E-mail : josecol27998@gmail.com
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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

M.Sc. BIOCHEMISTRY

I M.Sc Biochemistry	COURSE NAME:CHEMISTRY OF BIOMOLECULES	COURSE CODE : PBC11A
SEMESTER-I		HRS/WK-5
CORE-1		CREDIT-4

OBJECTIVES:

1. To provide information about biochemically important aspects of the biomolecules.
2. To understand the structure and properties of biomolecules like carbohydrates, proteins and lipids.
3. To know the DNA-protein interactions and the techniques used to characterize it.

COURSE OUTCOMES (CO's):

CO1- To understand and acquire knowledge about the classification, structure, properties and biological importance of carbohydrates.

CO2- To gain knowledge about the different structural aspects of proteins and the allosteric nature of hemoglobin.

CO3- To acquire knowledge about the classification, structure and properties of lipids and its importance in physiological process.

CO4- To acquire the knowledge about the structure, types, properties and functions of DNA and RNA

CO5- Be familiar with important motifs involved in DNA-protein interaction and also gain technical skills in predicting the interactions.

SEMESTER I	COURSE CODE: PBC11A					COURSE NAME: CHEMISTRY OF BIOMOLECULES								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	4	3	4	3	4	4	3	4	3	5	4	3.8
CO2	4	4	3	4	3	3	4	4	4	5	5	4	4	3.9
CO3	4	3	4	3	4	3	4	5	4	3	3	3	4	3.6
CO4	3	4	4	3	3	4	3	4	4	4	3	4	3	3.5
CO5	4	3	3	4	3	4	3	4	4	3	4	4	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 - CARBOHYDRATES [20 hrs]

Carbohydrates: classification-properties of monosaccharides and disaccharides. Polysaccharides– occurrence, structure and biological functions of cellulose, chitin, starch and glycogen. Bacterial cell wall polysaccharides and blood group antigens. Glycosaminoglycans – structure and biological role of hyaluronic acid, chondroitinsulfate and heparin. Sialic acid – structure and significance, Proteoglycans and their biological importance.

UNIT II - PROTEINS [15 hrs]

Amino acids: classification and properties.Classification of protein.Orders of protein structure: Primary structure – determination of amino acid sequence of proteins.The peptide bond, Secondary structures – α-helix, β-sheet and β-turns. Pauling and Corey model for fibrous proteins, Reverse turns and super secondary structures and Tertiary structure. Ramachandran plot, Collagen triple helix, Conformational properties of silk fibroin, Quaternary structure of proteins, Models for hemoglobin allostery,

UNIT III - LIPIDS [10 hrs]

Lipids – Introduction, classification: structure and functions. Fatty acids: saturated, unsaturated and hydroxy fatty acids. PUFA, significance of omega 3 and 6 fatty acids, DHA. Phospholipids and glycolipids – structure and functions. Structure and functions of cholesterol. Lipids as signal, cofactor and pigments. Lipoproteins – Types and function.

UNIT IV - NUCLEIC ACIDS [15 hrs]

DNA double helical structure – Watson and Crick model. A, B and Z forms of DNA.DNA supercoiling and linking number. Properties of DNA – buoyant density, viscosity, denaturation and renaturation – The cot curve. Major classes of RNA – mRNA, rRNA, tRNA, snRNA,micro RNA, Sno RNA – structure and biological functions.

UNIT V - DNA - PROTEIN INTERACTIONS [15 hrs]

Salient features of nucleic acid recognition by proteins. DNA binding motifs in proteins – the basic helix loop helix (bHLH) motif, zinc finger, the leucine zipper and helix-loop helix. RNA binding motifs in proteins. Techniques characterizing nucleic acid-protein complex – gel retardation assay, DNase I foot printing, CHIP.

TEXT BOOKS:

1. Jain, J.L& Jain, (2005) Fundamentals of Biochemistry. Sixth Edition, S.Chand& Company, New Delhi.
2. Deb, A.C., (2016), Fundamentals of Biochemistry, New Central Agency, Calcutta.
3. RenukaHarikrishnan. (2002),"Biomolecules and Enzymes. second edition, Indraja Pathipagam, Madurai.

REFERENCE BOOKS:

1. Donald Voet, Judith, G. Voet, and Charlotte, W Pratt, (2016). Fundamentals of Biochemistry, 5th Edition. John Wiley & Sons, New Jersey.
2. Zubay, G. (2017). Biochemistry, 5th Edition, WCB. Mcgraw-Hill, New York.
3. Bery J.M., Tymoezko J.L. and Stryer L. (2019) Biochemistry, 9th Edition, W.H. Freeman and Company, New York
4. Murray, K.R. Granner, K.D.Mayes, P.A. and Rodwell W.V. (2009).Harper's Biochemistry. 23rd Edition, Prentice Hall International Inc.,New Jersey.
5. Nelson, D.L. and Cox, M.M (2021). Lehninger Principles of Biochemistry. 8thEdition, W.H. Freeman and Company, New York.

I M.Sc Biochemistry	COURSE NAME:CELLULAR BIOCHEMISTRY (75 hrs)	COURSE CODE: PBC12A
SEMESTER-I		HRS/WK-5
CORE-2		CREDIT-4

OBJECTIVES:

1. To understand the structure and purpose of the basic components of the Cell and its organelles
2. To know the vast networks of communication that occurs between and within each cell in our body and the mechanism of cell cycle, cell death and genes to inhibit cancer.
3. To acquire knowledge about microfilaments, microtubulescomponents involved in cell- cell interaction.

COURSE OUTCOMES:

CO1: To gain in-depth knowledge about the structure and functions of various cell organelles, membrane and the techniques involved in visualization.

CO2: Able to understand the cell - cell interactions and the functional aspects of their components.

CO3: Able to understand the structure, functions and organization of microfilaments and microtubules.

CO4: To gain in-depth knowledge about the various mechanisms involved in cell signaling process.

CO5: To acquire knowledge and understand the different phases of cell cycle apart from types and tumorogenic properties of cancer.

SEMESTER I	CourseCode:PBC12A					COURSE NAME: CELLULAR 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	PSO8	
CO1	5	3	3	4	4	4	4	5	4	4	3	4	4	3.9
CO2	5	4	3	4	4	3	3	4	4	4	3	4	4	3.8
CO3	4	4	3	4	4	4	4	4	4	5	4	3	4	3.9
CO4	3	4	4	3	4	3	4	3	3	4	3	4	3	3.5
CO5	4	3	4	4	3	3	4	3	4	3	3	5	4	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 - BIOMEMBRANE AND ORGANELLES [25 hrs]

Structure and functions of organelles: nucleus, mitochondria, endoplasmic reticulum, golgi apparatus, lysosomes, ribosomes & peroxisomes. Membrane Models, Membrane lipids: fluidity, asymmetry and phase transition. Membrane proteins - Types, proteins on RBC membrane, Purification of subcellular organelles, Marker enzymes for different organelles.

UNIT II - CELL – ADHESION AND CELL CELL INTERACTION [15 hrs]

Cell-Cell interaction: ECM, Collagen, hyaluronan & proteoglycans, laminin, integrins and fibronectins. Cell-Cell adhesion: Specialised junctions - Desmosomes, Gap junctions, tight junctions. Adhesion molecules: Cadherins and Connexins.

UNIT III - CELL ORGANIZATION AND MOVEMENT [10hrs]

Microfilaments: Actin – Structures, Assembly and disassembly. Microtubules – structure and composition. Microtubular associated proteins, MTOCs, Cilia and Flagella - Structure and functions, Intermediary filaments.

UNIT IV - CELL SIGNALLING [15hrs]

Cell surface receptor and signalling pathways – cell surface receptors, signal transduction and second messengers –adenylatecyclase system, cAMP, G-protein coupled receptors. G-protein as cellular transducer, inositol triphosphate and calcium, DAG and NO, ion channels, Signal transmission via Ras proteins and MAP kinase pathways. Crosstalk in signaling pathways. mTOR pathway.

UNIT V - CELL CYCLE &CELL DEATH 10hrs]

Overview of cell cycle and its control. Checkpoints in cell cycle regulation. Apoptosis (Programmed cell death) - Pathways, regulators & effectors in apoptosis and necrosis, Autophagy. Cancer: types & properties of cancer cells. Tumor suppressor genes- functions.

TEXT BOOKS:

1. Harvey Lodish. W. H. Freeman; 9th edition (2021), Molecular cell Biology
2. Alberts (2002). Molecular Biology of the Cell 4th ed. Garland Sci.
3. Verma P.S and Agarwal P.K. (2004). "Cell biology, Genetics, Molecular biology, Evolution and Ecology"24th edition, S. Chand & Company Ltd.New Delhi.

REFERENCE BOOKS:

1. Nalini Chander, Susan Viselli, (2023) Lippincott's Illustrated Reviews: Cell and Molecular Biology.3rd editon, Wolters Kluwer Health
2. De Robertis and De Robertis (2017) Cell and Molecular Biology. Lea and Febiger 8th ed.
3. Nelson, D.L. and Cox, M.M (2008). Lehninger Principles of Biochemistry. 5th Edition, W.H. Freeman and Company, New York
4. Kelein Smith, and M Kish, (2002).Principles of cell biology, 3rd Edition, Harper and Row Publisher.
5. Karp, G. Cell 2010, Molecular Biology: Concepts and Experiments, 6th edn, Wiley.

I M.Sc Biochemistry	COURSE NAME:METABOLISM AND REGULATION (75 hrs)	COURSE CODE:PBC13A
SEMESTER-I		HRS/WK-5
CORE-3		CREDIT-4

OBJECTIVES:

1. To understand the biological oxidation, ETC, Oxidative phosphorylation perform in cellular work.
2. To provide students with an understanding of key metabolic pathways of carbohydrates, aminoacids, proteins, lipids and its energy generation.
3. To gain skills to interpret how the pathways are regulated by various metabolic and hormonal changes.

COURSE OUTCOMES (CO's) :

CO1: To gain insights about the biological oxidation process, high energy compounds and key carbohydrate metabolic pathways such as glycolysis, TCA and ETC.

CO2: To understand the key metabolic steps involved in various pathways of carbohydrate metabolism.

CO3: To gain knowledge about the metabolic pathways of amino acid metabolism and its related inborn errors.

CO4: To gain knowledge about the metabolic pathways of lipid metabolism and its storage diseases.

CO5: Able to understand and interpret the metabolic pathways of nucleic acid metabolism and nucleotide coenzymes.

SEMESTER I	COURSE CODE:PBC13A					COURSE NAME: METABOLISM AND REGULATION								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	3	4	3	4	5	4	4	3	4	4	3	4	3.8
CO2	3	3	3	4	4	4	4	4	3	4	3	4	3	3.5
CO3	4	4	4	5	3	4	4	3	3	4	4	4	3	3.8
CO4	3	4	5	4	4	3	3	4	4	3	3	4	4	3.7
CO5	3	4	3	4	3	3	4	5	4	3	4	4	4	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 BIOLOGICAL OXIDATION [15 hrs]

Biological oxidation-reduction reactions, redox potentials, High energy phosphate compounds – phosphate group transfer, Glycolysis - regulation and energetic, Pyruvate dehydrogenase(PDH) complex, citric acid cycle - regulation and energeticcs. ETC and oxidative phosphorylation – Mechanism, regulation and inhibition, uncouplers.

UNIT II CARBOHYDRATE METABOLISM [15 hrs]

Pentose phosphate pathway. Gluconeogenesis, glycogenesis &glycogenolysis metabolism - regulation, glyoxylate cycle and Gamma aminobutyrate shunt pathways, Cori cycle, anapleurotic reactions, glucuronate pathway. Hormonal regulation of carbohydrate metabolism. Glycogen storage diseases

UNIT III AMINO ACID METABOLISM [15 hrs]

Amino Acids – General reactions of amino acid metabolism - Transamination, decarboxylation, oxidative & non-oxidative deamination of amino acids. Catabolism of carbon skeletons of amino acids tyrosine and aliphatic amino acids. Urea cycle and its regulation. In born errors of metabolism-PKU, Alkaptonuria, Tyrosinosis.

UNIT IV LIPID METABOLISM [15 hrs]

Introduction, hydrolysis of tri-acylglycerols, α-, β-, ω- oxidation of fatty acids. Oxidation of odd numbered fatty acids, PUFA, fate of propionate, role of carnitine, degradation of complex lipids. Fatty acid biosynthesis, Energetics of fatty acid cycle. Acetyl CoA carboxylase, fatty acid synthase, biosynthetic pathway for tri-acylglycerols, phosphoglycerides and sphingomyelin. Metabolism of cholesterol and its regulation. Lipid storage diseases.

UNIT V NUCLEIC ACID METABOLISM [15 hrs]

Nucleotides – Biosynthesis of Purines (de nova and salvage) and biosynthesis of Pyrimidines - catabolism and regulation of purine and pyrimidine biosynthesis. Biosynthesis of NAD^+/$NADP^+$ and FAD^+.

TEXT BOOKS:

1. Jain, J.L & Jain, (2005) Fundamentals of Biochemistry. Sixth Edition,S.Chand& Company, New Delhi.
2. U. Sathayanarayana,(2006). Biochemistry. 3rd Edition by Books and Allied (P) Ltd., India.
3. Deb, A.C., 2016. Fundamentals of Biochemistry, New Central Agency, Calcutta.

REFERENCE BOOKS:

1. Victor W. Rodwell, (2015) Harpers Illustrated Biochemistry 30th Edition Paper back– Import, 1 Jan
2. Berg, J. M.,Tymoczko, J. L. and Stryer, L, 2011.Biochemistry. Freeman, 7th edn,
3. Zubay, G. (2017). Biochemistry, 5th Edition, WCB. Mcgraw-Hill, New York.
4. Donald Voet, Judith, G. Voet, and Charlotte, W Pratt, (2016). Fundamentals of Biochemistry, 5th Edition. John Wiley & Sons, New Jersey.
5. Nelson, D.L. and Cox, M.M (2021). Lehninger Principles of Biochemistry. 8thEdition,W.H. Freeman and Company, New York.

I M.Sc Biochemistry	COURSE NAME:CLINICAL NUTRITION (75 hrs)	COURSE CODE:EPB14A
SEMESTER-I		HRS/WK-5
ELECTIVE-I		CREDIT-4

OBJECTIVES

1. To study the nutritional and functional aspects of vitamins, minerals, various foodstuffs and its measurement.
2. To understand the nutritional management of diet in different age groups and diseases.
3. To learn and gain knowledge about the functional foods, neutraceuticals, Probiotics and prebiotics.

COURSE OUTCOMES (CO's):

CO1: Students gain knowledge about diet and different nutritional disorders.
CO2: To understand and gain knowledge about different types of nutritional measurements.
CO3: Students are able to comprehend the daily requirements and functions of vitamins & minerals.
CO4: Students are able to demonstrate and exhibit different dietary plan for different age groups & disease condition.
CO5: Students are able to gain knowledge about importance of neutraceuticals and antioxidants in human health.

SEMESTER I	COURSE CODE:EPB14A					COURSE NAME: CLINICAL NUTRITION								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	PSO1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	4	4	3	5	2	2	3	3	5	5	3	5	4	3.7
CO2	5	4	4	3	2	2	3	4	5	3	4	3	3	3.5
CO3	4	3	3	2	2	5	3	3	3	3	5	5	3	3.4
CO4	3	3	4	5	2	2	5	4	4	2	5	5	4	3.7
CO5	4	3	4	5	2	5	3	4	3	5	5	3	3	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 1 - NUTRITIONAL DISORDER [15 hrs]

Introduction:Balanced diet, Diet-composition, fiber in diet. Calorific value of proteins, carbohydrates, Biological value of proteins, Chemical score. Disorders associated with protein metabolism-marasmus and kwashiorkor. Fats: sources, essential and non-essential fatty acids-disorders concerned with fatty acid metabolism. Refsum'sdisease, atherosclerosis and fatty liver.

UNIT II - BASAL METABOLIC RATE [15 hrs]

Basal metabolic rate-factors affecting BMR-determination of BMR, direct and indirect methods-Benedict's Roth apparatus-respiratory quotient, BMI and its measurement. SDA, Anthropometry: height, weight, skin fold thickness and arm circumference and their importance in nutrition.

UNIT III - VITAMINS & MINERALS [15 hrs]Vitamins-Classification, fat soluble and water soluble vitamins-source, daily requirements, functions and deficiency manifestations. Micro,Macro and trace elements-daily requirements, functions and deficiency manifestations.

UNIT IV - NUTRITIONAL MANAGEMENT [15 hrs]

OBJECTIVES of diet therapy-regular diet and rationale for modifications in energy and other nutrients, texture-fluid,soft diets etc. Glycemic index. Nutritional management of:obesity,cardiovasculardiseases,Diabetes mellitus, Renal disorders and neurological disorders (Parkinson's disease, Alzheimer's disease). Nutrition requirements at different stages of life -during infancy, adolescence, pregnancy, lactation and Geratics.

UNIT V - RECENT ADVANCES IN CLINICAL NUTRITION [15 hrs]

Neutraceuticals: Adverse effects of neutraceuticals.Functional foods-Health benefits of functional foods in Immune function & mental health. Probiotics and prebiotics: Types & Health benefits.Antioxidants-Role of antioxidants in human health, Phytoceuticals (polyphenols, flavonoids & terpenes).

TEXT BOOKS:

1. Sathyanarayana U andChakrapani U." Biochemistry", 5 thediditon, (2020) Allied Publishers.
2. Mahan,L. KandEscott-Stump,S (2000):Krause's Food Nutrition and Diet therapy,10thed, W-13 Saunders Ltd.
3. M. Swaminathan, 1987, "Food and Nutrition Vol I&II", Second edition, Bangalore, Bappco Publishers.

REFERENCE BOOKS:

1. Williams, SR(1993):Nutrition and Diet Therapy,7thed, Times Mirror/Mosby College Publishing
2. Shills,ME,Olson,JA,Shike,M and Ross,A.C(1999):Modern Nutrition in Health and Disease,9thed,A.Vaiiams and willons
3. Davidson and Passmore(2000):Human Nutrition and Dietetics
4. Patricia Trueman, 2007, "Nutritional Biochemistry" (I edition), Chennai, MJ publishers
5. M.N Chatterjea and RanaShinde," (2012), Text book of Medical biochemistry",8th edition, Jaypee Publishers, New Delhi.

I M.Sc (Biochemistry)	COURSE NAME:CLNICAL LAB TECHNOLOGY (75 hrs)	COURSE CODE: EPB14B
SEMESTER-I		HRS/WK-5
ELECTIVE-2		CREDIT-4

OBJECTIVES:

1. To impart basic knowledge of apparatus, UNITs, equipment, and analysis in the Clinical Biochemistry.
2. To discuss the basic laboratory test, techniques and diagnosis of various blood components.
3. To learn about various histological and culturing techniques, handling and processing of tissue specimens as well as staining procedures.

COURSE OUTCOMES:

CO1: To learn about the handling of the laboratory equipment's and also know about how to collect and preserve the biological samples.
CO2: To gain the knowledge about to accessing various blood components and predict its clinical significance.
CO3: To acquire the knowledge and skill about various steps involved in the histopathological techniques.
CO4: To understand the importance of various biochemical parameters and its clinical significance.
CO5: To learn the basic skills of microbial culture and its safety measures.

SEMESTER I	COURSE CODE:EPB14B					COURSE NAME: CLINICAL LAB 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	3	5	4	3	5	4	4	5	5	4	3	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	4	3	3.8
CO4	4	5	3	4	3	4	4	3	3	5	4	5	4	3.9
CO5	3	5	4	4	3	4	4	5	4	5	4	3	5	4.2
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 -GOOD LABORATORY PRACTICEAND INSTRUMENTATION [15 hrs]

Automation in clinical lab – Instrumental concept, selection of instrument, quality control of pre analytical and analytical variables. Internal and external quality control measurements. Collection, storage, calibration, and preservation of samples. Good laboratory practice (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, MCHC, MCH, MCV. Erythrocyte Sedimentation Rate (ESR), Hematocrit value (Packed Cell Volume). Screening test-HIV, HbsAg and TPHA. Platelet and its significance, Coombs test.

UNIT III - CLINICAL PATHOLOGY [15 hrs]

Brief outline of histopathology: Tissue cutting, fixation, embedding, tissue slicing by microtome, slide mounting and staining techniques. Fine needle aspiration, preservation of tissues and H/E staining.

UNIT IV - CLINICAL BIOCHEMISTRY [15 hrs]

Biochemical parameters: Blood glucose, HbA1c, urea, uric acid, lipid profile, total protein, albumin test, A/G ratio- normal values and their significance. Enzymes: SGOT, SGPT, serum alkaline and acid phosphatase, amylase, lactic dehydrogenase test- normal values and their significance. Electrolytes: sodium, potassium, calcium, phosphorous - its role and abnormalities.

UNIT V - MICROBIOLOGY AND STERILIZATION TECHNIQUES [15 hrs]

Sterilization, culture media, culturing of organisms from various specimens and antibiotic sensitivity test (pus, urine, blood, sputum, throat swab). Gram stain and Ziehl-Neilson staining (TB, Lepra bacilli). Hazards & safety practices in microbial techniques.

TEXT BOOKS:

1.Mukherjee, L. (2005). Medical Laboratory Technology. Tata McGraw- Hill education Pvt Ltd.

2.Gradwohls, B.H. (2000). Clinical laboratory methods and diagnosis. B.I. Publications, New Delhi.

3. J Ochei and Kolhatkar, 2002. Medical laboratory science theory and practice, Tata McGraw-Hill, New Delhi

REFERENCE BOOKS:

1.Fischbach Francis A, (2003). Manual of laboratory and diagnostic tests. Philadelphia, J.B. Lippincott & Co, N.Y.

2.Sood, R, (2005). Medical Laboratory methods and interpretation. Jaypee brothers' medical publications, New Delhi.

3.Darshan, P. (2014). Text book of medical laboratory technology. Bhalani publishing house.

4.Arundhatikolhatkar, J. (2001). Medical laboratory science: Theory and practice. Tata McGraw-Hill education Pvt Ltd.

5.Luxton, R. (2010). Clinical Biochemistry. Vinoth Vasishta Pvt Ltd.

I M.Sc Biochemistry	COURSE NAME:FOOD TECHNOLOGY (75 hrs)	COURSE CODE: EPB14C
SEMESTER-1		HRS/WK-5
Elective - 3		CREDIT-4

OBJECTIVES

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

2. To gain knowledge about the important pathogens.

3.To study the source and variability of raw food materials andgain skills towards solving theoretical problems in food science and technology.

COURSE OUTCOMES:

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

CO2: To acquire knowledge about the important pathogens and spoilage microorganisms in foods 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: EPB14C					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- nutritive value. Milk- kinds of milk: whole milk, low-fat & skimmed milk, toned 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 PRODUCTION 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 (2009), Microbiology an introduction, 2rd Ed, Cengage learning, New Delhi.
3. Patricia Trueman, (2007), "Nutritional Biochemistry" 1st edition, Chennai, MJ publishers

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. Avantina Sharma, (2017). Text book of food science and technology, 3rd Ed, CBS Publishers.
4. Rao E. S. (2013). Food Quality Evaluation,variety books publishers and distributors. CBS publishers & distributors Pvt.
5. Carolyn D. Berdanier. (2014). Handbook of nutrition and food, 3rd Ed, CRC Press.

I M.Sc Biochemistry	COURSE NAME: MOLECULAR BIOLOGY (75 hrs)	COURSE CODE :PBC21A
SEMESTER-II		HRS/WK-5
CORE-IV		CREDIT-4

OBJECTIVES:

1. To understand the mechanisms and factors involved in replication, transcription and translation process in prokaryotes and eukaryotes.
2. To gain knowledge about features of genetic code, protein targeting, transportand gene regulation.
3. To learn about different repair systems present in DNA damage, HSPs and transposons.

COURSE OUTCOMES:

Students can able to

CO1: Understand the mechanisms and factors involved in replication process in prokaryotes and eukaryotes and its packaging model.

CO2: Acquire knowledge about transcription process in prokaryotes and eukaryotes, inhibitors and its modification.

CO3: Comprehend the features of genetic code and steps involved in translation process

CO4: Gain knowledge about protein targeting, transport to different organelles, and gene regulation with respect to different operons.

CO5: Understand the mechanisms of various DNA repair systems and diseases caused due its disorders.

SEMESTER II	Course Code:PBC21A					COURSE NAME-MOLECULAR BIOLOGY								HOURS:5 CREDITS:4
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	3	4	3	5	4	3	5	4	4	3	3	4	3	3.7
CO2	3	4	3	4	3	5	3	4	4	3	4	3	4	3.6
CO3	4	3	4	3	4	4	5	4	3	5	3	4	3	3.8
CO4	4	5	3	3	3	4	4	3	3	4	2	5	4	3.6
CO5	3	3	2	4	3	4	4	3	3	3	4	3	3	3.2
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: DNA REPLICATION **15 hrs**

Central Dogma of Molecular Biology, Organisation of Chromosome, C value, C value paradox, Replication:Types of replication, evidence for semiconservative replication - Meselson and Stahl experiment, DNA Polymerases in prokaryotes and eukaryotes. Replication in prokaryotes-Initiation, elongation and termination, inhibitors of replication, bidirectional replication, reverse transcriptase, replication in RNA virus, Eukaryotic replication and inhibitors of replication.

UNIT-II: TRANSCRIPTION **15 hrs**

Transcription - definition, coding strand, template strand, sense strand and antisense strand, promotor,, DNA - dependent RNA polymerase, prokaryotic transcription: initiation, elongation and termination, posttranscriptional processing in prokaryotes, split genes, overlapping genes, eukaryotic transcription, spliceosome machinery, alternative splicing, polyadenylation and capping, processing of rRNA and tRNA. Catalytic roles of RNA; RNA editing. Post-transcriptional modifications of eukaryotic RNAs.

UNIT-III: GENETIC CODE AND TRANSLATION **15 hrs**

Genetic code - features, deciphering of the genetic code, codon dictionary. Wobble hypothesis, composition of prokaryotic and eukaryotic ribosomes, prokaryotic and eukaryotic protein biosynthesis - initiation, elongation, and termination, polysomes, post-translational modifications in prokaryotes and eukaryotes, inhibitors of protein synthesis.

UNIT-IV : PROTEIN TRANSPORT AND GENE EXPRESSION 15 hrs

Protein targeting, translocation, glycosylation, SNAPs and SNAREs, bacterial signal sequences, heat shock proteins, mitochondrial, chloroplast and nuclear protein transport, endocytosis-viral entry, ubiquitin TAG protein destruction.

Regulation of gene expression: Lac, Trp, Ara operon, DNA methylation in prokaryotes, DNA methylation in eukaryotes- CpG islands.

UNIT-V: DNA DAMAGE AND REPAIR 15 hrs

Mutagenesis, Different types of DNA damages, recognition of DNA damage, types of DNA repair systems including photoreactivation, excision repair, mismatch repair, recombination repair and SOS repair. Diseases associated with DNA repair problems

TEXT BOOKS:

1. G. Karp (2019).Cell and molecular biology(9th edition), John Wiley & Sons Inc.
2. Nelson, D.L. and Cox, M.M (2021). Lehninger Principles of Biochemistry. 8thEdition, W.H. Freeman and Company, New York.
3. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D. (2002). *Molecular Biology of the Cell*. (4rth edition.), Garland Publishing, Inc., New York

REFERENCEBOOKS:

1. Robert J Brooker (2017).Genetics: Analysis and Principles, (6th Edition), McGraw Hill Education.
2. Karp, G. Cell (2010), Molecular Biology: Concepts and Experiments, 6th edn, Wiley
3. Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick (2014) Lewin. *Genes XI*(11^{th} edition), Oxford University Press.
4. Twyman (2005) Advanced Molecular Biology(3rd edition), Viva Publ.
5. David Baltimore and Harvey Lodish (2016). *Molecular Cell Biology*.8th edition, WH Freeman.

I M.Sc Biochemistry	COURSE NAME:ENZYMOLOGY (75 hrs)	COURSE : CODE :PBC22A
SEMESTER-II		HRS/WK-5
CORE-V		CREDIT-4

OBJECTIVES:

1. To gain knowledge about fundamentals of enzyme structure, Nomenclature, IUB classification and kinetics of the enzyme catalyzed reaction using different plots.
2. To learn the mechanisms of enzyme regulation, allosteric effects and inhibition with suitable examples.
3. It deals with current applications of enzymes and the methods of immobilization.

COURSE OUTCOMES (CO's)

CO1- To provide a deeper insight into the Nomenclature, IUB classification, and assay of enzymes.

and function and kinetics of enzymes

CO2-Able to understand the kinetics of the enzyme catalyzed reaction using different plots.

CO3-To exhibit knowledge and understanding about the enzyme catalytic reactions in the active site with appropriate example

CO4- To understand the mechanisms of enzyme regulation and its allosteric effects with suitable examples.

CO5- To gain knowledge about the types of inhibition in enzyme catalysis, immobilization of enzymes and its applications.

SEMESTER II	Course Code:PBC22A					COURSE NAME- ENZYMOLOGY								HOURS:5 CREDITS:4
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	3	4	3	5	4	3	4	2	4	3	3	4	3	3.5
CO2	5	4	3	4	3	5	3	4	4	3	4	3	4	3.8
CO3	4	3	2	3	4	4	5	4	3	5	3	4	3	3.6
CO4	5	3	4	3	3	5	4	3	3	4	2	3	4	3.5
CO5	4	3	2	4	3	4	4	3	4	3	4	3	3	3.2
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 INTRODUCTION AND ASSAY OF ENZYMES [20 hrs]

Introduction, Classification and Nomenclature of enzymes - General characteristics of enzyme activity, factors affecting enzyme activity. Enzyme UNITs- Katal, IU, Measurement of enzyme activity-two point assay, Kinetic assay, using radiolabeled substrates. Non protein enzymes (Brief account). Coenzymes-Vitamin and non vitamin coenzymes-PLP, NADH, NADPH and Coenzyme-Q.

UNIT II KINETICS OF ENZYME ACTION [15hrs]

Concept of ES complex, collision, transition state theories and energy of activation, derivation of Michaelis-Menten equation for uni- substrate reactions. Different plots for the determination of K_m , $V_{max}$and their significance. Turn over number. The rate of expression for Bisubstrate reactions for Ping Pong, random & ordered Bi-Bi mechanisms. Multienzyme complex and its function with reference to PDH.

UNIT III MECHANISM OF ENZYME ACTION [10hrs]

Acid-base catalysis, covalent catalysis, metal ion catalysis, proximity, orientation effect. Active site – definition, common features of active site – Investigation of active site structure – trapping ES complex, Use of substrate analogue. Modification of aminoacid side chain change by single chemical procedure. Strain & distortion theory. Lock and Key, Chemical modification of active site of enzymes. Site directed mutagenesis of enzymes. Mechanism of action of chymotrypsin and lysozyme.

UNIT IV ENZYME REGULATION [15hrs]

General mechanisms of enzyme regulation, product inhibition. Reversible and irreversible. Covalent modifications of enzymes. Allosteric enzymes - positive and negative co-operatively with special reference to aspartate transcarbamoylase& Phosphofructokinase.

UNIT V ENZYME INHIBITION AND APPLICATION [15hrs]

Types of inhibition- Irreversible inhibition, reversible - competitive, noncompetitive, uncompetitive inhibition. Kinetic differentiation and Graphical analysis- Suicide inhibition. Immobilized enzymes- methods of immobilization-applications of immobilized enzymes. Industrial enzymes and its application. Isolation and Purification and characterization of enzymes.

TEXT BOOKS:

1. Trevor Palmer, (2004). Enzymes. 5th edition, Affiliated East –West press (P)Ltd. New Delhi.
2. Marangoni, 2002. Enzyme kinetics. A modern approach, John Wiley.
3. Sathyanarayana U andChakrapani U." Biochemistry", 5 thedidition, (2020) Allied Publishers.

REFERENCE BOOKS:

1. Zubay, 2020" Principles of Biochemistry", 4th ed.. William C.Brown Publ.
2. Berg, J. M., Tymoczko, J. L. and Stryer L, (2011) Biochemistry. Freeman, 7th edn, 2011.
3. Uhlig H. (2013). Industrial enzymes and their applications. John Wiley,
4. Balasubramanian. (2004). Concepts in Biotechnology Universities Press (India) Ltd., 2nd edition.
5. Chapline, Bucke, 2016. "Protein Biotechnology,"2nd edition, Cambridge University Press.

I M.Sc Biochemistry	COURSE NAME: BIOCHEMICAL TECHNIQUES (75 hrs)	COURSE CODE :PBC23A
SEMESTER-II		HRS/WK-5
CORE-VI		CREDIT-4

OBJECTIVES:

1. To study about various types of chromatography, electrophoresis and centrifugation techniques and its applications.
2. To gain in-depth Knowledge about the principle, instrumentation and application of spectroscopic techniques
3. To learn about the basic concepts of radioactivity and Microscopy

COURSE OUTCOMES:

CO1: To gain knowledge about the Principle, instrumentation and application of various types of chromatography and its interpretation**.**

CO2: To acquire knowledge about the principle, preparation, instrumentation and application of different kinds of electrophoretic techniques.

CO3: To get in-depth understanding about the basic principle: types of rotors, instrumentation and application of different types of centrifugation process.

CO4: Able to exhibit their knowledge about the principle, instrumentation and application of spectroscopic techniques.

CO5: Able to demonstrate their skills in basic concepts of radioactivity, its measurement and application.

SEMESTER II	CourseCode:PBC23A					COURSE NAME- BIOCHEMICAL TECHNIQUES								HOURS:5 CREDITS:4
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	3	5	3	4	5	4	5	4	5	4	4	5	4.2
CO2	4	4	4	5	4	3	5	3	4	5	3	5	4	4.1
CO3	3	4	5	3	3	3	4	5	4	5	4	3	5	3.9
CO4	4	5	4	5	4	4	4	3	5	3	3	5	4	4.1
CO5	5	3	4	5	4	3	5	4	3	5	4	4	5	4.2
Mean overall score														4.1

Result: The Score of this Course is 4.1 (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 CHROMATOGRAPHY [15 hrs]

Principle, instrumentation and applications of thin layer, gas chromatography and HPTLC. Column chromatography-packing, loading, elution and detection. Ion-exchange chromatography-preparation of resins, procedure and applications. Molecular exclusion chromatography-principle, gel preparation, operation and applications. Affinity chromatography– principle, materials, procedure and applications. HPLC– principle, materials, instrumentation and applications, UPLC, UHPLC .

UNIT II ELECTROPHORETIC AND ELECTROCHEMICAL TECHNIQUES[15 hrs]

Electrophoresis: General principles. Support media. Cellulose acetate electrophoresis. Electrophoresis of proteins–native gels, SDS-PAGE, gradient gels, isoelectric focusing, 2-D PAGE. Detection, estimation and recovery of proteins in gels. Electrophoresis of nucleic acids– agarose gel electrophoresis.

UNIT III CENTRIFUGATION TECHNIQUES [10 hrs]

Centrifugation–principle, types of centrifuges, rotors-types, preparative centrifugation– types, instrumentation and applications. Analysis of subcellular fractions. Analytical ultracentrifuge– instrumentation and applications. Sedimentation velocity and sedimentation equilibrium.

UNIT IV SPECTROSCOPIC TECHNIQUES [20 hrs]

Laws of absorption and absorption spectrum., UV-visible spectrophotometry and spectrofluorimetry. Flame spectroscopy– principle and applications of atomic absorption and flame emission. NMR, FTIR, mass spectroscopy: principle, instrumentation and application. LCMS, GCMS, ICPMS.

UNIT V- RADIOISOTOPE TECHNIQUES & MCROSCOPY [15 hrs]

Detection and measurement of radioactivity– GM counter, solid and liquid scintillation counting, Applications of radioisotopes in biology. Autoradiography. TEM, AFM, FACS-Principle and applications. Microscopy-Phase contrast Microscopy, Fluorescence Microscopy, Inverted Microscopy.

TEXTBOOKS:

1. AvinashUpadhyaye, and NirmalendheNath, (2002). Biophysical Chemistry Principles and Techniques. 3rd edition, Himalaya Publishers,New Delhi.
2. Keith Wilson, and John Walker, (2010). Principles and Techniques of Practical Biochemistry. 7th edition, Cambridge University Press. UK.
3. RenukaHarikrishnan. 2002. "Biomolecules and Enzymes. second edition, Indraja Pathipagam, Madurai.

REFERENCE BOOKS:

1. Boyer, R. 2000.Modern Experimental Biochemistry. 3rd ed. Addison Wesley Longman,
2. Simpson CFA &Whittacker, M. Electrophoretic techniques.
3. Sambrook, 2001.Molecular Cloning. Cold Spring Harbor Laboratory.
4. Friefelder and Friefelder, 1994. Physical Biochemistry – Applications to Biochemistry andMolecular Biology. WH Freeman & Co.
5. Pavia, 2000. Introduction to Spectroscopy. 3rd ed. Brooks/Cole Pub Co.

I M.Sc Biochemistry	COURSE NAME: PLANT BIOCHEMISTRY (75 hrs)	COURSE CODE:EPB24A
SEMESTER-II		HRS/WK-5
ELECTIVE-II		CREDIT-4

OBJECTIVES:

1. To acquire knowledge of the chemistry of important biological processes in plants.
2. To study about the functions and mechanisms of different plant hormones and photosynthesis, metabolism of nitrogen compounds and about molecular mechanisms of signalization and regulation.
3. To acquire knowledge about the importance of secondary metabolites and stress metabolism and nitrogen fixation mechanism.

COURSE OUTCOMES (CO)

CO1- Able to gain knowledge about the different components of plant cells apart from mechanism of absorption by plants.

CO2- To get in-depth knowledge about the functions and mechanisms of different plant hormones.

CO3- To acquire knowledge about the steps and mechanisms involved in photosynthesis of plants.

CO4- To know and interpret the different secondary metabolites present in the plants and its stress adaptation.

CO5- To gain thorough understanding about the nitrogen fixing mechanisms adopted by the soil microbes.

SEMESTER II	Course Code: EPB24A					COURSE NAME: PLANT BIOCHEMISTRY								HOURS:5 CREDITS:4
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	4	3	5	4	3	4	3	4	5	4	3	4	3.8
CO2	5	3	4	4	3	4	5	4	3	4	5	4	3	3.9
CO3	4	4	3	3	4	5	3	4	3	4	5	3	4	3.8
CO4	5	3	3	4	3	3	5	3	4	3	4	4	3	3.6
CO5	4	4	3	4	4	5	4	4	4	3	4	3	4	3.8
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 PLANT CELL & ABSORPTION [10 hrs]

Discovery and definition of plant cell – cell wall, plasmadesmata, meristematic cells, and secretary systems. Mechanism of absorption .Ion exchange passive absorption. Active absorption .The carrier concept. Donnan's equilibrium.

UNIT II PLANT HORMONES [10 hrs]

Structure, biosynthesis, mode of action & physiological effects of auxins, giberellins, cytokinins and IAA. Biochemistry of seed dormancy, seed germination, fruit ripening and senescence.Synthetic seeds.

UNIT III PLANT PIGMENTS & PHOTOSYNTHESIS [20 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. Photosynthesis-factors and regulation. Chloroplast ATP synthase, complexes associated with thylakoid membranes, light harvesting complexes. C3, C4 pathway and CAM.

UNIT IV SECONDARY METABOLITES &STRESS METABOLISM [15 hrs]

Secondary metabolites in plants –classification & function of alkaloids, terpenoids, tannins, polyphenols, flavanoids, saponins, lignin and pectin. Stress metabolism in plants - Environmental stresses, salinity, water stress, heat, Heavy metals, radiations, chilling and their impact on plant growth.

UNIT V NITROGEN FIXING ORGANISMS [20hrs]

Nitrogen fixation: Structure and mechanism of action of nitrogenase: Rhizobium symbiosis. Leghaemoglobin; strategies for protection of nitrogenase against the inhibitory effect of oxygen; nif genes of klebsiella pnemoniae including their regulation. Nitrate Assimilation: Nitrate reductase; regulation of nitrate assimilation. Ammonia assimilation by glutamine synthetase- glutamine oxoglutarate amino transferase (GS-GOGAT). Nitrite and nitrate reductase.

TEXTBOOKS:

1. Jain.V.K., 2005. Fundamentals of Plant Physiology,revised 1st edition S.Chand and Co.
2. Verma, 2001. Plant physiology, 7th Revised edition, Emkay Publications.
3. Attri L K & V C Chandel, (2002)Fundamentals Of Plant Biochemistry, 2nd edition,New Delhi Publishers

REFERENCE BOOKS:

1. Solisbury and Ross,(2006). Plant Physiology,3rd edition,CBS Publishers and Distributors.
2. Hans-Walter Held, (2004), Plant Biochemistry, 3rd edition, Elsevier India Pvt.Ltd.
3. Bonner and Varner, (2003) Plant Biochemistry, 4thedition, Academic Press.
4. Bowsher, C, Steer, M. and Tobin, A (2008). Plant Biochemistry. Garland Science,Taylor and Francis Group, LLC. New York.
5. S. N. Pandey and B.K. Sinha, (1999).Vikas Publishing House Pvt. Ltd, 3rd edition, Plant Physiology.

II M.Sc Biochemistry	COURSE NAME: CLINICAL BIOCHEMISTRY (75 Hrs)	Course Code 19PBC31
SEMESTER-III		HRS/WK-5
CORE-7		CREDIT-4

OBJECTIVES

1.To acquire knowledge about blood sugar homeostasis and its complications.
2.To understand the functional tests for liver, gastric and renal and disorders of carbohydrate, protein and lipid metabolism.
3.To gain knowledge about the endocrine functional test.

COURSE OUTCOMES

CO1: To gain knowledge about the blood sugar homeostasis and its complications.
CO2: To understand and interpret the functional tests for liver, gastric and renal disorder.
CO3: To understand and analyze the various renal function tests.
CO4: To gain in depth insights about the metabolic disorders related to amino acid and carbohydrate metabolism.
CO5: To acquire the skill and knowledge about the endocrine functional test.

SEMESTER III	COURSE CODE: 19PBC31					COURSE NAME: CLINICAL 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	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5	PSO 6	PSO 7	PSO 8	
CO1	3	3	4	2	4	5	3	5	5	4	3	2	2	3.4
CO2	3	3	5	4	2	4	5	2	4	3	5	4	4	3.6
CO3	5	4	4	3	4	4	4	3	4	3	5	4	3	3.8
CO4	5	2	4	5	3	3	4	5	3	4	4	3	2	3.6
CO5	3	5	4	3	4	5	3	4	5	4	3	2	4	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 BLOOD SUGAR HOMEOSTASIS [15 hrs]

Role of tissues and hormones in the maintenance of blood sugar. Diabetes mellitus-classification, stages of diabetes-metabolic abnormalities, acute complications – diabetic ketoacidosis –hyper osmolar, non-ketotic coma. Long-term complications – diabetic retinopathy, Neuropathy and Nephropathy, Cataract, GTT, $HbA1_C$ and its significance.

UNIT-II LIVER & GASTRIC FUNCTION [15 hrs]

Heme metabolism -Jaundice- classification, biochemical findings -Liver function tests based on bile pigments, SGOT, SGPT, plasma proteins- A: G ratio, Prothrombin time.**Detoxification function**: Hippuric acid excretion, BSP dye test and metabolic functions -Galactose tolerance test, Gall stones. **Gastric Function Test**: Physical examination of gastric contents-basal and maximal secretion. Stimulation tests – histamine,alcohol and Pentagastrin, FTM analysis-Azure A test, Analysis of gastric contents, Disorders of gastric function- Peptic ulcer, Gastritis and hypoacidity and hyper acidity.

UNIT- III RENAL FUNCTION [10hrs]

Renal concentration test-PSP dye test, clearance tests - Inulin clearance, Urea clearance, Creatinine clearance, NPN, Biochemical findings in Glomerulonephritis, renal failure and nephrotic syndrome. Renal stones –types, factors influencing renal calculi formation and treatment.

UNIT- IV ENDOCRINE DYSFUNCTION [15 hrs]

Thyroid function test- Radioactive Iodine uptake, serum PBI. Dynamic function test - T_3 suppression test, TSH & TRH stimulation Test, dexamethasone suppression test, Metyrapone test. Leptin, Prostate specific antigen and Obesity.

UNIT- V METABOLIC DISORDERS [20hrs]

Disorders of amino acid & carbohydrate Metabolism - Albinism, Tyrosinosis, Maple syrup urine disease and Glycogen storage diseases. **Disorders of Lipid Metabolism**– Hypo and Hyper lipoproteinaemia. Lipid storage diseases – Gaucher's, TaySach's and Niemann pick disease. Fatty liver & Atherosclerosis- Risk and anti-risk factors.**Clinical Enzymology**: Isoenzymes, Enzyme patterns in disease– Liver, pancreas and myocardial infarction.

TEXT BOOKS:

1. M.N Chatterjea and RanaShinde," Text book of Medical biochemistry",8th edition, 2012, Jaypee Publishers, New Delhi.

2. Devlin, T.M. Textbook of Biochemistry with Clinical Correlations, 7th edition 2002, John Wiley and sons, INC. New York.

3.Mayne,"Clinical chemistry in diagnosis and treatment",6th edition , 1994, ELBS Publications.

REFERENCE BOOKS:

1. Victor W. Rodwell, Harpers Illustrated Biochemistry 30th Edition, 2015 Lange publishers.

2. Harold Varley et al. Practical clinical biochemistry, Volume I & II,1980,CBS publishers.

3.. Harrison's Principles of Internal Medicine Vol. I and II. 19th edition,2015, McGraw Hill.

4. William J Marshall et al. "Clinical Biochemistry: Metabolic and Clinical Aspects". 3rd edition, 2014, Elsevier Health Sciences.

5. DM.Vasudevan. Textbook of Biochemistry for medical students. 5th edition, Jaypee Publishers, 2008.

II M.Sc Biochemistry	COURSE NAME: IMMUNOLOGY (75 Hrs)	Course Code 19PBC32
SEMESTER-III		HRS/WK-5
CORE-8		CREDIT-4

OBJECTIVES

1.To understand the cellular components, types and functions of the immune system and antibodies.

2.To gain knowledge about the different kinds of immunological techniques and transplantation immunology.

3. To understand about the hypersensitivity and autoimmune diseases.

COURSE OUTCOMES:

CO1-To gain acquaintance on the significance of different cells, types and organs involved in the immune system.

CO2-Students are able to figure out the structure and functions of the different types of antibody.

CO3-Students are proficient to gain knowledge about the importance of different immunological techniques.

CO4-Students will able to acquire knowledge about the transplantation immunology and antigen presentation.

CO5-Students are able to comprehend the complications of hypersensitivity and autoimmune diseases.

SEMESTER III	Course Code:19PBC32					COURSE NAME: IMMUNOLOGY								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	3	4	3	4	4	4	4	4	4	3.8
CO2	3	4	3	4	4	4	3	4	4	4	3	4	4	3.6
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														3.82

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 - CELLS AND ORGANS OF IMMUNE SYSTEM [15 hrs]

Types of ImmUNITy-innate, acquired, Humoral & Cell mediated immUNITy,lymphocyte development, Antigen processing & presentation by B-cell and T-cell. Cells of the immune system- structure &function of mononuclear phagocytes, Phagocytosis process, Dendritic cells, Granulocytes, Kupffers cell, Osteoclasts, Microglial cell, Null cell, Mast cell & APC. Organs of the immune system- structure and function of primary & secondary lymphoid organs (bone marrow, thymus, lymph node & spleen).

UNIT II - IMMUNOGLOBULINS & ANTIGEN [15 hrs]

Antibodies- Basic structure of immunoglobulins & classes. Antigenic determinants on immunoglobulins -isotype, allotype,& idiotype. Immunoglobulin-organization, expression & rearrangement of heavy & light chains sequencing, Diversity, Clonal selection theory. Monoclonal Antibodies – Formation, selection, production & clinical uses. Antigen- properties, immunogenicity & antigenicity. Factors that influence immogenicity- adjuvants , epitopes, &haptens.

UNIT III - IMMUNE SYSTEM IN HEALTH & DISEASE [15 hrs]

MHC- Types, structure & function. HLA Complex.Cytotoxicity- Immunological memory, Immunotolerance &Immuno suppression. Transplantation immunology- immunologic basis of graft rejection, hyper, acute & chronic rejection Eg. kidney and skin.

UNIT IV - HYPERSENSITIVITY &AUTOIMMUNE REACTION [15 hrs]

Type I-components, mechanism &consequences of type I. Type II Transfusion reaction and Hemolytic disease of the newborn & drug induced hemolytic anemia. Type III &Type IV. Auto immUNITy- organ & specific. Systemic autoimmune diseases (eg.Grave's disease, Hashimoto's thyroiditis,SLE& Rheumatoid arthritis). Treatment of autoimmune diseases.

UNIT V - IMMUNO TECHNIQUES [15 hrs]

Cytokines -properties, structure & function. Complement components and its pathway. Principle & application of precipitation reaction in fluids & gels (radial, double immune electrophoresis). Agglutination reaction- Hemagglutination, bacterial agglutination, passive & agglutination inhibition reaction. Widal test, Radioimmuno Assay, ELISA, FISH, Immuno fluorescence, Immunoblotting, Complement fixation test and Immuno histochemistry.

TEXT BOOKS:

1.Ian Tizard,2004. Immunology-An introduction, 7thedition, Saunders College Publishing Harcourt Brace College Publishers, USA

2.Abbas, Lightman and Pober, 1994.Cellular and Molecular Immunology,2nd edition, W.B.Saunders.

3.Kuby Richard A.Goldsby,ThomasJ.Kindt, Barbara A.Osborne,2007. Immunology, sixthedition, Freeman publications, USA.

REFERENCE BOOKS:

1.Mark Peakman, Diegovergani, 2009.Basic & Clinical Immunology"2nd edition, Elsevier saunders.

2.David Male, Brian Champion, Anne Cooke & Michael Owen , 1988. Advanced Immunology, 2nd edition, Mosby; New Ed edition, New York.

3.P.M.Lydyard, A.Whelan and M.E.Finger, 2003."Immunology"Taylor & Francis, Inc.

4.Ivon Roitt , 2006 . "Essential Immunology", 7th edition ,Blackwell publishers.

5. Ananthanarayanan.K and Jayaraman Paniker, 2022. "Textbook of Microbiology"S.Chand publisher.,

II M.Sc Biochemistry	COURSE NAME: BIOTECHNOLOGY (75 Hrs)	Course Code 19PBC33
SEMESTER-III		HRS/WK-5
CORE-9		CREDIT-4

OBJECTIVE

1.To understand the the importance of restriction enzymes, various types of vectors and gene expression for prokaryotic and eukaryotic genomes.
2.To gain knowledge about plant and animal cell culture techniques.
3.To provide the knowledge about solid waste management, bioremediation, biogas and biofertilizers.

COURSE OUTCOMES

CO1: To gain knowledge about the importance of restriction enzymes, various types of vectors and gene expression for prokaryotic and eukaryotic genomes.

CO2: To understand about the cell and tissue culture media preparation, different kinds of cell culture, importance of embryogenesis, organogenesis, various stages of micro propagation, somaclonal variation, germplasm storage and cryopreservation.

CO3: To acquire knowledge about different types of vaccines, in vitro fertilization, process of transgenic animals and its applications.

CO4: To gain knowledge about basic principles of microbial growth, various types of culture medium and fermenters and also biosynthesis of Vitamin B_{12}, penicillin and its applications.

CO5: To learn about the solid waste management, bioremediation, biogas and biofertilizers.

SEMESTER III	Course Code:19PBC33					COURSE NAME: BIOTECHNOLOGY								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	4	3	4	4	3	3	4	4	4	4	3.8
CO2	3	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	4	2	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 - TOOLS IN BIOTECHNOLOGY [15 hrs]

Tools in Biotechnology, RE, ligation, low capacity vectors and high capacity vectors. Manipulation of DNA –Restriction and modification enzymes, Design of linkers and adaptors. Vectors – low capacity and high capacity. Characteristics of cloning and expression vectors based on plasmid (pBR322) and bacteriophage (lambda).Vector for yeast (pPIC), insect (Baculo virus) and plants (Ti) systems. Prokaryotic and eukaryotic expression host systems.

UNIT II - PLANT BIOTECHNOLOGY [15 hrs]

Introduction to cell and tissue culture-Media, composition and preparation. Culture types -callus culture, cell suspension culture and protoplast culture. Somatic embryogenesis, organogenesis, Embryo culture and embryo rescue. Micropropagation.Protoplast-Isolation, culture and fusion. Selection of hybrid cells,cybrids and somaclonal variation. Germplasm storage and cryopreservation. Gene manipulation in pest resistance and disease control.

UNIT III - ANIMAL BIOTECHNOLOGY [15 hrs]

In vitro fertilization and embryo transfer.Vaccines-types,subUNIT recombinant vaccine – hepatitis B and vector recombinant vaccine-vaccinia.Development of transgenic animals retroviral, microinjection and embryonic stem cell methods. Applications of transgenic animals. Gene therapy-ex vivo and in vivo.

UNIT IV - BIOPROCESS TECHNOLOGY [10 hrs]

Bioprocess- Basic principles of microbial growth.Types, design and operation of fermenters.Fermentation culture medium – carbon, nitrogen and vitamin sources. Downstream processing-separation, concentration, purification and modification. Production of vitamin B_{12} & Penicillin.

UNIT V - ENVIRONMENTAL BIOTECHNOLOGY [20 hrs]

Industrial waste management – aerobic and anaerobic processes. Solid waste management, Composting and Municipal sewage treatment .Biogas, Biofertilizer, Bioremediation of hydrocarbons and pesticides.

TEXT BOOKS:

1.Sathyanarayana U. Biotechnology. 3rd edition. 2006. Books and Allied Publishers, India.
2. Gupta P.K.Biotechnology and Genomics. 2nd edition. 1998. Rastogi Publications.
3. Dubey.R.C. A Textbook of Biotechnology. 6th edition. 1993. S.Chand& Company Ltds.

REFERENCE BOOKS:

1. John.E.Smith. Biotechnology. 4th edition. 1996. Cambridge universitypress.
2.Ignasimuthu.S.Plant Biotechnology. 1st edition. 2005.Oxford, IBH Publishing company Pvt Limited.
3. Slater A, Scott N.W. and Fowler M.R.Plant Biotechnology. 2nd edition .2008.Oxford University press.
4.Glick R and Pasternak J.J.Molecular Biotechnology. 3rd edition.2002.ASMpress,Washington,USA.
5. Verma P.S and Agarwal P.K. 2002. "Cell biology, Genetics, Molecular biology, Evolution and Ecology". 24th edition, S. Chand & Company Ltd.New Delhi.

II M.Sc Biochemistry	COURSE NAME: DEVELOPMENTAL AND INHERITANCE BIOLOGY (75 Hrs)	Course Code 19EPB34A
SEMESTER – III		HRS/WK - 5
Elective Paper III		CREDIT - 4

OBJECTIVE

1.To gain knowledge about the gene mapping.
2.To understand the steps involved in morphogenesis and organogenesis in plants and animals.
3.To in depth knowledge about ageing, stem cells and apoptosis.

COURSE OUTCOMES:

CO1: To gain knowledge about gene mapping and genetic basis of development in human and animal.
CO2: To understand the fundamental aspects and in depth knowledge about gametogenesis, fertilization and early development in plants and animals.
CO3: To get insight knowledge about the morphogenesis and organogenesis in animal.
CO4: Able to gain thorough knowledge about the morphogenesis and organogenesis in plants especially Arabidopsis and Antirrhinum.
CO5: To get-in depth understanding knowledge about ageing, stem cells and apoptosis..

SEMESTER III	COURSE CODE: 19PBC34A					COURSE NAME: DEVELOPMENTAL AND INHERITANCE BIOLOGY								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	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5	PSO 6	PSO 7	PSO 8	
CO1	3	2	3	4	5	2	5	5	4	2	3	3	4	3.4
CO2	3	4	5	3	2	3	4	3	4	3	4	3	5	3.6
CO3	3	4	4	3	2	3	4	5	4	3	4	3	4	3.5
CO4	4	5	3	4	2	4	4	3	3	2	4	4	3	3.4
CO5	4	4	4	5	2	3	4	5	4	4	3	2	5	3.7
	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 GAMETOGENESIS, FERTILIZATION AND EARLY DEVELOPMENT [15 hrs]

Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; mammalian cleavage and gastrulation.

UNIT II - GENE MAPPING AND HUMAN GENETICS [15 hrs]

Linkage maps, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Pedigree analysis, LOD score for linkage testing, karyotypes. Polygenic inheritance, heritability and its measurements, QTL mapping.

UNIT III - MORPHOGENESIS AND ORGANOGENESIS IN ANIMALS [15 hrs]

Eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination.

UNIT IV - MORPHOGENESIS AND ORGANOGENESIS IN PLANTS [15 hrs]

Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum.

UNIT V -- AGEING AND STEM CELLS [15 hrs]

Ageing- theories of ageing, senescence, programmed cell death (Apoptosis). Stem cells- properties, markers commonly used in stem cells, embryonic stem cells and applications.

TEXT BOOKS:

1. Twyman, Advanced Molecular biology,3st edition, 2004. Viva books private limited.
2. William H. Elliot & Daphne C. Elliott, Biochemistry and Molecular biology, 4st edition, 2009. Oxford Universtiy Press.
3. Gilbert S.F. Developmental biology 11th edition, 2010. Sinauer Publisher.

REFERENCE BOOKS:

1. Primrose S.B. & Twyman R.M., Principle of gene manipulation and genomics. 7th edition, 2006. Oxford Publisher.
2. Gurbarchan&Miglani. S. Basic genetics, 1st edition, 2000. Narosa publisher.
3. David Freifelder, Molecular biology, 4nd edition, 2004. Jones and Bartlett publisher.
4. Winter. P. C., Instant notes in genetics, 4th edition 2003. Bio scientific publishers limited.
5. Verma P.S and Agarwal P.K. 2002. "Cell biology, Genetics, Molecular biology, Evolution and Ecology". 24th edition, S. Chand & Company Ltd.New Delhi.

II M.Sc Biochemistry	COURSE NAME: BIOINFORMATICS AND COMPUTATIONAL BIOLOGY	Course Code 19EPB34B
SEMESTER-III	(75 Hrs)	HRS/WK-5
ELECTIVE III		CREDIT-4

OBJECTIVES

1.To equip the students with the requisite background in areas of modern biology and computer science

2.To launch the students into core areas of Bioinformatics like sequence alignment ,phylogenetic trees, genomics, proteomics

3.To make the students to explore the applied areas of Bioinformatics

COURSE OUTCOMES

CO1: The student should be able to understand basics of bioinformatics and the important bioinformatics databases

CO2: Students exhibit the knowledge about the phylogenetic evolution and gene prediction.

CO3: Understanding the basics about proteomics & computational techniques.

CO4: Understanding of the principles of genomics and its applications.

CO5: To understand the knowledge about molecular docking and cheminformatics.

SEMESTER III	COURSE CODE: 19EPB34B	COURSE NAME: BIOINFORMATICS AND COMPUTATIONAL BIOLOGY	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	PS05	PSO6	PSO7	PSO8	
CO1	4	4	3	4	3	3	4	3	4	4	3	4	3	3.53
CO2	4	4	4	3	4	4	4	2	4	5	3	3	4	3.69
CO3	3	5	3	3	5	4	4	3	4	3	3	4	3	3.61
CO4	5	4	2	3	4	3	3	4	4	3	4	3	4	3.53
CO5	4	3	4	4	3	3	4	3	4	3	3	3	4	3.46
Mean Overall Score														3.56

Result: The Score of this Course is 3.56 (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 BASICS OF BIOINFORMATICS [15 Hrs]

Introduction to Bioinformatics; Sequence Databases: Database concepts; Introduction to Data types and source; Nucleic acid sequence databases: GenBank, EMBL, DDBJ; Protein sequence databases: Uniprot-KB: SWISS-PROT, TrEMBL, UniParc; Structure Databases: PDB, NDB, PubChem, ChemBank.

UNIT –II PHYLOGENY AND GENE PREDICTION [15 Hrs]

Phylogeny: Basic concepts of phylogeny; molecular evolution; Brief introduction to Phylogenetics and phylogenetic tree construction. Gene prediction in prokaryotes and eukaryotes, SNPs, Methods for gene prediction – GenScan, GRAIL, FGENESH/FGENES, Metabolic pathways-KEGG.

UNIT-III PROTEOMICS [15 Hrs]

Introduction and scope of proteomics; techniques commonly used for Proteome Analysis. Transcriptomes and analysis: SAGE, Microarray Technology, Analytical Proteomoics Tools-(1D &2D Gel Electrophoresis. Mass Spectrometry and Analysis-ESI, MALDI, LC/MS-MS. Interactomes and Proteomic Interactions-Y2H Approaches, Co-IP. Proteins structure determinations and structural proteomics tools – experimental and computational.

UNIT -IV GENOMICS [15 Hrs]

Genome Anatomies—overview the anatomy of eukaryotic & prokaryotic genome, repetitive DNA content of genomes. How genes work, gene-protein relations, genetic fine structure.

Structural genomics: Classical ways of genome analysis, Physical mapping of genomes- Genome sequencing, sequence assembly and annotation; metagenomics and methods of metagenomics. Applications of genomics and proteomics in agriculture, human health and industry.

UNIT – V MOLECULAR DOCKING AND CHEMINFORMATICS [15 Hrs]

Docking Methods: Introduction, Docking and scoring. Electrostatic interactions, Prediction of Protein- protein interactions, Prediction of Protein- nucleic acid interactions. Constraints and restraints in Molecular Docking. Application in the drug design. **Cheminformatics:** Introduction; Cheminformatics tools; Chemical structure representation (SMILES and SMARTS); Chemical Databases: CSD, ACD, WDI, Chemical Structure file formats; Structural Isomers; Structure visualization.

TEXT BOOKS:

1. Lesk, A.M. “Introduction to Bioinformatics”; UK, Fourth edition, 2014, Oxford University Press,

2. Zhumur Ghosh, Bioinformatics: Principles and Applications, edition, 2008, OUP India.

3. Rastogi, Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery, 4th Revised edition edition, 2013, Prentice Hall India Learning Private Limited.

REFERENCE BOOKS:

1. Jean-Michel, CandNotredame, C. “Bioinformatics for Dummies”; Second Edition,2006, John Wiley& Sons,

2. Baxevanis, A.D. and Francis Ouellellette, B.F. “Bioinformatics –a practical guide to the analysis of Genes and Proteins”; 3rd Edition,2011, John Wiley & Sons, UK.

3. Hossein G. Gilani,Katia G .Samper, Reza KhodaparastHaghi, “Chemoinformatics: Advanced Control and Computational Techniques”, First edition, 2012, Apple Academic Press

4. Mount David W, Bioinformatics: Sequence And Genome Analysis, first edition, 2004, Cshl Press.

5. Baxevanis Andreas D et al.,, Bioinformatics: A Practical Guide To The Analysis Of Genes And Proteins, (2011)3rd edition, Wiley India

II M.Sc Biochemistry	COURSE NAME: NANOTECHNOLOGY (30 Hrs)	Course Code 19SPBC31A
SEMESTER-III		
SSC		CREDIT-2

OBJECTIVES

1.To know the different types, synthesis of various nanomaterials and its applications.
2.To gain knowledge about different types of biomaterial based nanostructures.
3. To understand various fields of applications in nanotechnology.

COURSE OUTCOMES

CO1: To understand the different types of nanomaterial.

CO2: To know the various aspects of synthesis of nanomaterials.

CO3: To know about the different types of biomaterials and its compatibility properties.

CO4: To get insights about protein and DNA based nanostructures.

CO5: To understand various applications of nanotechnology in food and agriculture field.

SEMESTER – III	COURSE CODE: 19SPBC31A					COURSE NAME: NANOTECHNOLOGY								CREDITS :2
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								MEAN SCORE OF CO'S
	PO1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	
CO1	3	4	2	4	3	5	3	5	5	4	3	2	2	3.4
CO2	3	3	5	4	3	4	5	3	4	3	5	4	4	3.8
CO3	4	4	4	3	4	4	4	3	4	3	4	4	3	3.6
CO4	5	2	4	5	3	3	4	5	3	4	4	3	2	3.6
CO5	3	4	4	3	4	3	3	4	5	4	3	2	4	3.5
													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 - NOMENCLATURE OF NANOMATERIALS [6 hrs]

Nanotechnology, Introduction to Nanostructures: Carbon Nanotubes (CNT), Graphenes, Fullerenes, Nano Peapods, Quantum Dots and Semiconductor Nanoparticles, Metal-based Nanostructures (Iron Oxide Nanoparticles), Nanowires, Polymer-based Nanostructures including dendrimers, Introduction to metal based nanostructures. Protein-based Nanostructures, Nanomotors: Bacterial (E.coli) and Mammalian (Myosin family) Nanobiosensors. Science of Self assembly - From Natural to Artificial Structures. Nanoparticles in Biological Labeling and Cellular Imaging.

UNIT II - SYNTHESIS OF NANOMATERIALS [6 hrs]

Nucleation and growth of nanosystems; self-assembly, mechanical milling, laser ablation, sputtering and microwave plasma, chemical reduction and oxidation, hydrothermal, micelles, sol-gel processes, photolysis and radiolysis.

UNIT III -NANOBIOMATERIALS AND BIOCOMPATIBILITY [6 hrs]

Surface and Bulk Properties of Bio materials – Nanobiomaterials, NanoCeramics, Nanopolymers, Nano Silica and Hydroxy apatite – Carbon Based nanomaterials.

UNIT IV - PROTEIN AND DNA BASED NANOSTRUCTURES [6 hrs]

Nanocircuitry – S-layer proteins: structure, chemistry and assembly – lipid chips – S - Layers as Templates – engineered nanopores. DNA–Protein Nanostructures DNA - based Metallic Nanowires and Networks, DNA–Gold-Nanoparticle Conjugates.

UNIT V - APPLICATIONS IN FOOD & AGRICULTURE [6 hrs]

Enzyme Biosensors and Diagnostics - DNA-Based Biosensors and Diagnostics Radiofrequency. Food and New Ways of Food Production - Efficient Fractionation of Crops Efficient Product Structuring -Optimizing Nutritional Values - Applications of Nanotechnology in Foods : Sensing, Packaging, Encapsulation, Engineering Food ingredients to improve iioavailability.

TEXT BOOKS

1. Molecular Cell Biology,HarveyLodish, 2016, 8th edition, Published by W.H. Freeman & Company
2. Biomaterials: A Nano Approach,S Ramakrishna, M Ramalingam, T.S. Sampath Kumar, Winston O. Soboyejo, 2010, 1st edition, Published by CRC Press
3. Bionanotechnology: Lessons from Nature, D S. Goodsell, 2006, 4th edition, by John Wiley & Sons, Inc.

REFERENCE BOOKS

1. The structure and properties of materials by R.M.Rose, L.A.Shepard and J. Wulff, Wiley Eastern Ltd., 1966
2. Semiconductor Devices – Physics and Technology by S.M. Sze, Wiley, 1985.
3. Semiconductor Material and Device Characterization by D. K. Schroder, John Wiley &Sons,New York, 1998.
4. Encyclopedia of Materials Characterization by C. Richard Brundle Charles A. Evans, Jr.ShaunWilson ,Butterworth-Heinemann, 1992.
5. Nanobiotechnology: Concepts, Applications and Perspectives, 2000, 2nd edition, (edited by C. M. Niemeyer and C. A. Mirkin), Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim

II M.Sc Biochemistry	COURSE NAME: NEUTRACEUTICALS AND FUNCTIONAL FOODS (30 Hrs)	Course Code 19SPBC31B
SEMESTER-III		
SSC		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, theirsources and functions.
3. To understand the basics of phyto-chemicals, development of functional foods and effects of nutrigenomics foods.

COURSE OUTCOMES

CO1: To Understand the basics, importance and applications of nutraceuticals
CO2: To acquire the knowledge about Nutraceuticals of plant and animal origin
CO3: To understand the Nutraceutical remedies for common disorders
CO4: To understand the basics for functional foods
CO5: To gain knowledge about foodomics.

SEMESTER III	COURSECODE: 19SPBC31B					COURSE NAME: NUTRACEUTICAL AND FUNCTIONAL FOODS								CREDITS:2
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								MEAN SCORE OF CO'S
	PO 1	PO 2	PO3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PS0 5	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 - NUTRACEUTICALS OF PLANT & ANIMAL ORIGIN [6 hrs]

Nutraceuticals - Sources of Nutraceuticals. phytonutraceuticals - Alkaloids, phenols, Terpenoids. Animal metabolites: chitin, chitosan, glucosamine- uses and applications.

UNIT II -CLASSIFICATION OF NUTRACEUTICALS [6 hrs]

Nutraceuticals -. Dietary Fiber, Probiotics , Prebiotics, Polyunsaturated fatty acids,. Antioxidant ,vitamin, Polyphenols and. Spices and their importance.

UNIT III -NUTRACEUTICAL REMEDIES [6 hrs]

Nutraceutical remedies for common disorders like Arthritis, Bronchitis, hyperglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers. Nutraceutical rich supplements : Caffeine, Green tea, Mushroom extract and Spirulina.

UNIT IV - FUNCTIONAL FOODS [6 hrs]

Functional foods - Definition, development of functional foods, Applications of herbs to functional foods. Concept of free radicals and antioxidants; Health effects of common beans, *Capsicum annum*, mustards, Ginseng, garlic, grape, citrus fruits, fish oils, and sea foods. Use of nanotechnology in functional food industry.

UNIT V - HEALTH BENEFITS OF NUTRACEUTICALS [6 hrs]

Nutraceuticals: Carotenoids-lycopene,lutein,saponins,tocotrienol. Polyphenolic compounds: Flavanones,flavones,curcumin,glucosinolates. Phytoestrogens: isoflavones,lignans. Dietary fibre-soluble,insolublefibre and sulphides. Prebiotics, probiotics and omega3 and 6 fatty acids.

TEXT BOOKS

1.Taylor C, Wallace rebert E.C, Wildman, Robert Wildman (2016).Hand book of NutraceuticalsAnd Functional Foods. 2nd edition, CRC press.

2.MandalikaSubhadra (2014), Functional Foods And Nutrition, 1st edition,Daya Publishing House.

3. Patricia Trueman. 2007. "Nutritional Biochemistry" I edition, MJ publishers, Chennai.

REFERENCE BOOKS:

1. Israel Goldberg (Ed.) (1999) Functional foods, designer foods, pharma foods, Nutraceuticals, Aspen publishers Inc., USA .

2. L. Rapport and B. Lockwood (2002)Nutraceuticals, 2nd Edition, Pharmaceutical Press.

3. M. Maffei (Ed.) (2003) Dietary Supplements of Plant Origin, Taylor & Francis

4 Shahidi and Weerasinghe (Ed.) (2004) Nutraceutical beverages Chemistry, Nutrition and health Effects, , American Chemical Society.

5 Young, J. (1996) Functional Foods: Strategies for successful product development.

II M.Sc Biochemistry	COURSE NAME: HUMAN PHYSIOLOGY (75 Hrs)	Course Code 19PBC41
SEMESTER-IV		HRS/WK-5
CORE-11		CREDIT-4

OBJECTIVES

1.To learn the structure and functions of the different organs present in the human body.
2. To gain knowledge about the digestion and absorption of various macromolecules.
3. To insight about the blood cells, cardiac and respiratory system.

COURSE OUTCOMES

CO1: To learn about the digestion and absorption of various macromolecules.

CO2: To learn and gain knowledge about the blood cells and cardiac system.

CO3: To understand the mechanism of respiration and its types.

CO4: To acquire the knowledge about the structure and functions of kidney, nephron and mechanism of urine formation.

CO5: To gain the knowledge about the structure, types and functions of muscles and nervous system.

SEMESTER IV	COURSE CODE:19PBC41					COURSE NAME: HUMAN PHYSIOLOGY								HOURS:5	CREDITS :4
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								MEAN SCORE OF CO'S	
	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO2	PSO3	PSO 4	PSO5	PSO6	PSO7	PSO8		
CO1	5	5	2	3	2	5	4	4	3	2	4	5	5	49/13=4	
CO2	4	5	2	2	2	5	4	5	2	2	4	5	3	45/13=3	
CO3	4	5	2	2	2	5	3	4	2	2	3	5	3	41/13=3	
CO4	4	5	2	2	2	5	3	4	3	2	4	5	4	45/13=3	
CO5	5	5	2	4	3	5	5	5	4	2	4	5	5	54/13=4	
	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 - DIGESTIVE SYSTEM [15 hrs]

Digestion-Digestive system of man, Digestive processes at various regions of digestive system-Liver,stomach,pancreas,gall bladder &intestine,Composition, functions and regulation of saliva, gastric, pancreatic, and intestinal juice and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids.

UNIT II - RENAL PHYSIOLOGY [15 hrs]

Renal system: structure of kidney & nephron. Glomerular filtration, tubular reabsorption of glucose, water and electrolytes and tubular secretion. Mechanism of formation of urine- homeostatic regulation of water and electrolytes,counter current mechanism.Regulation of acid-base balance. Role of renin-angiotensin & ADH, renal failure.

UNIT III - RESPIRATORY PHYSIOLOGY [15 hrs]

Respiratory system: functional anatomy of air passages and lung respiratory muscles, mechanism of respiration, pulmonary ventilation, alveolar surface tension, lung volumes and capacities. Gas-exchange in the lungs & Blood, Regulation of respiration-Role of 2,3-diphosphoglycerate, Bohr's effect and chloride shift, oxygen toxicity& therapy, artificial respiration.

UNIT IV - CARDIO PHYSIOLOGY [15 hrs]

Cardiac system – physiologic anatomy of heart- genesis and spread of cardiac impulses-coronary cycle, cardiac cycle, heart sound, cardiac output, cardiovascular regulatory mechanisms, E.C.G-Measurement Of ECG. Composition of blood, blood coagulation – mechanism and regulation, fibrinolysis, anticoagulants.

UNIT V - MUSCLE & NERVE PHYSIOLOGY [15 hrs]

.Nervous system-structure of neuron and synapse-basic functions of synapses & neurotransmitters. Mechanism of transmission of impulse -synaptic transmission, neuromuscular junction.Central nervous system-Cerebrospinal fluid.Basis of EEG, sleep, learning & memory.

Muscles - types of muscle -skeletal and smooth muscle- Molecular basis of muscle contraction.

TEXT BOOKS:

1. Ganong W. E, 2019. Review of Medical Physiology", 26th ed, Tata Mc. GrawHill.
2. Guyton. A.C, Hall. J.E, 2005."Textbook of Medical Physiology", 11th ed. Saunders Company.
3. Jain, J.L & Jain, (2005) Human physiology. Sixth Edition,S.Chand&Company,New Delhi.

REFERENCE BOOKS

1. Meyer, HS Meij, AC Meyer,' Human Physiology', AITBs Publishers and Distributors.
2. K. SaradhaSubramanyam,"A Hand Book of Basic Human physiology", S.Chand&Co.,Ltd.
3. DM.Vasudevan,2008. Textbook of Biochemistry for medical students, 5th edition,Jaypee publishers.
4. Gerard J. Tortora and Sandra Grabowski. Principles of Anatomy and Physiology,2003 10th Edition By Publisher: John Wiley and Sons.
5. K..Sembulingam,PremaSembulingam,(2012)" Essentials of medical physiology"sixth edition, Jaypee publishers.

II M.Sc Biochemistry	RESEARCH METHODOLOGY & BIOSTATISTICS (75 Hrs)	Course Code 19PBC42
SEMESTER-IV		HRS/WK-5
CORE 12		CREDIT-4

OBJECTIVES:

1. To provide knowledge and skills to understand the role of statistics in research.
2. To develop skill in scientific writing and recent techniques.
3. To provide sufficient background to interpret statistical results in research papers

COURSE OUTCOMES

CO1: To understand the basic concepts of scientific research, objectives of various research, research process, research design and sampling.
CO2: To gain appropriate knowledge about sample collection, hypothesis testing analysis, tabulation of statistical data apart from measures of central tendency and averages.
CO3: To acquire in-depth knowledge about the statistical analysis and hypothesis testing.
CO4: To understand and gain insight knowledge about bioethics and patenting.
CO5: To gain knowledge about the principle and application of various biochemical techniques.

SEMESTER IV	CourseCode:19PBC42					COURSE NAME: COURSE NAME: RESEARCH METHODOLOGY & BIOSTATISTICS								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	4	4	3	4	3	4	4	4	3	4	3.8
CO2	3	4	4	3	5	4	5	4	3	5	3	4	3	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 3.5 (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 - SCIENTIFIC RESEARCH [15 hrs]

Research definition, importance & need for research ethics, selection of topic, review of literature, preparation of manuscript, scientific writing, features of abstract, mode of collection of literature, yearbooks, books & monograph, journals,conference proceedings, abstracting and indexing journals, notes & index cards, internet, magazines. Research design.References-Vancouver and Harvard system.

UNIT II - DATA COLLECTION AND PRESENTATION [15 hrs]

Collection and classification of data - diagrammatic and graphical representation of data.Tabulation of statistical data-Frequency Distribution-Simple and Cumulative. Displaying data-Histogram, Bar chart, Frequency polygon, Pie chart, less than & more than Ogives. Measures of Central tendency. Mean (arithmetic, harmonic & geometric) median and mode. Measure of Averages – Mean, Median and mode.

UNIT III - STATISTICAL ANALYSIS [15 hrs]

Measures of Dispersion for biological characters – Quartile Deviation, Mean Deviation and Standard deviation. Correlation & regression Co-efficient, levels of significance, Student t test, Chi square test. F test for equality of variances, Six sigma and Minitab, ANOVA –one way and two way classification.

UNIT IV - BIOETHICS AND PATENTING [15hrs]

Ethics in animal experimentation and overview about other bioethics .CPCSEA guidelines - Animal care, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia.Ethics in food and drug safety.Patenting - definition of patent. Product and process patent. Procedure for patent drafting.

UNIT V - BIOCHEMICAL TECHNIQUES [15 hrs]

FPLC, HPTLC, Capillary electrophoresis, Mass spectrometry, Circular dichroism - DNA sequencing, FISH - RFLP& RAPD -techniques & application. PCR Technique- Basic principle, Real time PCR &*In Situ* PCR. Applications of PCR.

TEXT BOOKS:

1. Green. R. H. 1979. 'Sampling Design and Statistical Methods for Environmental Biologists' .John Wiley & Sons.
2. Dr.A.WilsonAruni,Dr.P.Ramadass "Research and writing: Across the disciplines", MJP Publishers

3.Upadhyay, Upadhyay and Nath,1997. Biophysical Chemistry- Principles and Techniques' Himalaya Publ.

REFERENCE BOOKS

1.Wayne W, Daniel 2006, biostatistics: a foundation for analysis in the health sciences (9^{th}edition), John Willey and Sons Inc., USA.Dr.G.Vijayalashmi, Dr.C.Sivapragasam "Research methods: Tips and Techniques",MJP Publishers

2.Matthews,2001.Sucessful Scientific writing: A step-by step guide for Biomedical Scientists'. 2nd ed. Cambridge University Press

3.Thomas Glover, Kevin Mitchell.,2001. Introduction to Biostatistics', 1^{st} ed. McGraw Hill Science.

4.Dr N .Gurumani, "Thesis writing and paper presentation", MJP Publishers

5.Pavia et al.2000. Introduction to Spectroscopy', 3^{rd} ed. Brooks/Cole Pub Co.

II M.Sc Biochemistry	COURSE NAME: PHARMACOLOGY (75 Hrs)	Course Code19EPB43A
SEMESTER-IV		HRS/WK-5
ELECTIVE IV		CREDIT-4

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OBJECTIVES:

1. To understand the various route of drug administration, distribution, metabolism and excretion.

2. To gain knowledge about various types of drug receptors, actions and adverse effects.

3. To acquire knowledge about mode of action of drugs used in different diseases and chemotherapeutic value of drugs.

Course Outcomes:

CO1: To acquire knowledge about the study of drugs particularly their metabolism and actions on living system.

CO2: To gain thorough knowledge about the different drug receptors and their actions.

CO3: To get insight knowledge about the adverse effects of drug actions.

CO4: To gain in-depth insights about the mode of action of drugs used in different diseases.

CO5: To acquire knowledge about the study of different chemotherapeutic value of drugs.

SEMESTER – IV	COURSE CODE: 19EPB43A					COURSE NAME: PHARMACOLOGY								HOURS:5 CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES (POS)					PROGRAMME SPECIFIC OUTCOMES (PSOS)								
	PO1	PO 2	PO 3	PO 4	PO5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	MEAN SCORE OF CO'S
CO1	3	4	2	4	3	5	3	5	5	4	3	2	2	3.4
CO2	3	3	5	4	3	4	5	3	4	3	5	4	4	3.8
CO3	4	4	4	3	4	4	4	3	4	3	4	4	3	3.6
CO4	5	2	4	5	3	3	4	5	3	4	4	3	2	3.6
CO5	3	4	4	3	4	3	3	4	5	4	3	2	4	3.5
													Mean Overall Score	3.5

Result: The Score of this Course is 3.5 (Hig

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]

Drug: Definition. Classification of drugs based on their sources (plant, animal,& synthetic).Dosages-single and multiple. Routes of administration & absorption. Factors modifying drug absorption.Distribution of Drugs – structural features and pharmacological activity, prodrugconcept.Metabolism and excretion of drugs-phase-I, II reaction, action of cytochrome P_{450}.Microsomal & non-microsomal metabolism of drugs, drug metabolising enzymes.

UNIT II - DRUG –RECEPTOR INTERACTIONS [15hrs]

Drug receptor- localization, types and sub types, models and theories. Examples of drug –receptor interactions-G-protein coupled receptor, Acetylcholine receptor, Tyrosine kinase receptor, steroid hormone receptor. Agonist and Antagonist.

UNIT III - PHARMACOKINETICS [15 hrs]

Drug tolerance and dependence.Principles of basic pharmacokinetics.Adverse response to drugs, drug intolerance, pharmacogenetics, drug allergy, tachyphylaxis, drug abuse, factors modifying drug potency. Drug assay & types - chemical, bio assay and immunoassay.

UNIT IV - DRUG THERAPY-I [15hrs]

Mechanism of action of drugs used in therapy of respiratory system(cough- eg-chlorpheniranime,Diphenhydramine,bronchial-asthma-eg.,salbutamol, methylxanthines, pulmonary tuberculosis),- General principles & mechanism involved in the chemotherapy of cancer (antimetabolites, alkylating agents, antibiotics. Anti-thyroid drugs eg.Carbimazole and oral Antidiabetic drugs eg-sulfonylurea, biguanide. Anti-BP drugs (adrenergic blockers).

UNIT V - DRUG THERAPY-II [15 hrs]

Antimalarial drugs –mode of action of chloroquine, quinine, antifungal drugs – mode of action of chlorphenesin, griseofulvin and candicidin. Antiviral drugs - mode of action of idoxuridine, acyclovir and amantadine hydrochloride. Anti-microbial drugs- sulfonamides, trimethoprim, penicillin, aminoglycosides.

TEXT BOOKS:

1. G.R.Chatwal, (2020),"Pharmaceutical Chemistry -Vol-I &II"3rdedition,,Himalaya Publishing House ,New Delhi
2. JayasreeGhosh (2003),"Text book of Pharmaceutical Chemistry", 1st edition, S.Chand& Company, Ltd., New Delhi
3. MantTimothy,G.K.Ritter,Jemes,M and Lewis Lionel,D:A Text Book of Clinical Pharamacology,(2000), 2nd edition,

REFERENCE BOOKS

1. Joseph R.Palma,JohnDiGregorio (2001), "Basic Pharmacology in Medicine",1st edition,McGraw Hill Publishing Company,New York.
2. Good man, Gilman "The Pharmacology, volume I and II".(2003),2nd edition,
3. Katzung ,"Basic and Clinical Pharmacology", 7th edition- ,Prentice hall ,New Delhi
4. Atherden , (1996), "Text book of Pharmaceutical Chemistry", 8th edition, Oxford Medical Publications,
5. K.D Tripathi,(2004), Essentials of medical pharmacology, Jaypee publications 5th edition.

II M.Sc Biochemistry	COURSE NAME: RECOMBINANT DNA TECHNOLOGY (75) Hrs	Course Code 19EPB43B
SEMESTER-IV		HRS/WK-5
ELECTIVE IV		CREDIT-4

OBJECTIVES

1. To learn the recent advances in Bio-techniques and in-depth concepts in Recombinant protein production.
2. To gain knowledge about gene transfer and expression of cloned genes.
3. To acquire skill about the techniques in recombinant DNA technology.

Course Outcomes:

CO1: To acquire knowledge about the mechanism of action and the use of restriction enzymes in biotechnology research and recombinant protein production

CO2: To gain knowledge about the various steps involved in gene transfer and various selection processes for identifying transformants.

CO3: To get insight about the strategies involved in the expression of cloned genes.

CO4: To understand the site-Directed Mutagenesis (SDM),Protein Engineering and its applications in transgenic plants

CO5: To gain skill and knowledge about the techniques in recombinant DNA technology

SEMESTER IV	COURSE CODE: 19EPB43B					COURSE NAME: RECOMBINANT DNA TECHNOLOGY								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	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													3.58	

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 -CLONING STRATEGIES [15 hrs]

Restriction endonucleases - nomenclature and action. DNA ligases. Recombinant DNA (rDNA). Basic steps in cloning. Cloning in plasmid (pBR322, pUC18), phage (λ and M13) Cosmids vectors. BACs and YACs.

Methods of splicing of DNA molecules- cohesive end method, homopolymeric tailing, blunt-end ligation. Linkers and adaptors. Construction of genomic and cDNA libraries.

UNIT II- GENE TRANSFER AND rDNA SCREENING [15 hrs]

Gene transfer methods: calcium phosphate coprecipitation, electroporation, lipofection, viruses, microinjection. Host organisms for cloning- bacteria, yeast and mammalian cells.

Screening of recombinants: marker inactivation (antibiotic resistance, blue-white selection), colony PCR, colony hybridization and immunological screening.

UNIT III -EXPRESSION OF CLONED GENES [15 hrs]

Expression vectors. Heterologous gene expression. Factors affecting expression of cloned genes. Prokaryotic expression of cloned genes - strong and weak promoter, Fusion proteins- staphylococcus protein A, glutathione-S-transferase, maltose-binding protein, cellulose-binding protein, chitin binding domain, polyhistidine, fluorescent protein tag and its uses.

UNIT IV - SITE-DIRECTED MUTAGENESIS (SDM) AND PROTEIN ENGINEERING [15hrs]

SDM methods- cassette, oligonucleotide-directed, PCR-based. Protein engineering by directed evolution and DNA shuffling. Applications- increasing enzymes action, stability and specificity.Outline of metabolic engineering.

UNIT V – TECHNIQUES IN rDNA TECHNOLOGY [15hrs]

Preparation of probes. DNA sequencing- enzymatic and automated methods. next generation sequencing - Lynx Therapeutics' Massively Parallel Signature Sequencing (MPSS).DNA fingerprinting - principle and applications. Basic principles of gene knock-in and knock-out technology. Precise genome editing - CRISPR/Cas 9 system. Techniques involved in protein-protein interactions:*In vivo* techniques- Yeast two hybrid, Split ubiquitin system,Co-

immunoprecipitation FRET and Bi-Fluorescence system.Hazards and safety aspects of genetic engineering

TEXT BOOKS:

1. G. Karp (2019). Cell and molecular biology (9th edition), John Wiley & Sons Inc.
2. Nelson, D.L. and Cox, M.M (2021). Lehninger Principles of Biochemistry. 8thEdition, W.H. Freeman and Company, New York.
3. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J.D. (2002). *Molecular Biology of the Cell*. (4rth edition.), Garland Publishing, Inc., New York

REFERENCEBOOKS:

1. Robert J Brooker (2017). Genetics: Analysis and Principles, (6th Edition), McGraw Hill Education.
2. Karp, G. Cell (2010), Molecular Biology: Concepts and Experiments, 6th edn, Wiley
3. Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick (2014) Lewin. *Genes XI*(11th edition), Oxford University Press.
4. Twyman (2005) Advanced Molecular Biology(3rd edition), Viva Publ.
5. David Baltimore and Harvey Lodish (2016). *Molecular Cell Biology*. 8th edition, WH Freeman.

II M.Sc Biochemistry	COURSE NAME: PRACTICAL – III	Course Code-PBCP303
SEMESTER – III		HRS / WEEK: 8
PRACTICAL – III		CREDITS: 6

1. Estimation of blood glucose by OT method
2. Estimation of serum cholesterol
3. Estimation of serum triglycerides
4. Estimation of phospholipids
5. Estimation of serum creatinine
6. Estimation of LDL/HDL cholesterol
7. Estimation of SGPT and SGOT in serum
8. Estimation of alkaline phosphatase in serum
9. Estimation of acid phosphatase in serum
10. Estimation of glutathione peroxidase
11. Estimation of blood urea
12. Estimation of vitamin A
13. Estimation of vitamin E
14. Estimation of vitamin C
15. Estimation of SOD& Catalase

HEMATOLOGY

1. Collection of Blood
2. Blood Grouping
3. Clotting Time
4. Bleeding Time
5. ESR
6. RBC Count
7. WBC Count
8. Hb Estimation

URINE ANALYSIS - Normal and abnormal constituents

TECHNIQUES:

1. Immunoelectrophoresis
2. Separation of DNA by submarine electrophoresis

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.

3.Sadasivam S and Manickam P. (2004) Biochemical Methods. 2nd Edition. New Age International (P) Limited. New Delhi.

REFERENCE BOOKS

1. avid, 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.

3.Henry, John Bernard, Todd Sanford and Davidson, 2002. Clinical diagnosis and management by laboratory methods. W.B. Saunders & Co.

5.Fischbach Francis A, 2003. Manual of laboratory and diagnostic tests.

6. Gradwohls, 2000. Clinical laboratory methods and diagnosis Alex.C.

Practical-III Question paper pattern (60 marks)

1. Colorimetric estimation 1-20
2. Colorimetric estimation2/Urine analysis - 20
3. Hematology-6
4. Spotters-4
5. Viva-5
6. Record-5