ST.JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS), CUDDALORE-1

PG&RESEARCHDEPARTMENTOFBIOCHEMISTRY

UG

Syllabus

2019-2020

B.Sc. BIOCHEMISTRY

Sem	Subject code	Part	Subject Title	Hrs	Cr	Exam.Hrs
I	LT101T	I	Language-I	4	3	3
	LE101T	II	English-I	4	3	3
	19BC101	III	Main Paper–I(Biomolecules-1)	4	3	3
	19BC102	III	Main Paper–II(Cell Biology)	3	2	3
	BCP201S	III	Main Practical–I*	3		
	ACH101T	III	Allied1(Chemistry)	5	3	3
	ACHP101	III	Allied1(Chemistry Practical)	3	2	3
	VE101T	IV	Value education	3	2	3
			Total	**30**	**19**	
II	LT202T	I	Language-II	4	3	3
	LE202T	II	English-II	4	3	3
	19BC203	III	Main Paper–III(Biomolecules-II)	4	3	3
	19BC204	III	Main Paper–IV(Nutritional Biochemistry)	3	2	3
	BCP201S	III	Main Practical–I*	3	4	6
	ACH202T	III	Allied2 (Analytical Chemistry)	5	3	3
	ACHP202	III	Allied2AnalyticalchemistryPractical	3	2	3
	EPD201T	IV	Personality development	3	2	3
			Total	**30**	**23**	
III	LT303T	I	Language-III	4	3	3
	LE303T	II	English-III	4	3	3
	BC303S	III	Main Paper– V(Enzymes)	4	4	3
	BC304S	III	Main Paper–VI(Analytical Biochemistry-I)	4	4	3
	BCP402S	III	Main Practical–II*	3		-
	AMBC302	IV	Allied3Principlesof Microbiology	5	3	3
	AMBCP301	III	Allied3MicrobiologyPractical	3	2	3
	AOFA301	IV	Skill-First aid	3	4	3
			Total	**30**	**23**	
IV	LT404T	I	Language-IV	4	3	3
	LE404T	II	English-IV	4	3	3
	BC405S	III	Main Paper – III(Intermediary Metabolism)	4	4	3
	BC406S	III	Main Paper –IV(Analytical Biochemistry-II)	4	4	3
	BCP402S	III	Main Practical–II*	3	4	6
	AZBC401T	III	Allied4Advanced Zoology	5	3	3
	AZBP401	III	Allied4Advanced Zoology Practical	3	2	3
	EVS401S	IV	EVS	3	2	3
			Total	**30**	**25**	

V	BC507S	III		Main Paper–IX(Molecular Biology)	6	5	3
	BC508S	III		Main Paper– X(Immunology)	6	5	3
	EBC509A	III	Elective paper-1	Food Technology	5	5	3
	EBC509B			Environmental Toxicology & Herbal Medicine			
	EBC510A	III	Elective papers	Plant Biochemistry	5	5	3
	EBC510B			Pharmaceutical Biochemistry and Bioinformatics			
	BCP603S	III		Main Practical–III***1**	4		-
	BCP604S	III		Main Practical–IV***1**	4		-
				Total	**30**	**20**	
VI	BC611S	III		Main Paper – XII(Medical Biochemistry)	6	5	3
	BC612S	III		Main Paper–XIII(Biotechnology& Genetic Engineering)	6	5	3
	EBC613A	III	Elective papers	Clinical Endocrinology	5	5	3
	EBC613B			Medical Physiology			
	EBC614A	III	Elective papers	Biostatistics & Clinical research	5	5	3
	EBC614B			Medical Laboratory Technology			
	BCP603S	III		Main Practical–III*1	4	4	6
	BCP604S	III		Main Practical–IV*1	4	4	6
				Total	**30**	**28**	
	EU601	V		Extension activities		2	
				Total credits		**140**	

*End of the Academic Year

I B.Sc (Biochem)	BIOMOLECULES-I (60hrs)	19BC101
SEMESTER-I		HRS/WK-4
CORE-1		CREDIT-3

Learning objectives:

- To provide information about biochemically important aspects of carbohydrates and nucleic acids using appropriate examples.
- To understand the structural principles that govern reactivity/physical properties of molecules as opposed to learning structural detail
- To acquire knowledge about the structure and function of heterocyclic compounds.

Course outcomes

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 monosaccharide's 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	SUBCODE:19BC101					BIOMOLECULES I								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
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

ThisCourseishaving**HIGH**associationwithProgrammeOutcomeandProgrammeSpecific Outcome

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

UNIT I CHEMICALBONDING [10hrs]

Chemical Bonding- nature and types- ionic bond (or) polar bond, covalent (or) non-polar bonds, co-ordinate bond and non-covalent bonds (Hydrogen, hydrophobic, Vander walls interactions). Isomerism - structural isomerism and stereoisomerism.

UNIT II CARBOHYDRATESI [15hrs]

Carbohydrates: definition, classification – monosaccharide's, oligosaccharides and polysaccharides; occurrence, structure and functions of monosaccharide's (glucose and fructose).General properties with reference to glucose, anomers, epimers, enantiomers and mutarotation. Ring and straight chain structure of glucose (Haworth projection formula).

UNIT III CARBOHYADRATESII [10hrs]

Structure, occurrence, properties and biological importance of disaccharides(sucrose, lactose, maltose). Inversion of sucrose. Structure, occurrence, properties and biological importance of polysaccharides: Storage polysaccharides (starch, glycogen & inulin), Structural polysaccharides (cellulose, chitin, pectin), Heteropolyasaccharides (hyaluronic acid &heparin).

UNIT IV NUCLEICACIDS [10 hrs]

Nucleic acids–Bases, Nucleosides and Nucleotides, Phosphodiester linkage, DNA and RNA, Structure–doublehelicalstructureofDNA,PropertiesofDNA–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.

UNITV HETEROCYLICCOMPOUNDS [15hrs]

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

TEXTBOOKS:

1. RenukaHarikrishnan,1995,"BiomoleculesandEnzymes"(secondedition),Madurai, IndrajaPathipagam
2. J.L.Jain, Sanjay Jain and Nitin Jain, 1997, "Fundamentals of Biochemistry"(6th Edition) , New Delhi,S.Chand& Company Ltd

REFERENCES:

1. Power&Chatwal"Biochemistry",4thedition, Himalaya Publishing House
2. Cambell&Farrell,2007,"Biochemistry"5thedition,Delhi,BabaBorkhanath printers
3. T.N.Pattabiraman,1993"PrinciplesofBiochemistry"5thedition,Bangalore, Gajanana Book Publishers and Distributors
4. Dr.A.C.Deb,1983,"FundamentalsofBiochemistry"(8thedition),Kolkata,NewCentral Book Agency
5. Lehninger, Nelson And Cox ,1982, " Principles of Biochemistry", (4th ed)UK, Macmillan Worth Publishers.
6. Chemistry of chemical bonding,Jyothi Roshan Kumar.2008

IB.Sc (Biochem)	CELL BIOLOGY (60hrs)	19BC102
SEMESTER-I		HRS/WK-4
CORE-2		CREDIT-3

Objectives:

- To understand the structure and purpose of the basic components of the Cell and its organelles
- To understand the phases of cell cycle and cell division.
- To acquire knowledge about microfilaments and microtubules.

Course Outcomes:

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: To understand 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 their distribution.

SEMESTER I	SUBCODE:NEWCODE					CELLBIOLOGY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
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

ThisCourseishaving**HIGH**associationwithProgrammeOutcomeandProgrammeSpecific Outcome

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

UNIT I CELL AND TRANSPORT [15hrs]

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, facilitated diffusion, osmosis) and active transport- Na+-K+, ATPase, sodium potassium pump, $Ca^{2+}$and ATP_{ase}pumps, endocytosis and exocytosis. Symport and antiport.

UNIT II CELL ORGANELLES-I [10hrs]

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

UNIT III CELL ORGANELLES-II [10hrs]

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

UNIT IVCELL DIVISION AND CELL CYCLE [15hrs]

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

UNIT-V MICROTUBULES AND MICRO FILAMENTS [10hrs]

Cytoskeleton - components and biological functions. Microtubules, Microfilaments and IF proteins: Distribution, chemical composition and function.

TEXTBOOKS:

1. Verma.P.SandAgarwal.P.K,1999,"Cellbiology,Genetics,Molecularbiology, Evolution and Ecology",(24th edition) New Delhi,S.Chand& Company Ltd
2. DeRobertisEDPandDeRobertisEMF,1987,"CellandMolecularBiology", (8^{th}edition),New Delhi, B.I.WaverlyPvt Ltd

REFERENCES:

1. SheelaA.Stanly,2008,"Cellbiologyforbiotechnologist",(IEdition),Narosa Publishing House Pvt-Ltd
2. PrakashS.Lohar,2007,"CellandMolecularbiology"(Iedition),Chennai,MJP publishers
3. DarnellJ, LodishH, altimoreD,1986,"Molecularcellbiology",England,WH Freeman.
4. Cell biology–Gerald karp(7^{th}edition)–International student version, Wiley publications

IB.Sc (Biochem)	BIOMOLECULES-II (60hrs)	19BC203
SEMESTER-II		HRS/WK-4
CORE-3		CREDIT-3

Objectives:

- To provide information about biochemically important aspects of the chemistry of lipids and proteins using appropriate examples.
- To understand the structural principles that govern reactivity/physical properties of molecules.
- To acquire knowledge about the structure and function of biologically important peptides/proteins.

Course Outcomes:

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	SUBCODE:NEWCODE					BIOMOLECULES-II								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
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

ThisCourseishaving**HIGH**associationwithProgrammeOutcomeandProgrammeSpecific Outcome

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

UNIT I - LIPIDS [15 hrs]

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 phosphotidyl serine) Sphingomyelin, plasmalogen, sterols (cholesterol), Glycolipids-cerebrosides and gangliosides.

UNIT II AMINOACIDS [10hrs]

Classification of Amino acids based on structure, metabolism & Polarity. Essential &Non essential amino acids, Non protein amino acids. General properties of amino acids. Titration curve of amino acids.

UNIT III PROTEIN [10hrs]

Classificationofproteinsbasedonsizeandshape,solubility,composition&functions.Peptide bond. General reactions of proteins (Reactions of both NH_2 group & COOH group). Separation technique of protein-Ammonium salt fractionation, solvent fractionation, dialysis and lyophilisation.

UNIT IV PROTEIN STRUCTURE [15hrs]

Structureofproteins:primary,secondary,tertiary&quaternary.Ramachandranplotandforces stabilizing the structure of proteins, 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 [10hrs]

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

TEXTBOOKS:

1. RenukaHarikrishnan,1995,"BiomoleculesandEnzymes"(secondedition),Madurai, Indraja Pathipagam
2. J.L.Jain,SanjayJainandNitinJain,1997,"FundamentalsofBiochemistry"(6thEdition) ,NewDelhi,S.Chand & Company Ltd

REFERENCES:

1. Power&Chatwal"Biochemistry"4th edition, Himalaya Publishing House
2. Cambell&Farrell,2007,"Biochemistry"5thedition,Delhi,BabaBorkhanath printers
3. Dr.A.C.Deb,1983,"FundamentalsofBiochemistry"(8thedition),Kolkata,New Central Book Agency
4. Lehninger,NelsonAndCox,1982,"PrinciplesOfBiochemistry",(4THEd)UK, Macmillan Worth Publishers.
5. DonaldVoetandJudithVoet,"Biochemistry",2nd edition,JohnWiley&Sons,Inc,NY

IB.Sc (Biochem)	NUTRITIONALBIOCHEMISTRY (60hrs)	19BC204
SEMESTER-II		HRS/WK-4
CORE-4		CREDIT-3

OBJECTIVES:

- To study the nutritional aspects of various foodstuffs and its measurement.
- To study the functional aspects of vitamins and minerals
- To enable them to gain knowledge in the nutritional management of different age groups

COURSE OUTCOMES:

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	SUBCODE:NEWCODE					NUTRITIONALBIOCHEMISTRY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
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

ThisCourseishaving**HIGH**associationwithProgrammeOutcomeandProgrammeSpecific Outcome

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

UNIT I FOODNUTRITION [15hrs]

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 BIOLOGICALVALUEOFPROTEIN [10hrs]

Biological value of proteins, evaluation of proteins by nitrogen balance method – DC, BV, NPU and NAP, sparing action of carbohydrates, single cell proteins (SCPs) (e.g., spiraling only). PCM: Kwashiorkor and Marasmus- preventive and curative measures.

UNIT III VITAMINS [10hrs]

Vitamins –classification- sources, 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 [10hrs]

Minerals – physiological role and nutritional significance of principal and essential trace elements (sodium, potassium, calcium. Magnesium, phosphorous, copper, zinc, iron, iodine, fluorine, selenium, Molybdenum). Mineral toxicity with reference to copper & iron.

UNIT V NUTRITIONAL REQUIREMENTS [15hrs]

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

TEXTBOOKS:

1. Dr.M.Swaminathan,1987,"FoodandNutritionVolI&II",Secondedition,Bangalore, Bappco Publishers.
2. M.N Chatterjea and RanaShinde," Text book of Medical Biochemistry",4th edition, Jaypee Publishers, New Delhi

REFERENCES:

1. PatriciaTrueman,2007,"NutritionalBiochemistry"(Iedition),Chennai,MJpublishers
2. DarnellJ,LodishH,BaltimoreD,1986,"MolecularCellBiology",England,WH Freeman publishers.
3. William's Basic Nutrition and Diet Therapy Williams(14th edition), Staci Nix.
4. U.Sathyanarayana and U.Chakrapani,"Biochemistry",BooksAndAllied Publishers.
5. Dr.A.C.Deb,1983,"FundamentalsofBiochemistry"(8thedition),Kolkata,New Central Book Agency

IIB.Sc (Biochem)	ENZYMES (60hrs)	BC303S
SEMESTER-III		HRS/WK-4
CORE-3		CREDIT-4

OBJECTIVES:

To understand the structure and classification of enzyme and its mechanism of action.

COURSE OUTCOMES:

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

CO2: To acquire knowledge about the mechanism of enzyme action using different kinetic equations and also get in-depth 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 and commercial applications of enzymes.

SEMESTER III	COURSE CODE : BC303S					COURSE TITLE :ENZYMOLOGY								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PS05	PSO6	PSO7	PSO8	
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 ENZYMES-CLASSIFICATION & MECHANISM OF ACTION [15hrs]

Introduction of Enzymes-Classification-nomenclature-chemical nature and general characterization, factors affecting enzyme activity , Active site determination- trapping ES complex, use of substrate analogue. Mechanism of enzyme action –Lock and key, induced fit theory. Coenzymes and Cofactor, units of enzyme activity, Monomeric and oligomeric enzymes.

UNIT II ENZYME INHIBITION [10hrs]

Michaelis-MentenequationdeterminationofKmandVmaxanditssignificance.Lineweaver 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 ALLOSTERIC INHIBITION [15hrs]

Allosterism, nature of allosteric enzymes, sigmoidal curve, mode of action (sequential & symmetrymodel), Allosteric in hibition and it sregulation Eg.Aspartate transcarbomylase and PFK.Mechanism of enzyme action without cofactors eg. Chymotrypsin

UNIT IV CHEMICAL NATURE OF ENZYMES [10hrs]

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 VI SOLATION & APPLICATIONS OF ENZYMES [10hrs]

Purification of enzymes, immobilization of enzymes- methods: adsorption, entrapping, ionic bonding, cross -linking and encapsulation. Applications of enzymes - Therapeutic, analytical and industrial use.

TEXTBOOKS:

1. TrevorPalmer,(2004).Enzymes.5thedition,AffiliatedEast–Westpress(P)Ltd.New Delhi
2. RenukaHarikrishnan,1995,"BiomoleculesandEnzymes"(secondedition),Madurai, IndrajaPathipagam
3. Dixon,Malcolm;Webb,EdwinClifford,Enzymes:ThirdEdition,Publishedby Longman, USA, 1979.

REFERENCES:

1. Bery J.M., Tymoezko J.L. and Stryer L. (2008) Biochemistry, 5thEdition,W.H. Freeman and Company, New York.
2. LehningerPrinciplesofBiochemistry6thEditionbyDavidL.Nelson,6th edition,2012
3. Victor W. Rodwell, Harpers Illustrated Biochemistry 30th Edition Paper back– Import, 1 Jan 2015
4. Nicholas C.Price. Fundamentals of enzymology–14th edition 1989 by Oxford University press.
5. Dixon,M.andWebb,J.F.,1979,Enzymes,LongmanPublishing,London.
6. PriceandStevens,1999,Fundamentals of Enzymology,OxfordUniversityPress,UK.
7. Jain,J.L&Jain,(2005)FundamentalsofBiochemistry.SixthEdition,S.Chand&Company, New Delhi.

IIB.Sc(Biochem)	ANALYTICALBIOCHEMISTRY-I (60hrs)	BC304S
SEMESTER-III		HRS/WK-4
CORE-4		CREDIT-4

OBJECTIVES

To understand the principle and applications of various biochemical techniques

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 absorption spectroscopy.

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

SEMESTER III	COURSE CODE: BC304S					COURSE TITLE:ANALYTICAL BIOCHEMISTRY- I								HOURS:4 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	PS05	PSO6	PSO7	PSO8	
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

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

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

UNIT I PHYSICAL PROPERTIES OF BIOMOLECULES [10hrs]

Units of measurements. Colloids - properties of colloids, osmosis and viscosity and its significance in biology, surface tension, factors affecting surface tension.

UNIT-II ELECTROCHEMICAL TECHNIQUES [10hrs]

Electrochemical techniques: Principles of electrochemical techniques pH, pOH, buffer ,buffer

capacity,Henderson-Hasselbalchequation,buffersinbodyfluids,Redbloodcellsandtissues, Measurement of pH using indicator – Glass electrode, Oxygen electrode – Principle and application of Clark electrode.

UNIT III ELECTROMAGNETIC RADIATION [15hrs]

Electromagneticradiation:BasicPrinciplesofelectromagneticradiation.Energy,wavelength, wave number and frequency, absorption and emission 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 [15hrs]

Fluorescence and Phosphorescence. Spectrofluorimetry techniques-Principle, instrumentation andapplicationsinVitaminassays(RiboflavinandThiamine),Flamephotometry–Principle, instrumentation and applications in trace elements (Na^+, K^+ analysis), Principle and instrumentation of Atomic absorption spectrophotometer with one example.

UNIT V CENTRIFUGATION [10hrs]

Centrifugationtechnique:Basicprinciples-typesofcentrifugation,rotors,Sedimentationrate, Svedberg unit. Preparative centrifugation: Differential, Density gradient. Analytical ultracentrifugation techniques- Determination of molecular weight of proteins.

TEXTBOOKS:

1. KeithWilson,andJohnWalker,(2010).PrinciplesandTechniquesofPractical Biochemistry. 7th edition, Cambridge University Press. UK.
2. AvinashUpadhyaye,andNirmalendheNath,(2002).BiophysicalChemistryPrinciples and Techniques. 3rd edition, Himalaya Publishers, New Delhi.

REFERENCES:

1. Shawney, Randhir Singh,Narasa Pub,N.Introduction to Practical Biochemistry– Delhi.
2. Subramanian, M.A. (2005). Biophysics : Principles and Techniques. MJP Publishers, Chennai.
3. Pingoud,A.,Urbanke,Claus,Hoggett,Jim,Jeltsch,Albert.Biochemicalmethods. Wiley
4. Rodney F.Boyer.2011.Biochemistry Laboratory: Modern Theory and Techniques (2nd Edition)

II –Year	FIRST AID	AOFA31
SEMESTER-III &IV		HRS/WK-3
Skill Elective		CREDIT-2

Learning objectives:

Objectives

- To inculcate the students for handling the medical emergencies.
- At the end of the course the candidate will be able to manage a casualty who is injured at work, or suffers from a serious illness, while waiting for more qualified medical help to arrive.

Course Outcomes

CO1: To understand basic concept of first aid, wounds, hemorrhages and also demonstrate skill needed to assess the ill or injuries.

CO:2 To demonstrate skill to assess and manage respiratory emergencies, DM and also gain knowledge about liver and kidney emergencies.

CO3: To acquire in depth knowledge about various types of poisoning, bites and also learn causes, symptom and treatment for heart attack

CO4: To gain knowledge about causes, symptom and treatment for head ache, ear ache, tooth ache common cold, diarrhea, dysentery and constipation

CO5: To understand importance of fat, carbohydrate, protein, vitamins and its physiological function.

SEMESTER II	SUB CODE: A0FA31					COURSE TITLE: FIRST AID								HOURS:3 CREDITS :2
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	3	4	3	5	5	4	5	3	4	4	5	5	4.2
CO2	3	4	3	3	4	5	5	3	4	5	5	4	4	4
CO3	3	4	4	3	5	3	5	5	5	5	4	3	5	4.1
CO4	5	3	4	4	5	4	5	3	4	3	4	4	3	3.9
CO5	5	4	4	4	5	5	3	3	4	4	4	3	5	4.0
Mean overall score														4.0

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 PRINCIPLES OF FIRST AID

Definition of first aid, objects of first aid, principles of first aid-Responsibilities-golden rules of first aid - kit for first aider. Diagnosis –blood pressure-bleeding or hemorrhage-types of hemorrhage-Wounds-types-open and closed wounds-emergency care for general wounds-wound with foreign body-special wounds-wounds to the palm of the hand, abdominal wounds.

UNIT II MEDICAL EMERGENCIES

Choking-symptoms –signs and treatment –methods of back slap-adults –infants and children-asphyxia –causes-symptoms and signs and treatment- drowning -effects-symptoms and signs and treatment-suffocation – suffocation by poisonous gases. Diabetic emergencies –Hyperglycemia, Hypoglycemia-symptoms, signs and treatment, Liver emergency and Kidney emergency.

UNIT III INJURIES AND ANAPHYLACTIC SHOCK

Poisoning –Routes of poisoning, Effects of poisoning-treatment and measures, Stroke-Heart Attack-coronary obstruction and cardiac arrest- signs and symptoms –Treatment, insect bites- snake bites-dog bites-symptoms and treatment. Injuries-head injuries-burns and scalds-chemical burns-electric burns-radiation burns-and cold burns-sign-symptoms and treatment.

UNIT IVCOMMON AILMENTS

Headache, tooth ache and ear ache: causes, signs, symptoms and treatment. Common cold, cough, Diarrhea and dysentery: causes, symptoms, signs and treatment. Constipation and travel sickness: signs, symptoms and treatment

UNIT V FOOD AND NUTRITION

Importance of carbohydrates-proteins-fats –their physiological function –Vitamins –fat soluble –water soluble-daily requirements –functions and deficiency

References

1. Sathya Narayanan U,1999, "Biochemistry", (2nd Edition),Kolkata, Allied Publishers
2. Manual of First aid –L.C.Gupta Abhitab-2004, jaypee brothers, medical publishers (p)ltd, newdelhi, India.
3.Dr. M. Swaminathan,1987, "Food and Nutrition Vol I&II", Second edition, Bangalore, Bappco Publishers

II B.Sc(Biochem)	INTERMEDIARY METABOLISM (60hrs)	BC405S
SEMESTER-IV		HRS/WK-4
CORE-5		CREDIT-4

OBJECTIVES

To understand the pathways of various bimolecular and its energetics.

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:BC405S					COURSE TITLE :INTERMEDIARY METABOLISM								HOURS:4 CREDITS:3
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	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 CARBOHYDRATE METABOLISM [15hrs]

Glycolysis–aerobic and anaerobic ,energetics, Pyruvatedehydrogenase complex,oxidationof pyruvate, citric acid cycle (energetics included).Glycogenesis and glycogenolysis (key enzymesandregulationofthesemetabolicpathwaysareincluded).Pentosephosphatepathway and Gluconeogenesis.

UNIT II BIOSYNTHESIS OF FATTY ACIDS [15hrs]

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

UNIT III FATEOFDIETARYPROTEINS [10hrs]

Introduction–fateofdietaryproteins–GlucogenicandKetogenicaminoacids,catabolism of amino acids – Transamination , oxidative and non-oxidative deamination, Decarboxylation – urea cycle .

UNIT IV BIOSYNTHESISOFNUCLEOTIDES [10hrs]

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

UNIT V ELECTRONTRANSPORTCHAIN [10hrs]

TheElectrontransportchain-componentsandreactionsofETC.Oxidativephosphorylation– chemiosmotic theory, P/O ratio, uncouplers of oxidative phosphorylation.

TEXTBOOKS:

1. M.NChatterjeaandRanaShinde,"TextbookofMedicalbiochemistry",8thedition,2012, Jaypee Publishers, New Delhi
2. Jain,J.L&Jain,(2005)FundamentalsofBiochemistry.SixthEdition,S.Chand&Company, New Delhi.
3. U.Sathayanarayana, (2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.

REFERENCES:

1. Lehninger,2012.PrinciplesofBiochemistry6thEditionbyDavidL.Nelson
2. VictorW.Rodwell,2015.Harpers Illustrated Biochemistry,30thEdition.
3. Voet,D.&Voet,J.G.2010.Biochemistry.4thedition

IIB.Sc(Biochem)	ANALYTICAL BIOCHEMISTRY- II (60hrs)	BC406S
SEMESTER-IV		HRS/WK-4
CORE-6		CREDIT-4

OBJECTIVES

To understand the principle and applications of various biochemical techniques

COURSE OUTCOMES

CO1: To gain knowledge about the operating principles & applications of chromatography

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: BC406S					COURSE TITLE: ANALYTICAL BIOCHEMISTRY- II								HOURS:4 CREDITS: 3
COURSE OUTCOMES	PROGRAMME OUTCOMES(POS)					PROGRAMME SPECIFIC OUTCOMES(PSOS)								MEAN SCORE OF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5	PSO 6	PSO 7	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													4.672

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 CHROMATOGRAPHYI [10hrs]

Paper chromatography, Thin layer chromatography, Column chromatography Gas liquid chromatography

UNIT II CHROMATOGRAPHYII [10hrs]

Procedure and applications of Molecular sieve chromatography, Ion exchange chromatography, Affinity chromatography, HPLC, Reverse phase chromatography (elementary knowledge)

UNIT III ELECTROPHORESIS [15hrs]

Electrophoresis-Factors affecting electrophoretic mobility, Tiselius moving boundary electrophoresis, Paper, Cellulose acetate, Gel electrophoresis: Polyacrylamide, SDS-PAGE. Blotting techniques- Southern blot, Northern blot, Western blot.

UNIT IV RADIOISOTOPETECHNIQUES I [10hrs]

Radio isotope Techniques: Atomic structure, isotopes, radiation, type of radioactive decay, half-life, and units of radioactivity. Detection and measurement of radioactivity – Methods based upon ionization -GM counter and Scintillation counter.

UNIT V RADIOISOTOPE TECHNIQUES II [15hrs]

Radio isotope Techniques: Auto radiography and isotope dilution techniques. Applications of radio isotopes in biology, clinical scanning and radio dating, Radio immuno assay. Biological hazards of radiation and its safety aspects.

TEXTBOOKS:

1. KeithWilson,andJohnWalker,(2010).PrinciplesandTechniquesofPracticalBiochemistry . 7th edition, Cambridge University Press. UK.
2. AvinashUpadhyaye,andNirmalendheNath,(2002).BiophysicalChemistryPrinciples and Techniques. 3rd edition, Himalaya Publishers, New Delhi.
3. AnalyticalBiochemistrybyAsokan,3rdedition,2006.

REFERENCES:

1. IntroductiontoPracticalBiochemistry–Shawney,RandhirSingh,NarasaPub,N. Delhi.
2. Subramanian, M.A. (2005). Biophysics : Principles and Techniques. MJP Publishers, Chennai.

3. BiochemistryLaboratory:ModernTheoryandTechniques,2011,2ndEdition by Rodney F. Boyer.

YEAR-III	MOLECULARBIOLOGY (90hrs)	BC507S
SEMESTER-V		HRS/WK-6
CORE-VII		CREDIT-5

OBJECTIVES

- To study the cellular interactions of molecules present in the cell.
- To provide information about the organization of chromosomes and the various important processes involved in the molecular biology.
- 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: BC507S					COURSE TITLE: MOLECULAR BIOLOGY								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	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 [15hrs]

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

UNIT II REPLICATION [20hrs]

Replication-conservative and semi conservative methods, experimental proof for semi-conservative replication-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 [20hrs]

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

UNIT IVGENETICCODE&TRANSLATION [20hrs]

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 trpoperon.

UNIT V DNAREPAIR [15hrs]

DNA repair-photo reactivation, Excision repair, recombination, SOS and Mismatch repair, SNPs.

TEXTBOOKS:

1. Nelson,D.L.&Cox,M.M.2008,LehningerPrinciplesofBiochemistry.Freeman,5thedn,
2. DavidFreifelder,2008.MolecularBiology.(Ed:2).NarosaPublications,NewDelhi.
3. WatsonJ.D.,2006.MolecularBiologyof the gene (Ed.5)Pearson Education, UK

REFERENCES:

1. EDPdeRobertisandEMFdeRobertis,(2001).CellandMolecularBiology.8thEdition, Lippincott W&W.
2. Lodish,H.,Berk,A.,Zipursky,S.L.,Matsudaira,P.,Baltimore,D.andJamesDarnell, J.2012,Molecular Cell Biology,Freeman,7thedn
3. Karp,G.2010,CellandMolecularBiology:ConceptsandExperiments.Wiley,6thedn
4. Primrose(2001)-Principlesofgenemanipulation.6thEditionBlackwellScientific Publishers. UK
5. Krebs,J.E.2011.Lewin'sGenes IX.(Ed:9).Jones and Barlett Publishers,US.
6. Twyman.2003.AdvancedMolecularBiology,3RD edition Bios Scientific Publishers LTD. Oxford, UK.

YEAR-III	IMMUNOLOGY (90hrs)	BC508S
SEMESTER-V		HRS/WK-6
CORE-VIII		CREDIT-5

Objectives

To understand the components of immune system and to study the various components of immune system with their functions.

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

SEMESTERV	SUBCODE:BC508S					IMMUNOLOGY								HOURS:5 CREDITS:5
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO 8	
CO1	5	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	3	4	4	3	4	4	4	3	4	3	4	3.7
CO4	3	4	4	4	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

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

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

UNIT I IMMUNESYSTEM [20hrs]

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, KC, dendritic cell and APC]. Immune response - T and B cell mediated immune response, B & T lymphocytes cooperation. Phagocytosis and pinocytosis.

UNIT II ANTIGEN&ANTIBODY [20hrs]

Antigen-properties, epitope, paratope, specificity, cross space reactivity, antigenicity and immunogenicity, haptens, adjuvants and multivalent binding sites. Antibody -structure, specificityanddistributionofantibodies.Differentclassesandsubclassesofimmunoglobulins. Clonal selection theory and Antibody diversity.

UNIT III COMPLEMENT&TRANSPLANTATION [20hrs]

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&ANTIBODYREACTIONS [15hrs]

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

TEXTBOOKS:

1. Abbas, Lightman and Pober.W.B.Sounders, 1994. Cellular and Molecular Immunology",2nd edition,
2. Ananthanarayanan.Kand JayaramanPaniker,1996."Textbook of Microbiology",
3. JudithA.Owen,JenniPunt,SharonA.Kuby,2013.Immunology,WHFreeman&Co (Sd); 7th edition

REFERENCES:

1. David Male,Jonathan Brostoff, DavidRothIvanRoitt.2005.Essential Immunology. 10th edition. Blackwell Science,
2. Tizard.R, "Immunology-An introduction", 1995 Saunders College Publishing 2nd Revised edition)
3. Weir,D.N.(1997):Immunology(8thedition)(Churchil Livingstone).
4. IvanM.Roitt,D.Male,1995.Immunology,MosbyPublishers;4thRevised edition

YEAR-III	FOODTECHNOLOGY	EBC509A
SEMESTER-V	(75hrs)	HRS/WK-5
Elective-I		CREDIT-5

OBJECTIVES:
To study the nature of food, spoilage, preservation and its applications

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	SUBCODE:EBC509A					FOODTECHNOLOGY								HOURS:5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
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

ThisCourseishavingHIGHassociationwithProgrammeOutcomeandProgrammespecific outcome

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

UNIT–I FOODCONSTITUENTSANDADULTERATION [20hrs]

Constituents of food: Introduction, water, carbohydrate, fat, oil, vitamins and minerals. Pulses, grams, vegetables and fruits-varieties, composition, nutritive value and cooking. Milk- kinds of 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 FOODSPOILAGE [15hrs]

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–IIIFOODPROCESSINGANDPRESERVATION [20hrs]

Food processing: Principle and methods of food processing and preservation-freezing, heating, dehydration, canning, additives, 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 INDUSTRIALPRODUCTIONSOFFOODS [10hrs]

Yogurt preparation, Cheese varieties 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 LEGALISSUESANDGOVERNMENTNORMS [10hrs]

Food regulations – History of Indian Food Regulations: BIS, ISI, FPO, PFA and FDA. Food SafetyandStandardsAct2006.Foodlawsandqualitycontrol–HACCP,Codexalimentarius, PFA,FPO,MFPO,BIS,AGMARKandFSSAI.Legalaspectsrelatedtostorageanddisposal.

TEXTBOOKS:

1. Gabriel Virella(1997),Microbiologyandinfectiousdisease,3rdEd,Ingraham international, New Delhi.
2. John L In graham and Catherine A.Ingraham. Microbiology an introduction, 2rd Ed,Cengage learning, New Delhi
3. Sivasankar,B.(2005),Food processing and preservation,3rd Ed, Prentice Hall India(P) Ltd.
4. VijayaKhader(2009),Textbookoffoodscienceandtechnology,5thEd,Indiancouncil of Agricultural research.
5. Avantina Sharma, Textbook of food science and technology,3rdEd, CBS Publishers.

REFERENCES:

1. Belitz,H.D.Grosch Wet al.,(2005).FoodChemistry.4thedition,SpringerVerlag.
2. Adams,M.R.andM.G.Moss(2009):FoodMicrobiology,1stedition,NewAgeInternational (P) Ltd.
3. Fellows,P.J.(2005).Foodprocessingtechnology:PrincipleandPractice.2ndEd.CRC Publishers.
4. BibekRay,Fundamental food microbiology,3rdedition,PRCPress,Washington D.C.
5. James, M.J.(2000)ModernFoodMicrobiology,2nd Edition.CBSPublisher.

YEAR-III	ENVIRONMENTALTOXICOLOGYAND HERBAL MEDICINE	EBC509B
SEMESTER-V		HRS/WK-5
Elective–I	(75hrs)	CREDIT-5

Objectives:

- To study various harmful chemical agents in environment and its impacts.
- To study the basics of medicinal and therapeutic use of plants

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 plans and Preparation of Herbs for common ailments.

CO5: To gain insights about the herbal drugs for Dengue fever, urinogenital disorders, Memory stimulants, dissolving kidney stones, inflammatory and Anticancer drugs.

SEMESTER V	SUBCODE:EBC509B					ENVIRONMENTALTOXICOLOGYAN D HERBAL MEDICINE								HOURS:5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF 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

This Course is having HIGH association with Programme Outcome and Programme specific outcome.

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

UNIT-I TOXICOLOGY[[20hrs]

Toxicsubstances:Types-degradable&non-degradable.Factorsinfluencingtoxicity.Drugtoxicity.Mechanism of toxicity. Receptor mediated events. Acute and chronic toxicity.

UNIT-II TOXICSUBSTANCESINENVIRONMENT [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 [20hrs]

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 INTRODUCTIONTOHERBALSCIENCE [10hrs]

Herbs, characterization of herbs based on plant properties, usage and active constituents. Preparation of herbal medicine. Herbs for common ailments. Dosage and formulation.

UNIT-VHERBAL MEDICINE [10hrs]

Drugsforurinogenitaldisorders–rootsof*Withaniasomnifera*–Memorystimulants–*Centellaasiatica*– Drugs for dissolving kidney stones – *Musa paradisiacal*(pseudo stem) – Anti- inflammatory drugs – *Curcuma longa*, Cardiospermum – Anticancer drugs – *Catharanthusroseus* and A*zardicaindica*. Dengue fever – Papaya leaves.

TEXTBOOKS:

1. David Hoffmann., 2003.Medical Herbalism: The Science Principles and Practices of Herbal Medicine, 1ST edition, Healing Arts Press publishers.
2. AgnesArbe,1987.Herbals:TheirOriginandEvolution,CambridgeUniversityPress; 3 edition,
3. Kumar,N.C.1993.An Introduction to Medicalbotany and Pharmacognosy. Emkay Publications, New Delhi.
4. P.D.Sharma,2014.Environmental Biology andToxicology,Rastogi Publications.

REFERENCES:

1. Gupta,P.K.andSalunka,D.K.1985.Moderntoxicology.VolI and II.Metropolitan, New Delhi.
2. Ming-HoYu,HumioTsunoda,MasashiTsunoda,2011.EnvironmentalToxicology: Biological and Health Effects of Pollutants, CRC Press; 3 edition

YEAR-III	PLANTBIOCHEMISTRY (75hrs)	EBC510A
SEMESTER-V		HRS/WK-5
ELECTIVE-II		CREDIT-5

OBJECTIVES:

- To make available information about the plant cell wall and the mechanism of absorption.
- To acquire knowledge about the Physiological significance of various plant hormones, role of pigments in photosynthesis and the importance of secondary metabolites
- 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: EBC510A					PLANTBIOCHEMISTRY								HOURS :5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCORE OFCO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
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

ThisCourseishavingHIGHassociationwithProgrammeOutcomeandProgrammespecific outcome.

UNIT I PLANTCELL&ABSORPTION [20hrs]

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 PLANTHORMONES [10hrs]

Structure, biosynthesis, mode of action and physiological effects of auxins, gibberellins,

cytokinins and IAA.Biochemistry of seed dormancy, seed germination, fruit ripening and senescence.

UNIT III PLANTPIGMENTS&PHOTOSYNTHESIS [20hrs]

Structure & synthesis of chlorophyll, phycobilins and carotenoids. Photosynthesis: photo system 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.

UNIT IV SECONDARYMETABOLITES&STRESSMETABOLISM [15hrs]

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 NITROGENFIXINGORGANISMS [10hrs]

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*lebsiellapnemoniae* and their regulation. Nitrate reductase.

TEXTBOOKS:

1. Jain.V.K., 2005.'Fundamentals of Plant Physiology', Revised 1st edition,S.Chand&Company Ltd
2. Pandey.S.N.,andSinha.B.K.1999.PlantPhysiology,VikasPublishingHouse.
3. Verma,S.K.2005,TextBookofPlantPhysiology,7thRevisededition,Emkay Publications 2001, S. Chand & Co Ltd., New Delhi.

REFERENCES:

1. Solisburyand Ross, Plant Physiology,3rd edition,CBSPublishersandDistributors.
2. Hans-Walter Held, Plant Biochemistry,3rd edition,ElsevierIndiaPvt.Ltd.
3. Bonner and Varner,Plant Biochemistry,3rd edition,AcademicPress.
4. Heldt ,HW.(2005),PlantBiochemistry.3rd edition, Elseveir Academic Press Publication, USA.

YEAR-III	PHARMACEUTICAL BIOCHEMISTRY AND BIOINFORMATICS (75hrs)	EBC510B
SEMESTER-V		HRS/WK-5
ELECTIVE-II		CREDIT-5

OBJECTIVES:

- To gain essential knowledge about drugs and their metabolism.
- To understand the biological data base and their alignment.

Course Outcomes:

CO1: To acquire knowledge of drug design and development.

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 importance and applications of different database sequences

CO5: To gain knowledge about the sequence alignment and applications of computational methods in Biology.

SEMESTERV	SUBCODE:19EBC52B					PHARMACEUTICALBIOCHEMISTRY								HOURS:5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF CO'S
	PO 1	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

ThiscoursehavingHIGHassociationwithProgrammeoutcomeandProgrammespecific outcome.

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

UNIT I DRUGS [15hrs]

Definition, source and Nature of common drugs - Antimalarial drugs – Chloroquine, quinine, Hydroxychloroquine, Amodiquine. Antifungal drugs - Chlorophenesin, Griesofulvin and Candicidin.Antiviralagents-Idoxuridine,Acyclovir,Methisazone,Amantadinehydrochloride (structure not required).

UNIT II PHARMACOKINETICS [20hrs]

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 ANTIOXIDANTDEFENSE [10hrs]

Antioxidant defense system-oxygen dependent and independent (NOS) antioxidant defense enzymes SOD, Catalase, Glutathione peroxidase, Glutathione reductase and lipid peroxidation.

UNIT IV BIOINFORMATICS [15hrs]

Bioinformatics-definition, application, challenges and opportunities. Internet, www.Database-types, classification, sequence formats, DBMS, RDBMS, SQL (brief description), Nucleic Acid Database-NCBI, EMBL& DDBJ. Protein Sequence Database-PIR, SWISS-PROT, Structure database-PDB, CDS, ORF, EST motifs, domain and annotation.

UNIT V SEQUENCEALIGNMENT [15hrs]

Sequence alignment-algorithm, global and local alignment, sequence alignment methods, pairwise alignment-dot matrix, dynamic programming, FASTA & BLAST. Multiple sequence alignment-HMM & CLUSTAL [brief descrption]. Homology, orthology, paralogs & xenologs. Soft wares used for phylogenetic analysis.

TEXTBOOKS:

1. Tripathi KD, 2013.Essentials Of Medical Pharmacology, 7th edition. Jaypee Brothers Medical Publishers
2. KatzungBertram,2015.BasicandClinicalPharmacology13thed.,McGraw Hill,.
3. S.Ignacimuthu,2005.BasicBioinformatics,Narosapublications
4. ArthurM.Lesk.2002.IntroductiontoBioinformatics,Oxford University press.
5. Rastogi,S.C. Mendiratta, N. and Rastogi P ,"Bioinformatics-Methods and applications",Prentice-Hall of IndiaPvt. Ltd, New Delhi.
6. KarenWhalen,2014.LippincottIllustratedReviews:6thedition.Pharmacology– Publisher: Wolter Kluwer

REFERENCES:

1. David R.Westhead,J.HowardParish &Richard,2003.Instant notes on bioinformatics" ,vivabookPvtltd.
2. K.Mani&N.Vijayaraj,2004 "Bioinformatics- a practical approach",Aparna publications, Coimbatore
3. LubertStyrer, Biochemistry ,4th edition, W.H.Freeman and Company, New York.
4. G.R.Chatwal, Pharmaceutical chemistry, Himalaya Publishing House.
5. Joseph R.Dipalma,,G.Johndi Gregorio, Basic Pharmacology in Medicine,3th edition.
6. Attwood, T.K. and Parry-Smith, D.J. 1999. Introduction to bioinformatics. Pearson Education Ltd., Delhi, India

YEAR-III	MEDICALBIOCHEMISTRY (90hrs)	BC611S
SEMESTER-V		HRS/WK-6
COREIX		CREDIT-5

OBJECTIVES

To understand biochemical basis of various diseases and disorders.

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 amino acid 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.

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	SUBCODE:BC611S					MEDICALBIOCHEMISTRY								HOURS5 CREDITS:5
COURSE OUTCOMES	PROGRAMMEOUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF 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

ThisCourseishaving**HIGH**associationwithProgrammeOutcomeandProgrammeS pecific Outcome

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

UNIT I COLLECTION&PRESERVATIONOFSAMPLES [15hrs]

Biological samples, Specimen collection, anticoagulant, preservatives for blood and urine, transport of specimens. Normal and abnormal values of different blood parameters.

UNIT II DIABETESMELLITUS [15hrs]

Diabetes mellitus- definition, WHO criteria, classification of diabetes mellitus-signs, symptoms and complications, GTT, galactosemia, galactosuria and fructosuria.

UNIT III INBORN ERRORS & LIPID TRANSPORT [20hrs]

Inborn errors of metabolism- phenylketonuria, alkaptonuria, albinism, cystinuria and fanconi

syndrome. Exogenous and endogenous transport of lipids- chylomicron transport, VLDL transport-reverse cholesterol transport. Atherosclerosis, fatty liver- risk and anti-risk factors.

UNIT IV LIVER&GASTRICFUNCTIONTEST [20hrs]

Liver function test-Heme catabolism- Jaundice- classification- biochemical findings-liver function test based on bile pigments- Vandenberg test, Detoxification-Hip uric 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 RENALFUNCTIONTEST&DIAGNOSTICENZYMES [20hrs]

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

TEXTBOOKS:

1. Textbook of Biochemistry for medical students- DM.Vasudevan,5th edition,Jaypeepublishers, 2008.
2. Text book of Medical Biochemistry, Chatterjee,M.N. and RanaShinde,5th ed.Jaypee Medical Publishers, 2002.
3. Devlin, T.M, Textbook of Biochemistry with Clinical Correlations. John Wiley and sons, INC. New York, 2002.

REFERENCES:

1. Robert K. Murray, Daryl K. Grammar "Harper's Biochemistry",(25th Edition) McGraw Hill, Lange Medical Books.
2. SathyaNarayanaU,1999,"Biochemistry",(2nd Edition),Kolkata, Allied Publishers..
3. MallikarjunaRaoN,2002,"MedicalBiochemistry",2nd Edition,NewDelhi,NewAge International publishers.
4. Bhagavan.N.V(2004),"MedicalBiochemistry",(4th ed)Noida,Academicpress
5. Harrison, T.R.Fauci, Braunwalad, and Isselbaeher, "Principles of Internal Medicine, 1998, McGraw Hills.
6. VictorW.Rodwell,2015.Harpers Illustrated Biochemistry30thEdition.
7. LuxtonR,2010,Clinical Biochemistry,2ndedition,VinothVashistaPvt.Ltd.,New Delhi.

YEAR-III	BIOTECHNOLOGYANDGENETIC ENGINEERING (90hrs)	BC612S
SEMESTER-VI		HRS/WK-6
CORE-X		CREDIT-5

OBJECTIVES

To provide an insight into the basic concepts of biotechnology.

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

SEMESTER VI	COURSECODE:BC612S					TITLEOFTHEPAPER:BIOTECHNOLOGYANDGENETICENGINEERING								HOURS:5 CREDITS: 5
COURSEOUTCOMES	PROGRAMMEOUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEANSCOREOFCO'S
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5	PSO 6	PSO 7	PSO 8	
CO1	4	3	4	5	4	5	5	3	5	3	4	3	4	3.92
CO2	4	3	5	4	3	4	4	3	4	5	3	4	4	3.85
CO3	3	4	5	3	4	3	3	4	4	4	4	4	3	3.69
CO4	4	3	4	5	3	4	5	3	4	3	4	3	4	3.76
CO5	3	5	5	4	5	3	4	3	3	5	4	3	4	3.92
Mean Overall Score														3.83

ThisCourseishaving**HIGH**associationwithProgrammeOutcomeandProgrammeSpecific Outcome

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

UNIT I INTRODUCTION [15hrs]

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 ANIMALCELLCULTURE [20hrs]

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 III VACCINES&TRANSGENESIS [20hrs]

Productionofvaccinesinanimalcells-traditionalandrecombinantvaccines-subunitvaccines-HepatitisB,Vacciniavirus(Vectorrecombinantvaccine),DNAandRNAvaccines. Transgenic animals - techniques and applications - transgenic mice and sheep. Stem cells- isolation, identification and uses. Transgenic plants and its uses.

UNIT IV PLANTTISSUECULTURE [20hrs]

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 V FERMENTATION [15hrs]

Fermentation, Fermentor-common features and operation for a conventional bioreactor, classificationoffermentationprocess-type1,type2 and type3.Fermentation process-factors affecting fermentation process, media for fermentation – synthetic and crude media.

TEXTBOOKS:

1. Sathya Narayana U,1999,"Biotechnology",(2nd Edition),Kolkata, Allied Publishers.
2. P.K.Gupta,"BiotechnologyandGenomics",2004,Rastogi Publications.
3. Dubey.R.C.,A Textbook of Biotechnology, S.Chand & CompanyLtds.,

REFERENCES:

1. Bernard, Glick Jack. R,Pasternak.J, Molecular Biotechnology-Principle and Application of Recombinant DNA, 3rd edition,2003,Libraryof 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.

YEAR-III	CLINICALENDOCRINOLOGY (75hrs)	EBC613A
SEMESTER-VI		HRS/WK-5
ELECTIVE-III		CREDIT-5

OBJECTIVES

To provide an insight into the structure and functions of hormones.

COURSE OUTCOMES:

CO1: Able to gain in depth 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 hormones and its regulation.

SEMESTER VI	SUBCODE::EBC613A					CLINICALENDOCRINOLOGY								HOURS:5 CREDITS:4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
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

Thiscourseishaving**HIGH**associationwithprogrammeoutcomeandprogrammespecific outcome

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

UNIT I INTRODUCTION TO HORMONES [15hrs]

Hormones - feedback regulation. Different mechanisms of signal transduction, secondary messengers - camp mediation, calcium and DAG mediation, camp mediation, ionic conduction.

UNIT II PITUITARY & HYPOTHALAMUS HORMONES [15hrs]

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 [15hrs]

Thyroid hormones-structure and functions. Hypothyroidism-cretinism, my edema, simple

Goiter,Grave'sdisease.Parathyroidhormones-regulationofcalciumhomeostasisbyPTHand calcitonin.Hormones of pancreas- insulin & glucagon.

UNIT IV ADRENAL HORMONES [15hrs]

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 GASTROINTESTINALHORMONES&SEXHORMONES [15hrs]

Gastro intestinal hormones-chemical nature, functions of gastrin ,entero gastrone, secretin,and cholecystokinin. Sex steroids-male sex hormones - biosynthesis and its metabolic functions. Female sex hormones - biosynthesis and its metabolic functions.

TEXTBOOKS:

1. Chatterjee,M.N.and Rana Shinde.TextbookofMedical.Biochemistry,2002.5th edition. Jaypee Medical Publishers.
2. DM.Vasudevan.Textbook of Biochemistry formedicalstudents.5th edition, Jaypee Publishers, 2008.

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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)TextbookofBiochemistrywithClinicalCorrelations.JohnWiley and sons, INC. New York.
4. RamakrishnanS,PrasannaK.G.andRajanR,1980,"TextbookofMedicalBiochemistry",3rd edition, Chennai, Orient Longman.
5. Bhagavan.N.V(2004),"MedicalBiochemistry",4thedition,Noida,AcademicPress.

YEAR-III	MEDICALPHYSIOLOGY (15hrs)	EBC613B
SEMESTER-VI		HRS/WK-5
ELECTIVE-III		CREDIT-5

OBJECTIVES

To learn the structure and functions of the different organs present in the human body

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	SUBCODE:EBC613B					HUMANPHYSIOLOGY								HOURS:5 CREDITS4
COURSE OUTCOMES	PROGRAMME OUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEAN SCOREOF CO'S
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
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
Meanoverallscore														4.0

Thiscourseishaving**HIGH**associationwithprogrammeoutcomeandprogrammespecific outcome

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

UNIT I BLOODANDCIRCULATORYSYSTEM [15hrs]

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

UNIT II DIGESTION [15hrs]

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

UNIT III RESPIRATORYSYSTEMANDEXCRETORYSYSTEM [15hrs]

Respiration, types of Respiration, Respiratory system of man, 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 NERVOUSSYSTEM [15hrs]

Neuron, types of neuron, conduction of nerve impulse, Synapse - types of synapse, synaptic transmission, Neurotransmitter, Neuromuscular junction, Reflex action.
Human brain - Anatomy of brain - meanings, cerebrum, brain stem, cerebellum and functions. Spinal cord and its function.

UNIT V MUSCLE [15hrs]

Introduction, types of muscle, Ultra structure of skeletal muscle - light band, dark band, Macromere, thick filament-myosin, thin filament - acting, tropomyosin and troponin. Muscle contraction – types of muscle contraction and theories of muscle contraction, Molecular basis of skeletal muscle contraction.

TEXTBOOKS:

1. KAGoel,KVSastri, AText book of Animal Physiology,Rastogi publications,Meerut.
2. ArthurC.GuytonandJohnE.Hall,2016.TextbookofMedicalPhysiology,Harcourt Asia Pvt. Ltd, 10th edition.
3. Sembulingam, Premasembulingam,2012.Essentialsof medical Physiology-K 6th edition, Jaypee Brothers Medical Publishers (P) Ltd.,
4. A.K.Jain,2016.TextbookofPhysiologyVol-I&II,6th editionAvichalPublishing Company.

REFERENCES:

1. BJMeyer,HsMeij,ACMeyer,Human Physiology,2nd edition–AITBSPublishersand distributon.
2. Giese,CellPhysiology,5th edition, W.BSaunders company,Tokyo,Japan.
3. AnimalPhysiologyandbiochemistry–RAAgarval,Anil.K.Srivastav,Kaushal Kumar, S .Chand & CO.,
4. GanongW.E.2003.ReviewofMedicalPhysiology,21st edition.McGraw Hill.
5. West,E.S. and Todd,W.R.,1985,TextbookofBiochemistry,MacMillan,Germany.
6. Zubay,1998,Biochemistry 4thedition,WMCBrownPublishers,USA.

YEAR-III	BIOSTATISTICSANDCLINICAL RESEARCH (75hrs)	EBC614A
SEMESTER-VI		HRS/WK-5
ELECTIVE-IV		CREDIT-5

OBJECTIVES:

- To provide sufficient background to interpret statistical results in research papers.
- To ensure the students with requisite knowledge to pursue a career in the clinical research industry.

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.

SEMESTER VI	COURSECODE:19EBC64A					BIOSTATISTICSANDCLINICALRESEARCH								HOURS:5	CREDITS:4
COURSEOUTCOMES	PROGRAMMEOUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								MEANSCOREOFCO'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	

ThisCourseishaving**HIGH**associationwithProgrammeOutcomeandProgrammeSpecific Outcome

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

UNIT I DATA COLLECTION AND PRESENTATION [15hrs]

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, Barchart, Frequency polygon and Pie chart, graphical presentation of data- line graph.

UNIT II MEASURESOFCENTRALTENDENCY [15hrs]

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 STATISTICALANALYSIS [15hrs]

Test for correlation and regression coefficients, Chi-square test for goodness of an independenceofattributes.F-testforequalityofvariances,ANOVA–onewayclassification.

UNIT IV CLINICALRESEARCH [15hrs]

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.

UNITVDRUGDEVELOPMENT [15hrs]

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. Stocker RS, bhandarkar SD, AinapureSS,E.Padmini, 2003.Biochemical calculations and Biostatistics. Books and Allied (P) Ltd. Pharmacology & Pharmaco therapeutics. 18th ed. Mumbai: popular prakashan: 376.

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1. ThomasGlover,KevinMitchell.2001.'IntroductiontoBiostatistics',1sted. McGraw Hill Science
2. DrN.Gurumani,2015. "An Introduction to Biostatistics", MJPPublishers
3. Wilson & Walker, 2000. Principles and Techniques in Practical Biochemistry' 5th ed.. Cambridge Univ. Press.
4. ClinicalResearchPracticeandprospects-T.K.Pal,SangitaAgarwal,1stedition.
5. EssentialofMedicalPharmacology,Sixthedition-KD.ThripathiMD,Jaypeebrothers medical publishers (P) Ltd. St Louis (USA)

YEAR-III	MEDICALLABORATORYTECHNOLOGY (75hrs)	EBC614B
SEMESTER-VI		HRS/WK-5
ELECTIVEIV		CREDIT-5

OBJECTIVES

To provide insights in the basic techniques involved in medical diagnostics.

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, gram staining and safety procedure in microbiological techniques

SEMESTERVI	COURSECODE:EBC614B					MEDICALLABORATORYTECHNOLOGY								HOURS:5CREDITS:4
COURSE OUTCOMES	PROGRAMMEOUTCOMES(PO)					PROGRAMMESPECIFICOUTCOMES(PSO)								
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
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

ThisCourseishaving**HIGH**associationwithProgrammeOutcomeandProgrammeSpecific Outcome

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

UNIT I INTRODUCTIONTOLABORATORYEQUIPMENTS [15 hrs]

Introduction to laboratory equipments, Basic laboratory operation and the role of laboratory technician. Types of specimen collection and procedure - blood, urine, sputum, throat swab, stool and CSF. Unit of measurement, reagent preparation and laboratory calculation-metric system. Smear preparation and types, calibration, measurements, quality control & GLP.

UNIT II HEMATOLOGY [15 hrs]

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

UNIT III CLINICAL PATHOLOGY [15hrs]

Brief outline of histopathology: Tissue cutting, fixation, embedding, tissue slicing by microtome, slide mounting and staining techniques: types – carbohydrates, proteins & lipids.

UNIT IV CLINICAL BIOCHEMISTRY [15hrs]

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

UNIT V MICROBIOLOGY [15hrs]

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, Lepra bacilli).Safety procedure in microbiological techniques.

TEXTBOOKS:

1. KanaiL.Mukherjee,1996.Medical Laboratory Technology Vol.I, II & III Tata McGraw Hill New Delhi.
2. GradWohl, Clinical Laboratory-Methods and Diagnosis, 8th edition, mosby year book publisher, Vol-I.
3. Mukherj,2000.MedicalLaboratoryTechnology,TataMcGrawHillEducation
4. DarshanP.GodkarPrafulB.Godkar,2014.TextbookofMedicalLaboratoryTechnology Vol 1 & 2,Bhalani Publishing House; 3rd edition

REFERENCES

1. Henry,John Bernard,ToddSanfordandDavidson,2002.Clinicaldiagnosisand management by laboratory methods. W.B. Saunders & Co.
2. FischbachFrancisA,2003.Manual of laboratory and diagnostictests. Philadelphia,J.B. Lippincott & Co, N.Y.
3. Gradwohls, 2000. Clinical laboratory methods and diagnosis Alex.C. Sonnenwirth & Leonard Jarret.M.D.B.I. Publications, New Delhi,
4. Sood R, 2005, Medical Laboratory methods and interpretation, Jaypee Brothers Medical Publications, New Delhi.
5. Arundhati Kolhatkar,J. Ochei, 2000. Medical Laboratory Science: Theory and Practice, Tata McGraw-Hill Education Pvt. Ltd.

I B.Sc (BC)	MAIN PRACTICAL I	COURSE CODE: BCP201S
SEMESTER I & II		HRS/WK-3
Major		CREDIT-4

VOLUMETRICANALYSIS

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

BIOCHEMICALPREPARATION

9. Preparation of albumin from egg
10. Preparation of albumin from milk
11. To find out the moisture and water content in food stuffs.

QUALITATIVEANALYSIS

12. Qualitative analysis of carbohydrates - Glucose, fructose, arabinose, maltose, lactose, galactose, dextrin, mannose ,sucrose and starch

13. Qualitativeanalysisofaminoacids-Tyrosine,tryptophan,arginine,Histidine,Proline and cysteine

SPOTTERS.

14. Cell division identification(mitosis &meiosis)
15. BMI calculation

II B.Sc (BC)	MAIN PRACTICAL II	COURSE CODE: BCP402S
SEMESTER III & IV		HRS/WK-3
Major		CREDIT-4

1. PREPARATIONOFBUFFERS

- Saline
- Bicarbonate buffer
- Phosphate buffer
- Trisbuffer

2. FOODANDBIOCHEMICALANALYSIS

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

3. COLORIMETRICANALYSIS

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

4. BIOCHEMICAL ANALYSIS (Demonstration)

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

5. BIOCHEMICALPREPARATION

- Preparation of starch from potatoes
- Preparation of case in and lactalbumin from milk
- Preparation of albumin from egg

6. VOLUMETRICANALYSIS

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

PRACTICALMARKS:60

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

III B.Sc (BC)	MAIN PRACTICAL III	COURSE CODE: BCP603S
SEMESTER V & VI		HRS/WK-3
Major		CREDIT-4

1. COLORIMETRICESTIMATION

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

2. EXPERIMENTSONENZYMESBYCOLORIMETRY

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

3. CHROMATOGRAPHY

- Thinlayer chromatography- AminoAcids & Carbohydrates
- Column chromatography–leaf pigments.

4. 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
- Fiber in food
- Iron in food
- Food additives /adulterants

PRACTICAL MARKS: 60
Colorimetric analysis I &II -
20 Enzymeassay-15
Spotters/estimation(food)- 15
Record -10

III B.Sc (BC)	MAIN PRACTICAL IV	COURSE CODE: BCP604S
SEMESTER V & VI		HRS/WK-3
Major		CREDIT-4

1. COLORIMETRICESTIMATION

a. Estimation of glucose by
   i. Folin Wuand
   ii. Orthotoluidine methods
b. b.Estimation of albumin and A/ G ratio in serum.
c. c. Estimation of cholesterol byZak's method
d. Estimation of protein by Lowry method
e. Estimation of protein concentration by A_{280nm}
f. Isolation & purification of DNA from onion.

2.ENZYMEASSAY

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

3.URINEANALYSIS

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

4. PREPARATIONOFSOLUTIONS

- Normality, molarity & percentage solution

4.HAEMATOLOGY

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

5.ELECTROPHORETICTECHNIQUES

- Separation of protein by SDS-PAGE and Agarose.

PRACTICALMARKS:60

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

REFERENCES

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 AgeInternational (P) Limited. New Delhi.
3. Sadasivam S and Manickam P. (2004) Biochemical Methods. 2nd Edition. New Age International (P) Limited. New Delhi.
4. David, T. Plummer, (1988). An Introduction to Practical Biochemistry. 3rdEdition. TataMcGraw Hill Publishing Company Ltd. New Delhi.

5. Pattabiraman,T.N.(1998).LaboratoryManualinBiochemistry.3rdEdition.AllIndia Publishers and Distributors. Chennai.