in expressions.

UNIT – II	**CONTROL STRUCTURES & ARRAYS**	**9**

Basic input/output and library functions: Single character input/output i.e. getch( ), getchar( ), getche( ), putchar( ) – Formatted input/output: printf( ) and scanf( ) – Library functions (mathematical and character functions). Decision Making and Branching – Looping statements.

UNIT – III	**ARRAYS, STRING, STRUCTURE & UNION**	**9**

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays. Strings: Declaration – Initialization and string handling functions. Structure and Union: structure declaration and definition – Accessing a Structure variable – Structure within a structure – Union.

UNIT – IV	**FUNCTIONS AND POINTERS**	**9**

Function – Function Declaration – function definition – Pass by value – Pass by reference – Recursive function – Pointers – Definition – Initialization.

UNIT – V	**MEMORY AND FILE MANAGEMENT**	**9**

Static and dynamic memory allocation – Storage class specifier – Preprocessor directives. File handling concepts – File read – write – Functions for file manipulation: fopen, fclose, gets, puts, fprintf, fscan, getw, putw, fputs, fgets, fread, fwrite.

TEXT BOOK:

1. Balaguruswami. E, “Programming in C”, TMH Publications, 1997.

REFERENCES:

1. Behrouz A. Forouzan & Richard F. Gilberg, “Computer Science A Structured Programming using C”, Cengage Learning, 3rd Edition, 2007.
2. Gottfried, “Programming with C”, schaums outline series, TMH publications, 1997.
3. Mahapatra , “Thinking in C”, PHI publications, 2nd Edition, 1998.
4. Subbura.R , “Programming in C”, Vikas publishing, 1st Edition, 2000.

COURSE CODE : **NAME OF THE COURSE : PROGRAMMING IN C**												
COURSE DESIGNED BY		**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
		√				√			√			
2	Mapping of instructional objectives with student outcome	1 - 5				1 - 5			1 -5			
3	Category	HSS	BS	ES	CC	EC	EEC	PII				
				√								

COURSE CODE	SEMESTER – II				
	NAME OF THE COURSE: **CELL BIOLOGY**	**L**	**T**	**P**	**C**
	TOTAL HOURS : **45**	**3**	**0**	**0**	**3**
	PREREQUISITE : **NIL**				

PURPOSE:

The course aims to develop skills of the students in the area of Cell biology and cell signaling pathways.

INSTRUCTIONAL OBJECTIVES:

1.	To study cell structure and functions of organelles and understand the mechanism of cellular transport within and outside the cell membrane.
2.	To focus on different receptors and model of signaling and introduce the concept of cell signaling and their role in diseases.

UNIT – I	CELL AND FUNCTIONS OF THE ORGANELLES	9

General structure – Prokaryotic and eukaryotic cell, Molecular organization of the cell membrane, Cell membrane – Proteins, Lipids and Carbohydrates, Cell organelles, Cytoskeletal proteins, Types of cell functions, Cell cycle - Mitosis and meiosis, apoptosis.

UNIT – II	CELL MEMBRANE AND PERMEABILITY	9

Passive and active transport, Permeases, Sodium potassium pump, Ca^{2+}, AT Pase pumps, Lysosomal and vacuolar membrane, Co-transport, Uniport, Symport, Antiport, Protein localization & Membrane trafficking, Endocytosis and exocytosis, Entry of viruses and toxins into cells.

UNIT – III	CELL SIGNALING MOLECULES AND THEIR RECEPTORS	9

Cytosolic, Nuclear and membrane bound receptors, Examples of receptors, Modes of cell – cell signaling: Autocrine, Paracrine and Endocrine models of action, Secondary messenger's molecules, Quantitation and characterization of receptors.

UNIT – IV	PATHWAYS AND INTRACELLULAR SIGNAL TRANSDUCTION	9

Signal amplification – Different models of signal amplifications, Cyclic AMP, Role of inositol phosphates as messengers, Biosynthesis of inositol triphosphates, Cyclic GMP and G proteins role in signal transduction, Calcium ion flux and its role in cell Signaling, Current models of signal amplification, Phosphorylation of protein kinases.

UNIT – V	CELL CULTURE	9

Techniques for the propagation of prokaryotic and eukaryotic cells, Cell line, Generation of cell lines, Maintenance of stock cells, Characterization of cell, Morphological analysis techniques in cell culture, Explant cultures, Primary cultures, Contamination, Differentiation.

TEXT BOOKS:

1. De Robertis E.D.P and De Robertis E.M.F, "Cell and Molecular Biology", 8th Edition, Lippincott Williams & Wilkins, New York, USA, 2001.
2. Harvey Lodish, Arnold Berk, Chirs A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher, Hidde Ploegh and Paul Matsudaira, "Molecular Cell Biology", 6th Edition, W. H. Freeman and Company, New York, 2008.

REFERENCES:

1. B Alberts, A Johnson, J Lewis, M Raff, K Roberts and P Walter, "Molecular Biology of the Cell", (4th Edition) New York: Garland Science, 2002.
2. Kimball, T.W., "Cell Biology', Addision Wesley Publishers, 1989.
3. Geoffrey M. Cooper and Robert E. Hansman, "The Cell: A Molecular Approach", ASM Press and Sinauer Associates Inc., USA, 4th Edition, 2007.
4. Ian Freshney, R, "Culture of Animal Cells", Alan R. Liss Inc., New York, 4th Edition, 2005.

COURSE CODE :
NAME OF THE COURSE : CELL BIOLOGY

COURSE DESIGNED BY		**DEPARTMENT OF BIOTECHNOLOGY**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
		√	√	√	√		√	√	√	√		
2	Mapping of instructional objectives with student outcome	1	2	1	1, 2		2	1	2	1		
3	Category	HSS	BS	ES	CC	EC	EEC	PII				
					√							

COURSE CODE	SEMESTER – II				
	NAME OF THE COURSE : **SMART MATERIALS**	**L**	**T**	**P**	**C**
	TOTAL HOURS : **45**	**3**	**0**	**0**	**3**
	PREREQUISITE : **PHYSICAL SCIENCES**				

PURPOSE:

The fundamental knowledge gained will be useful for various applications in Engineering & Technology.

INSTRUCTIONAL OBJECTIVES :

1.	To understand the properties of smart materials.
2.	To understand the structure of crystalline materials.
3.	To learn the synthesis of Nano materials.
4.	To learn the properties and classification of magnetic materials.
5.	To understand the concept of superconducting materials and their properties.

UNIT – I	**SMART MATERIALS**	**9**

Shape Memory Alloys (SMA) – Characteristics and properties of SMA, Application, advantages and disadvantages of SMA. Metallic glasses – Preparation, properties and applications.

UNIT – II	**CRYSTALLINE MATERIALS**	**9**

Unit cell – Bravais lattice – Miller indices – Calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC, HCP structures.

UNIT – III	**NANO MATERIALS**	**9**

Nanophase materials – Top-down approach – Mechanical Grinding – Lithography – Bottom-up approach – Sol-gel method – Carbon nanotubes – Fabrication – applications.

UNIT – IV	**MAGNETIC MATERIALS**	**9**

Basic concepts – Classification of magnetic materials – Domain theory – Hysteresis – Soft and Hard magnetic materials.

UNIT – V	**SUPERCONDUCTING MATERIALS**	**9**

Superconducting phenomena – properties of superconductors – Meissner effect – isotope effect – Type I and Type II superconductors – High T_c Superconductors – Applications of superconductors.

TEXT BOOK:

1. Mani P, “Engineering Physics II”, Dhanam Publications, 2011.

REFERENCES:

1. Pillai S.O., “Solid State Physics”, New Age International (P) Ltd., publishers, 2009.
2. Senthilkumar G., “Engineering Physics II”, VRB Publishers, 2011.

COURSE CODE : **NAME OF THE COURSE : SMART MATERIALS**												
COURSE DESIGNED BY		**DEPARTMENT OF PHYSICS**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
		√	√	√	√	√		√	√	√	√	√
2	Mapping of instructional objectives with student outcome	3	1	1	3	5		2	4	3	5	1
3	Category	HSS	BS	ES	CC	EC	EEC	PII				
			√									

COURSE CODE	SEMESTER – II				
	NAME OF THE COURSE : **ESSENTIALS OF BIOCHEMISTRY**	**L**	**T**	**P**	**C**
	TOTAL HOURS : **45**	**3**	**0**	**0**	**3**
	PREREQUISITE : **NIL**				

PURPOSE:

To provide the students a sound but crisp knowledge on the biochemical basis of life processes and biotechnology.

INSTRUCTIONAL OBJECTIVES:

1.	To understand the basic structure and properties of Biomolecules.
2.	To emphasize the role of biomolecules by providing basic information on specific metabolic diseases and disorders.

UNIT – I	**CARBOHYDRATES**	**9**

Biological importance, Classification and Properties of Monosaccharides, Disaccharides and Polysaccharides (Starch, Glycogen, Cellulose and their derivatives, Chitin, Peptidoglycans, Glycoaminoglycans, Glycoconjugates).

UNIT – II	**LIPIDS**	**9**

Biological importance, Classification. Fattyacids: classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, Triacylglycerols: nomenclature, physical properties, chemical properties. Glycerophospholipids (lecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, sphingomyelins).

UNIT – III	**AMINO ACIDS AND PROTEINS**	**9**

Amino acids – Classification, Structure, Properties and Biological importance. Proteins – Classification, Structural organization of Proteins – Primary, Secondary (α-helix, β-pleated structure, triple helix), Tertiary and Quaternary (Myoglobin and Hemoglobin), Factors stabilizing, Properties and Biological importance, Denaturation and Renaturation.

UNIT – IV	**NUCLEIC ACIDS**	**9**

Nucleosides and nucleotides, configuration and conformation, Composition of RNA and DNA, Physico-chemical properties of nucleic acids – effect of alkali, acid and heat (denaturation and renaturation), features of phosphodiester bond, endonucleases. Complementary base pairing, secondary structure of RNA, features of DNA double helix (Watson-Crick model), Nucleoproteins – histone and nonhistone.

UNIT – V	**VITAMINS AND MINERALS**	**9**

Nutritional importance of vitamin, classification, source, daily requirements and functions, Deficiency symptoms – hypervitaminosis of fat soluble vitamins. Nutritional importance of Minerals – classification, source, daily requirement and deficiency symptoms.

TEXT BOOK:

1. "Fundamentals of Biochemistry", Jain J.L., Sunjay Jain and Nitin Jain., S.Chand & Company Ltd., 6th Edition, 2005.

REFERENCES:

1. "Text Book of Biochemistry for Medical Students", Ambika Shanmugham, Lippin cott Williams & Wilkins, 7th Edition, 2012.
2. "Biochemistry", Rastogi S.C. Mc. Graw-Hill Publishing Company Ltd, 6th Edition, 2007.
3. "Principles of Biochemistry", David L. Nelson and Michael M. Cox, W. H. Freeman and Company, 4th Edition, 2005.
4. "Text book of Biochemistry", Sathyanarayana U and Chakrapani U., Uppala Author Publishers Interlinks, 3rd Edition, 2006.

COURSE CODE : **NAME OF THE COURSE : ESSENTIALS OF BIOCHEMISTRY**												
COURSE DESIGNED BY		**DEPARTMENT OF BIOTECHNOLOGY**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
			√	√	√			√	√	√		
2	Mapping of instructional objectives with student outcome		1	2	2			1,2	2	2		
3	Category	HSS	BS	ES	CC	EC	EEC	PII				
					√							

COURSE CODE	SEMESTER – II				
	NAME OF THE COURSE : **PROGRAMMING IN C LAB**	**L**	**T**	**P**	**C**
	TOTAL HOURS : **60**	**0**	**0**	**4**	**2**
	PREREQUISITE : **NIL**				

PURPOSE:

This Lab course will give thorough knowledge in C Programming.

INSTRUCTIONAL OBJECTIVES :

1.	To understand Control Structures & Arrays.
2.	To implement String concept, Structure and Union in C.
3.	To implement Functions and Pointers.

LIST OF EXPERIMENTS:

1. Write a C Program to Implementation of Sine and cosine series.
2. Write a C Program to calculate Simple Interest.
3. Write a C Program to generate Fibonacci Series using for loop.
4. Write a C program to calculate factorial using while loop.
5. Write a C Program to
   a) Find the greatest of three numbers using if condition.
   b) Find the greatest of three numbers using conditional operator.
6. Write a C program for finding the roots of a given quadratic equation using conditional control statements.
7. Write a C program to
   a) Compute matrix multiplication using the concept of arrays.
   b) Illustrate the concept of string handling functions.
8. Write a C program to find the largest element in an array using pointers.
9. Write a C program to read and write data using file concepts.
10. Write a C program to store employee details using the concept of structures.

REFERENCE:

1. Laboratory Reference Manual

COURSE CODE:
NAME OF THE COURSE: **PROGRAMMING IN C LAB**

COURSE DESIGNED BY		**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
		√				√						√
2	Mapping of instructional objectives with student outcome	1-5				1-5						1-5
3	Category	HSS	BS	ES	CC	EC	EEC	PII				
				√								

COURSE CODE	SEMESTER II				
	NAME OF THE COURSE: **CELL BIOLOGY LAB**	**L**	**T**	**P**	**C**
	TOTAL HOURS: **60**	**0**	**0**	**4**	**2**
	PREREQUISITE: NIL				

PURPOSE:

To offer hands on training in the areas of cell culture, cell identification and to demonstrate various techniques to learn the morphology, identification and propagation of cells.

INSTRUCTIONAL OBJECTIVES:

1.	To demonstrate working principles of microscopy.
2.	To understand the basic techniques to work with cells.
3.	To understand and perform cells staining.
4.	To identify the various stages of mitosis.
5.	To identify the types of blood cells.

LIST OF EXPERIMENTS:

1. Introduction to principles of sterilization techniques and cell propagation.
2. Principles of Microscopy.
3. Isolation of Cell organelle – Mitochondria, Microtubules, Actin and Myosin filaments.
4. Cell Fractionation – Separation of peripheral blood mononuclear cells from blood.
5. Cell staining - Gram's staining, Leishman staining
6. Cell counting - Tryphan blue assay, Alamar blue assay.
7. Osmosis and Tonicity.
8. Staining for different stages of mitosis in *Allium cepa* (Onion).

REFERENCE:

1. Laboratory Manual

COURSE CODE:
NAME OF THE COURSE: CELL BIOLOGY LAB

COURSE DESIGNED BY		**DEPARTMENT OF BIOTECHNOLOGY**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
		√										√
2	Mapping of instructional objectives with student outcome	1-5										1-5
3	Category	HSS	BS	ES	CC	EC	EEC	PII				
					√							

COURSE CODE	SEMESTER – II				
	NAME OF THE COURSE: **BIOCHEMISTRY LAB**	**L**	**T**	**P**	**C**
	TOTAL HOURS: **60**	**0**	**0**	**4**	**2**
	PREREQUISITE: **ESSENTIALS OF BIOCHEMISTRY**				

PURPOSE:

To develop the skills of the students by providing hands on training in various techniques in Biochemistry.

INSTRUCTIONAL OBJECTIVES:

At the end of the course, the students would have developed their skills in

1.	Laboratory safety and standard operating procedures of common laboratory equipment's.
2.	To impart skills in preparation of solutions and biological buffers.
3.	To extend knowledge in analysis & estimation of biomolecules.

LIST OF EXPERIMENTS:

1. pH measurements and Buffer preparations.

TITRIMETRIC EXPERIMENTS

2. Estimation of Ascorbic acid by Titrimetric method using 2, 6 Dichloro phenol indophenols.
3. Determination of Saponification value of Edible oil
4. Determination of Acid number of Edible oil.
5. Determination of Iodine value of Oil.

BIOCHEMICAL PREPARATIONS

6. Isolation of Chloroplast from Spinach leaves.
7. Cheese Production from Milk.
8. Casein from Milk.
9. Starch from Potato.

REFERENCE:

1. Laboratory Manual

COURSE CODE :
NAME OF THE COURSE : BIOCHEMISTRY LAB

COURSE DESIGNED BY		**DEPARTMENT OF BIOTECHNOLOGY**										
1	Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
		√	√	√	√	√					√	√
2	Mapping of instructional objectives with student outcome	1	2	3	3	3					1	2
3	Category	HSS	BS	ES	CC	EC	EEC	PII				
					√							

CATEGORY :			
HSS	HUMANITIES AND SOCIAL SCIENCES	CC	CORE COURSES
BS	BASIC SCIENCES	EC	ELECTIVE COURSES
ES	ENGINEERING SCIENCES	EEC	EMPLOYABILITY ENHANCEMENT COURSES + EXTRA CURRICULAR COURSES + CO - CURRICULAR COURSES
PII	PROJECT + INTERNSHIP + INDUSTRY ELECTIVES		

STUDENT OUTCOMES :	
a.	An ability to apply knowledge of Mathematics, Science and Engineering.
b.	An ability to design and conduct experiments, as well as to analyze and interpret data.
c.	An ability to design a system, component, or process to meet desired needs within realistic constraints such as Economic, Environmental, Social, Political, Ethical, Health and Safety, Manaufaturability and Sustainability.
d.	An ability to function on Multi Disciplinary Teams.
e.	An ability to identify, formulate and solve Engineering Probems.
f.	An understanding of professional and Ethical Responsibility.
g.	An ability to Communicate Effectiely.
h.	The broad education necessary to understand the impact of Engineering Solutions in Global, Economic, Environmental and Social Context.
i.	A recognition of the need for, and an ability to engage in Life-Long Learning.
j.	A knowledge of contemporary issues.
k.	An ability to use the Techniques, Skills and Modern Engineering Tools necessary for Engineering Practice.