E-mail : josecol27998@gmail.com
Website: www.sjctnc.edu.in

1.1.2: The programmes offered by the institution focus on employability / entrepreneurship / skill development and their course syllabi are adequately revised to incorporate contemporary requirements

SYLLABUS OF THE COURSES FOCUSING EMPLOYABILITY / ENTREPRENEURSHIP / SKILL DEVELOPMENT

Colour Coding

EMPLOYABILITY

ENTREPRENEURSHIP

SKILL DEVELOPMENT

B.Sc. BIOCHEMISTRY

I B.Sc Biochemistry	COURSE NAME: BIOMOLECULES-I (60 hrs)	COURSE CODE: BC101A
SEMESTER-I		HRS/WK-4
CORE-1		CREDIT-3

OBJECTIVES:

1. To gain knowledge about the various kinds of bonds thar are involved in biological system.
2. To provide information about biochemically important aspects of the chemistry of carbohydrates with examples.
3. To acquire knowledge about nucleic acids and its sequencing methods.

COURSE OUTCOMES (CO's):

CO1-Students are able to understand the nature and types of chemical bonds and types of isomerism.

CO2-Students are able to comprehend the classification of monosaccharides and their properties.

CO3-Students are able to gain knowledge about classification and properties of disaccharides and polysaccharides.

CO4-Students are able to acquire knowledge about the structure and types of DNA and RNA

CO5-Students are able to exhibit the understanding about the structure and functions of heterocyclic compounds

SEMESTER I	SUB CODE: BC101A					COURSE NAME: BIOMOLECULES I								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	4	5	4	3	4	4	4	4	3	4	3	4	4	3.5
CO2	3	4	4	4	4	4	3	4	4	4	3	4	4	3.8
CO3	4	4	3	4	4	3	4	4	4	3	4	3	4	3.7
CO4	4	4	4	3	4	3	3	3	5	5	5	5	3	4.3
CO5	4	4	4	4	3	4	3	3	3	4	3	4	3	3.7
Mean overall score														3.8

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT I - CHEMICALBONDING **[12hrs]**

Chemical Bonding- nature and types- covalent bond, ionic bond, co-ordinate bond and non-covalent bonds (Hydrogen, hydrophobic, Vander walls interactions). Isomerism - structural isomerism and stereoisomerism. Elemental, chemical compositions and properties of water.

UNIT II - CARBOHYDRATES I **[12hrs]**

Carbohydrates: definition, classification – monosaccharides, oligosaccharides and polysaccharides; occurrence, structure and functions of monosaccharides (glucose and fructose). General properties with reference to glucose, anomers, epimers, enantiomers and mutarotation.Ring and straight chain structure of glucose (Haworth projection formula).Structure, occurrence, properties and biological importance of disaccharides (sucrose, lactose, maltose). Inversion of sucrose.

UNIT III - CARBOHYADRATES II **[12hrs]**

Structure, occurrence, properties and biological importance of polysaccharides: Storage polysaccharides (starch, glycogen, inulin), Structural polysaccharides (cellulose, chitin, pectin), Heteropolyasaccharides (hyaluronic acid, heparin, chondrition sulphate). Glycoproteins and proteoglycans (Brief study).

UNIT IV - NUCLEIC ACIDS **[12hrs]**

Nucleic acids – Bases, Nucleosides and Nucleotides, Phosphodiester linkage, DNA and RNA, Structure –double helical structure of DNA, Properties of DNA – Denaturation, Renaturation, Tm and Hyperchromicity, Effect of acid & alkali on DNA.Types of DNA, Structure of RNA and its major types - tRNA, mRNA and rRNA. Sequencing of DNA: basic principles of the methods: Sanger dideoxy sequencing (chain-termination method)

UNIT V - HETEROCYLIC COMPOUNDS **[12hrs]**

Porphyrin nucleus and its classification, functions of Bile pigments. Biological importance of Heterocylic compounds- Thiazole, Indole, Pyridine, Pteridine, Pyrrole and Imidazole.

TEXT BOOKS:

1. RenukaHarikrishnan. 2002. “Biomolecules and Enzymes. second edition, Indraja Pathipagam, Madurai.
2. JainJ.L., Sanjay Jain and Nitin Jain. 2005. “Fundamentals of Biochemistry”6thEdition, S.Chand& Company Ltd,New Delhi.
3. Ambika shunmugam, “Fundamendals of Biochemistry(8th Edition)2016, Wolters Kluwer India Pvt Ltd

REFERENCE BOOKS:

1. Power & Chatwal. 2001.“Biochemistry”. 4thedition,Himalaya Publishing House.
2. Cambell&Farrell.2007, “Biochemistry”. 5th edition, Delhi, Baba Borkhanath printers.
3. Pattabiraman T.N.2000.“Principles of Biochemistry”.7th edition, Bangalore, Gajanana Book Publishers and Distributors.
4. DebA.C, 2004,“Fundamentals of Biochemistry”. 8th edition, Kolkata, New Central Book Agency.
5. Lehninger, Nelson And Cox. 2007.“Principles of Biochemistry”.6th edUK, Macmillan Worth Publishers.

I B.Sc Biochemistry	COURSE NAME: CELL BIOLOGY (60 hrs)	COURSE CODE: BC102A
SEMESTER-I		HRS/WK-4
CORE-2		CREDIT-3

OBJECTIVES:

1. To provide the various mechanisms of membrane transport and its ion channels.
2. To understand the structure and purpose of the basic components of the Cell and its organelles.
3. To understand the phases of cell cycle, microfilaments and cell signalling

COURSE OUTCOMES (CO's):

CO1: To understand the structure and basic components of prokaryotic and eukaryotic cells and also gain insights about various types of membrane transport.

CO2: Students gain knowledge and understanding about the morphology, types and functions of cell organelles such as lysosomes, ribosomes and chloroplast.

CO3: Students acquire knowledge about the morphology and functions of cell organelles like Mitochondria, Golgi complex and micro bodies.

CO4: Tounderstand the structure and functions of chromosomes and learn the phases of cell cycle and cell division.

CO5: Students are able to understand the components and functions of cytoskeleton and cell adhesion molecules.

SEMESTER I	COURSE CODE: BC102A					COURSE NAME: CELL BIOLOGY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	5	5	2	2	2	5	2	5	3	2	5	5	4	3.6
CO2	5	5	2	2	2	5	2	2	2	2	2	5	3	3.0
CO3	5	5	2	2	2	5	2	2	2	2	2	5	3	3.0
CO4	5	5	2	2	5	5	3	5	5	5	5	5	2	3.9
CO5	5	5	2	2	2	5	2	3	2	2	5	5	3	3.0
Mean overall score														3.3

Result: The Score of this Course is 3.3 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT I - CELL AND TRANSPORT [12 hrs]

Prokaryotic and eukaryotic cell. Cell membrane: chemical composition of Fluid Mosaic Model. Carbohydrate, lipids, proteins and their function in FMM. Membrane transport – Types of transport, passive- (diffusion, facilitateddiffusion, osmosis) and active transport-Na+-K+, ATPase, sodium potassium pump, $Ca^{2+}$and ATP_{ase} pumps, endocytosis and exocytosis. Symport and antiport. Ion channels, ionophores.

UNIT II - CELL ORGANELLES - I [12 hrs]

Endoplasmic reticulum: occurrence, morphology, types and functions. Enzymes of the ER membrane. Lysosomes: structure, types and chemical composition and enzymes of lysosomes. Ribosomes: structure, types and functions. Chloroplast – structure and functions.

UNIT III - CELL ORGANELLES - II [12hrs]

Mitochondria: morphology and functions. Golgi complex: structure & functions. Microbodies: structure, morphology and functions, peroxisomes and glyoxysomes

UNIT IV - CELL DIVISION AND CELL CYCLE [12 hrs]

Nucleus – structure, nuclear core complex composition and biochemical function, chromosome structure -polytene and lambrush chromosome with example. Cell cycles– Phases of cell cycle, mitotic and meiotic division. Apoptosis and necrosis.

UNIT V - CYTOSKELETON & CELL SIGNALLING [12hrs]

Cytoskeleton - components and biological functions. Microtubules, Microfilaments and IF proteins: Distribution, chemical composition and functions. Cell-cell adhesion- functions of Cadherins, desmosomes, gap junction & tight junction. Cell signaling: GPCR with reference to cAMP as secondary messenger.

TEXT BOOKS:

1. Verma P.S and Agarwal P.K. 2002. “Cell biology, Genetics, Molecular biology, Evolution and Ecology”. 24th edition, S. Chand & Company Ltd.New Delhi.
2. De Robertis EDP and De Robertis EMF.2003. “Cell and Molecular Biology”, 8thedition, B.I. Waverly Pvt Ltd.New Delhi.
3. Rastogi . S.C. Cell Biology. Newage Publishers, (2008)

REFERENCE BOOKS:

1. Sheela A. Stanly.2008. “Cell biology for biotechnologist”. I Edition, Narosa Publishing House Pvt-Ltd.
2. Prakash, Lohar S. 2007, “Cell and Molecular biology” I edition, MJP publishers, Chennai.
3. Darnell J, Lodish H, Baltimore D. 2005. “Molecular cell biology”, England, W. H Freeman.
4. Gerald karp. Cell biology. 2001. 7th edition –International student version, wiley publications.
5. Lehninger, Nelson And Cox. 2007.“Principles of Biochemistry”.6th edUK, Macmillan Worth Publishers.

I B.Sc Biochemistry	COURSE NAME: BIOMOLECULES-II (60 hrs)	COURSE CODE: BC203A
SEMESTER-II		HRS/WK-4
CORE-3		CREDIT-3

OBJECTIVES

1. To provide information about biochemically important aspects of the classification & chemistry of lipids.
2. To gain the knowledge about the classification of amino acid and proteins.
3. To understand the general reactions and the structure of proteins and its sequences

COURSE OUTCOMES (CO's):

CO1: Students are able to understand the classification, structure and functions of lipids and their properties.

CO2: Students are able to gain knowledge about the classification of amino acids and their properties.

CO3: Students are able to learn and understand the different classification of proteins, properties, and their separation methods.

CO4: Students are able to acquire knowledge about the different levels of protein structure apart from the determination of amino acid sequences and chemical synthesis of proteins.

CO5: To acquire knowledge about the structure and function of biologically important peptides.

SEMESTER II	COURSE CODE:BC203A					COURSE NAME: BIOMOLECULES-II								HOURS :4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PS O8	
CO1	3	5	2	2	2	4	4	4	3	2	4	4	4	3.3
CO2	5	4	2	3	2	5	5	5	5	3	3	4	3	3.8
CO3	4	5	3	2	3	4	4	4	4	3	4	3	4	3.6
CO4	5	4	2	2	2	3	5	5	3	2	3	4	4	3.4
CO5	4	5	2	3	3	5	5	5	5	2	4	4	4	3.4
Mean overall score														3.5

Result: The Score of this Course is 3.3 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

UNIT I - LIPIDS **[12hrs]**

Lipids - definition and classification of lipids, Physical properties, classification of fatty acids – saturated, unsaturated and essential fatty acids, properties of fatty acids (Iodine number, Acid number, RM number, Saponification number and Rancidity). Structure and function of commonly occurring phospholipids (Lecithin, cephalin, phosphatidyl inositol and phosphotidylserine)Sphingomyelin, plasmalogen, sterols(cholesterol).

UNIT II - AMINO ACIDS **[12hrs]**

Classification of Amino acids based on structure & polarity. Essential & non essential amino acids, Non protein amino acids. General properties of amino acids. Titration curve of amino acids. Classification of proteins based on size and shape, solubility, composition & functions.

UNIT III – PROTEIN STRUCTURE **[12hrs]**

Peptide bond. General reactions of proteins (Reactions of both NH_2 group & COOH group). Structure of proteins- primary, secondary, tertiary & quaternary, forces stabilizing the structure of proteins. Ramachandran plot.

UNIT IV - PROTEINSEQUENCE DETERMINATION **[12hrs]**

Separation technique of protein-Ammonium salt fractionation, solvent fractionation, dialysis and lyophilisation. Determination of amino acid sequence, N -terminal determination- Edman's and Dansylchloride method. C- terminal determination-enzymatic method, solid phase polypeptide synthesis.

UNIT V - BIOLOGICAL IMPORTANT PROTEINS **[12hrs]**

Structure and functions of biologically important peptides- Glutathione, vasopressin & oxytocin. Biologically important proteins- structure and functions of Globular proteins (Haemoglobin, Myoglobin), Fibrous protein (Keratins, collagen).

TEXT BOOKS:

1. Jain J.L. 2005. Fundamentals of biochemistry. 6th Edition, S. Chand Publication.Chennai.
2. Satyanarayana.U. 2019. Fundamentals of Biochemistry. Allied & Books Pvt Ltd, Calcutta.
3. Deb, A.C., 2016. Fundamentals of Biochemistry, New Central Agency, Calcutta.

REFERENCE BOOKS:

1. Power & Chatwal. 2001. "Biochemistry". 4th edition, Himalaya Publishing House.

2. Cambell&Farrell.2007, "Biochemistry". 5th edition, Delhi, Baba Borkhanath printers.

3. Pattabiraman T.N. 2000. "Principles of Biochemistry".7th edition, Gajanana Book Publishers and Distributors, Bangalore.

4.DebA.C. 2004. "Fundamentals of Biochemistry". 8th edition, New Central Book Agency, Kolkata.S

5. Lehninger, Nelson And Cox. 2007."Principles of Biochemistry".6th edUK, Macmillan Worth Publishers.

I B.Sc Biochemistry	COURSE NAME : NUTRITIONAL BIOCHEMISTRY (60 hrs)	COURSE CODE: BC204A
SEMESTER-II		HRS/WK-4
CORE-4		CREDIT-3

OBJECTIVES:

1. To study the nutritional aspects of various foodstuffs and its measurement.
2. To gain the knowledge about the biological value of proteins.
3. To study the functional aspects of vitamins, minerals and its management in different age groups

COURSE OUTCOMES (CO's):

CO1: To understand and demonstrate their nutritional measurement of different food stuffs.

CO2: Able to gain knowledge about the biological value of proteins by different methods

CO3: To gain insights depth about the deficiency and functional aspects of different types of vitamins

CO4: To acquire knowledge about the physiological functions and deficiency of minerals

CO5: Able to demonstrate different dietary plan for different age groups

SEMESTER II	COURSE CODE : BC204A					COURSE NAME : NUTRITIONAL BIOCHEMISTRY								HOURS:4 CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PS O8	
CO1	5	4	3	4	4	3	4	3	5	4	3	4	4	3.8
CO2	4	3	3	5	5	3	3	4	5	4	5	4	4	4.0
CO3	3	5	3	3	3	4	5	3	3	5	4	3	5	3.8
CO4	3	4	4	5	5	3	2	4	5	4	5	3	4	3.7
CO5	5	3	3	3	3	2	3	3	5	3	3	2	3	3.2
Mean overall score														3.7

Result: The Score of this Course is 3.7 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - FOOD NUTRITION [12 hrs]

Basic food groups – Energy yielding, body building and protective foods. Basic concepts of energy expenditure, UNIT of energy, measurement of foodstuffs by bomb calorimeter, Calorific value of proteins, carbohydrates and lipids, RQ of foods, Basic metabolic rate (BMR), its measurements and influencing factors, SDA of foods. Role of fibre and dietary lipids (Omega 3 and 6 fatty acids) in our body.

UNIT II - BIOLOGICAL VALUE OF PROTEIN [12hrs]

Biological value of proteins, evaluation of proteins by nitrogen balance method – DC, BV, NPU, Single Cell Proteins (SCPs) (e.g.,spirulina only). PCM: Kwashiorkor and Marasmus- preventive and curative measures.

UNIT III - VITAMINS [12hrs]

Vitamins –classification- sources, structure, RDA, deficiency and functions of fat soluble vitamins (A,D,E,K) and water soluble vitamins (B – complex – B_1, B_2, B_5, B_6, B_9, B_{12} and vitamin – C). Role of Vitamin as antioxidant and co-factor.

UNIT IV - MINERALS [12hrs]

Minerals – physiological role and nutritional significance of principal and essential trace elements: Principal elements-sodium, potassium, calcium. Trace elements-Magnesium, phosphorous, copper, zinc, iron, iodine, fluorine, selenium, Molybdenum.

UNIT V - NUTRITIONAL REQUIREMENTS [12hrs]

Composition of balanced diet. RDA. Nutritional requirements for infants, children, adolescents, adult (male and female), pregnant and lactating women and old age.

TEXT BOOKS:

1. Swaminathan M. 1987 “Food and Nutrition Vol I&II”, Second edition, Bappco Publishers, Bangalore.
2. Chatterjea M.N and Rana Shinde. 2005” Text book of Medical Biochemistry”,4th edition, Jaypee Publishers, New Delhi.
3. R.K. Murray, D.K. Granner, P.A. Mayes, D.W. Rodwell (2006), Harper’s Biochemistry, twenty fifth edition, Prentice Hall, New Jersey

REFERENCE BOOKS:

1. Patricia Trueman. 2007. “Nutritional Biochemistry” I edition, MJ publishers, Chennai.
2. Darnell J, Lodish H, Baltimore D.1986. “Molecular Cell Biology”. WH Freeman publishers England.
3. William’s. Basic Nutrition and Diet Therapy Williams 14th edition, Staci Nix.
4. Sathyanarayana U andChakrapani U.” Biochemistry”, Books and Allied Publishers.
5. A.C. Deb. 1983. “Fundamentals of Biochemistry”. 8th edition, New Central Book Agency, Kolkata.

I B.Sc Biochemistry	COURSE NAME:MAIN PRACTICAL – I	COURSE CODE:BCP201A
SEMESTER-I		HRS / WEEK: 8
PRACTICAL – I		CREDITS: 6

OBJECTIVES

1. To know the awareness of good laboratory practices.
2. To study the laboratory safety and management of hazards in the laboratory.
3. To learn the uses of balances-common, analytical and electronic balances.

VOLUMETRIC ANALYSIS

4. Estimation of Glycine by formal titration method
5. Estimation of ascorbic acid using dichlorophenolindophenol dye as link solution
6. Determination of Saponification value of an edible oil
7. Determination of acid number of an edible oil
8. Determination of iodine value of an edible oil
9. Estimation of chloride by Mohr's method and Volhard's method
10. Estimation of reducing sugar from biological fluids by benedict's method
11. Titration curve of amino acids

BIOCHEMICAL PREPARATION

12. Preparation of albumin from egg
13. Preparation of albumin from milk
14. To find out the moisture and water content in food stuffs.

QUALITATIVE ANALYSIS

15. Qualitative analysis of carbohydrates - Glucose, fructose, arabinose, maltose, lactose,galactose,dextrin,mannose,sucrose and starch
16. Qualitative analysis of aminoacids - Tyrosine, tryptophan, arginine, Histidine,Proline and cysteine

SPOTTERS.

17. Cell division identification (mitosis & meiosis)
18. BMI calculation

II B.Sc Biochemistry	ENZYMOLOGY (60 hrs)	COURSE CODE: 19BC305
SEMESTER-III		HRS/WK-4
CORE-5		CREDIT-3

OBJECTIVES:

1. To understand the structure and classification of enzyme and its mechanism of action.
2. To gain knowledge about the regulation of Allosteric enzymes
3. To understand the application of enzymes and coenzymes

COURSE OUTCOMES:

CO1: To gain knowledge about the classification, mechanism and chemical nature of enzymes.

CO2: To aquire knowledge about the mechanism of enzyme action using different kinetic equations and also get indepth insights about various enzyme inhibition.

CO3: To understand and able to interpret the inhibition and regulation of Allosteric enzymes

CO4: To gain knowledge about the different types of enzyme catalysis and coenzymes.

CO5: To gain skill and knowledge about the purification andcommercial applications of enzymes.

SEMESTER III	COURSE CODE : 19BC305					COURSE NAME :ENZYMOLOGY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PS O1	PS O2	PS O3	PS O4	PS0 5	PS O6	PS O7	PS O8	
CO1	5	4	3	5	4	4	4	3	4	4	5	4	5	4.15
CO2	4	5	3	4	5	4	4	3	4	4	4	5	3	3.92
CO3	4	4	5	4	5	5	4	4	4	4	3	3	4	4.07
CO4	3	4	4	5	4	5	3	3	3	5	5	3	3	3.84
CO5	4	3	3	4	4	5	5	4	5	4	4	5	4	4.15
Mean Overall Score														4

Result: The Score of this Course is 4.0 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - CLASSIFICATION & CHARACTERIZATION OF ENZYMES [15 hrs]

Introduction of Enzymes – Classification, nomenclature, properties and specificity, factors affecting enzyme activity, Active site determination - trapping ES complex, use of substrate analogue. Coenzymes and Cofactors, UNITs of enzyme activity, Monomeric and oligomeric enzymes. Isoenzymes.

UNIT II - ENZYME INHIBITION [10 hrs]

Mechanism of enzyme action – Lock and key, induced fit theory. Michaelis-Menten equation - determination of Km and Vmax and its significance. Line weaver Burk plot & Eadie-Hofstee plot. Enzyme inhibition – Competitive, Non-competitive and Uncompetitive inhibition (no derivation), reversible & irreversible inhibition, mixed - partial inhibition (definition) – suicidal inhibition.

UNIT III - CHEMICAL NATURE OF ENZYMES [10 hrs]

Chemical nature of enzyme catalysis: Acid base catalysis, covalent catalysis, metal ion catalysis, proximity, orientation effects. catalysis reaction, Co-enzymes – NAD^+, $NADP^+$, FMN & FAD, COA, TPP.

UNIT IV - ALLOSTERIC INHIBITION [10hrs]

Allosteric enzymes, sigmoidal curve, mode of action (sequential & symmetry model), Allosteric inhibition and its regulation Eg. Aspartate transcarbomylase and PFK.

UNIT V - ISOLATION & APPLICATIONS OF ENZYMES [15hrs]

Basic steps involved in isolation and purification of enzymes, immobilization of enzymes- methods: adsorption, entrapping, ionic bonding, cross -linking and encapsulation. Applications of enzymes - Therapeutic, analytical and industry.

TEXT BOOKS:

1. Trevor Palmer, Enzymes, 5th edition, 2004, Affiliated East –West press (P) Ltd. New Delhi.
2. Renuka Harikrishnan, "Biomolecules and Enzymes" 2nd edition, 1995, IndrajaPathipagamMadurai.
3. Dixon, Malcolm; Webb, Edwin Clifford, Enzymes, 3rd Edition, 1979, Publishedby Longman, USA,.

REFERENCE BOOKS:

1. BeryJ.M., Tymoezko J.L. and Stryer L, Biochemistry,5thEdition, 2008, W.H. Freeman and Company, New York,.
2. David L. Nelson, LehningerPrinciples of Biochemistry, 6th Edition, 2012,W.H. Freeman and Company, New York,.
3. Victor W. Rodwell, Harpers Illustrated Biochemistry 30th Edition, 2015, Lange publishers.
4. Jain,J.L& Jain, Fundamentals of Biochemistry. 6th Edition, 2005,S.Chand & Company, New Delhi.
5. U. Sathya Narayanan and U. Chakrapani. (2007), Text book of Biochemistry - 3rdedition, Pvt Ltd.

II B.Sc Biochemistry	COURSE NAME : ANALYTICAL BIOCHEMISTRY- I (60 hrs)	COURSE CODE: 19BC306
SEMESTER-III		HRS/WK-4
CORE-6		CREDIT-3

OBJECTIVES

1. To understand the principle and applications of various biochemical techniques.
2. To obtain analytical skills and practical knowledge on various techniques involved in biochemistry.
3. To understand and gain knowledge about the practical knowledge on the preparation of solutions.

COURSE OUTCOMES

CO1: To gain knowledge about the properties of colloidal particles and understand the viscosity, surface tension and osmosis concept.

CO2: To acquire knowledge about the principles of pH and its measurement using electrodes and understand the buffers and its role in biological system.

CO3: To get in-depth understanding about the principles of spectroscopy and gain thorough knowledge about UV-Visible spectroscopy.

CO4: Able to gain knowledge and understanding about the working principles, instrumentation and applications of spectroscopic techniques such as spectrofluorimetry, flame photometry and atomic absorbtion spectroscopy.

CO5: To gain knowledge about the principles and applications of centrifugation and its types.

SEMESTER III	COURSE CODE: 19BC306					COURSE NAME:ANALYTICAL BIOCHEMISTRY- I								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PS O1	PS O2	PS O3	PS O4	PS05	PS O6	PS O7	PS O8	
CO1	5	5	5	5	5	5	5	3	5	4	5	5	5	4.38
CO2	5	5	5	5	4	5	5	3	5	5	5	5	5	4.76
CO3	5	5	5	5	4	5	5	4	5	4	4	4	5	4.61
CO4	5	5	5	5	4	5	5	3	5	5	5	5	5	4.76
CO5	5	5	5	5	4	5	5	4	5	5	4	5	5	4.76
Mean Overall Score														4.654

Result: The Score of this Course is 4.7 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **Very High** association with Programme Outcome and Programme Specific Outcome

UNIT I - PHYSICAL PROPERTIES OF BIOMOLECULES [10 hrs]

UNITs of measurements (Normality, Molarity, Molality & % solution). Colloids - properties of colloids, osmosis and viscosity and its significance in biology, surface tension, factors affecting surface tension.

UNIT II - ELECTRO CHEMICAL TECHNIQUES [10 hrs]

Electro chemical techniques : Principles of electro chemical techniques pH, pOH, buffer, buffer capacity, Henderson-Hasselbalch equation, buffers in body fluids,Composition of buffer. Measurement of pH using indicator, Glass electrode, Oxygen electrode – Principle and application of Clark electrode.

UNIT III - ELECTROMAGENTIC RADIATION AND SPECTROSCOPY [15 hrs]

Basic Principles of electromagnetic radiation. Energy, wavelength, wave number and frequency, spectrum,absorption and emission spectra,band and line spectra, Beer-Lambert Law, light absorption and its transmittance. UV and Visible Spectrophotometry – Principles, instrumentation and applications with examples, Infrared – principle and application of spectrophotometry.

UNIT IV - SPECTROSCOPY [15 hrs]

Fluorescence and Phosphorescence. Spectrofluorimetry-Principle, instrumentation and applications in Vitamin assays (Riboflavin and Thiamine),Principle and instrumentation of Atomic absorption spectrophotometer with one example(Absorption & Emission). FTIR, Luminometry- principle and instrumentation of Bioluminescence and Chemiluminescence.

UNIT V - CENTRIFUGATION [10 hrs]

Centrifugation technique: Basic principles - types of centrifugation, rotors, Sedimentation rate, Svedberg UNIT. Preparative centrifugation: Differential, Density gradient. Analytical ultracentrifugation- Determination of molecular weight of proteins.

TEXT BOOKS:

1. Keith Wilson, and John Walker, Principles and Techniques of Practical Biochemistry. 7th edition; (2010). Cambridge University Press. UK.
2. AvinashUpadhyaye, and Nirmalendhe Nath, Biophysical Chemistry Principles and Techniques. 3rd edition; (2002). Himalaya Publishers, New Delhi.
3. P.Ashokan, Analytical Biochemistry, 3rd edition; 2006,Chinna Publication.

REFERENCE BOOKS:

1. S.K. Shawney, Randhir Singh, N, Introduction to Practical Biochemistry, 3rd edition, 2002, Narasa Publication, Delhi.
2. Subramanian, M.A. Biophysics: Principles and Techniques, 4th edition, 2016,MJP Publishers, Chennai.
3. Pingoud, A., Urbanke, Claus, Hoggett, Jim, Jeltsch, Albert. Biochemical methods, (2002), Wiley.
4. Rodney F. Boyer. Biochemistry Laboratory: Modern Theory and Techniques, 2nd Edition, 2011, Pearson Education.
5. Chatwal Anand, Instrumental methods of Analysis, Himalaya Publishing house 2014

II B.Sc Biochemistry	COURSE NAME : INTERMEDIARY METABOLISM (60 hrs)	COURSE CODE: 19BC407
SEMESTER-IV		HRS/WK-4
CORE-7		CREDIT-3

OBJECTIVES

1. To understand the pathways of various metabolism and its energetics.
2.To acquire knowledge about the catabolic pathway.
3. To gain knowledge about metabolic steps involved in ETC.

COURSE OUTCOMES:

CO1: To gain knowledge about the major pathways of carbohydrates such as Glycolysis, TCA cycle, Glycogen metabolism and pentose phosphate pathway.

CO2: To acquire knowledge about the various pathways of lipids: how it generates energy and performs cellular work.

CO3: To understand the different catabolic pathway of amino acid metabolism along with urea cycle.

CO4: Able to understand the different biosynthetic and biodegrade pathway of nucleotide metabolism and its coenzymes.

CO5: To gain insights about the various components and metabolic steps involved in ETC.

SEMESTER IV	COURSE CODE:19BC407					COURSE NAME :INTERMEDIARY METABOLISM								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO2	PO 3	PO 4	PO 5	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	4	5	4	3	4	4	4	4	3	4	3	4	4	3.5
CO2	3	4	4	4	4	4	3	4	4	4	3	4	4	3.8
CO3	4	4	3	4	4	3	4	4	4	3	4	3	4	3.7
CO4	4	4	4	3	4	3	3	3	5	5	5	5	3	4.3
CO5	4	4	4	4	3	4	3	3	3	4	3	4	3	3.7
Mean overall score														3.8

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - CARBOHYDRATE METABOLISM [12hrs]

Glycolysis – aerobic and anaerobic, energetics, Pyruvate dehydrogenase complex, oxidation of pyruvate, citric acid cycle Glycogenesis and glycogenolysis. Pentose phosphate pathway and Gluconeogenesis.

UNIT II - BIOSYNTHESIS OF FATTY ACIDS [12hrs]

Biosynthesis of fatty acids -saturated and unsaturated, Fatty acid synthase complex, Biosynthesis of cholesterol, Biosynthesis of triglycerides and phospholipids (lecithin and cephalin only). Degradation of fatty acids, oxidation of fatty acids – alpha, beta, and omega oxidation.

UNIT - III FATE OF DIETARY PROTEINS [12hrs]

Introduction – fate of dietary proteins – Glucogenic and Ketogenic amino acids, catabolism of amino acids – Transamination , oxidative and non-oxidative deamination, Decarboxylation – urea cycle .

UNIT IV - BIOSYNTHESIS OF NUCLEOTIDES [12hrs]

Biosynthesis of purine and pyrimidine – de novo and salvage pathway. Degradation of purine and pyrimidine nucleotides. Regulation of purine & pyrimidine nucleotides. Biosynthesis of nucleotide coenzymes – NAD and FAD. Conversion of ribonucleotides to deoxyribonucleotides.

UNIT V - ELECTRON TRANSPORT CHAIN [12hrs]

The Electron transport chain - components and reactions of ETC. Oxidative phosphorylation – chemiosmotic theory, P/O ratio, uncouplers of oxidative phosphorylation.

TEXT BOOKS:

1. M.N Chatterjea and Rana Shinde," Text book of Medical biochemistry",8th edition,2012, Jaypee Publishers, New Delhi
2. Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.
3. J.M. Bery, J.L. Tymoezko and L. Stryer (2008) Biochemistry, 6th Ed, W.H. Freeman and Company, New York

REFERENCE BOOKS:

1. Lehninger, 2012. Principles of Biochemistry 6th Edition by David L. Nelson
2. Victor W. Rodwell, 2015.Harpers Illustrated Biochemistry, 30th Edition.
3. Voet, D. &Voet, J. G. 2010. Biochemistry. 4th edition
4. U.Sathayanarayana, (2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.
5. S.M. Bhatt (2011), Enzymology and Enzyme Technology. (2011), S. Chand Publishing, New Delhi

II B.Sc Biochemistry	COURSE NAME : ANALYTICAL BIOCHEMISTRY- II (60 hrs)	COURSE CODE: 19BC408
SEMESTER-IV		
CORE-8		CREDIT-3

OBJECTIVES

1. To understand and gain knowledge about the chromatographic techniques
2. To obtain analytical skills and practical knowledge on electrophoresis and detector
3. Students able to know about the vaarious types of microscopy and blotting techniques

COURSE OUTCOMES

CO1: To gain knowledge about the operating principles & applications ofchromatography.

CO2: To gain knowledge about the working principle, instrumentation, & applications of various types of detectors used in chromatography.

CO3: To understand and acquire knowledge about the working principle, instrumentation & applications of different kinds of electrophoretic techniques.

CO4: Able to demonstrate their skills in basic concepts in types of radiation, detection and its measurement using radioisotope techniques.

CO5: To gain knowledge about the operating principles & applications of microscopy and Blotting techniques.

SEMESTER IV	COURSE CODE: 19BC408					COURSE NAME: ANALYTICAL BIOCHEMISTRY - II								HOURS:4 CREDITS :3
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PS O1	PS O2	PS O3	PS O4	PS0 5	PS O6	PS O7	PSO8	
CO1	5	5	5	5	5	5	5	3	5	4	4	5	4	4.61
CO2	5	5	5	5	5	5	5	3	4	5	5	5	5	4.76
CO3	5	5	5	5	5	5	5	4	4	4	4	5	5	4.69
CO4	5	5	5	5	5	5	5	3	4	5	5	5	4	4.69
CO5	5	5	5	5	5	5	5	3	3	5	4	5	5	4.61
Mean Overall Score														4.72

Result: The Score of this Course is 4.7 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **VeryHigh**association with Programme Outcome and Programme Specific Outcome

UNIT I - CHROMATOGRAPHY **[12hrs]**

Principle, procedure and types of Paper chromatography, Thin layer chromatography, Gas liquid chromatography, Molecular sieve chromatography, High performance liquid chromatography, Affinity chromatography and ion exchange chromatography.

UNIT II - COLUMN&DETECTORS **[12hrs]**

Column types.-Phase, reverse phase, ion exchange and size exclusion types and its applications. Detectors in chromatography – UV, PDA, electron capture, Thermal conductivity and Flourescence detector.

UNIT III – ELECTROPHORESIS **[12hrs]**

Electrophoresis-Factors affecting electrophoretic mobility, Principle, procedure and applications of Paper,Cellulose acetate, Gel electrophoresis:Agarose, Polyacrylamide, SDS-PAGE. Isoelectro focusing.

UNIT IV - RADIOISOTOPE TECHNIQUES **[12hrs]**

Radio isotope Techniques: Atomic structure, isotopes, type of radioactive decay, half-life, and UNITs of radioactivity. Detection and measurement of radioactivity, Methods based upon ionization - GM counter and Scintillation counter. Autoradiography, applications of radioisotopes in biology.

UNIT V - MICROSCOPY & BLOTTING TECHNIQUES **[12hrs]**

Basic principle and components of Light microscopy, Phase field inverted microscopy, fluorescence microscopy. Blotting techniques-Southern, Northern, Western and Eastern.

TEXT BOOKS:

1. Keith Wilson, John Walker, Principles and Techniques of Practical Biochemistry. 7th Edition, 2010, Cambridge University Press, UK.
2. AvinashUpadhyaye, NirmalendheNath, Biophysical Chemistry Principles and Techniques. 3rd Edition, 2002, Himalaya Publishers, New Delhi.
3. P.Ashokan, Analytical Biochemistry, 3rdEdition, 2006, Chinna Publication.

REFERENCE BOOKS:

1. S.K. Shawney, Randhir Singh, N, Introduction to Practical Biochemistry, 3rdEdition, 2002, Narasa Publication, Delhi.
2. Subramanian, M.A. Biophysics: Principles and Techniques, 4thEdition, 2016,MJP Publishers, Chennai.
3. Rodney F. Boyer. Biochemistry Laboratory: Modern Theory and Techniques, 2nd Edition, 2011, Pearson Education.
4. Rodney F. Boyer. Biochemistry Laboratory: Modern Theory and Techniques, 2nd Edition, 2011, Pearson Education.
5. Chatwal Anand, Instrumental methods of Analysis, Himalaya Publishing house 2014

II B.Sc Biochemistry	COURSE NAME: MAIN PRACTICAL II	COURSE CODE: 21BCP402
SEMESTER III & IV		HRS/WK-3
Major		CREDIT-4

1. PREPARATION OF BUFFERS

2. Normality, percentage and molarity solutions
   - Saline
   - Bicarbonate buffer
   - Phosphate buffer
   - Tris buffer
   - Acetate buffer
3. Determination of pH using pH meter.
4. Determination of pKa value of amino acid using pH meter

5. FOOD AND BIOCHEMICAL ANALYSIS

- Carbohydrate content
- Protein content
- Fibre content
- Water content
- Ash content

6. COLORIMETRIC ANALYSIS

- Estimation of proteins by Biuret method
- Estimation of phosphorous –Fiske and Subarrow method
- Estimation of DNA
- Estimation of RNA
- Estimation of proteins by Lowry's method

7. BIOCHEMICAL ANALYSIS (Demonstration)

- Aminoacids by paper chromatography
- Lipids by thin layer chromatography
- SDS-PAGE electrophoresis

8. VOLUMETRIC ANALYSIS

- Estimation of iron, copper, oxalate, potassium dichromate and calcium

PRACTICAL QUESTION PATTERN TOTAL MARKS: 60

Volumetric analysis - 24
Biochemical preparation/ Colorimetric analysis - 20
Spotters - 6
Record - 10

III B.Sc Biochemistry	COURSE NAME: MOLECULAR BIOLOGY (60 hrs) (For the Batch 2019-22)	COURSE CODE: 19BC509
SEMESTER-V		HRS/WK-5
CORE-9		CREDIT-5

OBJECTIVES

1. To study the cellular interactions of molecules present in the cell.
2. To provide information about the organization of chromosomes and the various important processes involved in the molecular biology.
3. To acquire knowledge about the significance of replication, transcription and translation.

COURSE OUTCOMES

CO1-Students are able to understand the DNA as a genetic material and central dogma of molecular biology

CO2-Students are able to figure out the difference between the prokaryotic and eukaryotic replications.

CO3-Students are able to gain knowledge about the various essential steps involved in the transcription.

CO4-Students are able to acquire knowledge about genetic code and mechanism of the translation.

CO5-Students are able to understand the DNA repair and the recombination process.

SEMESTER V	COURSE CODE: 19BC509					COURSE NAME: MOLECULAR BIOLOGY								HOURS:5 CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	4	5	4	3	4	4	4	4	3	4	3	4	4	3.5
CO2	3	4	4	4	4	4	3	4	4	4	3	4	4	3.8
CO3	4	4	3	4	4	3	4	4	4	3	4	3	4	3.7
CO4	4	4	4	3	4	3	3	3	5	5	5	5	3	4.3
CO5	4	4	4	4	3	4	3	3	3	4	3	4	3	3.7
													Mean Overall Score	3.8

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - CHROMOSOMES **[15 hrs]**

DNA is the genetic material-Griffith, Avery *et al* and Hershey and Chase experiment, C value paradox, Cot value, organization of chromosomes and nucleosomes, euchromatin, heterochromatin, centromeres and telomeres, central dogma of molecular biology.

UNIT II - REPLICATION **[15 hrs]**

Replication-conservative and semi conservative methods, Meselson and Stahl experiment,factors involved in prokaryotic and eukaryotic replication, DNA polymerases in prokaryotes and eukaryotes, inhibitors of replication, repetitive DNA-Highly repetitive, moderately repetitive and unique DNA sequences. Satellite DNA, Transposons.

UNIT III - TRANSCRIPTION **[15 hrs]**

Transcription-promoters, RNA polymerase in prokaryotes and eukaryotes, initiation, elongation and termination of transcription process in prokaryotes, inhibitors of transcription, Group I & II introns, post transcriptional modification of mRNA, tRNA and rRNA.

UNIT IV - GENETIC CODE &TRANSLATION **[15 hrs]**

Genetic code-features and deciphering of genetic code, Wobble hypothesis, Translation- activation of amino acids, initiation, elongation and termination process in prokaryotes, Inhibitors of protein synthesis, post translational modification. Operon concept- Lac and Trp operon.

UNIT V - DNA REPAIR **[15 hrs]**

DNA repair-photo reactivation, Excision repair, recombination, SOS and Mismatch repair. Site specific recombination, serine and tyrosine recombinase.

TEXT BOOKS:

1. Nelson, D. L. & Cox, M. M. 2008, Lehninger Principles of Biochemistry. Freeman, 5th edn,
2. David Freifelder, 2008. Molecular Biology. (Ed: 2). Narosa Publications, New Delhi.
3. Watson J.D., 2006. Molecular Biology of the gene (Ed. 5) Pearson Education, UK

REFERENCE BOOKS:

1. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and James Darnell, J. 2012, Molecular Cell Biology , Freeman, 7th edn

2. Karp, G. 2010, Cell and Molecular Biology: Concepts and Experiments. Wiley, 6th edn

3. Primrose (2001) - Principles of gene manipulation. 6th Edition Blackwell Scientific Publishers. UK

4. Krebs,J.E. 2011. Lewin's Genes IX.(Ed: 9).Jones and Barlett Publishers, US.

5. Twyman. 2003. Advanced Molecular Biology, 3RD edition Bios Scientific Publishers LTD. Oxford, UK.

III B.Sc Biochemistry	COURSE NAME: IMMUNOLOGY (60 hrs) (For the Batch 2019-22)	COURSE CODE: 19BC510
SEMESTER-V		HRS/WK-5
CORE-10		CREDIT-5

OBJECTIVES

1. To understand the components of immune system and to study the various components of immune system with their functions.
2. To acquire knowledge about the autoimmune diseases
3. To study and gain knowledge about the Antigen-Antibody reactions

COURSE OUTCOMES:

CO1: To understand basic concept of immune system and gain insight knowledge about T&Bcell mediated immune response.

CO2: To acquire sufficient knowledge about antigen and its properties apart from structure of antibody and its sub class.

CO3: To gain appropriate knowledge about complement system, structure and functions of MHC molecules and also get cleare insight of transplantation.

CO4: To acquire in-depth knowledge about the hypersensitivity and autoimmune diseases.

CO5: To understand and gain insight about antigen – antibody reactions

SEMESTER V	COURSE CODE: 19BC510					COURSE NAME: IMMUNOLOGY								CREDITS:2
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PS O1	PS O2	PS O3	PSO 4	PS0 5	PS O6	PS O7	PS O8	
CO1	4	3	3	4	3	4	3	4	3	4	4	3	3	3.46
CO2	5	3	4	5	3	3	3	3	4	5	3	3	4	3.69
CO3	4	4	3	3	4	4	4	3	2	3	3	3	4	3. 38
CO4	3	5	3	3	3	3	3	4	3	2	4	2	4	3.23
CO5	3	2	5	3	2	3	4	3	4	3	4	3	4	3.30
Mean Overall Score														3.41

Result: The Score of this Course is 3.4 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - IMMUNE SYSTEM [15 hrs]

Immune system: Introduction and characteristics, classification of immUNITy-innate and acquired immUNITy. structure and functions of Primary and secondary lymphoid organs. Structure and functions of immune cells [macrophage, T cell, B cell, NKC, dendritic cell and APC]. Immune response - T and B cell mediated immune response, B & T lymphocytes cooperation. Phagocytosis and pinocytosis.

UNIT II – ANTIGEN & ANTIBODY [15 hrs]

Antigen-properties, epitope, paratope, specificity, cross reactivity, antigenicity and immunogenicity, haptens, adjuvants and multivalent binding sites. Antibody -structure, specificity and distribution of antibodies. Different classes and subclasses of immunoglobulins.Clonal selection theory,Antibody diversity.

UNIT III - COMPLEMENT & TRANSPLANTATION [15 hrs]

Complement components- complement cascade-classical, alternate and lectin pathway, complement deficiencies. Major Histocompatibility Complex (MHC) - Structure and function of MHC-I, II & III molecules. Role of MHC antigen in immune response. Transplantation – Graft and its types, mechanism of graft rejection in skin, graft versus host reaction and Immunosuppressive drugs.

UNIT IV - HYPERSENSITIVITY [15hrs]

Allergy and hypersensitivity- type I, II, III and IV and their clinical manifestations, Autoimmune diseases-myasthenia gravis, rheumatoid arthritis, thyrotoxicosis and SLE. Immuno tolerance.

UNIT V - ANTIGEN & ANTIBODY REACTIONS [15 hrs]

Antigen-antibody interaction: Precipitation reaction in gel (double and radial immuno diffusion). Agglutination reaction - Widal, VDRL and pregnancy test. Principle and applications of immuno electrophoresis, RIA & ELISA.

TEXT BOOKS:

1. Abul Abbas, Andrew h.Lichtman, and Shiv Pillai, 2022. Cellular and Molecular Immunology", Elsevier publication,10 th edition.
2. Ananthanarayanan.K and Jayaraman Paniker, 1996. "Textbook of Microbiology",
3. Sharon A. Stranford, Judith A. Owen , Jenni Punt ,Patricia p.Jones, Kuby , .Immunology,2023, Macmillan learing ,8 th edition .

REFERENCE BOOKS:

1.Richard Coico, Immunology, 2021,John wiley Black well pub,8 th edition

2.David Male, Jonathan Brostoff, David Roth Ivan Roitt. 2017. Essential Immunology. 13th edition. Blackwell Science.

3.Tizard.R, "Immunology-An introduction", 1995 Saunders College Publishing 2nd Revised edition).

4. Weir,D.N.(1997):Immunology(8th edition)(Churchil Livingstone).

5. Ivan M. Roitt , D.Male, 1995. Immunology, Mosby Publishers; 4 th revised edition

III B.Sc Biochemistry	COURSE NAME: TOXICOLOGYAND PHYTOMEDICINE (60 hrs)	COURSE CODE: 19EBC51A
SEMESTER-V	(For the Batch 2019-22)	HRS/WK-5
Elective – I		CREDIT-4

OBJECTIVES:

1. To study various harmful chemical agents in environment and its impacts.
2. To study the phytonutrients present in medicinal plants and its uses
3. To acquire knowledge about the herbal drugs for some diseases.

COURSE OUTCOMES:

CO1: To understand and gain knowledge about the toxic substances,types, mechanism and factors influencing the toxicity.

CO2: Able to understand the toxic substances, sources and routes of exposure and transport of toxicants in environment.

CO3: To gain & understand Bioassy, neurotoxicity & nephrotoxicity.

CO4: To acquire knowledge about the herbs, characterization, usage and active constituents of plants and Preparation of herbal formulations for common ailments.

CO5: To gain insights about the herbal drugs for Dengue fever, urinogenital disorders, memory stimulants, kidney stones, inflammation and cancer.

SEMESTER V	COURSE CODE: 19EBC51A					COURSE NAME: TOXICOLOGY AND PHYTOMEDICINE								HOURS:5 CREDITS: 4
COURSE OUTCOMES	PO 1	PO2	PO 3	PO 4	PO 5	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8	MEAN SCORE OF CO'S
CO1	5	4	3	2	3	5	5	4	4	3	5	4	3	3.8
CO2	4	3	3	2	3	4	3	3	4	5	4	3	3	3.4
CO3	3	4	3	2	3	3	4	4	3	3	3	4	3	3.2
CO4	4	4	2	2	2	4	4	3	4	3	4	4	3	3.2
CO5	3	3	2	3	3	4	3	4	3	3	4	3	3	3.2
Mean overall score														3.4

Result: The Score of this Course is 3.4 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - TOXICOLOGY **[15 hrs]**

Introduction to toxicology, Toxic substances: Types-degradable & non-degradable. Factors influencing toxicity. Drugtoxicity. Mechanism of toxicity, Acute and chronic toxicity.

UNIT II - TOXIC SUBSTANCES IN ENVIRONMENT **[15hrs]**

Toxic substances in environment: sources and routes. Transport of toxicants through food chain-bioaccumulation and bio-magnification. Toxicology of major pesticides, Biotransformation, bio-monitoring, bio-indicator and its examples. Environmental impact of pesticides.

UNIT III - BIOASSAY **[15 hrs]**

Bioassay- Types, characteristics and importance. Microbial bioassay for toxicity testing. LC50, LD50. Hepatotoxicity- examples of hepatotoxicants and its impacts on liver. Nephrotoxicity - examples of nephrotoxicants and its impacts on kidney. Neurotoxicity - examples of neurotoxicants and its impacts on brain.

UNIT IV - INTRODUCTION TO HERBAL SCIENCE **[15 hrs]**

Herbs, characterization of herbs based on plant properties, usage and active constituents. medicinal uses and health benefits of Ginger, Garlic, Green tea, kabasurakudineer and Herbal tea Preparation of herbal medicine. Bioavailability and bioequivalence. Dosage and formulation.

UNIT V - PHYTOMEDICINE **[15 hrs]**

Drugs for urinogenital disorders – *Withaniasomnifera,* Memory stimulants – *Centellaasiatica,* Herbal drugs for dissolving kidney stones – *Musa paradisica,* Anti-inflammatory drugs from plants– *Curcuma longa*, Cardiospermum. Anticancer drugs from plants - *Catharanthus roseus* and A*zardica indica*. Dengue fever – Papaya leaves.

TEXT BOOKS:

1.David Hoffmann., 2003.Medical Herbalism: The Science Principles and Practices of Herbal Medicine, 1ST edition, Healing Arts Press publishers.

2.Agnes Arbe, 1987.Herbals: Their Origin and Evolution, Cambridge University Press; 3 edition,

3.Kumar, N.C. 1993.An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi.

REFERENCE BOOKS:

1. Gupta, P.K. and Salunka, D.K. 1985. Modern toxicology. Vol I and II. Metropolitan, New Delhi.

2. Ming-Ho Yu, HumioTsunoda, Masashi Tsunoda, 2011.Environmental Toxicology: Biological and Health Effects of Pollutants, CRC Press; 3 edition

3. O Pelkonen, P Duez, PM Vuorela, H Vuorela, Toxicology of Herbal Products, Springer, 2017.

4. M.Heinrich, J. Barnes, J.Prieto-Garcia, S. Gibbons. Fundamentals of Pharmacognosy and Phytotherapy, 2017.

5. Dr. Iqbal Ahmad, Farrukh Aqil, Dr. Mohammad Owais, Modern Phytomedicine: Turning Medicinal Plants into Drugs, Wiley-VCH Verlag GmbH & Co. KGaA, 2006.

III B.Sc Biochemistry	COURSE NAME: FOOD TECHNOLOGY (60 hrs) (For the Batch 2019-22)	COURSE CODE: 19EBC51B
SEMESTER-V		HRS/WK-5
Elective - I		CREDIT-4

OBJECTIVES:

1.To study the nature of food, spoilage, preservation and its applications

2. To understand the properties of raw materials used in food processing.

3. To gain knowledge about the Food laws and quality control

COURSE OUTCOMES:

CO1: To study the structure, composition, nutritional quality of milk products and implications of Food Adulteration.

CO2: To acquire knowledge about the important pathogens in food spoilage and the conditions under which they will grow.

CO3: To understand the source and variability of raw food materials and their impact on food processing operations.

CO4: To Emphasis the various properties of the raw materials used in food processing, different processing technologies required in transforming them into quality food products.
and material handling equipment involved in food processing operations.

CO5: To gain the knowledge about Food laws and quality control.

SEMESTER V	COURSE CODE: 19EBC51B					COURSE NAME: FOOD TECHNOLOGY								HOURS:5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	5	4	2	3	2	5	4	4	3	2	5	5	5	3.7
CO2	4	5	2	2	2	4	4	5	2	2	4	5	3	3.5
CO3	4	4	2	2	2	5	3	4	2	2	3	5	3	3.1
CO4	4	5	2	2	2	4	3	4	3	2	4	4	5	3.3
CO5	5	5	2	4	3	5	5	5	4	2	4	4	5	3.9
Mean overall score														3.5

Result: The Score of this Course is 3.5 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - FOOD CONSTITUENTS AND ADULTERATION [15 hrs]

Constituents of food: Introduction, water, carbohydrate, fat, oil, vitamins and minerals. Pulses, grains, vegetables and fruits-varieties, composition, nutritive value and cooking. Milk- kinds of milk: whole milk, low-fat & skimmed milk, composition, nutritive value, pasteurization and homogenization. Food Adulteration: types of adulterants, common adulterants in foods, toxicants in foods, impact of food adulteration in humans.

UNIT II - FOOD SPOILAGE [15 hrs]

Food spoilage: Characteristic features, dynamics and significance of spoilage of different groups of foods - Cereal and cereal products, vegetables and fruits, meat poultry and sea foods, milk and milk products, packed and canned foods. Factors affecting growth & survival of microorganism in food, physical & chemical methods to control microorganism.

UNIT – III FOOD PROCESSING AND PRESERVATION [15hrs]

Food processing: Principle and methods of food processing and preservation-freezing, high pressure, heating, dehydration, canning and Packaging. fermentation, irradiation and osmotic pressure. Application of enzymes and microorganisms in food processing and preservation. Food Additives - Definition, types and functions, permissible limits and safety aspects.

UNIT IV - INDUSTRIAL PRODUCTIONS OF FOODS [15 hrs]

Yogurt preparation, Cheese and its classification, cheese making, fermented vegetables, production of oil from soya beans. Fruit and vegetable juices,jams, production of beer, wine and vinegar.

UNIT V - LEGAL ISSUES AND GOVERNMENT NORMS [15hrs]

Food regulations – History of Indian Food Regulations: BIS, ISI, FPO, PFA and FDA. Food Safety and Standards Act 2011. Food laws and quality control – HACCP, Codex alimentarius, MFPO, BIS, AGMARK and FSSAI. Legal aspects related to storage and disposal.

TEXT BOOKS:

1. Gabriel Virella (1997), Microbiology and infectious disease, 3rd Ed, Ingraham international, New Delhi.
2. John L Ingraham and Catherine A.Ingraham. Microbiology an introduction, 2rd Ed, Cengage learning, New Delhi
3. Rao E. S. (2013). Food Quality Evaluation.

REFERENCE BOOKS:

1. Sivasankar,B.(2005),Food processing and preservation,3rd Ed, Prentice Hall India (P) Ltd.
2. VijayaKhader (2009), Text book of food science and technology,5thEd, Indian council of Agricultural research.
3. The Atlas of Food by Erik Millstone; Tim Lang; Marion Nestle, Reference 2nd Edition 2008
4. Dietary Reference Intakes by Jennifer J. Otten (Editor); Jennifer Pitzi Hellwig, Reference 2nd Edition, 2006
5. Wiley Encyclopedia of Food Science and Technology, 4 Volume Set by Frederick J. Francis, Reference 2nd Edition vol.1-4 2000

III B.Sc Biochemistry	COURSE NAME:PLANT BIOCHEMISTRY (60 hrs) (For the Batch 2019-22)	COURSE CODE: 19EBC52A
SEMESTER-V		HRS/WK-5
Elective – II		CREDIT-4

OBJECTIVES:

1. To make available information about the plant cell wall and the mechanism of absorption.
2. To acquire knowledge about the Physiological significance of various plant hormones, role of pigments in photosynthesis and the importance of secondary metabolites
3. To gain proper information about the role of nitrogen fixing bacteria in the nitrogen assimilation.

COURSE OUTCOMES

CO1-Students are able to comprehend the structure and functions of the plant cells and the several processes involved in the exchange of ions.

CO2-Students are able to figure out the structure, biosynthesis and the biological functions of different hormones.

CO3-Students are able to gain knowledge about the structure and the physiological effects of pigments in photosynthesis.

CO4-Students are able to acquire knowledge on the various secondary metabolites and stress metabolism.

CO5-Students are able to understand about the role of nitrogen fixing bacteria in the nitrogen assimilation.

SEMESTER V	COURSE CODE: 19EBC52A					COURSE NAME :PLANT BIOCHEMISTRY								HOURS:5 CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	4	5	4	3	4	4	4	4	3	4	3	4	4	3.5
CO2	3	4	4	4	4	4	3	4	4	4	3	4	4	3.8
CO3	4	4	3	4	4	3	4	4	4	3	4	3	4	3.7
CO4	4	4	4	3	4	3	3	3	5	5	5	5	3	4.3
CO5	4	4	4	4	3	4	3	3	3	4	3	4	3	3.7
Mean overall score														3.8

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - CELL **[15 hrs]**

Discovery and definition of plant cell, cell wall, plasmodesmata, meristematic cells and secretary systems. Mechanism of absorption- Ion exchange, passive absorption & Active absorption.The carrier concept and Donnan membrane equilibrium.

UNIT II - PLANT HORMONES **[15 hrs]**

Structure, biosynthesis, mode of action and physiological effects of auxins, gibberellins and cytokinins. Biochemistry of seed dormancy, seed germination, fruit ripening and senescence.

UNIT III - PLANT PIGMENTS & PHOTOSYNTHESIS **[15 hrs]**

Structure & synthesis of chlorophyll, phycobilins and carotenoids. Photosynthesis: photosystem I & II, Light absorption, Hill reaction, Red drop & Emerson's enhancement effect. Cyclic and non-cyclic photophosphorylation, Calvin cycle, C3, C4 & CAM. Photosynthesis-factors and regulation. Glyoxalate cycle.

UNIT IV - SECONDARY METABOLITES &STRESS METABOLISM **[15 hrs]**

Secondary metabolites in plants – classification & function of alkaloids, terpenoids, tannins, lignin and pectin. Stress metabolism in plants - Environmental stresses, salinity, water stress, heat, chilling and their impact on plant growth, criteria of stress tolerance**.**

UNIT V - NITROGEN FIXING ORGANISMS **[15 hrs]**

Nitrogen fixing organisms: Structure and mechanism of action of nitrogenase: *Rhizobium* symbiosis. Leghaemoglobin, strategies for protection of nitrogenase against the inhibitory effect of oxygen, nif genes of K*lebsiella pnemoniae* and their regulation.Ammonia assimilation by glutamine synthetase, glutamine oxoglutarate amino transferase (GS-GOGAT). Nitrite and nitrate reductase.

TEXT BOOKS:

1. Dr. V. K. Jain Fundamentals of Plant physiology, S Chand Publishers 2016
2. Pandey.S.N.,and Sinha.B.K. 1999. Plant Physiology,Vikas Publishing House.
3. S. K. Verma and MohitVerma, Plant Physiology, Biochemistry and biotech S Chand Publishers, 2018

REFERENCE BOOKS:

1. Solisbury and Ross,Plant Physiology,3rd edition,CBS Publishers and Distributors.
2. Hans-Walter Held, Plant Biochemistry, 3rd edition,Elsevier India Pvt.Ltd.
3. Verma, Plant Physiology, Athena Academic Publishers, 2015.
4. Heldt, HW. (2005), Plant Biochemistry. 3rdedition, Elseveir Academic Press Publication, USA.
5. Lincoln Taiz, Angns Murphy, Fundamentals of Plant Physiology, Oxford University Press, 2018

III B.Sc Biochemistry	COURSE NAME: PHARMACEUTICAL BIOCHEMISTRY (60 hrs)	COURSE CODE: 19EBC52B
SEMESTER-V		HRS/WK-5
ELECTIVE-II		CREDIT-4

OBJECTIVES:

1. To gain essential knowledge about drugs and their metabolism.
2. To understand the various drug formulations and the drugs used in practice
3. To acquire knowledge about the antioxidant defense system.

COURSE OUTCOMES:

CO1: To acquire basic knowledge of drug design and its sources.

CO2: Able to understand drug absorption, Disposition, Elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition

CO3: To gain knowledge of antioxidant defense system and mode of action of different enzymes

CO4: To understand the different types of drug formulations and its uses

CO5: To gain knowledge about the common drugs used in different ailments.

SEMESTER V	COURSE CODE: 19EBC52B					COURSE NAME :PHARMACEUTICAL BIOCHEMISTRY								HOURS:5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	3	4	4	4	4	3	4	3	3	3	3.5
CO2	3	4	4	4	3	3	3	2	3	3	3	3	4	3.5
CO3	4	4	3	4	4	3	4	4	4	3	4	3	4	3.7
CO4	4	4	4	3	4	3	3	3	5	5	5	5	3	4.3
CO5	4	4	4	4	3	4	3	3	3	4	3	4	3	3.7
Mean overall score														3.7

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - INTRODUCTION TO PHARMACOGNOSY [12 hrs]

Definition, history, scope and development of Pharmacognosy. Sources of Drugs – Plants, Animals, Marine & Tissue culture .Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilage's, oleoresins and oleo- gum -resins).

UNIT II - PHARMACOKINETICS [12 hrs]

Basic principles of pharmacokinetics, Drug metabolism and Concepts of Prodrugs. Factors affecting metabolism, site of metabolism, routes of elimination (kidney, biliary excretion) Phase-I: oxidation, microsomal oxidation, microsomal reduction, non-microsomal metabolism, hydrolysis, Phase-II: Conjugation-glucuronide conjugation, acylation, methylation, mercapturic acid formation and sulphate conjugation.

UNIT III - ANTIOXIDANT DEFENSE [12 hrs]

Antioxidant defense system-oxygen dependent and independent. Antioxidant defense enzymes - SOD, Catalase, Glutathione peroxidase, Glutathione reductase and lipid peroxidase.

UNIT IV - DRUG FORMULATION [12 hrs]

Drug formulation: Types-solid,semi-solid,liquid and gas. Tablets- types and uses, Capsules- Hard and soft, Cream, gel, ointment, syrup, suspension- advantages and disadvantages.

UNIT V - COMMON DRUGS [12 hrs]

Definition, source and Nature of common drugs, Antimalarial drugs: Chloroquine, quinine, Hydroxychloroquine, Amodiquine. Antifungal drugs: Chlorophenesin, Griesofulvin and Candicidin. Antiviral agents: Idoxuridine, Acyclovir, Methisazone, Amantadine hydrochloride and Remedisivir for COVID 19 (structure not required).

TEXT BOOKS:

1. Tripathi KD, 2013. Essentials Of Medical Pharmacology, 7 th edition. Jaypee Brothers Medical Publishers
2. Karen Whalen, 2014. Lippincott Illustrated Reviews: 6th edition. Pharmacology – Publisher: Wolter Kluwer
3. G.R.Chatwal, Pharmaceutical chemistry, Himalayaa Publishing House.

REFERENCE BOOKS:

1. Lubert Styrer, Biochemistry, 4th editon, W.H.Freeman and Company, New York.
2. Joseph R.Dipalma,, G.Johndi Gregorio, Basic Pharmacology in Medicine,3th edition.
3. Katzung Bertram, 2015. Basic and Clinical Pharmacology 13th ed., McGraw Hill,
4. Padmaja Udaykumar,Medical Pharmacology, 7th ed,CBS publishers .
5. F.S.K.Barar ,Test book of Pharmacology, S.Chand & Co Ltd, 1 edu.2012.

III B.Sc Biochemistry	COURSE NAME:HISTOPATHOLOGICAL TECHNIQUES	COURSE CODE: 19SBC51A
SEMESTER-V		HRS/WK-2
SKILL PAPER-I		CREDIT-2

OBJECTIVES

1. To study and acquire knowledge about the morphology of normal and diseased cells
2. To analyse knowledge about the steps involved in tissue processing methods.
3. To gain knowledge about the staining process.

COURSE OUTCOMES

CO1-Students are able to understand the general organization of histopathological laboratory.

CO2-Students are able to acquire the information about the basic steps in tissue processing fixation, embedding, microtome, staining and mounting.

CO3-Students are able to gain knowledge about the various essential steps involved in the fixation and decalcification processes.

CO4-Students are able to acquire knowledge about steps involved in tissue processing

CO5-Students are able to understand the mounting methods and the different steps involved in the staining process.

SEMESTER I	COURSE CODE: 19SBC51A					COURSE NAME: HISTOPATHOLOGICAL TECHNIQUES								HOURS:2 CREDITS:2
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PS O3	PS O4	PS0 5	PS O6	PS O7	PSO8	
CO1	4	4	4	3	4	4	4	4	3	4	3	4	4	3.5
CO2	3	4	4	4	4	4	3	4	4	4	3	4	4	3.8
CO3	4	4	4	4	4	3	4	4	4	3	4	3	4	3.7
CO4	4	4	4	3	4	3	3	3	5	5	5	5	3	4.3
CO5	4	4	4	4	3	4	3	3	3	4	3	4	3	3.7
Mean Overall Score														3.8

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - INTRODUCTION **[12 hrs]**

General understanding of the terms – Histology, histopathology and histopathological techniques. General organization of histopathological laboratory and basic requirements of histopathology laboratory. (Glass wares, chemical and Reagent, Equipment and Instruments). Responsibilities of a histotechnologist.

UNIT II - GENERAL EXAMINATIONS OF TISSUES **[8 hrs]**

General introduction, Basic steps in tissue processing fixation, embedding, microtomy, staining, mounting. In vitro processing of Membrane protein, nuclear protein and cytoplasmic protein.

UNIT III - FIXATION AND DECALCIFICATION **[12 hrs]**

Fixation and fixatives- Aim of fixation, classification of fixation, different types of fixatives, advantages and disadvantages. Decalcification- Aim of decalcification, selection of tissue, fixation, and decalcifying agents used, Decalcification techniques. Difference between fixative and preservatives.

UNIT IV - TISSUE PROCESSING **[10 hrs]**

Tissue processing- Technique of dehydration, clearing (Aim of cleaning, different cleaning agents), Impregnation, Embedding, techniques of casting Blocking. Section cutting- Different types of microtomes, microtome knives. Cryopreservation- Principles, methods used, freezing sections.

UNIT V STAINING AND MOUNTING **[8 hrs]**

Staining- Principles of staining Basic staining techniques, special stains in histological studies. Mounting: Different mounting media and mounting techniques.

TEXT BOOKS:

1. J Ochei and Kolhatkar, 2002. Medical laboratory science theory and practice, Tata McGraw-Hill, New Delhi.
2. Kanai L. Mukherjee, 2007, Medical laboratory technology Vol.I& III Tata McGraw Hill, New Delhi.
3. Lillie, R.D. 1954. Histopathologic Technic and Practical Histochemistry, Second Edition, Blakiston, New York, pp-715

REFERENCE BOOKS:

1. Ramadas Nayak, Histopathology techniques & its management, 1st Edition, 2018, Jaypee Brothers Medical publishers.
2. Neelam vasudeva, Sabita Mishra, Text book of Human Histology, Kote, 8th Edition, 2015, Jaypee Brothers Medical publishers.
3. Darhanp.Godkarpraful B. Godkar, Text book of Medical Laboratory Technology Vol 1&2 3rd Edition 2014, Bhalani Publishing House.
4. Sood R, Medical LeboratoryMethods and interpretation, 2005, Jaypee Brothers Medical Publications, Newdelhi.
5. J. Brachet and A. E. Mirsky, The Cell - Biochemistry, physiology and morphology Academic Press (1963)

III B.Sc Biochemistry	COURSE NAME:FISHERIES BIOLOGY (60 hrs)	COURSE CODE: 19SBC51B
SEMESTER- V		HRS/WK-2
SKILL PAPER II		CREDIT-2

OBJECTIVES

1. To understand and learn the classification of fisheries
2. To gain knowledge about the ecology of fishes
3. To acquire the knowledge about the fish processing and its preservation

COURSE OUTCOMES:

CO1: To gain appropriate knowledge about classification of fisheries

CO2: To understand the basic concepts of fisheries management and also gain knowledge about diseases of fishes.

CO3: To acquire in-depth knowledge about physiology and ecology of fishes

CO4: To acquire sufficient knowledge and skill about different types of fish culture

CO5: To understand and gain significant knowledge about fish processing and preservation

SEMESTER V	COURSE CODE: 19SBC51B					COURSE NAME: FISHERIES BIOLOGY								HOURS:2 CREDITS:2
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PS O1	PS O2	PS O3	PS O4	PS05	PS O6	PS O7	PS O8	
CO1	5	4	4	3	5	5	5	5	4	3	4	5	5	4.38
CO2	5	4	3	3	4	5	4	4	3	3	5	3	4	3.84
CO3	5	5	3	4	4	5	4	4	4	3	4	5	3	4.07
CO4	5	5	3	4	4	5	4	5	5	5	3	5	3	3.92
CO5	5	5	3	5	4	4	4	4	3	4	4	5	4	4.15
Mean Overall Score														4.07

Result: The Score of this Course is 4.1 (Very High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **Very High** association with Programme Outcome and Programme Specific Outcome

UNIT I - CLASSIFICATION OF FISHERIES **[6hrs]**

Classification of fisheries: Marine fisheries (Coastal, Offshore and deep sea fisheries), inland fisheries, Crustacean fisheries (Prawn, shrimp, lobster and crab fisheries); Molluscan fisheries (Edible Oyster, pearl oyster, Cephalopod and lime fisheries).

UNIT II FISHERIES AND ITS MANAGEMENT **[6hrs]**

Fishing craft and gear in India, Fisheries Management. Parasites and diseases of fishes,Fish in relation to public health.

UNIT III PHYSIOLOGY AND ECOLOGY OF FISHES **[6hrs]**

Food and feeding habits –locomotion by fins and Body form – Respiration – Accessory respiratory organs – Airbladder – reproduction – Ecological factors influencing spawning in carps, parental care and migration.

UNIT IV - FISH CULTURE **[6hrs]**

Fish culture: Types – Hybridization, Induced spawning of Indian carps, Paddy cum fish culture, Monoculture, Composite fish culture, sewage – fed fisheries, cage fish culture – culture of Prawn, pearl – Oyster and Catla (Common carp).

UNIT V - FISH PROCESSING AND PRESERVATION **[6hrs]**

Drying, Salting, Smoking, Canning, Prawns and Fishery by products.Preservation and processing – chilling method. Drying – conventional methods. Salt curing, pickling and smoking. Freezing and cold storage, Canning procedures.

TEXT BOOKS

1. Kreuzer, , Fishery Products, 1974, FAO Fishing News (Books) Ltd., England.
2. Anon, Handling, Processing and Marketing of Tropical Fish. 1979, Tropical Products Institute, London.
3. Miller, M.D, Ciguatera Seafood Toxins, 1990, CRC Press New York.

REFERENCE BOOKS

1. Carison, V.R. and R.H. Graves, A Food Industry Perspective, Aseptic Processing and Packing of Food, CRC Press, 1996, New York.
2. Gopakumar, K., Tropical Fishery Products, 1997, Oxford & IBH Publications, New Delhi.
3. V.G.Jhingran, Fish and Fisheries of India, 1975, Hindustan Publishing Corp., Delhi.
4. J.R. Norman, A History of Fishes, 2018, Earnest Benn Limited, London.
5. N.B. Marshall, The life of Fishes, 2013, Weidnefeld& Nicholson, London.

III B.Sc Biochemistry	COURSE NAME : LIFE STYLE DISEASES (30 hrs)	COURSE CODE: 19SSBC52A
SEMESTER-V		HRS/WK-4
SSC-I		CREDIT-2

OBJECTIVES

1. To gain knowledge about the basis of various lifestyle diseases and their complications.
2. To understand and gain knowledge about the complcations of DM
3. To acquire knowledge abou the complications of Genitourinary diseases, cancer and Neuro psychiatric disorders

COURSE OUTCOMES

CO1: To understand the Pathophysiology of Diabetes mellites and its complication.
CO2: To gain in depth insights about the lifestyle disease like obesity and asthma.
CO3: To understand the several complications and management of Genitourinary diseases.
CO4: To gain the knowledge about the cancer and its complications
CO5: To acquire knowledge about the Neuro-psychiatric disorders

SEMESTER V	COURSE CODE: 19SSBC52A					COURSE NAME: LIFE STYLE DISEASES								CREDITS: 2
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5	PS O6	PS O7	PSO 8	
CO1	3	3	4	4	4	4	3	4	3	5	4	3	4	3.69
CO2	5	3	4	5	3	3	3	5	4	5	3	3	4	3.84
CO3	4	4	3	4	4	4	4	3	2	3	3	4	3	3.46
CO4	4	5	2	4	3	3	3	4	3	4	4	2	5	3.53
CO5	3	4	3	3	2	3	4	3	3	3	4	3	4	3.23
Mean Overall Score														3.55

Result: The Score of this Course is 3.6 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - DIABETES MELLITUS **[6hrs]**

Diabetes Mellitus- Type I and type II diabetes, risk factors, metabolic changes, acute and chronic complications, diagnosis, treatment and prevention. Gallstones and kidney stones - causes, symptoms, diagnosis and treatment.

UNIT II - ASTHMA & OBESITY **[6hrs]**

Asthma- symptoms, risk factors, complications, diagnosis, prevention, and treatment. Obesity- causes, complications, prevention and treatment.

UNIT III - GENITOURINARY DISEASES **[6hrs]**

Genitourinary diseases- causes, signs and symptoms, diagnosis and treatment of glomerulonephritis, hemolytic uremic syndrome, polycystic kidney disease, hydronephrosis, urinary tract infections and disorders of the genitourinary system

UNIT IV - CANCER AND CARDIO VASCULAR DISEASES **[6hrs]**

Cancer- types of cancer, causes, signs and symptoms of cancer, diagnosis and treatment of cancer. Cardiovascular disease- causes, signs and symptoms and treatment of coronary artery diseases, heart attack, heart failure, congenital heart disease.

UNIT V: NEURO-PSYCHIATRIC DISORDERS **[6hrs]**

Depression, Anxiety and Stress - causes, signs and symptoms and treatment. Antidepressant medicines, Cognitive Behavior Therapy (CBT). Arthritis - causes, signs and symptoms, management and therapy.

TEXT BOOKS:

1. RA Agarval, Anil. K. Srivastav, Kaushal Kumar, Animal Physiology and biochemistry, 1986, S.Chand& Co.
2. Ganong W. E..Review of Medical Physiology, 21st edition, 2003, McGraw Hill.
3. A.K.Jain, Textbook of Physiology Vol - I & II, 6th Edition, 2016, Avichal Publishing Company.

REFERENCE BOOKS:

1. L. Rapport, B. Lockwood, Nutraceuticals, 2 nd Edition, 2002, Pharmaceutical Press. M. Maffei, Dietary Supplements of Plant Origin, 2003, Taylor & Francis.
2. Shahidi and Weerasinghe, Nutraceutical beverages Chemistry, Nutrition and health Effects, 2004, American Chemical Society.
3. Young, J. Functional Foods: Strategies for successful product development. FT Management Report, 1996, Pearson Professional Publishers, London.
4. Turnock, B.J. (2007). Essentials of Public Health -. Jones & Bartlett, 7. Park and Park(2015). Text book preventive and social medicine.
5. Turnock, B.J. (2007). Essentials of Public Health -. Jones & Bartlett, 7. Park and Park (2015). Text book preventive and social medicine.

II B.Sc Biochemistry	COURSE NAME:FUNDAMENTALS OF PUBLIC HEALTH AND EPIDEMIOLOGY (30 hrs)	COURSE CODE: 19SSBC52B
SEMESTER-V		HRS/WK – 4
SSC-II		CREDIT-2

OBJECTIVES

1. To introduce students to the discipline of public health.
2. To give an overview of the methods of prevention and health promotion.
3. To understand the determinants and measures of vector borne disease and health.

COURSE OUTCOMES:

CO1: Students able to learn about the public health diseases and its criteria.
CO2: Students acquire knowledge about the parasite infections.
CO3: Students understand about the integrated vector management.
CO4: Students learn about the controlling and preventing vector borne diseases.
CO5: Students gain knowledge about the survey on epidemiology of vector-borne diseases.

SEMESTER V	COURSE CODE: 19SSBC52B					COURSE NAME: FUNDAMENTALS OF PUBLIC HEALTH AND EPIDEMIOLOGY								CREDITS :2
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO 6	PSO7	PSO8	
CO1	3	3	4	3	3	2	4	4	3	3	4	4	5	3.5
CO2	4	2	2	3	3	3	4	3	4	5	3	3	4	3.3
CO3	3	2	4	3	2	3	4	4	4	3	4	3	4	3.3
CO4	4	4	3	5	2	2	4	3	5	3	2	4	4	3.5
CO5	4	3	2	5	2	3	4	2	3	3	4	2	3	3.1
Mean Overall Score														3.3

Result: The Score of this Course is 3.3 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - ENVIRONMENT AND PUBLIC HEALTH [6 hrs]

Introduction to Environment and Public Health, Definition, Role of Vectors, Communicable and Non -Communicable Diseases. Pollution: Allergy and allergens.

UNIT II - VECTOR BORNE DISEASES [6 hrs]

History and geographic distribution of human malaria -Taxonomic position of different species - Distinguishing characters of different species of human malarial parasites - Life cycle and host-parasite interactions.

UNIT III - VECTOR CONTROL [6 hrs]

History and background. Aim, objectives, goals, importance and advantages of vector control.. Recent trends - Alternatives to the use of insecticides (chemical & microbial) - Vector control at individual or at commUNITy or at both levels.

UNIT IV- INTEGRATED VECTOR MANAGEMENT [6 hrs]

Concept and definition of IVM, merits and limitations. Aspects of IVM - role of vector in controlling/preventing vector borne diseases.Malaria control programmes and strategies - NVBDCP.

UNIT V - EPIDEMIOLOGY [6 hrs]

Definition, aim and scope of epidemiology - Epidemiological Survey: Development & application of questionnaires. Case studies on epidemiology of vector-borne diseases: (i) incidence and prevalence, (ii) relative risk, (iii) odds ratio. Determinations of sample size for cross sectional, prospective, case-control studies.

TEXT BOOKS

1. Oxford textbook of Public Health Ed. Roger Detels, James Mcewen, Robert BeagleholeadHeizo Tanaka Oxford University press 4th edition: 2002.
2. Public health at the crossroads-Achievements and prospects. Robert Beaglehole and RythBinita 2nd Edition, 2004, Cambridge University Press.
3. Dona Schneider and David E. Lillenfeld. Lillienfeld's Foundations of epidemiology, 4th Edition, 2015, Oxford University Press.

REFERENCE BOOKS

1. Rozendaal, J. A. 1997. Vector Control. Methods for use by individuals and commUNITies. World Health Organization, Geneva.
2. World Health Organization. 1986. Epidemiology and control of African trypanosomiasis. Report of a WHO Expert Committee, Geneva, (WHO Technical Report Series, No. 739).
3. Bruce-Chwatt, L.J. 1985. Essential Malariology, The Alden Press, Oxford.
4. Warnsdorfer, W.H. and Sri..Mc Gregor, I. 1988. Malaria: Principles and Practice of Malariology. Vol. I and II, Churchill Livingstone, New York
5. Turnock, B.J. (2007). Essentials of Public Health -. Jones & Bartlett, 7. Park and Park(2015). Text book preventive and social medicine.

III B.Sc Biochemistry	COURSE NAME:FUNCTIONAL FOODS ON HUMAN HEALTH (20 hrs)	COURSE CODE: 19SSBC52C
SEMESTER-V		
SSC-III		CREDIT-2

OBJECTIVES

1. To impart the concept of nutraceuticals and functional ingredients in foods, and to determine their role in health and disease prevention.
2. To learn about the various phytochemicals-their sources, functions and usefulness.
3. To know about the usefulness of nutraceuticals supplementation in day to day life.

COURSE OUTCOMES

CO1: To understand the basics, importance and applications of nutraceuticals
CO2: To acquire the knowledge about the concepts of functional foods with examples.
CO3: To understand the importance of Nutraceuticals and types of supplementation.
CO4: To gain knowledge about the common nutraceuticals used in day to day life
CO5: To acquire knowledge about the role of nutraceuticals in disease prevention.

SEMESTER V	COURSE CODE: 19SSBC52C					COURSE NAME: FUNCTIONAL FOODS AND HUMAN HEALTH								CREDITS:2
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	4	4	3	4	3	4	3	4	4	3	3	3.46
CO2	5	3	4	5	3	3	3	3	4	5	3	3	4	3.69
CO3	4	4	3	3	4	4	4	3	2	3	3	4	3	3. 38
CO4	3	5	2	4	3	3	3	4	3	2	4	2	4	3.23
CO5	3	4	3	3	2	3	4	3	4	3	4	3	4	3.30
Mean Overall Score														3.41

Result: The Score of this Course is 3.4 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - INTRODUCTION TO NUTRACEUTICALS [4hrs]

Nutraceuticals: Definitions and Limitations, Relevance of Functional Foods, Functional Food versus Pharmaceuticals, Impact on Health Care and Society. Functional Food: Sources and Classification

UNIT II - INTRODUCTION TO FUNCTIONAL FOODS [4hrs]

Functional foods- Fortified food, Protein enriched diet, cereals, milk and dairy products, fruits and vegetables as functional foods. Health effects of common beans, spices and condiments, fish oils, and sea foods. Concept of prebiotics and probiotics

UNIT III - NUTRITIONAL SUPPLEMENTATION [4hrs]

Nutritional importance, supplementation and requirements of carbohydrates, proteins, fats, vitamins and mineral. Supplementation of essential- fatty acids, aminoacids, vitamins and minerals requirements and health benefits.

UNIT IV - NUTRACEUTICALS FOR HEALTHY LIFE [4hrs]

Antioxidant activity- Onion, garlic, turmeric, beta-carotene, Renal and excretory function- Magnesium and potassium citrate, lycopnene, Gastrointestinal - Ginger, flavonoids, polyphenol, prebiotics.Reproductive- Biotin, coenzyme Q10 or ubiquinone, isoflavone, Omega-3 fatty acids, vitamin-C, vitamin-E and Zinc.

UNIT V - NUTRACEUTICALS FOR DISEASE PREVENTION [4hrs]

Cardiovascular diseases, Diabetic mellitus, obesity, cancer, osteoarthritis, oral diseases, eye disorder and stress management.

Brief outline on food safety management systems by Food Safety and Standards Authority of India (FSSAI)

TEXT BOOKS:

1. Taylor C, Wallace rebert E.C, Wildman, Robert Wildman, Hand book of Nutraceuticals and Functional Foods. 2nd Edition, 2016, CRC press.
2. MandalikaSubhadra, Functional Foods And Nutrition, 2014, Daya Publishing House.
3. Israel Goldberg, Functional foods, designer foods, pharma foods, Nutraceuticals, 1999, Aspen publishers, USA .

REFERENCE BOOKS :

1. L. Rapport, B. Lockwood, Nutraceuticals, 2nd Edition, 2002, Pharmaceutical Press.
2. M. Maffei, Dietary Supplements of Plant Origin, 2003.
3. Shahidi and Weerasinghe, Nutraceutical beverages Chemistry, Nutrition and health Effects, 2004, American Chemical Society.
4. Young, J. Functional Foods: Strategies for successful product development. FT Management Report, 1996, Pearson Professional Publishers, London.
5. Vattem, Dhiraj A. and Vatsala Maitin. Functional Foods, Nutraceuticals and Natural Products, Concepts and Applications. USA: DEStech Publications, Inc. 2016.

III B.Sc Biochemistry	COURSE NAME:MEDICAL BIOCHEMISTRY (75 hrs)	COURSE CODE: 19BC611
SEMESTER-VI		HRS/WK-5
CORE XI		CREDIT-5

OBJECTIVES

1.To understand biochemical basis of various diseases and disorders.

2. To understand the inborn errors of aminoacid metabolism and lipid transport

3. To study the importance of gastric, liver and renal functional test and diagnosic enzymes.

COURSE OUTCOMES:

CO1: Able to gain knowledge about the Diabetes mellitus and its complications.

CO2: To comprehend underlying factors involved in various lifestyle diseases.

CO3: To understand types and pathophysiology of inborn errors of aminoacid metabolism and lipid transport.

CO4: To understand the principle and importance of gastric and liver functional test.

CO5: To understand the principle and importance of renal functional test and diagnostic enzymes.

SEMESTER VI	COURSE CODE: 19BC611					COURSE NAME: MEDICAL BIOCHEMISTRY								HOURS5 CREDITS:5
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	3	3	3	4	4	4	3	3	3	3	3	3.3
CO2	3	4	4	4	4	3	3	4	3	3	3	3	4	3.4
CO3	4	4	3	4	3	3	4	4	3	5	4	3	4	3.7
CO4	4	4	4	3	4	3	3	3	5	5	5	5	3	4.3
CO5	4	4	4	4	3	4	3	3	3	4	3	4	3	3.7
Mean overall score														3.7

Result: The Score of this Course is 3.7 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - LIFE STYLE DISEASES I [15 hrs]

Diabetes mellitus- definition, WHO criteria, classification of diabetes mellitus-signs, symptoms and complications, regulation of blood glucose level, Impaired glucose tolerance, Impaired fasting glycemia, Gestational diabetes mellitus, Alimentary glucosuria, Renal glucosuria, Hyperosmolar nonketotic coma, Lactic acidosis, Glycated hemoglobin.Insulin resistance.

UNIT II - LIFE STYLE DISEASES II [15 hrs]

Cardiovascular diseases: Atherosclerosis, Coronary artery disease, Relation of cholesterol with myocardial infarction, Risk factors of atherosclerosis, Prevention of atherosclerosis, Hypolipoproteinemias, hyperlipoproteinemias. Obesity- factors leads to Obesity and its treatment.

Cancer: Etiology, Chemical carcinogens, Antimutagens, Oncogenic viruses, Oncogenes, Proto oncogene, Characteristics of cancer cells.

UNIT III - INBORN ERRORS & LIPID TRANSPORT [15 hrs]

Inborn errors of metabolism- phenylketonuria, alkaptonuria, albinism, cystinuria and fanconisyndrome.Exogenous and endogenous transport of lipids- chylomicron transport, VLDL transport-reverse cholesterol transport.

UNIT IV - LIVER& GASTRIC FUNCTION TEST [15hrs]

Liver function test-Heme catabolism- Jaundice- classification- biochemical findings-liver function test based on bile pigments- Vanden bergh test, Detoxification-Hippuric acid excretion and BSP dye test, metabolism-galactose tolerance test, Prothrombin time, Gastric function test-gastric contents, resting stage gastric analysis-stimulation test (histamine, pentagastrin) - FTM-AZURE-A test. Hypo and hyperacidity.

UNIT V - RENAL FUNCTION TEST & DIAGNOSTIC ENZYMES [15 hrs]

Renal function test-renal concentration test-PSP dye test-urea, creatinine and inulin clearance test. Plasma enzymes-functional and non-functional enzymes, isoenzymes, enzyme patterns in acute pancreatitis, liver diseases and myocardial infarction.

TEXT BOOKS:

1. Textbook of Biochemistry for medical students-DM.Vasudevan, 5thedition,Jaypee publishers, 2008.

2.Textbook of Medical Biochemistry, Chatterjee, M.N. and RanaShinde, 5th ed. Jaypee Medical Publishers, 2002.

3. Varley – Practical clinical biochemistry – William Heinemann Medical books – London Ltd. Inter Science books Inc, New York 1969.

REFERENCE BOOKS:

1.Robert K. Murray, Daryl K. Grammer "Harper's Biochemistry",(25th Edition) McGraw Hill, Lange Medical Books.

2. Sathya Narayana U,1999, "Biochemistry", (2nd Edition), Kolkata, Allied Publishers.

3. Devlin, T.M, Textbook of Biochemistry with Clinical Correlations. John Wiley and sons, INC. New York, 2002.

4. Conn E E and Stump P.K. – Outlines of Biochemistry – Wiley Eastern (P) Ltd. New Delhi, 1981.

5. Shanmugham Ambika – Fundamentals of bio-chemistry to medical students. NVA Bharat Printers, and traders 56, Peters Road, Madras-86. 1985.

III B.Sc Biochemistry	COURSE NAME:BIOTECHNOLOGY AND GENETIC ENGINEERING (75 hrs)	COURSE CODE: 19BC612
SEMESTER-VI		HRS/WK-5
CORE-XII		CREDIT-5

OBJECTIVES

1. To provide an insight into the basic concepts of biotechnology and gentic engineering
2. To acquire knowledge about the plant and animal cell culture
3. To know the importance of cell culture media and its applications

COURSE OUTCOMES:

CO1: Able to gain in-depth knowledge about the importance of Biotechnology and the molecular tools used in biotechnology and genetic engineering

CO2: To acquire the knowledge about the principle, importance of media and plant growth regulators used in plant cell culture

CO3: To acquire the knowledge about the principle, importance of media used in animal cell culture, cell culture maintenance and its applications

CO4: To exhibit the vaccine production method, differentiate the traditional and recombinant vaccines and acquire knowledge about the transgenic animals and plants.

CO5: Able to exhibit their knowledge in fermentation technology, types of fermentation and the nature of media used in fermentation and IPR

SEMESTER IV	COURSE CODE: 19BC612					COURSE NAME BIOTECHNOLOGY AND GENETIC ENGINEERING								HOURS :5	CREDITS: 5
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	5	5	2	3	2	5	4	4	3	2	4	5	5	3.8	
CO2	4	5	2	2	2	5	4	5	2	2	4	5	3	3.4	
CO3	4	5	2	2	2	5	3	4	2	2	3	5	3	3.2	
CO4	4	5	2	2	2	5	3	4	3	2	4	5	4	3.4	
CO5	5	5	2	4	3	5	5	5	4	2	4	5	5	4.1	
Mean Overall Score														3.6	

Result: The Score of this Course is 3.8 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - INTRODUCTION **[15 hrs]**

Introduction to Biotechnology: Scope & its importance. Enzymes involved in rDNA technology. Restriction and modification enzymes, vectors- plasmids, pBR322, Ti plasmid, bacteriophages-lambda, phage M13, cosmids, BAC, YAC, shuttle vectors. Gene transfer methods-Microinjection and Electroporation.

UNIT II - PLANT TISSUE CULTURE **[15 hrs]**

Totipotency, tissue culture: media, composition, nutrients, growth regulators, regeneration of plants-organogenesis and somatic embryogenesis, callus and cell suspension culture, micropropagation, production of haploid plants, protoplast isolation, fusion and regeneration.

UNIT III - ANIMAL CELL CULTURE **[15 hrs]**

Animal cell culture: requirements, sterilization& applications. Culture media: natural and artificial, properties & use of serum and serum-free media, cell adhesion molecules. Primary cell culture: mechanical disaggregation, enzymatic disaggregation and primary explants technique. Cell lines: finite and continuous.Subculture: mono layer and suspension cultures.

UNIT IV - VACCINES &TRANSGENESIS **[15 hrs]**

Production of vaccines in animal cells: traditional and recombinant vaccines -subUNIT vaccines-Hepatitis B, Vaccinia virus (Vector recombinant vaccine), DNA and RNA vaccines.Transgenic animals: techniques and applications - transgenic mice and sheep.Stem cells: isolation, identification and uses.Transgenic plants and its applications.

UNIT V – FERMENTATION & IPR **[15 hrs]**

Fermentation, Fermentor: common features and operation for a conventional bioreactor, classification of fermentation process – batch, continuous and fed-batch fermentation. Fermentation process-factors affecting fermentation process, media for fermentation – synthetic and crude media. PCR , RT PCR,.IPR & Patents.

TEXT BOOKS:

1. SathyaNarayana U, 1999, "Biotechnology", (2nd Edition), Kolkata,Allied Publishers.
2. P.K.Gupta,"Biotechnology and Genomics", 2004,Rastogi Publications.
3. Dubey.R.C.,A Textbook of Biotechnology,S.Chand& Company Ltds.

REFERENCE BOOKS:

1.Bernard, Glick Jack.R,Pasternak.J,Molecular Biotechnology-Principle and Application of Recombinant DNA, 3rdedition,2003,Library of Congress Cataloging in Publication Data.

2. Primrose (2001) - Principles of gene manipulation. 6th Edition Blackwell Scientific Publishers. UK

3. Zubay, 1998, Biochemistry 4th Edition, WMC Brown Publishers, USA.

4. Old, R.S. and Primrose, S.B. (1995) Principles of Gene manipulation. An introduction to genetic Engineering. 5th Edition. Blackwell Scientific Publication, London

5. Ajoy Paul (2007). Textbook of Cell and Molecular Biology, Books and Allied (P) Ltd, Kolkatha.

III B.Sc Biochemistry	COURSE NAME:CLINICAL ENDOCRINOLOGY (For the Batch 2019-22)	COURSE CODE: 19EBC63A
SEMESTER-VI	(75 hrs)	HRS/WK-5
ELECTIVE-III		CREDIT-4

OBJECTIVES

1.To provide an insight into the structure and functions of hormones.
2.To know the importance of pituitary, hypothalamus, pineal gland hormones an its regulations
3. To study the functions of male and female sex hormones with its regulation

COURSE OUTCOMES:

CO1: Able to gain indepth knowledge about the importance of hormone and their effect on target cells.

CO2: To gain knowledge about the functions of pituitary, hypothalamus and pineal gland hormones and its regulations.

CO3: To learn and understand the structure and functions of thyroid, parathyroid hormones and its regulations.

CO4: To acquire knowledge about the structure and functions of adrenal hormones and its regulation.

CO5: To understand the structure and functions of gastrointestinal, male and female sex hoTo rmones and its regulation.

SEMESTER VI	COURSE CODE: : 19EBC63A					COURSE NAME: CLINICAL ENDOCRINOLOGY								HOURS:5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	4	4	3	4	4	4	4	3	5	4	5	3	4	3.9
CO2	3	3	4	4	3	3	4	3	4	4	5	2	4	3.5
CO3	4	4	5	3	3	4	3	4	3	4	3	4	3	3.6
CO4	4	5	4	3	3	3	4	3	4	4	4	3	4	3.7
CO5	3	4	4	3	3	5	4	4	4	3	4	3	3	3.6
Mean overall score														3.7

Result: The Score of this Course is 3.7 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - INTRODUCTION TO HORMONES [15 hrs]

Hormones: types, feedback regulation. Different mechanisms of signal transduction, secondary messengers : cAMP mediation, calcium and DAG mediation, cGMP mediation, G-proteins and nuclear receptors.

UNIT II - PITUITARY& HYPOTHALAMUS HORMONES [15 hrs]

Structure of pituitary gland**,** Hormones of anterior pituitary: FSH, LH, TSH and its functions.Posterior pituitary - oxytocin and vasopressin with its functions.Hormones of hypothalamus.

UNIT III - THYROID, PARATHYROID & PANCREATIC HORMONES [15 hrs]

Thyroid hormones: structure and functions.Hypothyroidism-cretinism, myxedema, simple Goiter, Grave's disease. Parathyroid hormones- regulation of calcium homeostasis by PTH and calcitonin.Hormones of pancreas- insulin & glucagon.

UNIT **IV - ADRENAL HORMONES [15 hrs]**

Hormones of adrenal cortex - cortisol biosynthesis (structure not required) and its functions, Cushing's syndrome, Addison's disease - Aldosterone biosynthesis and its functions – renin - angiotensin mechanism, Conn's syndrome. Medullary hormones -biosynthesis of epinephrine and nor-epinephrine.Dopamine and its metabolic functions, pheochromocytoma.

UNIT V - GASTROINTESTINAL HORMONES & SEX HORMONES [15 hrs]

Gastrointestinal hormones: chemical nature, functions of gastrin, enterogastrone, secretin, and cholecystokinin. Sex steroids: male sex hormones - biosynthesis and its metabolic functions, Female sex hormones - biosynthesis and its metabolic functions.

TEXT BOOKS:

1. Chatterjee, M.N. and RanaShinde. Textbook of Medical. Biochemistry, 2002. 5th edition. Ja, pee Medical Publishers.
2. DM.Vasudevan. Textbook of Biochemistry for medical students. 5th edition, Jaypee Publishers, 2008.
3. Clinical Chemistry. W. J. Marshall, M. Lapsley, S. K. Bangert 8 thedition Mosby. (2016).

REFERENCE BOOKS:

1. U.Sathayanarayana, (2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.
2. Mallikarjuna Rao N,2002, " Medical Biochemistry",2nd edition, New Delhi,New Age International Publishers.
3. Devlin, T.M. (2002) Textbook of Biochemistry with Clinical Correlations. John Wiley and sons, INC. New York.
4. Ramakrishnan S, Prasanna K.G. and Rajan R,1980, " Textbook of Medical Biochemistry",3rd edition, Chennai, Orient Longman.
5. Bhagavan.N.V (2004),"Medical Biochemistry",4thedition, Noida, Academic Press.

I B.Sc Biochemistry	COURSE NAME:HUMAN PHYSIOLOGY (75 hrs)	COURSE CODE: 19EBC63B
SEMESTER-VI		HRS/WK-5
ELECTIVE-III		CREDIT-4

OBJECTIVES

1. To learn the structure and functions of the different organs present in the human body
2. To study the types of digestion and also absorption of macromolecules
3. To know the knowledge about the exchange of gases, structure and functions of nephrons, neurons and skeletal muscles.

COURSE OUTCOMES

CO1: To gain knowledge about the various types of RBC and WBC cells, different types of blood groups and basic structure and functions of heart.

CO2: To learn about the various types of digestion and absorption of macromolecules.

CO3: To understand about the respiration and its types, mechanism of exchange of gases, and structure and functions of nephrons.

CO4: To gain knowledge about the structure, types and functions of neurons, different parts of brain, spinal cord and its functions.

CO5: To acquire knowledge about the structure, types of skeletal muscle and its muscle proteins and also steps involved in molecular basis of muscle contraction.

SEMESTER VI	COURSE CODE: 19EBC63B					COURSE NAME: HUMAN PHYSIOLOGY								HOURS:5 CREDITS 4
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	4	5	3	5	4	3	5	4	4	5	5	3	4	4.2
CO2	4	4	5	4	3	5	3	5	4	3	4	3	4	3.9
CO3	4	3	4	3	4	4	5	4	3	5	3	3	4	3.8
CO4	4	5	3	4	3	4	4	3	3	5	4	5	4	3.9
CO5	5	3	4	4	3	4	4	5	4	5	4	5	3	4.2
Mean overall score														4.0

Result: The Score of this Course is 3.4 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I BLOOD AND CIRCULATORY SYSTEM [15 hrs]

Composition of blood – types of blood cells, morphology and its functions, Blood groups - ABO group and Rh type. Composition of lymph, circulatory system: Heart - basic anatomy, cardiac cycle, cardiac output and pace maker.

UNIT II DIGESTION [15 hrs]

Definition, digestive system: chemical process of digestion. Salivary digestion, gastric digestion - Mechanism of Hcl secretion in stomach, pancreatic digestion, intestinal digestion, Role of bile salt in Digestion, Digestion and absorption of carbohydrates, proteins, and lipids.

UNIT III RESPIRATORY SYSTEM AND EXCRETORY SYSTEM [15 hrs]

Respiration, types of Respiration, Respiratory system of human, Transport of O_2 and CO_2, Role of Hemoglobin in of O_2 and CO_2 transport. Oxygen Dissociation curve, Bohr Effect, Chloride shift. Excretory system of man, structure of nephron, Mechanism of urine formation – Ultra filtration, Reabsorption and Secretion.

UNIT IV NERVOUS SYSTEM [15hrs]

Neuron, types of neuron, conduction of nerve impulse, Synapse - types of synapse, synaptic transmission, Neurotransmitter, Neuromuscular junction.

Human brain: Anatomy of brain - meninges, cerebrum, brain stem, cerebellum and functions. Spinal cord and its function.Blood brain barrier and CSF.

UNIT V MUSCLE & BONES [15hrs]

Introduction, types of muscle, Ultra structure of skeletal muscle - light band, dark band, Sarcomere, thick filament-myosin, thin filament - actin, tropomyosin and troponin. Muscle contraction – types of muscle contraction and theories of muscle contraction, Molecular basis of skeletal muscle contraction. Bone structure and formation. Ligaments and tendons.

TEXT BOOKS:

1. KA Goel, KV Sastri, A Text book of Animal Physiology, Rastogi publications, Meerut.
2. Arthur C. Guyton and John E. Hall, 2016.Textbook of Medical Physiology , Harcourt Asia Pvt. Ltd, 10th edition.
3. Sembulingam, Premasembulingam,2012.Essentials of medical Physiology-K 6th edition, Jaypee Brothers Medical Publishers (P) Ltd.,

REFERENCE BOOKS:

1. BJ Meyer, HsMeij, AC Meyer, Human Physiology, 2nd edition – AITBS Publishers and distributon.
2. Giese, Cell Physiology, 5th edition, W .B Saunders company, Tokyo, Japan.
3. Animal Physiology and biochemistry – RA Agarval, Anil. K. Srivastav, Kaushal Kumar, S .Chand& CO.,
4. Ganong W. E. 2003.Review of Medical Physiology, 21stedition. McGraw Hill.
5. Zubay, 1998, Biochemistry 4th edition, WMC Brown Publishers, USA.

III B.Sc Biochemistry	COURSE NAME:BIOSTATISTICS AND CLINICAL RESEARCH (60 hrs)	COURSE CODE: 19EBC64A
SEMESTER-VI		HRS/WK-5
ELECTIVE-IV		CREDIT-4

OBJECTIVES:

1.To provide sufficient background to interpret statistical results in research papers.

2.To ensure the students with requisite knowledge to pursue a career in the clinical research industry.

3. To study the discovery of drugs and interpret the statistical values in clinical research.

COURSE OUTCOMES:

CO1: Students able to study the statistical data's and diagrammatic presentation of bar, pie chart etc.

CO2: Students understand the central concepts of modern statistical theory and their probabilistic foundation.

CO3: Students able to interpret results and principal methods of statistical inference and design.

CO4: Students able to study the origin and history of clinical research, and biochemical investigations.

CO5: Students learn about drug discovery, its development process, Pharmacokinetics, Pharmacodynamics and Pharmacogenomics.

SEMESTERVI	COURSE CODE: 19EBC64A					COURSE NAME: BIOSTATISTICS AND CLINICAL RESEARCH								HOURS:5	CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	3	4	3	3	2	4	4	3	3	4	4	5	3.5	
CO2	4	2	2	3	3	3	4	3	4	5	3	3	4	3.3	
CO3	3	2	4	3	2	3	4	4	4	3	4	3	4	3.3	
CO4	4	4	3	5	2	2	4	3	5	3	2	4	4	3.5	
CO5	4	3	2	5	2	3	4	2	3	3	4	2	3	3.1	
													Mean Overall Score	3.3	

Result: The Score of this Course is 3.3 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - DATA COLLECTION AND PRESENTATION [12 hrs]

Introduction: Collection of data, primary data, secondary data, methods of data collection. Processing of data- classification and tabulation of statistical data, Frequency Distribution: Simple and Cumulative, Diagrammatic presentation of data - Histogram, Bar chart, Frequency polygon and Pie chart, graphical presentation of data- line graph.

UNIT II -MEASURES OF CENTRAL TENDENCY [12 hrs]

Measurement of Central Value: Mean, Median, Mode, Geometric Mean (G.M) and Harmonic Mean (H.M), Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation.

UNIT III - STATISTICAL ANALYSIS [12 hrs]

Test for correlation and regression coefficients, Chi-square test for goodness of an independence of attributes. F-test for equality of variances, DMRT, ANOVA – one way classification.

UNIT IV - CLINICAL RESEARCH [12 hrs]

Introduction to clinical research, origin and history of clinical research, Biochemical investigations in clinical research, difference between clinical research and clinical practice, types of clinical research, phases of clinical research, career in clinical research.

UNIT V- DRUG DEVELOPMENT [12 hrs]

Drug discovery and development process, Preclinical testing, Clinical trials, ethical issues, new drug application and approval. Pharmacokinetics, Pharmacodynamics and Pharmacogenomics.

TEXT BOOKS

1. Green. R. H. 1979. 'Sampling Design and Statistical Methods for Environmental Biologists' .John Wiley & Sons.
2. Gupta.S.C& Kapoor. 1978.V.K. "Fundamental of Applied Statistics" (2nded), MJP Publishers.
3. Satoskar RS, bhandarkar SD, AinapureSS,E.Padmini, 2003.Biochemical calculations and Biostatistics. Books and Allied (P) Ltd.Pharmacology&Pharmacotherapeutics. 18th ed. Mumbai: popular prakashan: 376.

REFERENCE BOOKS:

1. Thomas Glover, Kevin Mitchell.2001.' Introduction to Biostatistics', 1st ed. McGraw Hill Science
2. Dr N .Gurumani,2015. "An Introduction to Biostatistics",MJP Publishers
3. Wilson & Walker, 2000. Principles and Techniques in Practical Biochemistry' 5th ed.. Cambridge Univ. Press.
4. Clinical Research Practice and prospects-T.K.Pal,Sangita Agarwal,1st edition.
5. Essential of Medical Pharmacology, Sixth edition-KD.Thripathi MD, Jaypee brothers medical publishers (P) Ltd. St Louis (USA)

III B.Sc Biochemistry	COURSE NAME:MEDICAL LABORATORY TECHNOLOGY (60 hrs)	COURSE CODE:19EBC64B
SEMESTER-VI		HRS/WK-5
ELECTIVE IV		CREDIT-4

OBJECTIVES

1.To provide insightsin the basic techniques involved in medical diagnostics.
2. To study the biochemical significance of marker enzymes
3. To know the staining and safety procedure involved in microbiological techniques.

COURSE OUTCOMES

CO1: To gain the knowledge about the laboratory equipments, role of laboratory technician and the types of specimen collection.
CO2: To acquire the knowledge about the blood grouping and the significance of haematological parameters.
CO3:To gain the knowledge about the various processes involved in the histopathological studies.
CO4:To understand the biochemical significance of marker enzymes.
CO5: To gain the knowledge about the culture of organism, culture media, gramstaining and safety procedure in microbiological techniques

SEMESTER VI	COURSE CODE:19EBC64B					COURSE NAME":MEDICAL LABORATORY TECHNOLOGY								HOURS:5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5	PSO 6	PSO 7	PSO 8	
CO1	4	5	4	4	5	3	4	4	3	4	5	4	3	4.0
CO2	5	4	3	4	3	4	3	3	4	5	3	3	4	3.69
CO3	4	5	4	4	3	4	4	3	3	3	3	4	3	3.61
CO4	4	4	3	2	4	3	3	4	4	2	4	2	4	3.30
CO5	5	3	4	3	4	3	4	4	4	3	3	3	4	3.61
	Mean Overall Score													3.64

Result: The Score of this Course is 3.6 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - INTRODUCTION TO LABORATORY TECHNOLOGY [12 hrs]

UNIT of measurement, reagent preparation and laboratory calculation. Code of ethics of laboratory technician, precautions taken to prevent hazards, handling and storage of chemicals. Types of specimen collection and procedure: blood, urine, sputum, throat swab, stool and CSF. Smear preparation and its types, calibration, measurements, quality control & GLP. Basic lab instruments - Centrifuge, incubator, colorimeter, oven and pH meter.

UNIT II - HEMATOLOGY [12 hrs]

Blood grouping and Rh factor, cross matching, clotting time, bleeding time, hemoglobin estimation, RBC count and WBC count- total and differential count, Erythrocyte Sedimentation Rate (ESR), Hematocrit value (Packed Cell Volume). Screening test: HIV (ELISA) HBs Ag, TPHA. Platelet and its significance, Coombs test.

UNIT III - CLINICAL PATHOLOGY [12 hrs]

Histopathology: Tissue cutting, fixation (Cryopreservation and formalin), embedding, tissue slicing by microtome, slide mounting and staining techniques: types – carbohydrates, proteins & lipids.

UNIT IV - CLINICAL BIOCHEMISTRY [12 hrs]

Blood glucose, urea, uric acid, triglycerides, SGOT, SGPT, serum alkaline and Acid phosphatase, calcium, phosphorous, total protein, albumin, amylase, lactate dehydrogenase, electrolytes-sodium and potassium -functions and its clinical significance.

UNIT V - MICROBIOLOGY [12 hrs]

Culturing of organisms from various specimens, culture media and antibiotic sensitivity test (pus, urine, blood, sputum, throat swab). Gram stain & Ziehl-Neilson staining method (TB,Mycobacterium leprae).Safety procedure in microbiological techniques.

TEXT BOOKS:

1. GradWohl, Clinical Laboratory-Methods and Diagnosis, 8th edition, mosbyyear book publisher, Vol-I.
2. Mukherj,2000. Medical Laboratory Technology,Tata McGraw Hill Education
3. Darshan P. Godkar Praful B. Godkar,2014. Textbook of Medical Laboratory Technology Vol 1 &2, Bhalani Publishing House; 3rd edition

REFERENCE BOOKS:

1. Henry, John Bernard, Todd Sanford and Davidson, 2002. Clinical diagnosis and management by laboratory methods. W.B. Saunders & Co.
2. Fischbach Francis A, 2003. Manual of laboratory and diagnostic tests.
3. Philadelphia,J.B. Lippincott & Co, N.Y.
4. Gradwohls, 2000. Clinical laboratory methods and diagnosis Alex.C.
5. Sonnenwirth& Leonard Jarret.M.D.B.I.Publications, New Delhi,

III B.Sc Biochemistry	COURSE NAME: HORTICULTURE (30 hrs)	COURSE CODE: 19SBC62A
SEMESTER – VI		HRS/WK – 2
Skill paper-I		CREDIT – 2

OBJECTIVES

1.To gain knowledge and skills in different aspects of garden products.

2. To understand the potential of organic farming.

3. To study the uses of Biertilizers in Nursery practice.

COURSE OUTCOMES:

CO1: To understand the economical importance of Horticulture.

CO2: To study the about the importance of making different types of garden products

CO3: To acquire the knowledge about the importance of organic forming.

CO4: To acquire scientific knowledge on cultivating different types of crops.

CO5: To understand the uses of Bio fertilizers in Nursery practice.

SEMESTER V	COURSE CODE: 19SBC62A					COURSE NAME: HORTICULTURE								HOURS:2 CREDITS: 2
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	5	3	4	4	2	5	2	3	4	2	5	3	4	3.5
CO2	3	5	3	2	5	3	3	5	3	4	3	4	4	3.6
CO3	3	4	4	3	3	5	4	2	4	3	5	4	3	3.7
CO4	5	3	5	2	4	2	3	5	3	3	4	3	2	3.4
CO5	5	2	4	2	4	4	3	4	5	4	5	4	4	3.8
Mean Overall Score														3.6

Result: The Score of this Course is 3.6 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - FUNDAMENTALS OF HORTICULTURE [6 hrs]

Definition and scope of horticulture, Importance of horticulture in terms of production, employment generation, environmental protection, economy, and human resource development. Identification of important horticultural crops in India.

UNIT II - GARDENING [6 hrs]

Preparation of land: layout plan and its methods for gardening. Vegetable gardens, nutrition and kitchen garden, truck garden, Vegetable forcing, market gardens and roof gardens.

UNIT III - ORGANIC FARMING [6 hrs]

Manures. Definition, different methods of application of manures to horticultural crops. Principles of organic farming-importance, procedure and technology of organic farming.

UNIT IV - NURSERY MANAGEMENT [6 hrs]

Definition, classification and importance of Nursery. Nutrient deficiency management – use of chemical and bio fertilizers. Growth regulators and its effects in Nursery management.

UNIT V - PRACTICAL APPROACH [6 hrs]

Digging of pits for fruit plants. Preparation of nursery beds for sowing of vegetable seeds. Preparation of fertilizer mixtures and field application.

TEXT BOOKS

1. Introduction to Horticulture, Kumar, N. 1990. Rajyalakshmi Publications, Nagarcoil, Tamilnadu.
2. Propagation of Horticulture crops, Principles and Practices; sama R K 2002, Kalyani Publications, New Delhi.
3. Prasad and Kumar, 2014. Principles of Horticulture 2nd Edn. Agrobios (India).

REFERENCE BOOKS

1. Gardner/Bardford/Hooker. J.R., 1957. Fundamentals of Fruit Production. Mac Graw Hill Book Co., New York.
2. Edmond,J.B, Sen,T.L, Andrews,F.S and Halfacre R.G., 1963. Fundamentals of Horticulture. Tata Mc Graw Hill Publishing Co., New Delhi.
3. Fundamentals of Fruit Production by Gomer V R, Bradford F C and Hooker Jr HD 1957 Mc Graw Hill Book co, New York
4. A.K.Tiwari, Fundamentals of Ornamentals Horticulture and Landscape Gardening, New India Publishing Agency,2012.
5. Supriya Bhattacharjee, Post Harvest Technology of Flowers and Ornamental Plants, Pointer Publishers, 2006.

III B.Sc *Biochemistry*	COURSE NAME:BIOINFORMATICS	COURSE CODE: 19SBC62B
SEMESTER-VI		HRS/WK-2
Skill paper-II		CREDIT-2

OBJECTIVES

1. To understand the biological database and their alignment.
2. To gain essential knowledge about sequence alignment.
3. To know the applications of computational methods in Biology

COURSE OUTCOMES:

CO1: To acquire knowledge about the applications of bioinformatics.

CO2: Able to understand biological database and its types.

CO3: To gain knowledge about the sequence alignment

CO4: To understand the importance and applications of different database sequences.

CO5: To gain knowledge about the applications of computational methods in Biology

Result: The Score of this Course is 3.7 (High)

SEMESTER V	COURSE CODE: 19SBC62B					COURSE NAME: BIOINFORMATICS								HOURS:2 CREDITS:2
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PS O1	PS O2	PS O3	PS O4	PS O5	PSO 6	PSO 7	PSO 8	
CO1	4	4	3	3	4	4	4	4	3	4	3	3	3	3.5
CO2	3	4	4	4	3	3	3	2	3	3	3	3	4	3.5
CO3	4	4	3	4	4	3	4	4	4	3	4	3	4	3.7
CO4	4	4	4	3	4	3	3	3	5	5	5	5	3	4.3
CO5	4	4	4	4	3	4	3	3	3	4	3	4	3	3.7
Mean overall score														3.7

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - BIOINFORMATICS [6hrs]

Bioinformatics-definition, application, challenges and opportUNITies. Internet, www. Database-types, classification, sequence formats, DBMS, RDBMS, SQL (brief description).

UNIT II - BIOLOGICAL DATABASE AND ITS TYPES [6hrs]

General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)

UNIT III - SEQUENCE ALIGNMENT [6hrs]

Sequence alignment-algorithm, global and local alignment, sequence alignment methods, pairwise alignment-dot matrix, dynamic programming, FASTA &BLAST.Basic multiple sequence alignment- HMM &CLUSTAL[brief descrption]. Homology, orthology, paralogs &xenologs.

UNIT IV - PHYLOGENETIC ANALYSIS [6hrs]

Softwares used for phylogenetic analysis. Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM series.
Human Genome Project.

UNIT V - SEQUENCE ALIGNMENTS AND VISUALIZATION [6hrs]

Introduction to Sequences, alignments and Dynamic Programming; Local alignment and Global alignment (algorithm and example),BLAST and FASTA Algorithm and multiple sequence alignment (Clustal W algorithm)

TEXT BOOKS:

1. S.Ignacimuthu, 2005. 2nd edition, Basic Bioinformatics, Narosa Publishing House Pvt. Ltd., New Delhi.
2. Arthur M.Lesk. 2002. Introduction to Bioinformatics, Oxford University press.
3. JinXiong. 2006. Essential Bioinformatics, Cambridge University press.

REFERENCE BOOKS:

1. David R.Westhead, J.Howard Parish &Richard, 2003. Instant notes on bioinformatics" ,viva book Pvt ltd
2. K.Mani&N.Vijayaraj,2004 "Bioinformatics- a practical approach",Aparnapublications,Coimbatore
3. Attwood, T.K. and Parry-Smith, D.J. 1999. Introduction to bioinformatics. Pearson Education Ltd., Delhi, India.
4. Gibas and Per Jambeck. Developing bioinformatics computer skills. 2 nd ed. O'Reilly Associates, 2013.
5. Baxevanis, Ouellette. Bioinformatics. A practical guide to the analysis of genes and proteins. 3 rd ed. Wiley Interscience, 2004.

III B.Sc Biochemistry	COURSE NAME:MAIN PRACTICAL III	COURSE CODE: 19BCP603
SEMESTER V & VI		HRS/WK-3
Major		CREDIT-4

1. **Calibration of pipette & burette**

2. **COLORIMETRIC ESTIMATION**

   - Estimation of creatinine by Jaffe's method
   - Estimation of urea by DiacetylMonoxime method.
   - Estimation of triglycerides in blood
   - Bilirubin in blood
   - Uric acid estimation

3. EXPERIMENTS ON ENZYMES BY COLORIMETRY

- Effects of pH,temperature and substrate concentration for amylase and urease.

4. CHROMATOGRAPHY

Thin layer chromatography - Amino Acids &CarbohydratesIsolation of lipids from egg yolk and separation byTLC.

- Column chromatography – leaf pigments.

5. Food & biochemical analysis

- Estimation of gluten content in wheat flour.
- Gelatinization of starch.
- Determination of pH density of milk & milk products.
- Lipid content in food
- Nutritive value of foods.
- Oxidative rancidity of potato chips
- Fibre in food
- Iron in food
- Food additivies/adulterants

PRACTICALQUESTION PATTERN TOTAL MARKS: 60

Colorimetric analysis I &II - 20
Enzyme assay- 15
Spotters/estimation(food)- 15
Record - 10

III B.Sc Biochemistry	COURSE NAME: MAIN PRACTICAL IV	COURSE CODE: 19BCP604
SEMESTER V & VI		HRS/WK-3
Major		CREDIT-4

1. COLORIMETRIC ESTIMATION

a. Estimation of glucose by Ortho toluidine methods
b. Estimation of albumin andA/G ratio in serum.
c. Estimation of cholesterol by Zak's method
d. Estimation of protein by Lowry method
e. Protein by Bradford method
f. Estimation of protein concentration by $A_{280\ nm}$
g. Extraction & purification of DNA from onion.

2. ENZYME ASSAY

a. Assay of activity of alkaline phosphatase in serum.
b. Assay of activity of acid phosphatase in serum.
c. Assay of SGOT and SGPT in serum

3. URINE ANALYSIS

a. Collection of urine sample.
b. Qualitative analysis of urine for normal and pathological conditions.

4. HAEMATOLOGY

- RBC count,,ESR,total and differential WBC count, blood grouping, blood pressure measuring , bleeding time,clottingtime, estimation of Hb.

5. ELECTROPHORETIC TECHNIQUES

- Separation of protein by SDS-PAGE and DNA by Agarose.

PRACTICAL QUESTION PATTERN **TOTALMARKS: 60**

Colorimetric analysis	- 20
Colorimetric analysis/urine analysis	- 15
Spotters/hematology	- 15
Record	- 10

TEXT BOOKS

1. Harold Varley, (1980). Practical Clinical Biochemistry, Volume I and II. 5th Edition. CBS Publishers. New Delhi.
2. Jayaraman, S. (2003). Laboratory Mannual in Biochemistry. 2nd Edition. New Age International (P) Limited. New Delhi.

REFERENCE BOOKS

1. David, T. Plummer, (1988). An Introduction to Practical Biochemistry. 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Pattabiraman, T.N. (1998). Laboratory Manual in Biochemistry. 3rd Edition. All India Publishers and Distributors. Chennai.

I B.Sc (Microbiology)	COURSE TITLE BASIC BIOCHEMISTRY	COURSE CODE: 19ABC101
SEMESTER-I		HRS/WK-4
ALLIED-1		CREDIT-4

OBJECTIVES

1.To learn and understand the structure, properties and functions of biomolecules like carbohydrate,proteins,lipids and nucleic acids.

Course Outcomes:

CO1: To gain knowledge about the classification, structure, properties and functions of carbohydrates.

CO2: Able to understand the classification, structure, properties and importance of amino acids.

CO3: To understand and gain knowledge about the classification of proteins, levels of structural organization of proteins and its properties.

CO4: To gain insights about the types, structure and properties of nucleic acids.

CO5: To acquire knowledge about the classification, structure and properties of different types of lipids.

SEMESTER II	SUB CODE: 19ABC101					COURSE TITLE: BASIC BIOCHEMISTRY								HOURS:4 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	5	5	2	2	2	4	2	2	3	3	3	5	3	3.2
CO2	4	3	2	2	2	4	4	3	3	3	3	5	3	3.2
CO3	3	3	2	3	2	3	5	3	3	4	4	5	3	3.3
CO4	4	4	4	3	2	3	5	5	5	5	5	5	5	4.2
CO5	3	3	2	2	2	4	5	5	4	3	5	5	3	3.5
Mean overall score														3.5

Result: The Score of this Course is 3.5 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - CARBOHYDRATES **[20 hrs]**

Carbohydrates: Definition, classification of carbohydrates; linear and ring forms (Haworth formula) Monosaccharides (Glucose , Fructose), Disaccharides (Lactose and Sucrose), Physical properties – Muta rotation, stereo isomerism and optical isomerism chemical properties-oxidation, reduction and osazone formation. Polysaccharides: starch and cellulose- structure and functions**.**

UNIT II - AMINOACIDS **[15 hrs]**

Aminoacids- structure and classification based on structure. Standard and non standard amino acids, essential and non essential amino acid. Physical properties: isoelectric points and zwitter ions. General reactions of amino acids – Edman's reaction, Sanger's reaction, reaction with Dansyl chloride, Van Slyke reaction and Ninhydrin reaction.

UNIT III - PROTEINS **[10 hrs]**

Proteins-Definition, classification of proteins based on size, solubility, chemical composition functions , structure of proteins- peptide bond, primary, secondary, tertiary and quaternary structure of proteins, forces that determine folding and conformation and structural organization, Physical properties: salting in and salting out and denaturation.

UNIT IV - CHEMISTRY OF NUCLEIC ACIDS **[15 hrs]**

Nucleic acid- base, Nucleotides and Nucleosides, phosphodiester linkage; Nucleic acid types –DNA and RNA; structure- double helical structure of DNA; Denaturation , Tm and hyperchromicity structure of RNA; tRNA, mRNA and rRNA.

UNIT V - CHEMISTRY OF LIPIDS **[15 hrs]**

Classification of lipids- simple, compound (phospholipids) and derived lipids (cholesterol).Classification and nomenclature of fatty acids – saturated fatty acid and unsaturated fatty acid. Physical property- emulsification.Chemical properties- saponification number, Rancidity, acid number, Iodine number and Reichert – Meissl number.

TEXT BOOKS:

1. Deb, A.C (2004). Fundamentals of Biochemistry. 8th Edition, New Central Book Agency,
2. Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.

REFERENCE BOOKS

1. Nelson, D. L. & Cox, M. M. Lehninger Principles of Biochemistry. Freeman, 5th edn, 2008.
2. Robert Murray, Bender, (2012) Harper's Illustrated Biochemistry.McGraw Hill
3. U.Sathayanarayana,(2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.
4. Mallikarjuna Rao N,2002, " Medical Biochemistry",2nd Edition, New Delhi, New Age International Publishers

I B.Sc (Microbiology)	COURSE TITLE ADVANCED BIOCHEMISTRY	COURSE CODE: 19ABC202
SEMESTER-II		HRS/WK-4
ALLIED-2		CREDIT-4

OBJECTIVES

1. To learn the key metabolic pathways and its energetics.
2. To teach the classification, nature and mechanism of action of enzymes.
3. To educate them with various types of enzyme inhibition.
4. To educate them with few common disorders by knowing their causes,symptoms and prevention.

COURSE OUTCOMES

CO1: To understand and gain knowledge about the metabolic pathways of carbohydrate such as Glycolysis, TCA cycle and HMP shunt.

CO2: Able to understand the classification of enzymes, mechanism of enzyme action and its inhibition.

CO3: To gain and understand the metabolic disorders such as diabetes mellitus, obesity, jaundice and gout.

CO4: To acquire knowledge about the amino acid metabolism and its inborn errors of metabolism.

CO5: To gain insights about the biochemical parameters and involved in the diagnostic purpose.

SEMESTER II	SUB CODE: 19ABC202					COURSE TITLE: ADVANCED BIOCHEMISTRY								HOURS:4 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	5	4	3	2	3	5	5	4	4	3	5	4	3	3.8
CO2	4	3	3	2	3	4	3	3	4	5	4	3	3	3.4
CO3	3	4	3	2	3	3	4	4	3	3	3	4	3	3.2
CO4	4	4	2	2	2	4	4	3	4	3	4	4	3	3.2
CO5	3	3	2	3	3	4	3	4	3	3	4	3	3	3.2
Mean overall score														3.4

Result: The Score of this Course is 3.4 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - METABOLISM **[20 hrs]**

Glycolysis – Aerobic & Anaerobic, key enzymes and energetics. TCA –key enzymes and energetic. HMP shunt, Gluconeogensis, Catabolism of amino acids - Deamination & transamination reactions, Urea cycle (structure not required).

UNIT II - ENZYMES **[15 hrs]**

Definition, Classification of Enzymes, mechanism of Enzyme action – Lock & key & induced fit model. Specifity – Factors affecting enzyme activity – pH, temperature & substrate concentration. MM Equation. Allosteric enzymes, Enzyme Inhibition – Irreversible, Reversible, competitive, uncompetitive, non competitive (Kinetics not required).

UNIT III - METABOLIC DISORDERS **[15 hrs]**

Jaundice: Classification, Biochemical findings. DM: Classification, Complications, Diagnosis and Treatment. Gout, obesity- definition, causes, symptoms & prevention.

UNIT IV - DISORDERS OF AMINO ACID METABOLISM **[10 hrs]**

Inborn errors of metabolism –Albinism, Phenylketonuria, Alkaptonuria, Maple's syrup and Hartnup'sdisease .

UNIT V - CLINICAL BIOCHEMISTRY **[15 hrs]**

Enzymes –isoenzymes-functional and non functional enzymes-diagnostic enzymes associated with liver disorder and myocardial infarction.

Blood glucose, urea, uric acid, TG,serum alkaline phosphatase ,calcium, total protein, electrolytes-significance and normal levels(Brief Discussion)

TEXT BOOKS:

1. Deb, A.C (2004). Fundamentals of Biochemistry. 8th Edition, New Central Book Agency,
2. Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.

REFERENCE BOOKS

1. Nelson, D. L. & Cox, M. M. Lehninger Principles of Biochemistry. Freeman, 5th edn, 2008.
2. Robert Murray, Bender, (2012) Harper's Illustrated Biochemistry.McGraw Hill
3. U.Sathayanarayana,(2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India
4. Thomas.M.Devlin,1997,"Textbook of Biochemistry with clinical correlations",4th Edition,US, Wiley-Liss
5. Ramakrishanan S, Prasannan K.G. and Rajan R,1980, " Textbook of Medical Biochemistry",3rdEdition,Chennai, Orient Longman

II B.Sc (Physics)	COURSE TITLE : BIOPHYSICS	COURSE CODE: 19ABC401
SEMESTER-IV		HRS/WK-5
ALLIED-3		CREDIT-3

OBJECTIVES

1. To provide information about biochemically important aspects of the chemistry of carbohydrates,proteins and nucleic acids using appropriate examples.
2. To understand the mechanism of membrane conduction with respect to nerve and muscle.
3. To learn the radiation techniques in biology and its instrumentation
4.To learn the principle and applications of certain common instruments- FTIR,XRD,UV-Vis and Fluorescence spectra.

Course Outcomes

CO1: To acquire knowledge about the structure and properties of biomolecules.
CO2: To understand about the structure, types and properties of nucleic acids
CO3: To know the mechanism how the muscle contraction and nerve conduction occurs
CO4: Able to demonstrate their skills in basic conceptsin types of radiation, detection and its measurement using radioisotope techniques.
CO5: To learn the principle and applications of certain common instruments- FTIR, XRD, UV-Vis and Fluorescence spectra.

SEMESTER II	SUB CODE: 19ABC401					COURSE TITLE: BIOPHYSICS								HOURS:5 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	5	4	4	4	3	4	4	3	3	4	4	4	4	3.8
CO2	4	3	3	3	4	3	4	4	3	3	4	3	5	3.5
CO3	3	4	4	2	3	4	4	4	4	4	3	4	4	3.6
CO4	4	4	4	2	4	3	3	3	4	4	3	4	4	3.5
CO5	3	3	3	3	3	3	3	4	3	4	4	3	4	3.3
Mean overall score														3.5

Result: The Score of this Course is 3.5 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - CARBOHYDRATES & AMINO ACIDS [15 hrs]

Carbohydrates- definition, classification and general properties. Classification of amino acids based on structure, Classification of proteins, Zwitter ion, Structure of proteins (primary, secondar y, tertiary and quaternary). Different types of bonds that stabilize the protein. Denaturation and renaturation of proteins.

UNIT II - NUCLEIC ACIDS [15 hrs]

Fundamental units of nucleic acids – purine. pyrimidine, nucleosides and nucleotides. DNA-double helical structure, Watson Crick model and base pairing. Nucleic acid-denaturation and annealing of DNA, DNA- carrier of genetic information by an experimental proof- RNA- Types - central dogma (DNA –RNA-Protein)

UNIT III - MEMBRANE BIOPHYSICS [15 hrs]

Nerve cell-structure, bioelectrical and biochemical conduction of nerve impulses, Membrane potential, Resting potential, action potential-bioelectrical phenomenon of ECG and EEG-Molecular basis of muscle contraction

UNIT IV - RADIATION BIOPHYSICS [15 hrs]

Radioactive isotopes, types of radioactive decay, units of radioactivity, Biological effects of radiation –Applications of radioisotopes in biology (tracing metabolic pathways, isotope dilution techniques radio dating and RIA) – Detection and measurement of radioactivity-GM counter and scintillation counter, Autoradiography.

UNIT V - BIOINSTRUMENTATION [15 hrs]

Principle and biological application of UV-VIS Spectrophotometry, Spectrofluorimetry, X-ray Diffraction, Flame photometer and FTIR.

TEXT BOOKS:

1. P.Narayanan ,"Essentials of Biophysics",2nd ed , New Age Publishers, New Delhi
2. Deb, A.C (2004). Fundamentals of Biochemistry. 8th Edition, New Central Book Agency,
3. Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.

REFERENCE BOOKS

1. M.A.Subramanian, "Biophysics- Principles And Techniques",MJP publishers, Chennai
2. M.V.Volbenshtein , "Biophysics", MIR publishers, Moscow ,1983
3. William huges , "Aspects of biophysics",John Wiley and sons,N.Y,1979

B.Sc MB III B.Sc. ZOD	COURSE TITLE : BIOINSTRUMENTATION	COURSE CODE: A19BI301 /20EZ618A
SEMESTER-III		HRS/WK-3
Skill –Elective		CREDIT-2

OBJECTIVES

1. To develop analytical skills of the students to prepare them for employability.
2. To enhance their ability to understand the working and principle of instruments used in life science.
3.To provide the students with a strong foundation in handling the laboratory equipments.

Course Outcomes

CO1: To acquire knowledge about the units of measurement of solutes in solution and principle, instrumentation & applications different kinds of electrophoretic techniques.
CO2: To gain knowledge about the principles of pH measurement and the acid-base, buffers and biological buffers concepts and systems and determination of pH using electrodes.
CO3: To gain knowledge about the working principle, instrumentation, & applications of various types of chromatography.
CO4: To acquire knowledge about the working principle, instrumentation, & applications of various types of chromatography.
CO5: To Understand the principles of centrifugation and different types of centrifuge and rotors..

SEMESTER II	SUB CODE: A19BI301					COURSE TITLE: BIOINSTRUMENTATION								HOURS:3 CREDITS: 2
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	5	4	3	4	4	3	4	3	4	4	4	3	4	3.8
CO2	4	3	4	3	5	4	5	4	3	5	3	3	4	3.8
CO3	4	4	3	4	3	4	4	2	3	4	4	4	3	3.6
CO4	3	3	2	3	4	3	3	3	4	4	3	3	4	3.2
CO5	4	4	3	4	4	4	4	3	4	5	4	2	3	3.7
Mean overall score														3.6

Result: The Score of this Course is 3.6 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I - ELECTROPHORESIS **[9 hrs]**

Units of measurement; units of measurement of solutes in solution. eg. Normality, Molality Percentage solution. Examples for this concept. Electrophoresis – Factors affecting migration rate – Tiselius Moving Boundary Electrophoresis, Paper electrophoresis, SDS – PAGE.

UNIT II BUFFERS AND ELECTRODES **[9 hrs]**

pH, pOH, Buffer, mechanism of buffer action – first line and second line of defence, buffers in body fluids, buffer capacity. Measurement of pH using indicator, Glass electrode and its applications.

UNIT III - CHROMATOGRAPHY I **[9 hrs]**

General principles of chromatography – Partition and Adsorption. Principle, operational procedure and applications of Paper Chromatography, Column Chromatography and Thin Layer Chromatography.

UNIT IV - CHROMATOGRAPHY II **[9 hrs]**

Procedure and Applications of Molecular sieve chromatography, Gas Liquid Chromatography, HPLC.

UNIT V - CENTRIFUGATION **[5 hrs]**

Centrifugation technique; Basic principles, Rotors – Types of Rotors. Preparative and Analytical Ultra Centrifugation techniques. Sedimentation Rate and Svedberg Unit, Differential, Density Gradient, Isopycnic & Rate Zonal Centrifugation.

TEXTBOOKS:

1.P.Narayanan ,"Essentials of Biophysics",2nded , New Age Publishers, New Delhi
2.Deb, A.C (2004). Fundamentals of Biochemistry. 8th Edition, New Central Book Agency,
3.Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.

REFERENCE BOOKS

1. M.A.Subramanian, "Biophysics- Principles And Techniques",MJP publishers, Chennai
2. M.V.Volbenshtein , "Biophysics", MIR publishers, Moscow ,1983
William huges , "Aspects of biophysics",John Wiley and sons,N.Y,1979
3. L.E.Ackermann, "Biophysical Science", L.B.E.Eillis And Williams ,1979
Wilson, K. & Walker, J. Principles and Techniques of Biochemistry and Molecular Biology. CUP, 7th edn, 2010

II B.Sc (Zoology)	COURSE TITLE ALLIED BIOCHEMISTRY	COURSE CODE: 19ABC303
SEMESTER-III		HRS/WK-5
ALLIED-1		CREDIT-4

OBJECTIVES

1.To learn and understand the structure, properties and functions of biomolecules like carbohydrate,proteins,lipids and nucleic acids.

COURSE OUTCOMES:

CO1: To gain the knowledge about the classification, structure, properties and functions of carbohydrates.

CO2: Able to understand the classification, structure, properties and importance of amino acids.

CO3: To understand and gain knowledge about the classification of proteins, levels of structural organization of proteins and its properties.

CO4: To gain insights about the types, structure and properties of nucleic acids.

CO5: To acquire knowledge about the classification, structure and properties of different types of lipids.

SEMESTER II	SUB CODE: 19ABC303					COURSE TITLE: ALLIED BIOCHEMISTRY								HOURS:5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMME SPECIFIC OUTCOMES(PSO)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	5	5	2	2	2	4	2	2	3	3	3	5	3	3.2
CO2	4	3	2	2	2	4	4	3	3	3	3	5	3	3.2
CO3	3	3	2	3	2	3	5	3	3	4	4	5	3	3.3
CO4	4	4	4	3	2	3	5	5	5	5	5	5	5	4.2
CO5	3	3	2	2	2	4	5	5	4	3	5	5	3	3.5
Mean overall score														3.5

Result: The Score of this Course is 3.5 (High)

Assciation	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **High** association with Programme Outcome and Programme Specific Outcome

UNIT I CHEMISTRY OF CARBOHYDRATES [20 hrs]

Carbohydrates-Definition, structure : linear and ring forms (Haworth formula), classification of carbohydrates; Monosaccharides (Glucose , Fructose), Disaccharides (Lactose and Sucrose), Physical properties – Mutarotation.chemical properties-oxidation, reduction and osazone formation. Polysaccharides: starch and cellulose- structure and functions**.**

UNIT II AMINOACIDS [15 hrs]

Aminoacids- structure and classification based on structure. Standard and non standard amino acids, essential and non essential amino acid. Physical properties: Acid base properties; isoelectric points and zwitter ions. General reactions of amino acids – Edman's reaction, Sanger's reaction, reaction with Dansyl chloride, Van Slyke reaction and Ninhydrin reaction.

UNIT III CHEMISTRY OF PROTEINS [10 hrs]

Classification of proteins based on size, chemical composition and functions , structure of proteins-peptide bond, primary, secondary, tertiary and quaternary structure of proteins, forces that determine folding and conformation and structural organization, Physical properties: salting in and salting out and denaturation.

UNIT IV CHEMISTRY OF NUCLEIC ACIDS [15 hrs]

Nucleotides and Nucleosides, phosphodiester linkage; Nucleic acid types –DNA and RNA; structure- double helical structure of DNA; Denaturation , Tm and hyperchromicity structure of RNA; tRNA, mRNA and rRNA.

UNIT V CHEMISTRY OF LIPIDS [15 hrs]

Introduction, definition and classification of lipids- simple, compound (phospholipids) and derived lipids (cholesterol).Classification and nomenclature of fatty acids – saturated fatty acid and unsaturated fatty acid.Physical property- emulsification. Chemical properties- saponification number, Rancidity, acid number, Iodine number and Reichert – Meissl number.

TEXT BOOKS:

1. Deb, A.C (2004). Fundamentals of Biochemistry. 8th Edition, New Central Book Agency,
2. Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.

REFERENCE BOOKS

1. .Nelson, D. L. & Cox, M. M. Lehninger Principles of Biochemistry. Freeman, 5th edn, 2008.
2. Robert Murray, Bender, (2012) Harper's Illustrated Biochemistry.McGraw Hill
3. U.Sathayanarayana,(2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.
4. Mallikarjuna Rao N,2002, " Medical Biochemistry",2nd Edition, New Delhi,New Age International Publishers.

II B.Sc (Zoology)	COURSE TITLE ALLIED BIOCHEMISTRY PRACTICALS	COURSE CODE: 19ABP303
SEMESTER-III		HRS/WK-3
ALLIED-3		CREDIT-2

QUALITATIVE ANALYSIS

1. Qualitative analysis of Carbohydrates (Glucose, Fructose ,Sucrose,Lactose , Maltose, Starch).
2. Qualitative analysis of Aminoacids(Arginine, Tryptophan, Tyrosine, Histidine).

VOLUMETRIC ANALYSIS

1. Estimation of Ascorbic acid using dicholorophenol indophenol dye as link solution
2. Estimation of Glycine by Sorrenson formal titration
3. Estimation of Glucose by Benedict's method

I B.Sc (Microbiology)	ALLIED BIOCHEMISTRY PRACTICAL-1	COURSE CODE: 19ABCP11
SEMESTER-I		HRS/WK-3
ALLIED-1		CREDIT-2

QUALITATIVE ANALYSIS

1. Qualitative analysis of Carbohydrates (Glucose, Fructose ,Sucrose,Lactose , Maltose, Starch).
2. Qualitative analysis of Aminoacids(Arginine, Tryptophan, Tyrosine, Histidine).

PREPARATION

1. Preparation of starch from potatoes
2. Preparation of casein from milk
3. Preparation of albumin from egg

I B.Sc (MB)	ALLIED BIOCHEMISTRY PRACTICAL-II	COURSE CODE: 19ABCP22
SEMESTER-II		HRS/WK-3
ALLIED-2		CREDIT-2

I VOLUMETRIC/ COLORIMETERIC ANALYSIS

1. Estimation of Ascorbic acid using dicholorophenol indophenol dye as link solution
2. Estimation of Glycine by Sorrenson formal titration
3. Estimation of Glucose by Benedict's method.
4. Estimation of protein by lowry method
5. Estimation of iron

II HEMATOLOGY

1. Blood grouping
2. ESR
3. RBC & WBC Count
4. Bleeding and clotting time.
5. Estimation of Hemoglobin

III Urine analysis

TEXT BOOKS

1. Harold Varley, (1980). Practical Clinical Biochemistry, Volume I and II. 5th Edition. CBS Publishers. New Delhi.
2. Jayaraman, S. (2003). Laboratory Mannual in Biochemistry. 2nd Edition. New Age International (P) Limited. New Delhi.

REFERENCE BOOKS

1. David, T. Plummer, (1988). An Introduction to Practical Biochemistry. 3rd Edition. Tata McGraw Hill Publishing Company Ltd. New Delhi.
2. Pattabiraman, T.N. (1998). Laboratory Manual in Biochemistry. 3rd Edition. All India Publishers and Distributors. Chennai

PRACTICAL QUESTION PATTERN **TOTALMARKS: 60**

Estimation/Preparation	- 25
Qualitative analysis	- 25
Record	- 10