.J. COLLEGE OF ARTS AND SCIENCE (Autonomous)

DEPARTMENT OF BIOCHEMISTRY

M.Sc BIOCHEMISTRY

Proposed Course Structure under Autonomous Status
Under Choice Based Credit System
(Applicable for the candidates admitted from academic year 2016-2017 onwards)

Sem	Course Code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks		Total Marks
						Int	Ext	
I	P1RBCCC1	Biomolecules	6	5	3	25	75	100
	P1RBCCC2	Analytical Biochemistry	6	5	3	25	75	100
	P1RBCCC3P	Core Practical-I(Covering CC1 and CC2)	6	5	6	40	60	100
	P1RBCCC4	Bioinformatics	6	5	3	**25**	**75**	100
	P1RBCEC1	Microbiology	6	3	3	25	75	100
TOTAL			**30**	**23**	**-**	**-**	**-**	**500**
II	P2RBCCC5	Enzyme Technology	5	5	3	25	75	100
	P2RBCCC6	Plant and Microbial Biochemistry	5	5	3	25	75	100
	P2RBCCC7P	Core Practical-II(Covering CC5 and CC6)	5	5	6	40	60	100
	P2RBCCC8	Metabolism and Regulation	5	5	3	25	75	100
	P2RBCEC2	Biotechnology and Genetic Engineering	5	3	3	**25**	**75**	100
	P2RBCEC3	Biopharmaceuticals	5	3	3	25	75	100
TOTAL			**30**	**26**	**-**	**-**	**-**	**600**
III	P3RBCCC9	Clinical Biochemistry	5	5	3	25	75	100
	P3RBCCC10P	Core Practical-III(Covering CC9)	5	5	6	40	60	100
	P3RBCCC11	Molecular Endocrinology	5	5	3	25	75	100
	P3RBCCC12	Immunotechnology	5	5	3	25	75	100
	P3RBCCC13	Molecular Biology	5	5	3	**25**	**75**	100
	P3RBCEC4	Principles of Biostatistics	5	3	3	25	75	100
TOTAL			**30**	**28**	**-**	**-**	**-**	**600**
	P4RBCCC14	Food technology	6	5	3	25	75	100
	P4RBCCC15PW	Project Work	24	8	3			100
TOTAL			**30**	**13**	**-**	**-**	**-**	**200**
GRAND TOTAL			**120**	**90**	**-**	**-**	**-**	**1900**

CC-Core Course / EC – Elective Course / P – Practical / T – Theory* Carry over Paper (Either Practical or Theory) Total Credit – 90 Total Marks – 1900

ELECTIVES

SEMESTER I

1. Microbiology
2. Medicinal Plants and Phytotherapy

SEMESTER II

1. Biotechnology and Genetic Engineering
2. Biopharmaceuticals
3. Evolutionary and Environmental Biology
4. Bioprocess Technology

SEMESTER III

1. Principles of Biostatistics
2. Genomics and Proteomics

SEMESTER I
SUBJECT TITILE: CORE COURSE I
BIOMOLECULES- (P1RBCCC1)

OBJECTIVE:

To have a detailed knowledge about

- **The structure and function of biomolecules**
- **The properties of biomolecules.**
- **The importance of biomolecules.**

UNIT I

Carbohydrates

Monosaccharides, Disaccharides and Polysaccharides: structure, occurrence, properties and biological functions. Homoglycans : structure, occurrence, properties and biological functions of glycans, chitin, fructans, mannans, arabinans, and galacturonans. Heteroglycans and complex carbohydrates : structure, occurrence, properties and biological functions of mucopolysaccharides – bacterial cell wall polysacharrides and sialic acid. Lectins – characteristics and uses, Blood group antigens, Major classes of glycoproteins: O-linked and N-linked oligosaccharides.

UNIT II

Proteins

Proteins a biological machinery: Amino acid structure, peptide bond, peptides. Physical interactions that determine the properties of proteins – shot range repulsions, electrostatic forces, van der waals interaction, hydrogen bond and hydrophobic interactions. Primary structure and its determination. The Ramachandran plot and cross links. Secondary structure : The α-helix, 310 and π-helix, β-sheets, reverse turns and super secondary structures. Tertiary structure and quaternary structure : Myoglobin and hemoglobin, Collagen. Corey model for fibrous proteins.

UNIT III

Lipids

Classification of lipids. Saturated and unsaturated fatty acids. Derived lipids: Phospholipids, glycolipids, structure and function. Eicosanoids- structure and biological actions of prostaglandins, prosracyclins, thromboxanes, leukotrienes and lipoxins. Lipoproteins- Classification and composition. Amphipathic lipids – membranes, micelles, emulsions and liposomes..Lipid and protein composition of biomembranes.

UNIT IV

Nucleic Acids

Bases, nucleosides and nucleotides, structure of nucleic acids. RNA : Types of RNA, secondary and tertiary structure. Structure of dsDNA : B,A,C, Z DNA, properties of dsDNA, Chemicals that react with DNA, DNA sequencing procedures- Maxam Gilbert method and Sanger's dideoxy methods. Renaturation and denaturation. DNA bending: The Wedge model and Junction model . Protein induced bending. Crucifrom DNA, Left handed DNA, Triplestranded DNA.

UNIT V

Vitamins and Porphyrins

Water soluble - thiamine, riboflavin, niacin, pyridoxine, folic acid, ascorbic acid sources, structure, biochemical functions, deficiency diseases, daily requirements. Fat soluble - vitamin A, vitamin D2, vitamin E and vitamin K - sources, structure, biochemical functions, deficiency diseases, daily requirements. Porphyrins the porphyrin ring system, chlorophyll, hemoglobin, myoglobin and cytochrome

Text Books:

1. Nelson,D.L. and Cox,M.M. 2013**.** Lehninger Principles of Biochemistry, 6th Edition, W.H. Freeman & Co.
2. Berg,J.M. *et al.,* 2012. Biochemistry, 7th Edition, W. H. Freeman & Co.
3. Voet,D. *et al.,* 2012. Fundamentals of Biochemistry: Life at the Molecular level, 4th Edition, John Wiley and Sons.

Reference Books:

1. Zubay,G.L. 1998. Biochemistry, Wm.C. Brown Publishers.
2. Sinden,S.R. DNA structure and function, First Edition**,** Academic Press, 1994.
3. Carl Branden and John Tooze, Introduction to Protein Structure, Second Edition, Garland Publishing, 1999.
4. Garrett,R. and Grisham,C. 2010. Biochemistry, 4th Edition, Saunders College Publishing.

SEMESTER I

SUBJECT TITLE: CORE COURSE II

ANALYTICAL BIOCHEMISTRY – (P1RBCCC2)

Objectives

- To impart analytical knowledge in Biochemistry and Molecular Biology
- To study the biochemical characters for beneficial manipulation
- To equip students with knowledge in relevant and recent advances in application in Biochemistry

UNIT I

Acid base

Acids, base and buffer system in living body, pH, Henderson equation, effect of pH on biological processes- buffer solution for biological investigations, methods of pH determination and glass electrode, osmotic pressure, osmolarity of body fluids, distribution of fluids, surface tension and viscosity of blood, Electrochemical techniques-redox reaction, pH electrode, lark oxygen electrode and their application.

UNIT II

Chromatographic & Centrifugation Techniques

Principle technique and applications of Affinity,TLC, Ion exchange, molecular sieve and adsorption chromatography. Principle ,components, limitations and applications of Paper, GLC& HPLC. Centrifugation: Principle and technique of preparative and analytical centrifugation, differential centrifugation, density gradient centrifugation ,ultra-centrifuge and its application.

UNIT III

Electrophoresis and Electrochemical techniques

Electrophoresis: General principle .Supporting media. Electrophoresis of proteins-SDS-PAGE, native gels, gradient gels, isoelectric focusing, 2-D PAGE. Detection, estimation and recovery of proteins and gels. Electrophoresis of nucelic acids-agarose gel electrophoresis, pulsed field gel electrophoresis. Capillary electrophoresis and its applications.

UNIT IV

Spectroscopy

Basic principle, instrumentation and application of colorimetry, UV, Visible and IR spectrophotometery, atomic absorption spectroscopy and atomic emission spectroscopy. Principle, technique and applications of spin Resonance, Nuclear magnetic Resonance and Mass spectrometry, Flame Photometry, Nephlometry, Turbidometry, Molecular luminescence, flourinometry. X-Ray diffraction, crystals and detectors, quantitative analysis and applications.

UNIT V

Radioactivity

An introduction to radiation chemistry, Units of radioactivity, Radio chemical methods: Detection and measurement of radioactivity-solid and liquid scintillation counting, scintillation cocktails and sample preparation. Cerenkov counting. Autoradiography. Applications of radioisotopes in biology. Radiation hazards and safety measures.

Text Books:

1.Upadhay, Upadhay and NA th Biosphysical Chemistry Principle and Techniques, Himalaya Publishing 1997.
2.Stryer, L., Biochemistry 6 th Edition W.H.Freeman & Company 2006.
3.Wilson, K. amd Walker, J. Principle and Techniques of Practical Biochemistry, Cambrige University, Press. Fouth Edition, 1999.

Reference Books:

1.Boyer, R. Modern Experimental Biochemistry,Benjamings, An imprint of Pearson Education Third Edition, 2001.
2.Sinden,S.R. DNA structure and function, Academic Press, 1994.
3.Friefelder, D. Physical Biochemistry- Application of Biochemistry and Molecular Biology,
4.W.H. Freeman and Co., Second Edition,1999.
5.Homie, D.J. and Peck, H.Analytical Biochemistry,Logman group, Third Edition, 1998.

SEMESTER I

SUBJECT TITLE: CORE COURSE III

CORE PRACTICAL- I (COVERING CC1 AND CC2) (P1RBCCCP3)

Estimations

1. Estimation of reducing sugars by Benedict `s titration
2. Isolation and estimation of starch from potato
3. Isolation and estimation of glycogen form liver
4. Estimation of maltose by calorimetric method
5. Estimation of fructose in fruits

6. Estimation of lactose from milk
7. Estimation of amino acids by Sorenson`s formal titration
8. Estimation of Protein by Lowry `s methods
9. Estimation of lecithin from egg of Yolk
10. Estimation of ascorbic acid from fruit
11. Estimation of β-Carotene from carrot.
12. Estimation of thiamine from cereals /fruits
13. Estimation of riboflavin.
14. Estimation of DNA and RNA

Demonstration

1. Separation of amino acids by circular , ascending and descending chromatography
2. Separation of Plant pigments by column chromatography
3. Separation of lipids by TLC

Reference Books:

1. David T. Plummer .An Introduction to practical biochemistry
2. Pattabiram Laboratory Manual in Biochemistry
3. J.Jayaraman , Practical Biochemistry

SEMESTER I
SUBJECT TITLE: CORE COURSE IV
BIOINFORMATICS – (P1RBCCC4)

OBJECTIVES

- To learn in detail about Biological databases.
- To let the students know the recent evolution of Biological science.
- To acquire knowledge regarding the tools in Bioinformatics.

UNIT I
DATABASES

Introduction to Bioinformatics. Biological databases - protein sequence databases – PIR, SWISS-PROT, Nucleic acid sequence database, GenBank, structural DB – SCOP, CATH specialized genome sequence database.

UNIT II
SEQUENCE ALIGNMENT

Pair wise alignment – Dot plots – scoring matrices – Blosum matrices – PAM matrix – Gap penalty – Alignment algorithms: Needle man – Wunsch global – Alignment algorithm: Smith – Waterman local alignment algorithm.

UNIT III
STRUCTURE PREDICTION

Secondary structure prediction – chou – Fasman – Jpred – Q3 – Transmembrane protein prediction- Tertiary structure prediction – Comparitive modeling – Fold recognition – Ab initio prediction – modeler – RASMOL – SWISS PDB Viewer.

UNIT IV
PHYLOGENETIC ANALYSIS
Evolutionary analysis: distances – clustering methods – rooted and un-rooted tree representation – Bootstrapping strategies – phylogenetic trees – PHYLIP.

UNIT V
GENOMICS
DNA microarrays – structural genomics – functional genomics – proteomics comparative genomics – whole cell simulation – human genome project – systems biology – Biodiversity informatics.

Text Books
1.Introduction to Bioinformatics, Arthur M. Lesk, Oxford University Press, New Delhi (2003).
2.Bioinformatics – Sequence, structure and databanks, D. Higgins and W. Taylor (Eds), Oxford University Press, New Delhi (2000).
3.Introduction to computational Biology Michael S. Watermann, Chapman & Hall (1995).
4.Introduction to Bioinformatics, Sundarajan. S and R. Balaji (2205) Himalaya Publishing House, Mumbai.

Reference Books
1. Bioinformatics, Westhead, Dr. HJ. Parish and RM. Twyman, Viva books Pvt. Ltd., New Delhi (2003).
2. Bioinformatics sequence and genome analysis,David w Mount,2nd Edition,Cold Springer Harbor Laboratory press.,2004.

SEMESTER I
SUBJECT TITILE: ELECTIVE COURSE I
MICROBIOLOGY- (P1RBCEC1)

OBJECTIVES
- To have a brief knowledge about the microbial world.
- To study the ultra structure of microbes.
- To learn the various methods of isolation and preservation of microbes.

Unit I
Classification
Definition and systematic, Nomenclatural rules and identification of microbes in the living world classification systems – Haeckel's three kingdoms, Whittaker's five kingdoms approach, Carl Woes three domain system. Major characteristics used in taxonomy – morphological, physiological and metabolic, genetic and molecular. Classification and salient features of bacteria according to Bergey's Manual of Determinative Bacteriology (9th edition). Modern classification of fungi, mycolpasma, cyanobacteria, protozoa.

Unit II
Ultra structure and function
Bacteria: Morphological types; cell walls of Gram negative, Gram positive bacteria, halophiles. L-forms and Archaebacteria, Cell wall synthesis, capsule - types, composition and function. Cell membranes in eubacteria, archaebacteria and cyanobacteria – membrane functions, periplasmic space. Structure and function of flagella, cilia and pili, gas vesicles,

chlorosomes, carboxysomes, magnetosomes and phycobilisomes. Reserve food materials – polyhydroxybutyrate, polyphosphates, cyanophycin and sulphur inclusions.

Unit III

Fungi

Cell wall – chemical composition and functions, membranes and their functions, nutritional strategies of fungi .Structure and life cycle of fungi – Ascomycetes (Aspergillus), Deuteromycetes (Candia), Zygomycetes (Mucor), Basodomycetes (Agaricus).

Unit IV

Algae and protozoans

Structure of algal cells – classification – reproduction and characteristics of Chlorophyta (Green algae), Chrysophyta (Golden Brown and Yellow), Green algae, Diatoms, Euglenophyta (Euglenoids). Rhodophyta (Red algae), Cyanophyta, Xanthophyta – Brief account of Protozoans.

Unit V

Cultivation methods of microbes

Isolation of different types of bacteria – Fungi – Actinomycetes – Cyanobacteria – Protozoa. Preservation methods of microbes for storage and microscopy studies , culture collections. Sterilization - Physical and chemical methods. A note on fossil microorganism.

Text Books

1. Prescott, L.M J.P. Harley and C.A. Klein 1995. Microbiology 2nd edition Wm, C. Brown publishers(All Units)
2. Michael J. Pelczar, Jr. E.C.S. Chan, Moel : Microbiology Mc Graw Hill Book R. Krieg, 1986 Company(All Units).
3. Text Book of Microbiology R.C.Dubey and Maheswary. S.Chand and company (P)LTD.

References

1. Salle A.J. : Fundamental Principles of Bacteriology 7th edition, Tata Mc Hill Publishing Company Ltd.,
2. Michael J. Pelczar, Jr. E.C.S. Chan, Moel : Microbiology Mc Graw Hill Book R. Krieg, 1986 Company
3. Stainer R.Y. Ingraham J.L. Wheolis H.H and Painter P.R. 1986 The Microbial world, 5th edition. Eagle Works Cliffs N.J. Prentica Hall..
4. William claus. G.W. 1989. Understanding Microbes – A Laboratory textbook for Microbiology,W.H. Freeman and Co., New York.
5. Wilson. K and Goulding. K.H. 1986. A Biologist's Guide to Principles and Techniques of Practical Biochemistry, ELBS, London

SEMESTER II
SUBJECT TITLE: CORE COURSE V
ENZYME TECHNOLOGY (P2RBCCC5)

Objectives

- To understand the industrial applications of different enzymes
- To learn the biochemistry of enzymes with therapeutic applications

Unit I

Nomenclature and classification

Nomenclature and classification of enzymes: according to IUB-EC,1964.intracellular localization of enzymes, homogenization techniques, isolation and fractionation of enzymes-classical methods of purification and selective adsorption, criteria of purity, units of enzymes activity, turn over number, specific activity and determination of active site residues.

Unit II

Enzyme catalysis

Acid base catalysis, electrostatic catalysis, covalent catalysis, enzyme catalysis ,mechanism of reaction catalyzed by enzymes-lysozyme and chymotrypsin. Metal activated enzymes and metalloenzymes. role of metal ions in mechanism-carbonic anhydrase, superoxide dismutase, carboxy pepditase. enzyme regulation-feedback inhibition, feed forward stimulation, sequential feedback, concerted feedback, cumulative feedback and enzyme multiplicity and covalent modification.

Unit III

Enzyme kinetics

Pre steady state and steady state kinetics, factors affecting enzyme activity, michaleis-menten plot, lineweaver-burk plot, eadien-hofstee plot and hanes plot. kinectics of allosteric enzymes-MWC and KNF models, Hills equation and coefficient, K and V series enzymes, bisubstrate reactions. enzyme inhibition-reversible-competitive, non-competitive, uncompetitive and mixed inhibition and their kinetic diffferentition, irreversible inhibition.

Unit IV

Clinical applications of enzymes

Enzyme as diagnostic reagents, antibodies as analytical reagents. therapeutic enzymes. determination of enzymes activities for clinical diagnosis-phosphatases,transaminases,LD,CK,amylase,cholinesterase.clinical enzymology of liver and heart diseases, enzyme inhibitors and drug design, enzyme therapy.biosensors-colorimetric,potentiometric,amphometric,optical and immunosensors.

Unit V

Industrial applications of enzymes

Industrial large scale enzyme extraction, purification and stabilization. industrial applications of carbohydrates, proteolytic enzyme, lignocellulose degrading enzyme, pectin and pectic enzyme. applications of enzymes in food industry, leather industry. additional industrial enzymes-lipase, enzyme in animal nutrition. immobilization of enzymes-methods and applications of enzyme engineering and artificial enzymes.

Text books

1.Palmer T.,understanding enzymes,ellis horwood limited,third edition,1991
2.Walsh G.,proteins biochemistry and biotechnology,john wiley and sons ltd,2002
3.Price N.C and stevens L.fundamentals of enzymology,oxford university press,third edition,1999.

Reference books

1.Chapline and Buke.Enzyme technology,Cambridge university press,first edition, 1990
2.Teitz NW.,Fundamentals of clinical chemistry,W.B.saunders company,second edition,1994
3.Nelson and Cox.Leninger principles of biochemistry,5th edition, W.H.freeman, 2008.

SEMESTER II
SUBJECT TITLE: CORE COURSE VI
PLANT AND MICROBIAL BIOCHEMISTRY (P2RBCCC6)

OBJECTIVES

- To improve knowledge about microbes
- To learn various techniques used to study microbes
- To have a brief knowledge about plant biochemistry

UNIT I

Microbial growth and metabolism

Microbial growth-definition. Mathematical expression of growth, growth cure, measurements of growth and growth yields, synchronous growth, continues culture, factors affecting growth. Microbial metabolism-overview. Photosynthesis in microbes. Role of chlorophylls, carotenoids and phycobilina, Calvin cycle. Chemolithotrophy; Hydrogen-iron-nitrite oxidizing bacteria: nitrate and sulfate reducation; methanogenesis and acetogenesis, fermentations-diversity, syntrophy-role anoxic decompositions. Nitrogen metabolism, nitrogen fixation, hydrocarbon transformation.

UNIT II

Microbiological Techniques

Methods in microbiology. Currents methods in microbial identification. Pure culture techniquies.Theory and practice of sterilization. Principles of microbial nutrition, construction of culture media, Enrichment culture techniques for isolation of chemoautotrophs, Chemoheterotrophs and Photosynthetic microbes.

UNIT III

Medical Microbiology

Disease reservoirs; Epidemiological terminologies. Infectious disease transmissions. Respiratory infections caused by bacteria and viruses; Tuberculosis, sexually transmitted diseases including AIDS; Vector bone diseases, water borne diseases. Public health and water quality. Pathogenic fungi. Antimicrobial agents, Antibiotics: Penicillins and cephalosporins, Broad spectrum antibiotics. Antibiotics from Prokaryotes, Antifungal antibiotics-Mode of action, Resistance to antibiotics. Lantibiotics.

UNIT IV

Overview of photosynthesis

Light absorption and energy conservation, Light properties of both particles and waves. Light absorbed by pigment molecules. Light reaction center complex. The Photosystem, organization of thylakoid. Electron transport pathways in chloroplast membranes, ATP synthesis in chloroplasts. Carbon reaction C3,C4, and CAM plants. Photorespiration: Biochemical basis of PR pathway-C2 cycle, role of photorespiration in plants. Metabolite transport between organelles.

UNIT V

Plant hormones

Synthesis, chemistry, mode of action and physiological role of auxine, gibberlline, cytokinins, abscisic acid, ethylene, salicylic acid and polyamines. Anti-nutritional factors in plants including enzyme inhibitors.

Text books

1.Madigan *et al*., Brock Biology of microorganisms 10 th ed. Prentice Hall, 2002.
2.Davis *et al*., Microbiology 4 th Lippincott Williams and wilkins, 1989.
3.Pelczar *et al*., Microbiology 5 th ed., Graw Hill, 2000.
4.Stainer Ry *et al*., General Microbiology 5 th, Prentice Hall 1998.
5.Brooks *et al*., Jawetz, Melinick and Adelberg`s Medical Microbiological.LangeMed.1998.
6.Prescott *et al*., Microbiology Mc Graw Hill, 1999.

Reference books

1.Encylopedia Microbiology-2 nd .Lederberg Vol. 1to 4 Acad.Press 2000
2.Joklik *et al*., Microbiology Mc Graw-Hill Professinal, 1995.

SEMESTER II
SUBJECT TITLE: CORE COURSE VII
CORE PRACTICAL - II (COVERING CC5 AND CC6) (P2RBCCCP7)

Microbial Techniques

1. Media Preparation, culturing and plating techniques
2. Determination of bacterial growth curve
3. Assessment of antimicrobial activity by tube dilution, phenol coefficient test, diffusion method
4. Preparation of Competent cell
5. Isolation of Plasmid DNA and estimations by DNP methods
6. Isolation and purification mitochondrial DNA and assay by Marker enzymes
7. Isolation and Purification of protein

Enzyme Kinetics

8. Determination of total and specific activity amylase
9. Effect of pH on enzyme activity (acid phosphatase)
10. Effect of temperature on enzyme activity (ALT/ALP) and determination of activation energy.
11. Effect of substrate concentration on enzyme activity (salivary amylase) and determination of km value.
12. Effect of inhibitor on activity of salivary amylase/urese.
13. Effect of activator on activity of salivary amylase/urease.

Demonstration:

14. Gel electrophoresis
15. Transformation
16. Polymerase chain reaction (Demonstration)
17. Comer assay
18. Southern blotting
19. Northern blotting
20. Immunodiffusion – Single radial and double diffusion
21. Immuno electrophoresis

References

1. James G. Cappuica, Natacie Sherman (1996) Microbiology – Laboratory Manual. The Benjamin Cummings publishing company.
2. Mackie & Mc carthey (1989) Practical Medical Microbiology. Churchill Livingston.
3. Albert Balows, Home F.Truper, Martin Dworkin. Wim, Hardes, Kart Heinz, Schoeifer (eds) (1192) A hand book on the biology of bacteria, eco-physiology isolation identification and application, springer verlag.

4. Methods in Molecular biology and protein chemistry by Brenda D. Spangler 2002. John Wiley and sons Ltd.
5. Recombinant gene expression protocols by Trans Rs (1997) Human a press.
6. Manuals in Biochemistry, Dr. J. Jeyaraman
7. Practical Biochemistry, Warley
8. Practical Biochemistry, Phummer
9. Practical Clinical Biochemistry, Herald warley

SEMESTER II
SUBJECT TITLE: CORE COURSE VIII
METABOLISM AND REGULATION (P2RBCCC8)

Objectives

- To know the importance of various metabolisms
- To learn the strategies of different types of metabolic regulation

UNIT I
Bioenergetics

Energy transducins, memberane energy interconversions, high energy compounds, standard free energy. Hydrolysis of ATP transfers potential of phosphate groups. Theories of electron transport. Mitochondrial electron transport chain, proton exchange during electron transport. Energetics of electron transport. electron transport in other membrane systems, microsomal electron transport. Coupling of electron transport to oxidative phosphorylation. Inhibitors of electron transport chain.

UNIT II
Carbohydrates metabolism

An overview and energetic of glycolysis- hexokinase,phosphofructokinase and pyruvate kinase as regulatory enzymes in glycolysis.HMP shunt, cori cycle, gluconeogenesis and regulation of gluconeogenesis by allosteric and substrate level control mechanisms. TCA cycle and its regulation at branch points and anaplerotic reactions.

Glycogen metabolism: Glycogenesis and its regulation, glycogenolysis and its regulation. Covalent modifications and hormonal regulations.

UNIT III
Lipid metabolism

Fatty acid synthesis and its regulation-regulation of fatty acid synthesis by hormone and diet. Synthesis and regulation of phospholipids, triacylglycerol, lipoproteins, cholesterol, sphingomyelin, ketone bodies. Synthesis and regulation of prostaglandins, eicosonids, thromboxins and leucotriens.

UNIT IV

Amino acid metabolism

An overview and regulation of α-keto glutarate, pyruvate, 3-phosphoglycerate, aspartate and aromatic family of aminoacids. An overview of γ-glutamyl cycle, methionine as a methyl donor. Conversion of aminoacids to specialized products. Porphyrin and mineral metabolism. Biosynthesis and degradation of hemoglobin, chlorophyll, cytochrome and its regulation.

UNIT V

Nucleic acid metabolism

De novo and salvage pathways of purine biosynthesis and degradation. Pathways of pyrimidine biosynthesis and degradation. Regulation of purine biosynthesis. Regulation of pyrimidine biosynthesis,regulation of deoxyribonucleotides by activators and inhibitors. Integration of metabolism-Metabolic integration of the liver, adipose tissue and brain. Altered metabolism in starvation.

Text books

1.Murray et al.Harpers Biochemistry,27th edition,2006,Mc Graw Hill publication
2.Zubay G.Biochemistry,John wiley and sons-Ltd.3rd edition,2002.

References

1.Nelson DL and Cox MM. Leninger Principles of Biochemistry, W.H.Freeman, 5th edition.2008.
2.Garratte and Grishman. Principles of Biochemistry, saunders college publishing ,1994

SEMESTER II
SUBJECT TITILE: ELECTIVE COURSE II
BIOTECHNOLOGY AND GENETIC ENGINEERING (P2RBCEC2)

OBJECTIVE

After the completion of the course the student will

- **Develop skills in biotechnological methods.**
- **Have a brief knowledge about the industrial applications of biotechnology.**
- **Also know about the ethical issues.**

UNIT I

TOOLS OF GENETIC ENGINEERING

Introduction, scope and history of genetic engineering. Restriction enzymes-types and restriction sites. Joining of DNA molecules by ligase, linkers, adapters, homopolymer tailing. Overview of enzymes used in genetic engineering. Cloning vehicles-plasmids, pBR322, pUC, YAC and its derived plasmids and its properties. λ bacteriophages as vectors, cosmids and phasmids.

UNIT II

DNA CLONING AND SEQUENCING

Cloning strategies-cloning with single stranded DNA vectors. C DNA cloning, c DNA library and gene library. Recombinant selection and screening methods. Expression of cloned genes-problem and solution. Shuttle vectors, DNA sequencing methods-Sangers and Gilbert methods. PCR- principle, methods, types and applications. DNA hybridization-southern, northern and western blotting.

UNIT III

GENE TRANSFER AND APPLICATIONS

Methods of gene transfer to bacteria, plant and animals-transformation, transduction, conjugation, transfection, electroporation, liposome mediated gene transfer. Techniques of tissue culture-protoplast fusion and its application. Transgenic plants and transgenic animals, GM foods and biopesticides, animal farming.

UNIT IV

INDUSTRIAL BIOTECHNOLOGY AND GENE THERAPY

Industrial biotechnology-fermentation-principle, types of fermentor, product recovery and purification of ethanol, citric acid, Vitamin B12 and streptomycin. Industrial production and applications of amylase, protease and cellulase. Solid waste treatment, Biogas production.
Gene therapy-principle, type, method and its application.

UNIT V

BIOSAFETY AND BIOETHICS

Biosafety-potential hazard, biosafety in GM foods and GMOs and safety testings. Human genome project-objectives, method and approaches. Genomics and genome prospectings-social and scientific issues of biotechnology. IPR-patenting of genes and cells.
Bioethics-ethics and guidelines for animal and human research.

Text Books:

1 Dubey R. C- Book on Biotechnology, S. Chand and company PVT. LTD., 5th edition,2014.
2 Singh B. D –Biotechnology, Kalyani publishers, 3rd edition, 2007.
3 Jogdand S.N- Gene Biotechnology, Himalaya Publishing House, 2nd edition, 2006.

Reference Books:

1 Wulf Crueger, Anneliese Crueger –Biotechnology, Panima Publishing corporation, 2nd edition, 2003 .
2 Tyagi I. D- Biotechnology and Genetic Engineering, Jain Brothers, 1st edition, 2005.
3 Mohan P. Arora- Biotechnology, Himalaya Publishing, 2004.
4 Dr Ignacimuthu S.-Immunology, Tata McGraw Hill publishing company limited, 13th edition 2006.

SEMESTER II
SUBJECT TITLE: ELECTIVE COURSE III
BIOPHARMACEUTICALS (P2RBCEC3)

Objectives

- To provide knowledge of general methodology of drug synthesis
- To understand the impact of metabolism and pharmacokinetics in design
- To provide the basic methodology of the structure identification uses spectroscope methods

UNIT I

Introduction

Drug structural features and basic concepts of pharmacology, pharmacological activity and prodrug concept, Biopharmacceutics (Absorption), Pharmacokinetics and Pharmacodynamics of the drug. Receptors concepts- Models, types, theories and localization. Drug receptor interactions. Agonist and antagonist and partial agonist.

UNIT II

Adverse response

Adverse drug response-drug tolerance, intolerance and idiosyncracy, allergy, tachyphylaxis drug abuse, drug induced disease, drug-drug interaction, drug synergism.Assay of drug. Assay of drug potency

UNIT III

Mechanism of action

Mechanism of action of drugs used in therapy of respiratory disease –cough, bronchial asthma, TB, G.I.T.- Vomiting , Pepticulcer, diahhorea. Antimicrobial drugs, cancer Chemotherapy. Endocrine disorders and neuro degenerative disorders-Senile sementia Huntington`s diseases. Renal disorder.

UNIT IV

Genome based medicine

Positional cloning for identifying diseased genes, cloning diseased genes, medical application of linkage map of the mouse. Analysis of human disease genes-Huntington`s disease. Cystic Fibrosis, Alzheimer`s disease and cancer. Therapeutic genomics: Human somatic cell gene therapy-exvivo and in vivo strategies, gene therapy for single gene disorders-AIDS and cancer, Antisense therapy.

UNIT V

Drug discovery

Drug discovery –By combinatorial chemistry and molecular diversity. Therapeutic targets for drug discovery.

Text Books

1.Jeyashree Ghosh, ``The Book of Pharamaceutical Chemistry,, Second Edition 1999, Chand & Company, New Delhi

2.A text book Pharamacology and Pharamacotherapeutics by R.S. Satoskar, S.D Bandarkar Ainapure.

References

1.W.O.Foye " Principles of medicinal chemistry

2.Satoskar " Pharmacology

SEMESTER III
SUBJECT TITLE: CORE COURSE VII
CLINICAL BIOCHEMISTRY (P3BCCC9)

Objectives

- **To study the organ function tests for various diseases**
- **To impart through knowledge about the biochemical basis of various disorder**

UNIT I

Specimen collection and processing

Collection of blood by various methods, anticoagulants, collection of urine, urine specimens, urine preservatives. Tests for urinary compounds, clinical significance of urinary compounds with reference to sugars, proteins, ketone bodies, bilirubin and porphyrins. stool-chemical examination and clinical significance. CSF-composition, collection, chemical examination for infections. Amniotic fluid: origin, collection, composition and analysis of amniotic fluid.

UNIT II

Hydrogen ion, fluid and electrolyte balance

Hydrogen ion homeostasis, factors regulating blood pH-buffers, respiratory and renal regulation, acid-base balance-biochemical findings and management of metabolic and respiratory acidosis. water and electrolyte homeostasis: distribution of water and electrolytes in the ECF and ICF. Role of ADH, rennin–angiotensin and aldosterone system. Disturbances in water and electrolytes balance.

UNIT III

Organ function tests

Liver function test- Pathogenesis, biochemical findings and consequences of jaundice, cirrhosis, hepaptitis and gall stones. Kidney function test- Pathogenesis, biochemical findings and consequences of glomerulonephritis, renal failure, nephritic syndrome and nephrolithiasis. Gastric function tests- pathogenesis, management of peptic ulcer and gastritis. Pancreatic function test: causes, biochemical findings and consequences of pancreatitis, cystic fibrosis and malabsorption.

UNIT IV

Inborn errors of metabolism

Disorders of carbohydrate metabolism-glycogen storage diseases, galactosemia, fructose intolerance and fructosuria. Disorders of lipid metabolism- lipid storage diseases, fatty liver and lipoproteinemias. Disorders of amino acid metabolism-aminoaciduria, phenylketonuria, hartnup's disease, alkaptonuria,albinism,cystinuria, homocystinuria and maple syrup diseases. Disorders of purine, pyrimidine and porphyrin metabolism-hyperurecemia and gout, orotic aciduria, porphyrias.

UNIT V

Diabetes, Atherosclerosis and Cancer

Blood glucose homeostasis-role of tissues and hormones. Diabetes mellitus-classification, complications, diagnosis and management. Atheroscelerosis-risk factor, biochemical findings and management. Cancer-types of cancer, invasion and metastasis.

Tumor markers- neuron specific enolase, prostate specific antigen, oncofetal antigen, AFP, CEA. Carbohydrate markers, genetic marker, C-myc gene, p53 gene, Ras gene. Free radicals in diseases and its management.

Text books

1.Teitz NW.,fundamentals of clinical chemistry,W.B.saunders company,second edition,1994

2.Varley et al.practical clinical biochemistry,vol I and II,CBS publishers,5th edition,1980

References

1.Philip DM.clinical chemistry in diagnosis and treatment, ELBS publications,6th edition, 1994.

2.Marshall WJ and Bangert SK.clinical biochemistry-metabolic and clinical aspects,pearson professional Ltd,1995.

SEMESTER III
SUBJECT TITLE: CORE COURSE X
CORE PRACTICAL - III (COVERING CC9) (P3RBCCC10)

Hematological studies

1. Collection and storage of blood
2. Estimation of hemoglobin content
3. Total RBC count & Total WBC count
4. Differential WBC count (DC)
5. Absolute eosinophil cont (AEC)
6. Total platelet count
7. Determination of ERS

Biochemical analysis of blood

1. Estimation of blood glucose
2. Estimation of serum proteins
3. Estimation of A:G ratio in serum
4. Estimation of blood urea
5. Estimation of Serum cholesterol
6. Estimation of serum phospholipids
7. Estimation of serum calcium
8. Estimation of creatinine by picric acid method
9. Estimation of Calcium by Permanganate method
10. Estimation of phosphorus by Fiske-Subbarow methods

Urine Analysis

Qualitative analysis of urine (Normal & Abnormal)

11. Estimation of Urea in Urine by DAM-TSC method
12. Estimation of Uric acid in urine by caraway method

Kit method:

1. Estimation of SGOT
2. Estimation of SGPT
3. Estimation of Triglycerides
4. Estimation of Hemoglobin

References

1. Manuals in Biochemistry ,Dr.J.Jayaraman

SEMESTER III
SUBJECT TITLE : CORE COURSE XI
MOLECULAR ENDOCRINOLOGY - (P3RBCCC11)

Objective

- **To Understand the function of the endocrine organs, metabolism of their hormones and their effect on the body**
- **To Understand the pathogenesis and pathophysiology of diseases of the pituitary, thyroid, Parathyroid, adrenal, Pancreas, testes and ovary**
- **To explore the various hormonal cell signaling mechanisms.**

UNIT I

Hypothalamic and Pituitary hormone

Hormones-classification, biosynthesis, circulation in blood, modification and degradation. Hormone receptors-structure and regulation. Mechanism of hormone action. Hypothalamic and pituitary hormone. Hypothalamic releasing factors. Anterior pituitary hormone: biological actions, regulation and disorders of growth hormone, ACTH, gonadotrophins and prolaction. Posterior hormone-biological actions and regulation of vasopressin. Diabetes insipdues and SIADH secretion. Oxytocin. Hypopituitarism.

UNIT II

Thyroid and parathyroid hormone

Thyroid hormones-synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Thyroid functions tests. Hyper and hypothyroidism. Hormonal regulation of calcium and phosphate metabolism. Secretion and biological actions of PTH, Calcitonin and calcitrial. Hypercalcema and hypocalcema Rickets and osteomalacia.

UNIT III

Adrenal hormone

Adrenal cortical hormones. Synthesis, regulation, transport, metabolism and biological effects. Adrenal funcation tests. Cushing `s syndrome, aldosteronism, congenial adrenal hyperplasia, adrenal cortical insufficiency, Adrenal medullary hormone-synthesis, secretion, metabolism, regulation and biological effect of catecholamines. Phaeochromocytoma.

UNIT IV

Sex hormone and Pancreatic hormones

Gonadal hormones, Biosynthesis, regulation, transport, metabolism and biological actions of androgens.Hypogonadism and gynecomastia.Biosynthesis, regulation, transport, metabolism and biological effects of oestrogen and progesterone. Pregnancy-diagnostic tests and biochemical changes.Ammenorrhoea. Pancreatic hormone-synthesis, regulation, biological effects and mechanism of action of glucagons, somatostatin and insuling receptor.

UNIT V

Signal transduction

Fundamentals concepts and definitions of signals, ligands and receptors, endocrine, paracrine and autocrine signaling. Receptors and signaling pathways-cell surface receptors, ion channels, G-protein coupled receptors, receptors kineses (tyr, ser/thr). Signal transduction through cytoplasmic and nuclear receptors.The Ras-raf MAP kinase cascade, second messengers-cyclic nucleotides, lipids and calcium ions. Crosstalk in signaling pathways.

Text Books

1. Biochemistry –Lehninger
2. Mammalian Biochemisity-white, Handler & Smith
3. Harper`s Biochemistry-Murray et al. 26 th ed. McGraw Hill 2003
4. Mammalian Biochemisity- Smith et al., McGraw Hill 7 th ed.

Reference Books

5. Biochemistry-Geoffry Zubay
6. Biochemistry-D.Voet &Judith G.Voet

SEMESTER III
SUBJECT TITILE: CORE COURSE XII
IMMUNOTECHNOLOGY – (P3RBCCC12)

OBJECTIVE

After the completion of the course the student will have

- A complete knowledge about the immune system.
- A detailed information regarding vaccination.
- A clear image about the importance of tissue matching during transplation.
- A brief knowledge about the imbalanced immune response.

UNIT-I:
LYMPHOID SYSTEM, ANTIGENS AND ANTIBODY

Lymphoid system - Central and Peripheral lymphoid organs and cells involved in immune system. Antigen, haptens, adjuvants, antigenicity, antigenic determinants and epitopes. Immunoglobulins basic structure, classification, functions, allotypes and idiotypes. Theories of antibody formation- side chain and clonal selection theory. Antibody diversity - mechanisms contributing to diversity - somatic recombination, rearrangement and generation of antibody diversity.

UNIT-II:
IMMUNITY AND COMPLEMENT SYSTEM

Types of immunity - innate and acquired immunity, antitoxin, antibacterial and antiviral immunity. Immune response - primary and secondary - humoral and cell mediated immunity. Antigen recognition - T cell and B cell receptor complexes, antigen processing and presentation. Interaction of T and B cells, cytokines. Immunological memory, cytotoxicity - immunotolerance, immunosuppression.

Complement system - nomenclature ,components, , activation of complement, complement receptors and alternate pathway.

UNIT-III:
VACCINES AND IMMUNOLOGICAL TECHNIQUES.

Vaccines – killed, attenuated, toxoid, recombinant vaccines, subunit vaccines, DNA vaccines, synthetic peptide vaccines, antiidiotypic vaccines. Immunization practices- immunoprophylaxis and immunotherapy.

Immunological techniques - Production of polyclonal and monoclonal antibodies. Immunoprecipitation, RIA, ELISA, fluorescent immunoassay, avidin-biotin mediated assay, immunohistochemistry, immunoelectrophoresis, immunoblotting. Complement fixation test.

UNIT-IV:
GENETIC BASIS OF IMMUNOLOGY

MHC complex - gene organization - HLA genes-class I and II antigens. Structure and function. Histocompatibility testing - lymphocytotoxicity test, cross matching. MHC and disease association.

Transplantation - types, genetics of transplantation , graft versus host reactions. Tissue matching and immuno suppressive agents.

Tumor immunology - immune surveillance, tumor antigens, immune response to tumors, immunotherapy of tumors.

UNIT-V:

HYPERSENSITIVITY AND AUTOIMMUNE DISORDERS

Hypersensitivity - definition , classification – types, hypersensitivity- mechanism involved, diagnosis and treatment.

Autoimmunity and autoimmune diseases - mechanism of development, diagnosis and treatment.

Immunodeficiency disorders-B cell deficiencies, T cell deficiencies, secondary immunodeficiency diseases-pathogenesis, diagnosis and treatment of AIDS.

Text Books

1. Ian R Tizard-Immunology-an introduction, Thomson, 4th edition, 1995.
2. Dr Rajeshwar Reddy K -Text book of immunology, AITBS publishers, 2nd edition, 2011.
3. Lydyard P.M., Whelan A., Fanger M.W – Instant notes in immunology, Viva Books Private Limited, 2002.
4. Rastogi S.C- Immunology, CBS Publishers and distributors, 2005.
5. Shastri N.V -Principles of Immunology, Himalaya Publishing house ,2005.

Reference Books:

1 Ivan Roitt, Jonanthan Brostoff David Male-Immunology, Mosby, 8th edition 2012.

2 Janis Kuby – Immunology, 7th edition, 2014

3 Donald M. Weir, John Steward- Immunology, Churchill Livingstone, 8th edition, 1997.

SEMESTER III

SUBJECT TITILE: CORE COURSE XIII

MOLECULAR BIOLOGY (P3RBCCC13)

OBJECTIVE

After the completion of the course the student will have

- **A complete knowledge about the replication mechanism.**
- **Detailed information regarding the mode of informations stored within the genome.**
- **A clear image of the way the codes are translated into functional proteins.**
- **A brief knowledge about the various ways of self repair mechanism.**

UNIT-I:

DNA REPLICATION

Types of replication, evidence for semi conservative replication - Messelson and Stahl experiment. Replications in circular chromosomes - Cairns model, rolling circle model. Replication in prokaryotes and inhibitors of replication, replication bubble, bidirectional replication, replicon, action of SSB, primase, DNA gyrase, topoisomerases, DNA polymerase I, II, and III, lagging and leading strand synthesis, Okazaki fragments, replication in RNA virus, plasmid replication , reverse transcriptase, retroviruses. Eukaryotic replication (overview and method), inhibitors of replication.

UNIT-II :

TRANSCRIPTION

Transcription - definition, coding strand, template strand, sense strand and antisense strand, promoter, DNA - dependent RNA polymerase, role of Pribnow box, template binding, prokaryotic transcription, Rho - dependent and independent transcription, post transcriptional processing in prokaryotes, split genes, overlapping genes, housekeeping genes. Biosynthesis of rRNA and tRNA, eukaryotic transcription, RNA editing - post-transcriptional modifications of eukaryotic RNAs, RNA splicing, introns and exons, spacer sequences, enhancers. Inhibitors of transcription.

UNIT-III:

GENETIC CODE AND TRANSLATION

Genetic code - definition, deciphering of the genetic code, , salient features of genetic code. Structure of tRNA, activating enzymes, binding of amino acids to tRNA, wobble mechanism and its significance. Composition of prokaryotic and eukaryotic ribosomes, leader region, Shine-Dalgarno sequence. Prokaryotic and eukaryotic protein biosynthesis - initiation, elongation, and termination, polysomes, post-translational modifications in prokaryotes and eukaryotes, role of endoplasmic reticulum, role of signal peptide, signal hypothesis, inhibitors of protein synthesis.

UNIT-IV:

PROTEIN TRANSPORT AND GENE EXPRESSION

Protein targeting, translocation, heat shock proteins, glycosylation, SNAPs and SNAREs, bacterial signal sequences, mitochondrial, chloroplast and nuclear protein transport, endocytosis-viral entry, ubiquitin TAG protein destruction, gene expression and regulations, molecular mechanism of regulation. Prokaryotes - operon model, lac, trp, arabinose operons, repression and attenuation. Eukaryotes - C value paradox, repetitive DNA, gene dosage and gene amplifications.

UNIT-V:

DNA DAMAGE AND REPAIR

Mutagenesis and replication fidelity, numerical mutations involving full chromosome set - causes, structural chromosome mutations - balanced and unbalanced mutation - causes, karyotype mixing, misincorporation of nucleotides during DNA synthesis, transient and spontaneous chemical changes in DNA, frameshift mutagenesis. DNA damage, DNA repair - direct reversal repair, direct repair of nicks, excision repair, nucleotide excision repair, mismatch repair, recombination error, SOS response.

Text Books:

1 Sundara Rajan- Cell and Molecular Biology, Anmol publication PVT., LTD., 2003.

2 Rastogi S.C- Cell and Molecular Biology, New age International publisher, 3rd edition, 2011.

3 Dr. P. Asokan-Molecular Biology, Chinnaa publications, 1st edition, 2005.

Reference Books:

1 Lewis J. Kleinsmith, Valerie M.Kish - Principles of Cell and Molecular Biology, Harpercollins College Publishers, 2nd edition, 1995.

2 Lodish et-al., Molecular Cell Biology,W.H.Freeman and company, 3rd edition, 1995.

3 David Freifelder-Molecular Biology,Narosa publishing house, 2nd edition, 2008.

4 Gerald Karp - Cell and Molecular Biology, John Wiley and Sons, Inc., 5th edition, 2008

SEMESTER III
SUBJECT TITILE: ELLECTIVE COURSE IV
PRINCIPLES OF BIOSTATISTICS (P3RBCEC4)

OBJECTIVES

- To study about the Correlation and its real life applications.
- To estimate Regression Analysis.
- Calculate descriptive statistics related to public health.
- Enables graphical ideas to descriptive statistics.
- To analysis the results by testing hypotheses

UNIT I
CORRELATION

Introduction to Biostatistics - Correlation Analysis: correlation – Correlation coefficient – Scatter Diagram – spearman's rank correlation coefficient. (Related problems)

UNIT II
REGRESSION

Regression Analysis: Regression – Regression coefficient – properties – Linear Regression line. (Related problems)

UNIT III :
PROBABILITY DISTRIBUTION

Theoretical Distribution – Binomial , Poisson and Normal Distributions.

UNIT IV :
SAMPLING

Basic Concepts of Sampling – Simple random sample, stratified sample and systematic sampling. Sample statistic.Sampling distribution and standard error. Tests of significance – Test for mean and difference of means.

UNIT V :
TESTING OF HYPOTHESIS

Student t – test, Chi – Square test, F-test, ANOVA : one way and two way classification,

TEXT BOOK

[1] " Biostatistics" – P.N.Arora and P.K. Malhan, Himalaya Publication House,2006.
Unit I : Chapter 8:8.1,8.4-8.7
Unit II : Chapter 9: 9.1-9.3,9.5
Unit III: Chapter 11: 11.1 to 11.5, 11.9, 11.11- 11.13,11.15, 11.17-11.21.
Unit IV: Chapter 12 : 12.1 to 12.5.
Unit V : Chapter 13: 13.8,13.9.13.10 ; Chapter 14: 14.7,14.8; Chapter 15: 15.4:
Chapter 8: 8.1 and 8.6 and Chapter 9: 9.1 and 9.2.

References

[1] "Fundamentals of BioStatistics" Veer BalaRastogi, Ane Books Pvt. Ltd, 2009.
[2] "Biostatistics" - P.Ramakrishnan - Saras Publications,1995.

SEMESTER IV
SUBJECT TITILE: CORE COURSE XIV
FOOD & NUTRITION (P4RBCCC14)

UNIT I

Carbohydrate lipids and proteins and fiber –(a) Sources requirement, absorption and function (b) Disease related to digestion and absorption of foods, Dietary factors in colorectal cancer. Vitamins-classification, chemistry, physiological and biochemical funcations, assay, requirement, food sources, absorption, deficiency disorders. Minerals- Physiological and biochemical function assay, requirement, sources, absorption, and deficiency.

UNIT II

Energy Metabolism

Energy value of foods, Energy requirements , BMR, balanced diet formulation. Diseases caused by Malnutrition (protein, minerals and vitamins) Metabolic disorders(carbohydrates, lipids, amino acids and proteins), diseases related to nucleotide metabolism, diseases related to hormones and hormone funcations, tropical disease.

UNIT III

Food Preservation

Methods of foods preservation. Control of microorganisms by retarding growth-low temperature, drying, intermediate moisture foods, chemicals. Control of microorganisms by destruction-gas treatments, heat, ionization, radiation, ultraviolet radiation. Elementary idea of tanning and packing.

UNIT IV

Food additives

Food additives and leavening agents, Flavor components in foods adulteration. Food Spoilage composition and spoilage of food , meat, fish, cereals, pulses, nuts and oil seeds, fruits and fruit products, vegetable and vegetable products.

UNIT V

Fermented Foods

Basic principle of food fermentation.Fermented foods –fermented milk –yoghurt, cheese, bread, fermented vegetables-Sauerkraut, olives. Fermented meats and fish, production beer and wine, vinegar, mushroom farming.Food –borne disease-Food borne illness.f,botulism,c.perfinges food poisoning,salmonellasis, shigellosis, fungal illness. Mycotoxins,aflatoxins.food borne viruses.detection of disease causing microorganisms.

Text books

1.food microbiology,2nd edi,adams and moss,royal society of chemistry,2000.
2.jay,J.M.Modern food microbiology,6th edi,aspen publishers,2000
3.Frazier and westhoff,food microbiology,4th edi,Mc Graw Hill,1988.

Reference Books

1.Borem et al.understanding biotechnology,prentice hall,2003.

2.ward,fermentation biotechnology,prentice hall,1989.

3.Applied nutrition.Dr.R.Rajaleshmi

ELECTIVE COURSE –I-2
MEDICINAL PLANTS AND PHYTOTHERAPY

UNIT-1

Medicinal plants and their importance

Plants with hepatoprotective, nephroprotective, hypoglycemic, anticancer, antimalarial, antifungal, antiviral, anti-iflammatory and anticholinegeic Properties.Secondary plant metabolites-alkalodis, flavonoids, terpenoids, Phenols: Occurrence, distribution and functions.

UNIT-II

Extraction and separation techniques

Solvent extraction, fractionation, distillation and rotary evaporation. Phytochemical studies: alkaloids, flavonoids, tannins, saponins,glucosides, carbohydrates, protein and steroids. Principles and use chromoatographic and spectroscopic techniques like column chromatograph. TLC, HPLC, GCMS ,IR and NMR for the purification and characterization of compounds.

UNIT-III

Biochemical studies

Free radicals, free radicals induced damages, disease caused by free radicals .Antioxidants-enzymic and non-enzymic antioxidants, role of antioxidants in prevention of diseases.

UNIT-IV

Biotechnology of medicinal plants

Producation of secondary metabolites, culture techniques, micropropagation of endangered species and conservation of herbal plants. Elicitors and immobilization techniques for the enhanced systhesis of pharmaceutical compounds.

UNIT-V

Mechanism of action

Metabolism, excretion and side effects of allopathic drugs –sulfonyl ureas and biguanides, Mechanism os herbal drugs –vincristine,vinblastine ans silymarin.

Text books

1. Satoskar et al., Pharmacology and Pharmacotherapeutics, Popular Prakam, Mumbai, 1999.
2. Foye, O.W. et al., Medicinal Chemisty , B.I. Waverly Pvt.Ltd. New Delhi 1995.

SUBJECT TITLE: ELECTIVE III
EVOLUTIONARY AND ENVIRONMENTAL BIOLOGY-P2BCEC3

Objectives

- To know the interrelationships between different living organisms.
- To learn the importance and conservation of ecosystem.

Unit I

Evolutionary biology

Origin of life,concepts of evolution,theories or organic evolution,mechanism of speciation,hardy Weinberg equilibrium,genetic polymorphism and selection,origin and evolution of economically important microbes,plants and animals.

Unit II

Environmental biology

Concepts and dynamics of ecosystem,components,food chain and energy flow,productivity,types of ecosystems,population biology and biological control,community structure and organization,sustainable development,economic importance of microbes,plants and animals.

Unit III

Resources and their conservation

Cultivation and improvement of plants fro food,drug,fibre and industrial values,plants as a source of renewable energy, genetic resources and their conservation.sewage treatment-primary,secondary ,tertiary treatment.industrial waste water treatment-sources and treatment process.

Unit IV

Water relation

Mineral nutrition,photosynthesis and photorespiration,nitrogen,phosphorus and sulphur metabolism.stomatal physiology.source and sink relationship,ecological pyramids and recycling,biotic community-concepts,structure.

Unit V

Biodiversity

Value of biodiversity-characterization,generation,maintenanace and loss,magnitude and distribution of biodiversity,economic value,wild life biology,conservation strategies,cryopreservation.

Text books

1. Environmental biology by P.D.Sharma
2. Textbook of environmental science by Richard
3. Text book of environmental studies by Erach bharucha.

BIOPROCESS TECHNOLOGY

Objectives

- **To learn the production of various biological compounds**
- **To study the different techniques used by the various industries**

Uint I

Basis of gene cloning:restriction endonucleases-types and features.ligations,linkers and adaptors.Vectors of gene cloning-plasmid vectors-basic feature,pBR332.bacteriophage vectors,cosmids.cloning hosts. Preparation of plasmid DNA fron bacteria.

Unit II

Introduction of DNA into bacterial cells.transformation of E.coli,selection of transformed cells,identification of recombinants. Introduction of phage DNA into bacterial cells, identification of recombinant phage. Genomic library and cDNA cloning. Hybridization probes: southern,northern and western blotting techniques

Unit III

DNA sequencing:outline of sangenrs method-applications Genetic finger printing-oligonucleotide directed mutagenesis,protein engineering PCR- technique and applications.

Unit IV

Expression vectors for E.coli:constituents,example of promoters-expression cassetts-problems caused in expression of eukaryotic genes. Fusion proteins:applications of gene technology,recombinant insulin,recombinant growth hormones.cloning HBV surface antigen in yeast. Insect cells as host system. Safety aspects and hazards of genetic engineering

Unit V

Bioprocess technology:fermentation:design of a commercial fermenter,solid substrate fermentation. Media for industrial fermentations:batch culture and fed-batch culture Down stream processing Production of aminoacids:SCP,pencillin and alcohol

Text books

1. T.A.Brown,gene cloning-an introduction,chapman and hall,1995.
2. Balasubramanian D,C.F.A.,Bryce,K.Dharmalingam, J.Green,kunthala jeyaraman concepts in biotechnology,COSTED-IBN university press,1996.
3. R.W.Old and S.B.Primrose,principles of gene manipulation,black well scientific publications,1994

References

1. Glick R,Bernard and Pasternak J,Jacj,molecular biotehnolgy,Asm press,Washington D.C.1994
2. Glazier N, Alexander,microbial biotechnology,W.H.Freeman & co., new York,1995.

GENOMICS AND PROTEOMICS

UNIT-I

Genome maps

Types of Genome maps and their uses: high and low resolution maps-map elements polymorphic markers, line sine , RFLP. SNP types of Maps: Cytogenic-Linkage map, Transcript map physical map-Comparative map, integrated map Practical uses of Genome

maps. Locating Genomic regions, target identification, arrangement of genes, SMP diagnosis, Positional specific cloning, Predicting Gene function, identifying regulatory genes.

UNIT-II

Structural annotations

Locating coding regions and other structural elements of the gene. Various approaches in gene prediction-ORF prediction, gene prediction in prokaryotes and eukaryotes.Hidden markov model , Pattern discrimination

UNIT-III

Human Genome and Genomic analysis:

Size, features, composition and characteristics of human genome-Sequence repeats, transposable elements, gene structure and pseudogenes.Genome analysis-Gene order (Synteny) ,Chromosome rearrangement, compositional analysis, clustering of genes and composite genes.

UNIT-IV

Proteomics:

Structural elements and terminology-phi and psi bonds, letter code for amino acids, helix sheet strand, loop and coil. Active site, Architecture, blocks, class and domains, fold, motif, PSSM, Profile Protein structure prediction: Use of sequence pattern-Leucine zipper, coiled coul, transmemebrane, and signal peptide and leavage site. Secondary structure Prediction: Chou-Fasma/GOR method, neural network, nearest neighbor method, tertiary structure prediction, threading, profile, contact potential and modeling

UNIT-V

Proteome

Analysis, 2D Electrophoresis- Immobilized pH gradient, sample preparation, first dimension criteria, second dimension criteria, stabilization, data analysis- Mass spectrometry based methods for protein identification and analysis. Database for 2D gel

Reference

1. David W. Mount. (2001) bio-informatics sequence and genome analysis, cold spring Harbor Laboratory press.
2. Ed. Andreas D. Baxewanis and Francis quellette, Bio-informatics a practical guide to the analysis of gene and Proteins, Jhon willey and sons publications
3. Pennigtons S.R. and Dunn M.J (2002), Proteomics,Viva books pvt , Ltd

MBE-INTRODUCTION TO BIOMATERIALS

UNIT-I

Biomaterials and biological materials-examples and uses: first generation biomaterials-general chharactristics-naturally occurring biomaterials-pure metals-alloys-ceramics-polymers-composites.

Unit-II

Second generation biomaterials and their properties-bioactive and biodegradable ceramics-biodegradable polymers-hydrogels.

UNIT-III

Third generation biomaterials- characteristics-biomaterials in tissue engineering-enzyme conjugates,DNA conjugates-DNA-protein Conjugates-microarray technologies-micronanotechnology-microfabrication-nanofabrication- interaction between biological matrials, molecular- biomolecules and nanomaterials.

UNIT-IV

Nanobiotechnology-introducation-DNA nanotechnology-structural DNA assembly nanopore and nanoparticles-biological arrays-nanoprobes for analytical applications-nanosensors-nanoscale organization- characterization –quantum size effects-nanobiosensors-sensors of the future.

UNIT-V

Microscopies –SEM-TEM-modern advances –microanalysis-optical detection of single molecules –applications in single molecule spectroscopy-single molecule DNA detection,sorting sequencing –DNA nanoparticles studies by AFM –DNA computer-PCR amplifications of DNA fragments-molecular surgery of DNA.

TEXT/REFERENCE BOOKS

1. Nano: The essentials: Pradeep .T. 2007 McGraw- Hill Publishing Company Ltd.
2. Nanoparticle assemblies and Superstructures: Nicholas A.kotov, 2006 CRC Press
3. Nanoscale Technology in Biological Systems: Editors: Ralph et al, 2005 ,CRC Press
4. Micromachines as Tools for Nanotechnology: H.Fujitha, 2003,Springer Verlag.
5. Nanobiotechnology: Concepts, application and Perspectives , C.M.Niemeyer & C.A. Mirkin ,2004, willey VCH Verlag GMBH &Co.
6. Biomaterials: An introduction. 1992.By Park JB, Lakes RS.
7. Advances in Biomatrials, Drug delivery-AICHE.J 2003, 49(12): 2990-3006