J.J. COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS), PUDUKKOTTAI – 622 422
DEPARTMENT OF BIOCHEMISTRY
M.Sc. BIOCHEMISTRY
Proposed Course Structure under Autonomous Status
Under Choice Based Credit System - 2019-2020 onwards

The objectives of M.Sc Biochemistry programme is to:

- Provide an advanced learning of core principles in the field of Biochemistry with appropriate skills and aptitude.
- Produce professionals who can engage in clinical laboratories, research laboratories and work in community health sectors.
- Apply the basic understanding to the study of specific and more advanced topics in pure or applied life science disciplines
- Be equipped with the up-to-date skills required for immediate practice and ability to use their knowledge to solve the real existing problems
- Provide basic and advanced understanding of Biochemistry principles both in¬ theory and practicals, which are required to clear competitive exams that are conducted based on interdisciplinary knowledge and application skills such as UGC, NET, CSIR, ICMR, TNPSC , etc.

Sem	*Course Code*	*Course Title*	*Hrs/ Week*	*Credit*	*Total marks*	*Exam Hours*
I	P1R1BCCC1	Biomolecules	6	5	100	3
	P1R1BCCC2	Analytical Biochemistry	6	5	100	3
	P1R1BCCC3P	Core Practical-I(Covering CC1 and CC2)	6	5	100	6
	P1R1BCCC4	Bioinformatics	6	5	100	3
	P1R1BCEC1	Microbiology	6	3	100	3
Total			**30**	**23**	**500**	
II	P2R1BCCC5	Enzyme technology	5	5	100	3
	P2R1BCCC6	Plant Biochemistry	5	5	100	3
	P2R1BCCC7P	Core Practical-II(Covering CC5 and CC6)	5	5	100	6
	P2R1BCCC8	Metabolism and regulation	5	5	100	3
	P2R1BCEC2	Principles of biostatistics	5	3	100	3
	P2R1BCEC3	Biopharmaceuticals	5	3	100	3
Total			**30**	**26**	**600**	
	P3R1BCIP	Internship	-	3	100	-
III	P3R1BCCC9	Clinical Biochemistry	6	5	100	3
	P3R1BCCC10P	Core Practical-III(Covering CC9)	6	5	100	6
	P3R1BCCC11	Molecular Endocrinology	6	5	100	3
	P3R1BCCC12	Immunotechnology	6	5	100	3
	P3R1BCCC13	Molecular Biology	6	5	100	3
Total			**30**	**28**	**600**	
	P3R1BCCC14	Biotechnology and Genetic Engineering	5	5	100	3
	P4RBCCC15PW	CC15 - Project Work	25	8	100	3
Total			**30**	**13**	**200**	
Grand Total			**120**	**90**	**1900**	

CC-Core Course / EC – Elective Course / P – Practical / T – Theory, Total Credit – 90 Total Marks – 1900

Elective courses for M.Sc. Programme

(any four from the list)

1. Microbiology

2. Principles of Biostatistics

3. Biopharmaceuticals

4.Evolutionary And Environmental Biology

5.Bioprocess Technology

6. Medicinal Plants And Phytotherapy

7.Genomics And Proteomics

M.Sc. BIOCHEMISTRY PROGRAMME OUTCOME

The M.Sc Biochemistry programme would have helped the students to:

- Acquire necessary knowledge and skills to undertake a career in research, in industry or in an academic set up.
- Apply the knowledge of experimental approaches to solve problems of a biochemical nature and establish a technology to permenantly solve the problem.
- Integrate and apply the techniques in Biophysics, Analytical biochemistry, Clinical biochemistry, Microbiology, Molecular biology and Basics in bioinformatics.
- Compare and contrast the breadth and depth of scientific knowledge in the broad range of fields of Biological Sciences.
- Describe and express the biochemical basis of human diseases, protein structure and conformation, non-invasive diagnostics, biochemical pathway regulation and drug development and apply the same for multitude of laboratory applications.

SEMESTER I
BIOMOLECULES

COURSE CODE: P1R1BCCC1	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course objectives:
The student will be able to:

- Understand and demonstrate how the structure of biomolecules determines their chemical properties and reactivity
- Understand the amino acid structures, describe their physical and chemical properties
- Understand and analyse the primary, secondary, tertiary and quaternary structure in proteins and identify the types of interactions.
- Understand the structure of nucleic acids: DNA, and RNA.
- Evaluate the structural and conformational freedom of biomolecules including proteins, DNA/RNA, carbohydrates and key metabolites/co-factors.

UNIT I **(14 Hours)**
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 **(14 Hours)**
PROTEINS **(ICT learning)**

Amino acid: structure, classification, peptide bond, biologically important peptides. Physical interactions that determine the properties of proteins – short 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 **(14 Hours)**
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 **(14 Hours)**
NUCLEIC ACIDS **(ICT learning)**

Structure of purines, pyrimidines, nucleosides and nucleotides. DNA double helical structure. A, B and Z forms of DNA. Triple and quadruple structures. DNA supercoiling and linking number. Properties of DNA: buoyant density, viscosity, hypochromicity, denaturation and renaturation– the cot curve. DNA sequencing – chemical and enzymatic methods. Chemical synthesis of DNA. RNA – types and biological role. Secondary, tertiary structures of RNA.

UNIT V **(11 Hours)**

VITAMINS AND PORPHYRINS **(ICT learning)**

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.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

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. . Sathyanarayana, 2017, Essentials of Biochemistry, Books and Allied (P) Ltd.
2. Zubay, G.L. 1998. Biochemistry, Wm.C. Brown Publishers.
3. Sinden,S.R. DNA structure and function, First Edition**,** Academic Press, 1994.
4. Carl Branden and John Tooze, Introduction to Protein Structure, Second Edition, Garland Publishing, 1999.
5. Garrett,R. and Grisham,C. 2010. Biochemistry, 4th Edition, Saunders College Publishing.
6. Pankaja Naik, Essentials of Biochemistry, 2017, 2nd editions, Jaypee Brothers.

e-books:

1.Textbook of Biochemistry,2011 by Thomas M. Devlin
2. lippincotts-biochemistry-6th-edition,2014 by Ferrier, Denise R.

Course Outcomes:

At the end of the course the student will be able to:

- Explain the significance of hydrophobic and hydrophilic forces for the structure of biomolecules with examples.
- Explain the significance of steric effects for the structure of biomolecules and give examples.
- Discuss the four structure levels of proteins.
- Draw the basic structure of carbohydrates, nucleic acids, peptides/proteins and lipids.
- Name the functional groups in carbohydrates, nucleic acids, peptides/proteins and lipids.

SEMESTER-I
COURSE TITLE: ANALYTICAL BIOCHEMISTRY

COURSE CODE: P1R1BCCC2	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course Objectives:
The student will be able to:

The student will be able to

- Get a comprehensive knowledge of the equipments used in Life sciences
- Understand the working principles, tools and techniques of various analytical methods
- Understand and analyze the principles and applications of centrifuge, electrophoresis and chromatography in research and related experiments.
- Apply the knowledge for the separation of proteins/peptides by selecting appropriate separation techniques.
- Apply the principle of spectrophotometry to understand certain functionalities of Biomolecules.

UNIT I **(14 Hours)**
SPECTROSCOPY **(ICT learning)**

Basic principle, instrumentation and application of colorimetry, UV, Visible and IR spectrophotometery, Laws of photometry. Beer-Lambert's law, Atomic absorption spectroscopy and atomic emission spectroscopy. Nuclear magnetic Resonance and Mass spectrometry, Flame Photometry, Nephlometry, Turbidometry, Molecular luminescence, flourinometry. X-Ray diffraction, crystals and detectors.

UNIT II **(14 Hours)**
CHROMATOGRAPHIC AND CENTRIFUGATION TECHNIQUES **(Lab oriented)**

Principle technique and applications of Affinity, Principle ,components, limitations and applications of Paper, GLC& HPLC. GC-MS: Principle, Technique and its applications. Centrifugation: Principle and technique of preparative and analytical centrifugation-Determination of Molecular weight, differential centrifugation, density gradient centrifugation , Ultra-centrifuge and its applications.

UNIT III **(14 Hours)**
ELECTROPHOROSIS AND ELECTROCHEMICAL TECHNIQUES **(Lab oriented)**

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 **(14 Hours)**
RADIOACTIVITY **(ICT learning)**

Properties of different types of radioisotopes normally used in biology, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines,Units of radioactivity, Radio chemical methods. Autoradiography. Applications of radioisotopes in biology. Radiation hazards and safety measures.

UNIT V **(11 Hours)**

ADVANCED INSTRUMENTATION AND TECHNIQUES **(ICT learning)**

Cell based Technique of Flow cytometry and its Applications , DNA based Technique-Comet Assay and RAPD Analysis. Protein Based Technique - FPLC.biomedical Instruments-CT and MRI Principles and Applications, Biochemical Autoanalyser and Hematological Autoanalyser (CBC) Principles and Applications.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

Text Books:

1. Upadhay, Upadhay and NA Biosphysical Chemistry Principle and Techniques, Himalaya Publishing 1997.
2 .Stryer, L., Biochemistry 6 th Edition W.H. Freeman & Company 2006.
3. Wilson, K. and Walker, J. Principle and Techniques of Practical Biochemistry, Cambrige University, Press. Fout Edition, 1999.
4. Keith Wilson and John Walker(2004): Principles and Techniques of Practical Biochemistry, 5th edition, United Kingdom, Cambridge University Press

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. 4. W.H. Freeman and Co., Second Edition, 1999.
5. Homie, D.J. and Peck, H. Analytical Biochemistry, Logman group, Third Edition, 1998.
6. Jessica Carol, Analytical Biochemistry, 2016, Syrawood Publishing House.

e-Books

1.Analytical Biochemistry 1998 by David Holme & Hazel Peck
2. Physical Chemistry Third Edition, 2008 by Robert G.Mortimer

Course Outcomes:

At the end of the course the student will be able to

- Understand the basic concepts and principles of biochemical techniques (centrifugation, chromatography, spectrophotometry and electrophoresis etc)
- Understand how various radiation detection instruments are constructed and become familiar with the electronic circuitry that is necessary for their operation
- Explain the theoretical principles of selected instrumental methods within electro analytical and spectrometric/ spectro photometric methods, and main components in such analytical instruments.
- Integrate different analytical techniques to solve analytical and bio analytical problems

SEMESTER I
COURSE TITLE: ANALYTICAL BIOCHEMISTRY

COURSE CODE: P1R1BCCC3P	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:40**
CREDIT: 5	**EXTERNAL MARKS:60**
	HOURS/WEEK: 6

Course objectives:
The student will be able to:

- Know the Estimation procedure of biomolecules
- Follow the amino acid assay and Protein assay methods
- Follow the method of nucleic acids assay: DNA and RNA.

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

Bioinformatics tools

1. Retrieval of protein sequences from UNIPROT
2. Retrieval of gene sequences from Genbank.
3. Retrieval of 3D structure from Protein Data Bank
4. Sequence similarity searching tool –BLAST
5. Primary Sequence Analysis –PROT PARAM
6. Secondary Structure Analysis –SOPMA Protein
7. Visualization Tools RASMOL, J MOL , SWISS PDB Viewer

Text Books

1. J. Jayaraman (2011). Laboratory Manual in Biochemistry, New Age International Pvt Limited.

Reference Books:

1. David T. Plummer .An Introduction to practical biochemistry
2. Pattabiram Laboratory Manual in Biochemistry
3. J.Jayaraman , Practical Biochemistry
4. Shivaraja Shankara YM, Ganesh MK, Shivashankara AR (2012). Laboratory Manual for Practical Biochemistry, Jaypee Brothers,Medical Publishers Pvt. Limited

Course Outcomes:

At the end of the course the student will be able to:

- Fabricate components with their own hands .
- Get practical knowledge of the Enzyme assays Procedures.
- Gain technical experience and handle adjustable micro pipettes in a reproducible manner
- Demonstrate the use of standard curves

- Plan experiments, prepare protocols
- Perform logical reasoning and criticizing data
- Know the bioinformatics tools

SEMESTER I
SUBJECT TITLE: BIOINFORMATICS

COURSE CODE: P1R1BCCC4	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course Objectives
The students will able to:

- 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 **(14 Hours)**
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 **(14 Hours)**
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 **(14 Hours)**
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 **(14 Hours)**
PHYLOGENETIC ANALYSIS
Evolutionary analysis: distances – clustering methods – rooted and un-rooted tree representation – Bootstrapping strategies – phylogenetic trees – PHYLIP.

UNIT V
GENOMICS **(11 Hours)**
DNA microarrays – structural genomics – functional genomics – proteomics comparative genomics – whole cell simulation – human genome project – systems biology – Biodiversity informatics.

UNIT VI **(05 Hours)**
LATEST LEARNINGS (For CIA Only)
Latest development related to course during the concerned semester.

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 (2005) 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.

e-books:
1.Bioinformatics: Volume I: Data, Sequence Analysis, and Evolution (Methods in Molecular Biology) 2nd ed. 2017 Edition by Jonathan M. Keith .

2. Developing Bioinformatics Computer Skills: An Introduction to Software Tools for Biological Applications 1st Edition.

Course Outcome:

After completion course students will able to:

- Describe computer networks and protocols
- Access search and retrieve information from various data bases
- Comparatively analyse the DNA and protein sequences

SEMESTER I
SUBJECT TITILE: MICROBIOLOGY

COURSE CODE: P1R1BCEC1	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course Objectives:
The student will be able to:

- Analyse the diversity of microorganisms, bacterial cell structure and function, microbial growth and metabolism.
- Understand and apply the major taxonomic groups when classifying microorganisms.
- Evaluate and apply the most appropriate sterilisation or disinfection approach for controlling the growth of microorganisms and explain how they work
- Explain the role of microorganisms in food and industrial production and preservation

UNIT I **(11 Hours)**
HISTORY AND SCOPE OF MICROBIOLOGY **(Digital Learning)**
Classification of Microorganisms- Microorganisms and their place in the living World; Historical developments of microbiology (Spontaneous generation, Germ theory of disease and Koch's postulates).; sterilization techniques, disinfectant and antiseptic agents. Microscopy - types of microscopes and their applications-simple and compound, bright field, dark field, fluorescence, phase-contrast and electron microscopes.

UNIT II **(11 Hours)**
MAJOR GROUP OF BACTERIA
Archaebacteria, Actinomycetes, Chemoautotrophs, Eubacteria, Pseudomonads, cyanobacteria, Rickettsias, chlamydias and spirochetes; Bacterial cell- structure and functions of cellular components-cell wall composition of Gram positive and Gram negative bacteria, sub-cellular organizations, flagella, capsule and spores; Bacterial Staining; antimicrobial agents-antibiotics,and antibacterial agents and their mode of action; antibiotic resistance.

UNIT III **(11 Hours)**
VIRUS AND FUNGI **(ICT learning)**
Classification, morphology and characteristics of Virus, and Fungi - structure of DNA, RNA viruses, replication of animal viruses, bacteriophages- Lysogeny and Lytic cycle; virus like agents- satellites, viroids and prions; mode of action of antiviral and antifungal drugs ; Classification of Protozoa and Helminthic parasites; Life cycle of malarial and filarial parasites; Antihelminthic and antiprotozoan drugs.

UNIT IV **(11 Hours)**
MICROBIAL CULTURE
Continuous culture and synchronous culture; composition of culture media -solid and liquid media, chemically defined media, complex and differential media; Effect of pH, temperature and radiation on microbial growth.

UNIT V **(11 Hours)**
MICROBES AND DISEASE
Major human diseases caused by bacterial, viral and fungal pathogens, Diseases of the respiratory tract- diphtheria, tuberculosis, pneumonia, influenza, mumps; Diseases of the skin- systemic mycoses, candidiasis; herpes viral infections, chicken pox, zoster and small pox; Genito-urinary infections Gonorrhea, syphilis, and HIV; Diseases of GIT- Cholera, shigellosis, salmonellosis, amebiasis, Escherichia gastroenteritis- ETEC,EIEC; Typhoid; Hepatitis; Major human protozoan diseases- Malaria, Trypanosomiasis.

UNIT VI **(05 Hours)**
LATEST LEARNINGS (For CIA Only)
Latest development related to course during the concerned semester.

Text book:

1. Ananthanarayan.R. and Jeyaram Paniker C.K. (1986) Text Book of Microbiology, Orient Longman Limited Madras.

Reference Books:

1. Pelczer M.J. Chan E.C.S. Noel R. Krieg (1993 Microbiology), Fifth Edn., Tata McGraw Hill publishing company Ltd., New Delhi.
2. Ananthanarayan.R. and Jeyaram Paniker C.K. (1986) Text Book of Microbiology, Orient Longman Limited Madras.
3. Frazier W.G. (1958) Food Microbiology. McGraw Hill Book of Company New York.
4. Power C.B. & Daginawala H.F. (1996) General Microbiology Volume I & II. Himalaya Publishing House , Bombay.
5. Stainer R.Y. Ingraham JL.Wheels M.L. & Painter P.R. (1992) General Microbiology, Macmillan, London.
6. Sharma P.D. (1993) Microbiology, Rastogi and Co., Meerut.
7. Purohit S.S (1992) Microbiology-Fundamentals and applications, Agro Botanical Publishers, India.

e-Books

1. Fundamentals of Microbiology, 2008 by Pelczar, Reid and Chan
2.Essentials of Medical Microbiology 2013 by Rajesh Bhatia

Course Outcomes:

At the end of the course the student will be able to:

- Explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations;
- Describe diversity of microorganisms, bacterial cell structure and function, microbial growth and metabolism, and the ways to control their growth by physical and chemical means
- Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes.
- Understand the Microbes and Diseases-major human diseases caused by bacterial, viral and fungal pathogens.

SEMESTER-II
SUBJECT TITLE: ENZYME TECHNOLOGY

COURSE CODE: P2R1BCCC5	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives:
The student will be able to:

- Enhance the understanding of enzymes, their mechanisms, kinetics, purification and
- characterization
- Gain an enhanced overall understanding of enzyme assays and in particular the influence of various physicochemical characteristics upon enzyme activity.
- Gain an understanding of buffers and their importance in the context of pH control.

Unit I **(11 Hours)**

ENZYME CLASSIFICATION AND TYPES

Classification of enzymes - Mechanisms of enzyme action, concept of active site and energetic of enzyme substrate complex formation - Specificity of enzyme action – Principles of catalysis - Collision theory, transition state theory - Role of entropy in catalysis - Types of enzymes - constitutive enzyme, induced enzymes, intracellular and extracellular enzymes.

Unit II **(11 Hours)**

ENZYME CATALYSIS **(Digital Learning)**

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 **(11 Hours)**

ENZYME KINETICS **(Digital Learning)**

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 **(11 Hours)**

CLINICAL APPLICATIONS OF ENZYMES **(ICT learning)**

Enzyme as diagnostic reagents, antibodies as analytical reagents. therapeutic enzymes. Overview of applications of immobilized enzyme systems. Determination of enzymes activities for clinical diagnosis-phosphatases,transaminases,amylase,cholinesterase.enzyme inhibitors and drug design, enzyme therapy. Applications of enzymes in pharmaceutical and other Biomedical important enzymes for analytical and diagnostic applications. Overview of applications of immobilized enzyme systems.

Unit V **(11 Hours)**

INDUSTRIAL APPLICATION OF ENZYMES **(ICT learning)**

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.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

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.

e-Books

1.Clinical Chemistry and Enzymology 2011 by Jaromir Kotyza.
2.Methods in enzymology 2006 by SIDNEY P. COLOWICK

Course Outcomes:

At the end of the course the student will be able to

- Explain the characteristics and catalytic mechanisms of enzymes
- Identify enzyme inhibition patterns and determine kinetics of single substrate enzyme catalyzed reactions
- Characterize enzymes and design enzyme assays
- Describe immobilization techniques, and their principles, advantages and disadvantages
- Illustrate the applications of enzymes

SEMESTER II
SUBJECT TITILE: PLANT BIOCHEMISTRY

COURSE CODE: P2R1BCCC6	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course objectives:
After the completion of the course the student will have

- A complete knowledge about the plant biochemistry system.
- A detailed information nitrogen metabolism and plant hormones.
- To understand about plant stress physiology and plant growth metabolism.

UNIT I **(11 Hours)**
Introduction to Plant cells
Photosynthesis: Chloroplast- structure and function; Photosynthetic pigments and light harvesting complexes, Photo inhibition of photosynthesis, Photosynthetic carbon reduction (PCR) cycle, C4 syndrome and Crassulacean acid metabolism. Oxidative respiration, Alternate electron pathways and Respiration rate.

UNIT- II **(11 Hours)**
Nitrogen metabolism
Physical and biological nitrogen fixation, Ammonification, Nitrification, Denitrification, Biochemistry and Genetics of nitrogen fixation and Ammonium assimilation.
Plant Hormones: Biosynthesis, Physiological effects and mechanism of action of Auxins, Gibberellic acids, Cytokinins, Abscisic acid, Ethylene, Brassinosteroids and Polyamines.

UNIT- III **(11 Hours)**
Plant Stress physiology
Plant stress, Plant responses to abiotic and biotic stresses, Water deficit and drought resistance, Flooding, Temperature stress, Salt stress, Ion toxicity, Pollution stress and potential biotic stress (insects and diseases). Radiations and their impact on plant growth and metabolism, criteria of stress tolerance.

UNIT IV **(11 Hours)**
Secondary metabolites
Special features of secondary plant metabolism, terpenes (classification, biosynthesis), lignin, tannins, pigments, phytochrome, waxes, alkaloids, biosynthesis of nicotine, functions of alkaloids, cell wall components.

UNIT V **(11 Hours)**
Toxins of plant origin
Mycotoxins, phytohemagglutinins, lathyrogens, nitriles, protease inhibitors, protein toxins. Antioxidative defence system in plants – reactive oxygen species and their generation, enzymic and non-enzymic components of antioxidative defence mechanism.

UNIT VI **(05 Hours)**
LATEST LEARNINGS (For CIA Only)
Latest development related to course during the concerned semester.

Text Book:
1.Mukherji, S and Gosh A. K. Plant Physiology. 2 nd ed. New Central Book Agency, Kolkata, 2005.

Reference Book :

1.Hopkins, W. G and Huner, N. P. A. Introduction to Plant Physiology. 3 rd ed. John Wiley & Sons Inc. New York, 2004.

e-Books

1. Handbook of Plant and Crop Physiology 2002 by A. D. McLaren and G. H. Peterson
2. Plant Biochemistry 2011 by Hans-Walter Heldt

Course Outcomes:

At the end of the course the student will be able to:

- Explain the mechanism of photosynthesis and nitrogen metabolism in plants.
- Describe about the plant stress, plant responses to abiotic and biotic stresses.
- Understand the Special features of secondary plant metabolites and their function.
- Understand the Toxins of plant origin, plants – reactive oxygen species.

SEMESTER II
SUBJECT TITLE: CORE PRACTICAL - II

COURSE CODE: P2R1BCCC7P	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:40**
CREDIT: 5	**EXTERNAL MARKS:60**
	HOURS/WEEK: 5

Course objectives:
The student will be able to

- Know the Microbial Techniques
- Follow the Plasmid DNA and estimations by DNP methods
- Follow the Enzyme Kinetics methods

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. Comet assay
18. Southern blotting
19. Northern blotting
20. Immunodiffusion – Single radial and double diffusion
21. Immuno electrophoresis

Reference Books

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)
4. (1192) A hand book on the biology of bacteria, eco-physiology isolation identification and application, springer verlag.
5. Methods in Molecular biology and protein chemistry by Brenda D. Spangler 2002. John Wiley and sons Ltd.
6. Recombinant gene expression protocols by Trans Rs (1997) Human a press.
7. Manuals in Biochemistry, Dr. J. Jeyaraman
8. Practical Biochemistry, Warley
9. Practical Biochemistry, Phummer
10. Practical Clinical Biochemistry, Herald warley

Course Outcomes:

At the end of the course the student will be able to:

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands .
- They will also get practical knowledge of the Media Preparation, culturing and plating techniques
- Gain technical experience and handle adjustable micro pipettes in a reproducible manner
- Demonstrate the use of standard curves related to bacterial growth
- Plan experiments, write protocols
- Perform logical reasoning and criticizing data
- Know blotting techniques and Immunodiffusion methods

SEMESTER II
SUBJECT TITLE: METABOLISM AND REGULATION

COURSE CODE: P2R1BCCC8	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives:
The students will be able to

- Know the importance of various metabolisms
- Learn the strategies of different types of metabolic regulation

(11 Hours)

UNIT I
BIOENERGETICS

Free energy, high energy compounds-ATP,Biological oxidation, electron transport chain-mechanism and inhibitors. oxidative phosphorylation-mechanism,energetics and inhibitors.
Transport of reducing equivalents-glycerol phosphate shuttle and malate-aspartate shuttle.
An outline of anabolism and catabolism.methods employed to study metabolism.

UNIT II **(11 Hours)**
CARBOHYDRATE METAOLISM **(ICT learning)**

Glycolysis- pathway,energetics and regulation. HMP shunt-pathway,regulation and importance, gluconeogenesis-pathway,regulation and importance.TCA cycle – pathway, enegetics,regulation and significance. Glycogen metabolism: pathway and regulation of Glycogenesis and Glycogenolysis.Metabolism of galactose – pathway and importance. Metabolism of fructose.Uronic acid pathway.

UNIT III **(11 Hours)**
LIPID METABOLISM **(ICT learning)**

Fatty acid synthesis and its regulation. Fatty acid oxidation – β-oxidation,α- oxidation and ω- oxidation. Phospholipids and Triacylglycerol -Synthesis,degradation and regulation.lipoproteins-classification,metabolism and importance. cholesterol- Biosynthesis,regulation and degradation. ketone bodies – pathway,utilization and regulation. Synthesis and regulation of prostaglandins, eicosonids, thromboxins and leucotriens.

UNIT IV **(11 Hours)**
AMINO ACID METABOLISM **(ICT learning)**

Amino acid pool-sources and utilization . Metabolism of aminoacids -transamination and deamination. Metabolism of ammonia- formation, disposal and toxicity. Urea cycle - pathway, regulation, disposal. Metabolism of glycine , phenylalanine, tryptophan- synthesis ,degradation and importance Metabolism of branched chain amino acid. Fate of carbon skeleton of amino acids . Biosynthesis and degradation of hemoglobin.

UNIT V **(11 Hours)**
NUCLEIC ACID METABOLISM **(ICT learning)**

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 deoxyribo nucleotides by activators and inhibitors. Integration of metabolism- integration of major metabolic pathways of energy metabolism. Metabolic interrelationship among major tissues during well fed state and starvation.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

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.

Reference Books

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.

e-Books

1.Textbook of Biochemistry , 2011·by Thomas M. Devlin, Ph.D
2.Biochemistry,2004 by Strayer

Course outcomes:

After completion of this course, the students will be able to

- To understand the energy production and utilization in the body
- To expose the knowledge of metabolism to our society
- To understand the avoid of starvation

SUBJECT TITLE: PRINCIPLES OF BIO – STATISTICS

COURSE CODE: P2R1BCEC2	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives

- To recognize the importance of Bio-Statistics
- To use technology to perform regression analysis
- To derive Mathematical Expectation, Binomial, Poisson and Normal Distribution
- To interpret concepts of sampling results correctly, effectively and in context
- To demonstrate a solid understanding of interval estimation and hypothesis testing

Unit I: **Introduction of Bio-Statistics and correlation**

Introduction to Bio-Statistics – Definition of Bio-statistics – Development of Bio-statistics – Application of Bio-statistics – Role of Bio-statistics

Correlation Analysis: Correlation – Correlation co-efficient – Scatter Diagram – Spearman's rank correlation co-efficient (Related problems)

Unit II: **Regression**

Regression Analysis: Regression – Regression co-efficient – properties – Linear Regression line (Related problems)

Unit III: **Probability Distribution**

Theoretical Distribution – Binomial, Poisson and Normal Distributions (Basic theory and related problems)

Unit IV: **Sampling**

Basic Concepts of Sampling – Simple random sample stratified sample and systematic sampling, sample statistic, sampling distribution and standard error

Unit V: **Testing of Hypothesis**

Test of significance – Test for mean and difference of means – Student t - test, Chi - Square test, F-test, ANOVA: one way and two way classification

Unit –VI:

Latest development related to the course during the semester concerned. [For continuous CIA Assessment only]

Text Books:

[1] "Biostatistics" – P.N.Arora and P.K. Malhan, Himalaya Publication House, 2006.

[2] "Statistical and Numerical Methods" – PR. Vittal, V. Malini.

Unit I: Chapter 1 Sec 1.1 – 1.4 [1]
Chapter 13 sec 13.1 - 13.61 [2]
Unit II: Chapter 14: sec 14.1 - 14.30 [2]
Unit III: Chapter 17 sec 17.1 - 17.21 [2]
Chapter 18 sec 18.1 - 18.17 [2]
Chapter 20 sec 20.1 - 20.22 [2]
Unit IV: Chapter 30 sec 30.1 - 30.18 [2]
Unit V: Chapter 26 sec 26.1 - 26.33 [2]
Chapter 27 sec 27.1 - 27.29 [2]
Chapter 28 sec 28.1 - 28.18 [2]

Reference Books:

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

e-book

1.Bioinformatics Techniques for Drug Discovery: Applications for Complex Diseases (SpringerBriefs in Computer Science) Paperback – April 26, 2018 by Aman Chandra Kaushik (Author), Ajay Kumar (Author), & 3 more

Course Outcomes:

The students will be able to

- Interpret results of descriptive statistics methods effectively.
- Demonstrate an understanding of the central concepts of Regression Analysis
- Discuss the relation between Binomial and Poisson Distribution
- Interpret results of the principal methods of statistical inference and design.
- Communicate the results of statistical analysis accurately and effectively.

SEMESTER II
SUBJECT TITLE: BIOPHARMACEUTICALS

COURSE CODE: P2R1BCEC3	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course 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
- To study the different guidelines for manufacturing of drugs and
- In-depth study of intellectual property rights.

UNIT I : (11 Hours)
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: (11 Hours)
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 III: (11 Hours)
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 IV: (11 Hours)
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: (11 Hours)
DRUG DISCOVERY AND REGULATORY AFFAIRS
Drug discovery –By combinatorial chemistry and molecular diversity. Therapeutic targets for drug discovery. Pharmaceutical products- their manufacturing, Registration and their requirement looking to WHO- GMP, US-FDA regulation, ICH guidelines. Computer Based Data Mining in Drug Research, Pharmaceutical Product Management Aspect

UNIT VI (05 Hours)
LATEST LEARNINGS (For CIA Only)
Latest development related to course during the concerned semester.

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.

Reference Books:

1.W.O.Foye " Principles of medicinal chemistry
2.Satoskar " Pharmacology.

e-Books

1.Pharmaceutical biochemistry, 2015 by DR. SIPOS KATALIN

2. Bio pharmaceuticals Biochemistry and Bio technology 2004 by Gary Walsh

Course outcomes:

After the completion of the course the students will able to:

- Gain detail understanding of how drug acts inside the body.
- Understand the process of product registration and different guidelines which control the manufacturer to follow Correct strategy for manufacturing of drug.
- Write and file the patent; document clinical data of the concern
- Undergo drug research.

SEMESTER III
SUBJECT TITLE: CLINICAL BIOCHEMISTRY

COURSE CODE: P3R1BCCC9	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course Objectives:
The students will able to:

- Understand the organ function tests for various diseases
- Impart thorough knowledge about the biochemical basis of various disorder

UNIT I **(14 Hours)**
SPECIMEN COLLECTIONS **(Lab Oriented Learning)**
Collection of blood by various methods, anticoagulants, collection of urine, 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 **(14 Hours)**
WATER AND ELECROLYTE 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 electrolyte balance.

UNIT III **(14 Hours)**
ORGAN FUNCTION TESTS **(Lab Oriented Learning)**
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,nephrotic syndrome and nephrolithiasis. Gastric function tests- pathogenesis, management of peptic ulcer and gastritis. Pancreatic function test:causes,biochemical findings,consequences of pancreatitis and cystic fibrosis

UNIT IV **(14 Hours)**
INBORN ERRORS METABOLISM **(Lab Oriented Learning)**
Disorders of carbohydrate metabolism-glycogen storage diseases,galactosemia, fructosuria.Disorders of lipid metabolism-lipid storage diseases, fatty liver and lipoproteinemias. Disorders of amino acid metabolism-phenylketonuria, hartnup's disease, alkaptonuria, albinism, maple syrup urine diseases.Disorders of purine and pyrimidine metabolism- gout, orotic aciduria. Disorders of porphyrin metabolism- porphyrias.

UNIT V **(11 Hours)**
DIABETES , ATHEROSCLEROSIS AND CANCER **(Lab Oriented Learning)**
Blood glucose homeostasis-role of tissues and hormones. Diabetes mellitus-classification, complications, diagnosis and management.Atheroscelerosis-risk factor, biochemical findings and management. Cancer-types,invasion and metastasis.Tumor markers-neuron specific enolase, prostate specific antigen, oncofetal antigen, AFP, CEA. Carbohydrate markers, genetic marker, p53 gene, Ras gene. Free radicals in diseases and its management.

UNIT VI
LATEST LEARNINGS (For CIA Only) **(05 Hours)**
Latest development related to course during the concerned semester.

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

Reference books

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.
3. Michael Murphy, Rajeev Srivastava, Kevin Deans, Clinical Biochemistry, 6th edition, 2018, Elsevier.

e-Books

1.Clinical biochemistry 2016 by Racek, Jaroslav
2.Clinical Biochemistry and Metabolic Medicine 2011 by Martin A Crook

Course outcomes:

After completion of this course, the students will be able to:

- Understand the collection and preservation of biological specimens.
- Establish clinical lab in future
- Understand basic concepts in various clinical disorders.

SEMESTER III
SUBJECT TITLE: CORE PRACTICAL

COURSE CODE: P3R1BCCC10P	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:40**
CREDIT: 5	**EXTERNAL MARKS:60**
	HOURS/WEEK: 5

Course objectives:
The student will be able to:

- Know the Hematological Observations
- Follow the Biochemical analysis of blood
- Follow the Urine Analysis

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 ESR

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

Reference Book:

1. Manuals in Biochemistry ,Dr.J.Jayaraman

Course Outcomes:
At the end of the course the student will be able to:

- fabricate components with their own hands .
- Have practical knowledge of the Biochemical analysis of blood
- Critically evaluate the role of clinical biochemistry in diagnosis, monitoring and treatment.
- Gain technical experience and handle adjustable micro pipettes in a reproducible manner
- Clinically assess the laboratory indicators of physiologic conditions and diseases Plan experiments, write protocols
- Perform logical reasoning and criticizing data

SEMESTER III
SUBJECT TITLE : MOLECULAR ENDOCRINOLOGY

COURSE CODE: P1R1BCCC11	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course Objectives:
The student will be able to:

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

UNIT I **(14 Hours)**
PITUITARY HORMONE **(e-learning)**
Hormones-classification, biosynthesis, circulation, modification and degradation.Hormone receptors-structure and regulation. Mechanism of hormone action.Hypothalamic releasing factors.Anterior pituitary hormone: biological actions, regulation and disorders of growth hormone, ACTH and prolactin. Posterior hormone-biological actions and regulation of vasopressin. Diabetes insipidus and SIADH secretion. Oxytocin. Hypopituitarism.

UNIT II **(14 Hours)**
THYROID AND PARATHYROID HORMONE **(e-learning)**
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 Parathyroid hormone, Calcitonin and calcitriol- mechanism of action,regulation and role . Hypocalcaemia and hypocalcaemia, rickets and osteomalacia.

UNIT III **(14 Hours)**
ADRENAL HORMONE **(e-learning)**
Adrenal cortical hormones - Synthesis, regulation, transport, metabolism and biological effects of glucocorticoids and mineralocorticoids. 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 **(14 Hours)**
SEX HORMONE AND PANCREATIC HORMONEAS **(e-learning)**
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.Ammenorrhoea. Pancreatic hormone-synthesis, regulation, biological effects and mechanism of action of insulin glucagon and somatostatin.

UNIT V **(11 Hours)**
SIGNAL TRANSDUCTION **(ICT learning)**
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.

UNIT VI **(05 Hours)**
LATEST LEARNINGS (For CIA Only)
Latest development related to course during the concerned semester.

Text Books

1. Biochemistry – Lehninger
2. Mammalian Biochemisity -white, Handler & Smith
3. Harper`s Biochemistry-Murray et al., 26th 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

e-Books

1. Textbook of Biochemistry 2011 by Thomas M. Devlin, Ph.D
2. Principles of Biochemistry 2004 by Lehninger

Course outcomes

After completion of this course, the students will be able to:

- Understand the endocrine system of the study
- Prevent the hormonal disorder in future
- Protect the body from diabetes mellitus

SEMESTER III
SUBJECT TITILE: IMMUNOTECHNOLOGY

COURSE CODE: P3R1BCCC12	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course objectives:
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 transplantation.
- A brief knowledge about the imbalanced immune response.

UNIT-I: (14 Hours)
LYMPHOID SYSTEM, ANTIGENS AND ANTIBODY (ICT learning)
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: (14 Hours)
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: (14 Hours)
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: (14 Hours)
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: (11 Hours)
HYPERSENSITIVITY AND AUTOIMMUNE DISORDERS (ICT learning)
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.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

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.
4. Jennipant, Sharon stranford, Patricia Jones, Juelith A.Owen, Kuby Immunology, 2018, W.H.Freeman

e-Books

1. Textbook of Biochemistry 2011 by Thomas M. Devlin, Ph.D
2. Principles of Biochemistry 2004 by Lehninger

Course Outcomes:

At the end of the course the student would have:

- Acquired knowledge regarding the lymphoid organs.
- Understood about the immune cells.
- Become aware of vaccination.
- Obtained detailed knowledge regarding immune imbalance.

SEMESTER III
SUBJECT TITILE: MOLECULAR BIOLOGY

COURSE CODE: P3R1BCCC13	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course objectives:
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: (14 Hours)
DNA REPLICATION (ICT learning)
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 : (14 Hours)
TRANSCRIPTION (ICT learning)
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: (14 Hours)
GENETIC CODE AND TRANSLATION (Digital Learning)
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: (14 Hours)
PROTEIN TRANSPORT AND GENE EXPRESSION (ICT learning)
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: (11 Hours)
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.

UNIT VI

LATEST LEARNINGS (For CIA Only) **(05 Hours)**

Latest development related to course during the concerned semester.

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.
5.David,P.Clark, Nanette J.Pazdernik, Michelle R.McGehee, Molecular Biology, 3rd edition, Academic cell.

Course Outcomes:

At the end of the course the student would have:

- Acquired knowledge about the complete structure and replication of prokaryotic and eukaryotic DNA.
- Understood about the various types of RNA and their mechanism of synthesis.
- Become aware of the genetic code and the way the codes are translated into functional form of proteins.
- Obtained detailed knowledge regarding DNA damage and repair mechanism.

SEMESTER -IV
SUBJECT TITILE: BIOTECHNOLOGY AND GENETIC ENGINEERING

COURSE CODE: P3R1BCCC14	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives:

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 **(11 Hours)**

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 **(11 Hours)**

DNA CLONING AND SEQUENCING **(ICT learning)**

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 **(11 Hours)**

GENE TRANSFER AND APPLICATIONS **(Digital Learning)**

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 **(11 Hours)**

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 **(11 Hours)**

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.

UNIT VI

LATEST LEARNINGS (For CIA Only) **(05 Hours)**

Latest development related to course during the concerned semester.

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, 2ndedition, 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.

e-Books

1. Introduction to biotechnology and genetic engineering 2007 by Vishal Nanda
2.Molecular Biology and Biotechnology 5th Edition 2009 by John M Walkerse

Course Outcomes:

At the end of the course the student would have:

- Gained insight in applications or recombinant DNA technology .
- Understood the principles of animal culture, media preparation.
- Known the bio safety hazards .
- Aquired knowledge about the IPR patent and about the bioethics and human research

ELECTIVE COURSE
MEDICINAL PLANTS AND PHYTOTHERAPY

	TOTAL MARKS:100
TOTAL HOURSRS: 60	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives :

- To provide knowledge of general medicinal plants.
- To understand the mechanism of action of drugs
- To provide the basic methodology of the structure extraction and separation techniques

UNIT-1 **(11 Hours)**

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 **(11 Hours)**

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 **(11 Hours)**

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 **(11 Hours)**

BIOTECHNOLOGY OF MEDICINAL PLANTS

ProducEtion 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 **(11 Hours)**

MECHANISM OF ACTION

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

UNIT VI

LATEST LEARNINGS (For CIA Only) **(05 Hours)**

Latest development related to course during the concerned semester.

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.

Course Outcomes:

At the end of the course the student would have:

- Aquired knowledge about the identification of the medicinal plant and their use.
- Gained skill in extracting the secondary metabolites from the plants.
- Obtained knowledge about quantifying and identifying the various biochemical components present in the plant extract.

SUBJECT TITLE: ELECTIVE COURSE
EVOLUTIONARY AND ENVIRONMENTAL BIOLOGY

	TOTAL MARKS:100
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives :

- To provide knowledge of evolutionary biology
- To understand the biodiversity
- To provide knowledge about various resources and their conservation

Unit I **(11 HOURS)**

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 **(11 Hours)**

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 **(11 Hours)**

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 **(11 Hours)**

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 **(11 Hours)**

BIODIVERSITY

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

UNIT VI

LATEST LEARNINGS (For CIA Only) **(05 Hours)**

Latest development related to course during the concerned semester.

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.

Course Outcomes:

At the end of the course the student would have:

- Gained knowledge about biodiversity.
- Obtained skill in identifying the resources and conserve them.
- Known the value of biodiversity.

SUBJECT TITLE: ELECTIVE COURSE
BIOPROCESS TECHNOLOGY

	TOTAL MARKS:100
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives :

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

Uint I **(11 Hours)**

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 **(11 Hours)**

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 **(11 Hours)**

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

Unit IV **(11 Hours)**

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 **(11 Hours)**

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

UNIT VI

LATEST LEARNINGS (For CIA Only) **(05 Hours)**

Latest development related to course during the concerned semester.

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

Reference Books:

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.

Course Outcomes:

At the end of the course the student would have:

- Obtained knowledge in Cloning the gene of interest.
- Known the various methods to introduce the chimeric DNA into the host.
- Aquired skill in expressing the gene of interest in a host.

SUBJECT TITLE: ELECTIVE COURSE
GENOMICS AND PROTEOMICS

	TOTAL MARKS:100
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives :

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

UNIT-I **(11 Hours)**

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 **(11 Hours)**

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 **(11 Hours)**

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 **(11 Hours)**

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 **(11 Hours)**

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

UNIT VI

LATEST LEARNINGS (For CIA Only) **(05 Hours)**

Latest development related to course during the concerned semester.

Reference Books:

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

Course Outcomes:

At the end of the course the student would have:

- Known the gene structure.
- Acquired knowledge on proteomics.

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