



VELS



INSTITUTE OF SCIENCE, TECHNOLOGY
& ADVANCED STUDIES (VISTAS)

(DEEMED TO BE UNIVERSITY Estd. u/s 3 OF THE UGC ACT, 1956)

NAAC ACCREDITED

PALLAVARAM - CHENNAI - INDIA

M.Sc.

BIOCHEMISTRY

Curriculum and Syllabus

(Based on Choice Based Credit System)

Effective from the Academic year

2019-2020

**Department of Biochemistry
School of Life Sciences**

M.Sc. BIOCHEMISTRY
REGULATIONS

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES

M.Sc. BIOCHEMISTRY

POST GRADUATE DEGREE COURSE

REGULATIONS

(Effective from the Academic Year 2018-19)

1. ELIGIBILITY FOR ADMISSION

Candidates for admission to the first year of the post graduate degree course in M.Sc. Biochemistry shall be required to have a Bachelor's degree in Science of any recognized University with Biochemistry, Microbiology, Biotechnology, Chemistry and Life Sciences as their main subject.

2. ELIGIBILITY FOR AWARD OF THE DEGREE

A candidate shall be eligible for the award of the Degree only if he/ she has undergone the prescribed course of study in the University for a period of not less than two academic years, passed the examinations of all the four semesters prescribed earning 90 credits and fulfilled such conditions as have been prescribed therefore.

3. DURATION OF THE PROGRAM

The duration of the course is for two academic years consisting of four semesters.

- a) Each academic year shall be divided into two semesters. The first academic year shall comprise the first and second semesters, the second academic year the third and fourth semesters respectively.
- b) The odd semesters shall consist of the period from July to December of each year and the even semesters from January to June of each year. There shall be not less than 90 working days for each semester.

4. ATTENDANCE

Students coming late will not be given attendance. Attendance is recorded for each hour separately. One hour of absence for each session is considered as being absent for the entire session. No student is permitted to absent himself/herself without prior sanction of leave. If a

student absent himself/herself for a week without leave, his/her name will be removed from the rolls. He/She has to get permission for re-admission after furnishing valid reasons.

Students appearing for the university examinations must have a minimum of 75 % attendance, failing which they will not be permitted to write the examinations. However, the University may condone the attendance shortage of 10 % after collecting a condonation fee from the students who have secured 65 to 74 % of attendance.

5. COURSE OF STUDY

The Main Subject of study for Masters Degree shall consist of the following.

- [1] CORE COURSES consisting of Fundamental papers, Practicals, Project and Internship.
- [2] ELECTIVE COURSES consisting of a) Discipline Specific Electives and (b) Generic Electives
- [3] COURSE ON COMMUNICATION SKILLS

6. SCHEME OF EXAMINATION

The University follows semester pattern with Credit Based Semester System (CBSS). The post graduate course is for four semesters. There shall be four examinations, the odd semester examinations at the middle of the academic year and even semester examinations at the end of the academic year.

The students have to earn minimum credits assigned by the Board of Studies to become eligible for the award of the degree. Students of post graduate courses are to undergo a course in communication skills during the first and second semesters, each carrying two credits.

For the students admitted from the academic year 2015-2016, the components of Continuous assessment and semester end examination marks are 40% and 60% respectively.

A passing minimum mark in continuous assessment is not necessary to get a pass. The statement of marks will be issued to the students on par with International Standard incorporating Weighted Average Marks (WAM) and Grade Point Average (GPA) for each semester.

Registration for exams - All candidates shall register their names for the first semester examinations and will be permitted to proceed up to final year irrespective of their failure in any of the semester examinations. The candidates should register for all the arrear subjects of earlier semesters along with the current semester subjects.

Practical examination -Practical examinations will be conducted at the end of the respective semesters.

Internship

The students have to undergo an internship for a period of four to six weeks for which they earn two credits.

Project

The course will have a project work in their final semester and the students have to earn the number of credits prescribed for by the Board of Studies.

7. REVALUATION OF ANSWER SCRIPTS

Revaluation of answer scripts for the current semester is permissible. The students have to apply for revaluation in the prescribed format within 10 days from the date of publication of results along with prescribed fee.

8. SUPPLEMENTARY EXAMINATION

A supplementary examination will be conducted during the month of July/August for Final semester students who have failed in one or two subjects so as to enable the students to qualify for the course to get their degree instead of waiting for another six months (i.e., till December) to appear for the failed subjects.

9. INTERNAL ASSESMENT:

The revised break-up marks of continuous assessment as applicable to PG courses has been shown as below

S.No.	Test Component	PG
1.	Two C.A. class tests	10 (2x5)
2.	Assignment/Class Seminar	05
3.	Model Examinations	05
4.	Attendance	05
5.	Field visit/Internship etc - PG	05
6	Aptitude of the Student	05
7.	Student's assessment by the Faculty	05
Total Marks		40

10. DISTRIBUTION OF MARKS FOR ATTENDANCE

S.No.	Percentage of Attendance	Marks
1.	91 % to 100 %	05
2.	75 % to 90 %	04
3.	65 % to 74 %	03
4.	Less than 65 %	00

11. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER

Candidates shall register their names for the First Semester Examination after the admission in the PG Courses.

Candidates shall be permitted to proceed from the First Semester upto Final Semester irrespective of their failure in any of the Semester Examinations subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subsequent) semester subjects.

Candidates shall be eligible to go to subsequent semester, only if they earn sufficient attendance as prescribed by the Board of Management from time to time, provided in case of a candidate earning less than 50% of attendance in any one of the semester due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Dean/Director & Head of the Department, shall be permitted to proceed to the next semester and to complete the Course of Study. Such candidates shall have to repeat the missed Semester by rejoining after completion of Final Semester of the Course, after paying the fee for the break of study as prescribed by the University from time to time.

12. PASSING MINIMUM

A candidate shall be declared to have passed in each paper/ practical of the Main Subject of Study wherever prescribed, if he/she secures not less than 50% of the marks prescribed for the examination. He/She shall be declared to have passed the whole examination, if he/she passes in all the papers and practical wherever prescribed / as per the scheme of examinations earning 90 credits.

13. RANKING

Candidates who pass all the subjects as prescribed for the Course in the first appearance itself or those with a break in the First Appearance due to the reasons as furnished in the Regulations 7(iii) supra are only eligible for Classification / Distinction.

14. TRANSITORY PROVISION

Candidates who have undergone the course of study prior to the academic year will be permitted to appear for the examinations under those Regulations for a period of two years i.e., up to and inclusive of April / May 2017 Examinations. Thereafter, they will be permitted to appear for the examination only under the regulations then in force.

M.Sc BIOCHEMISTRY CURRICULUM

Total Credits - 90

CATEGORY	CODE	TITLE OF THE PAPER	Hours / Week			CREDITS
			L	T	P	
SEMESTER I						
CORE		Chemistry of Biomolecules	5	-	-	4
CORE		Advanced Instrumental Techniques	5	-	-	4
CORE		Practical I Biochemistry & Instrumentation Lab	-	-	10	3
DSE		Discipline Specific Elective 1	4	-	-	4
DSE		Discipline Specific Elective 2	4	-	-	4
GE		Generic Elective 1	2	-	-	2
		Total	20	-	10	21
SEMESTER II						
CORE	15MBC004	Enzymology	5	-	-	4
CORE	15MBC005	Intermediary metabolism	5	-	-	4
CORE	15MBC006	Practical II Biotechnology Lab	-	-	4	3
CORE	15MBC007	Practical III Microbiology Lab	-	-	4	3
DSE		Discipline Specific Elective 3	4	-	-	4
DSE		Discipline Specific Elective 4	4	-	-	4
GE		Generic Elective 2	2	-	-	2
GE		Generic Elective 3	2	-	-	2
		Total	22	-	8	26
SEMESTER III						

CORE		Genetics and Molecular Biology	5	-	-	4
CORE		Clinical biochemistry	5	-	-	4
CORE		Practical III Clinical Biochemistry Lab	-	-	10	3
DSE		Discipline Specific Elective 5	4	-	-	4
DSE		Discipline Specific Elective 6	4	-	-	4
GE		Generic Elective 4	2	-	-	2
CORE		Internship	-	-	-	2
		Total	20	-	10	23
SEMESTER IV						
CORE	15MBC011	Toxicology and Forensic Biochemistry	4	-	-	4
CORE	15MBC012	Project	26	-	-	16
		Total	30	-	-	20

TOTAL CREDITS

90

List of Electives

List of Discipline Specific Electives

1. 15MBC101 Human Physiology And Basics Of Anatomy
2. 15MBC102 Cell Biology
3. 15MBC103 Fundamentals Of Computers, Biostatistics And Research Methodology
4. 15MBC104 Phytochemistry, Pharmacognosy & Quality Control
5. 15MBC105 Microbiology And Immunology
6. 15MBC106 Biotechnology and IPR
7. 15MBC107 Modern Lifestyle Associated Diseases
8. 15MBC108 Neurobiology
9. 15MBC109 Endocrinology
10. 15MBC110 Plant Biochemistry
11. 15MBC111 Biochemical Toxicology
12. 15MBC112 Molecular Developmental Biology
13. 15MBC113 Nanotechnology
14. 15MBC114 Stem cell technology
15. 15MBC115 Cancer Biochemistry
16. 15MBC116 Biochemistry of cell signaling
17. 15MBC117 Environmental Science

List of Generic Electives

1. 15MBC151 Communicative English I
2. 15MBC152 Communicative English II
3. 15MBC153 Bioinformatics
4. 15MBC154 Pathological Basis of Diseases
5. 15MBC155 Biomaterials
6. 15MBC156 Medicinal Botany

CORE COURSES

Course objectives

The objective is to study about the structure and biological functions of macromolecules such as proteins, polysaccharides, lipids, and nucleic acids, as well as small molecules such as primary metabolites, secondary metabolites, and natural products.

Course outcomes (Employability)

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

CO1: Easily understand the basic concepts/functions of solutes, chemical bonding and organic compounds

CO2: Describe the classification of biomolecules

CO3: Describe the basic reaction types and mechanisms of bio molecules

CO4: Understand the structures and functions of biomolecules

CO5: Analyse and study the chemical and biochemical properties of bio molecules

CO6: Understand relationships between biological molecules and human health

CO7: Identify biomolecules structural differences and its properties

CO8: Gain an understanding the basic principle of chemistry as well as biology

CO9: Understand the scope of biological chemistry

CO10: Easily understand the interrelationship of organic compounds and homeostasis in biological organisms

Unit 1 Carbohydrates (12)

Carbohydrates: Classification of Carbohydrates. Structure and functions of Monosaccharides, Disaccharides and Polysaccharides. Structure and biological importance of sugar derivatives, Glycosaminoglycans, Proteoglycans, Glycoproteins and Lipopolysaccharides.

Unit 2 Proteins (12)

Classification, structure and properties of amino acids and proteins. Structural organisation of proteins – Primary structure and its determination, Secondary and Super secondary structures, Tertiary and Quarternary Structure. Peptide Synthesis. Isolation and purification of proteins.

Unit 3 Lipids (12)

Lipids- Classification, structure and functions of fatty acids, alcohols and lipids. Physical and chemical properties of fatty acids. Structure and function of Eicosanoids, Lipoproteins-classes, transport and functions. Steroids.

Unit 4 Nucleic acids (12)

Structure of nucleosides, nucleotides. DNA double helical structure. A, B and Z forms of DNA. Triple and quadruple structure. DNA super coiling and linking number. Properties of DNA – buoyant density, viscosity, hypochromicity, denaturation, renaturation, Cot curve. Chemical synthesis of oligonucleotides. DNA sequencing. Major classes of RNA, their structure and biological role.

Unit 5 Nanoparticles

(12)

Definition of a nanosystem, Basic concepts of nanoscience and technology. Time and length scale in structures. Overview on nanomaterials. Protein nanoparticles. **Biological nanostructures, Novel delivery routes using nanoparticles with special reference to drug delivery process.**

Total : 60 hours

Text Books

1. J.L.Jain et al. Fundamentals of Biochemistry by S.Chand and Company 4th edition, 1994.
2. M.N.Chatterjea and Ranashinde Text book of Medical biochemistry Jaypee Brothers Medical Publisher (P) Ltd, 6th edition 2005.

Reference Books

1. Lippincott's illustrated biochemistry – Champe and Harvey; 6th edition 2007.
2. D.Voet and J.G. Voet, Biochemistry, John Wiley & Sons, USA 2004.
3. Albert L. Lehninger Principles of Biochemistry CBS Publishers & Distributors, New Delhi, 4th edition 2004.

Reference Books

1. Malcolm Dixon and Edwin Clifford Webb, Enzymes (Volume 6), 1964
2. Trevor Palmer, Understanding Enzymes, 4th edition, 1995
3. Robert K Murray , Daryl Granner and Victor W Rodwell, Harper's illustrated biochemistry, 27th edition; 2006
4. Julio Polaina and Andrew P MacCabe (Editors), Industrial Enzymes: Structure, Function and Applications (Springer), 2007

18CMBC12

ADVANCED INSTRUMENTAL TECHNIQUES

5 0 0 4

Course objectives

Advanced instrumental techniques are used to understand the theoretical principles involved in Bioinstrumentation which may be used for the determination of nutrients, major ions and trace elements, biological samples together with the analytical techniques. Some of these techniques are particularly useful for the detailed analysis of recent methodologies used in the chemical analysis of biota as discussed in the chapter.

Course outcomes (**Employability**)

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

- CO1: Demonstrate broad knowledge in **modern analytical instrumentation** with deep knowledge in its core concepts and its applications.
- CO2: Understand the principle, Instrumentation of different types of Light microscopy and electron microscopy and its applications in various fields of research.

CO3: Acquire knowledge about the basics and latest developments in the instrumentation techniques of Centrifugation, Electrophoresis (IEF, 2D PAGE) and Chromatography and their applications in various research fields.

CO 4: Demonstrate skill to explain about principle, Bioinstrumentation and applications of latest spectroscopy techniques like Turbidometry, AAS, NMR, ESR and Nephelometry.

CO5: Gain extensive exposure from basic to latest cytotechniques (FISH technology & Biochip technology).

CO6: Learn about basic Radioactivity principles, measurement method and its biological applications.

CO 7: Get exposed to latest technology of Biosensors and its wide range of applications ranging from clinical, environmental and agricultural field.

CO8: Acquire cognitive, technical and creative skills which enables students to gain an established knowledge and practice concerning modern analytical instrumentation and measurement techniques.

CO9: Understand the importance and applications of advanced biochemical instrumentation techniques in modern day research.

CO10: Develop skill in carrying out research projects by employing the basic biochemical and molecular techniques.

Unit 1 Microscopy and Cytotechniques (12)

Microscopy - Principles of Microscopy – bright and dark field, fluorescence, phase contrast, scanning and transmission electron microscopy.

Cytotechniques – tissue homogenization and Cell disruption, cell counting and sorting, cell culture techniques, preservation of cell and tissues.

Unit 2 Radioactivity and Biosensors (12)

Detection and measurements - GM counter, Scintillation counter. Safety aspects. Biological applications: assessing the metabolic pathways, radio dating, isotope dilution technique, autoradiography.

Biosensors - Introduction to Biosensors: Concepts and applications. Biosensors for diabetes management. Noninvasive Biosensors in Clinical Analysis.

Unit 3 Centrifugation and Electrophoresis (12)

Centrifugation: Basic Principles of Centrifugation. Instrumentation and applications of Preparative - Differential and Density Gradient Centrifugation, Analytical Ultracentrifugation – ultra centrifuge, applications.

Electrophoresis: Principles and Factors Affecting Electrophoresis. Principle, methodology and applications of PAGE, SDS-PAGE, IEF, 2D PAGE, Agarose Gel Electrophoresis.

Unit 4 Chromatography

(12)

Chromatography: Principles, Instrumentation and Applications of Paper Chromatography, TLC, Column Chromatography, LPLC, HPLC, Gel filtration Chromatography, Ion-Exchange Chromatography, Affinity Chromatography and GLC .

Unit 5 Spectroscopy

(12)

Spectroscopy: Basic Principles of Electromagnetic Radiation, Beer-Lambert's Law. Principle, instrumentation, operation and applications of UV-Visible, IR, Spectrofluorimetry, Flame Photometry, AAS, NMR, ESR, X-Ray Diffraction, Mass spectrometry

Total : 60 hours

Text Books

1. Keith Wilson and John Walker, Principles and techniques of Practical Biochemistry, 2010, Seventh edition, Cambridge University Press
2. Asokan P, Analytical biochemistry Biochemistry, 2009, Chinna publication.

Reference Books

1. Holme. D. J. and Peck. H., Longman Analytical Biochemistry, 1998, 3rd edition.
2. Chatwal, G & Anand, S, Instrumental methods of chemical analysis, 2005, Himalaya Publishing House
3. S. K. Sawhney & Randhir Singh, Introductory Practical Biochemistry, 2014, Narosa Publications House

18PMBC11 PRACTICALS I BIOCHEMISTRY AND INSTRUMENTATION LAB 0 0 8 3

Course objectives

The course aims to develop skills of performing basic biochemical tests important in clinical investigations, to develop familiarity with biochemical laboratory techniques, and to introduce students to various practical aspects of enzymology and their correlation in disease conditions.

Course outcomes (Employability)

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

CO1: Learn how to standardise various biomolecules.

CO2: Track various techniques adopted for separation of biomolecules.

CO3: Demonstrate separation of protein by electrophoresis.

CO4: Separate carbohydrates by paper chromatography,

CO5: Separate amino acids by paper and thin layer chromatography.

CO6: Practice isolation of biomolecules from biological samples.

CO7: Demonstrate isolate and estimate the amount of biomolecules in general.

CO8: Separate and purify proteins by gel filtration chromatography

CO9: Separate plant pigments by column chromatography

CO10: Isolate and separate glycogen from tissues

List of Experiments

Biochemical Studies

1. Estimation of Tryptophan
2. Estimation of Lactate
3. Estimation of pyruvate
4. Estimation of protein by Bradfords method
5. Isolation and estimation of DNA,
6. Isolation and estimation of RNA
7. Isolation and estimation of glycogen from tissues.

Bioinstrumentation Lab

8. Separation of Aminoacids/ sugars by paper chromatography and TLC
9. Separation of Plant pigments by column chromatography
10. Separation of Proteins by gel filtration chromatography
11. SDS PAGE-Demonstration

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).
2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).
3. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2 edition, 2005.

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.
2. Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.
3. Robert Eisenthal, Enzyme Assays: A Practical Approach (Practical Approach Series). Oxford University Press, U.S.A. 2 edition, 2002.

18CMBC21

ENZYMولوجY

5 0 0 4

Course objectives

This paper aims to provide a basic understanding of biological catalysis, Mechanism of action of enzymes, structure and function relationship, Understanding the enzyme kinetics and role of co-enzymes/co-factors and an overview of Industrial application of enzymes.

Course outcomes (**Employability**)

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

CO1: Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and mechanisms.

CO2: Apply biochemical calculation for enzyme kinetics.

CO3: Discuss the factors affecting enzymatic reactions.

- CO4: Describe the concepts of co-operative behaviour, enzyme inhibition and allosteric regulation.
- CO5: Compare methods for production, purification, characterization and immobilization of enzymes.
- CO6: Describe the major applications of enzymes in industry, understand the principles of enzyme immobilisation techniques and enzyme extraction procedures
- CO7: Develop new ideas for the development of enzyme-based drugs.
- CO8: Discuss enzymes that are responsible for energy conversion from nutrition
- CO9: Discuss various application of enzymes that can benefit human life
- CO10: Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products.

Unit 1 Introduction (12)

General introduction, Nomenclature and classification of enzymes, isolation and purification of enzymes –criteria of purity - specific activity. Enzyme units - Katal, IU. Measurement of enzyme activity - . Active site - determination of active site amino acids - chemical probe, affinity label, and site directed mutagenesis. Investigation of 3-D structure of active site. Isoenzymes.

Unit 2 Kinetics (12)

Kinetics of single substrate enzyme - catalysed reactions - Michaelis – Menten equation, importance of V_{max} , K_m , MM equation, and turnover number; Lineweaver - Burk plot, Eadie - Hofstee plot, Hanes - Woolf plot . Kinetics of Allosteric enzymes - MWC and KNF models. Hill' equation coefficient. Kinetics of multi – substrate enzyme - catalysed reactions - Ping-pong bi-bi, random order and compulsory order mechanism.

Unit 3 Catalysis and Inhibition (12)

Mechanism of enzyme action - general acid-base catalysis, covalent catalysis, role of metal ion in enzyme catalysis, mechanism of serine proteases - chymotrypsin, lysozyme, carboxy peptidase A and ribonuclease. Reversible inhibition - competitive, uncompetitive, noncompetitive, mixed, substrate and allosteric inhibition. Irreversible inhibition.

Unit 4 Coenzymes (12)

Coenzymes - prosthetic group and cofactors with examples. Structure, functions and mode of action of TPP (oxidative decarboxylation) , FMN , FAD ,NAD , NADP (redox reactions), PALP and PAMP – (transamination), Coenzyme A (Acylation/acetylation reactions), biotin – (carboxylation) , tetrahydro folate (one carbon transfer), cobalamine coenzymes-cyano, hydroxo, methyl and deoxy adenosyl cobalamine- role in methyl group transfer and mutase reactions. Co-enzymic functions of vitamin C, lipoic acid and coenzyme Q in metabolic reactions .

Unit 5 Applications of enzymes (12)

Industrial uses of enzymes - sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production. Immobilization of enzymes, methods and their applications. A brief account of non-protein enzymes - ribozymes and DNA enzymes.

Total : 60 hours

Text Books

1. David Nelson and Michael Cox, Lehninger Principles of Biochemistry, 4th edition; 2005
2. JL Jain, Sanjay Jain and Nitin Jain, Fundamentals of Biochemistry, 6th edition; 2005
3. Donald Voet and Judith Voet, Fundamentals of Biochemistry, 2nd edition; 2006
4. MJ Pelczar, ECS Chan and NR Krieg, Microbiology, Tata McGraw Hill Edition, 1998

18CMBC22

INTERMEDIARY METABOLISM

5 0 0 4

Course objectives

The paper intends to provide a basic understanding of the biochemical reactions of molecules, Role of enzymes as key elements that govern the biochemical transformations, break-down and synthesis of various biomolecules and the turnover of carbohydrates, proteins, lipids and nucleic acids.

Course outcomes (Employability)

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

- CO1: Discuss the overall concept of cellular metabolism – anabolic and catabolic pathways, energy storage and release, production of building blocks for **macromolecule synthesis**.
- CO2: Differentiate how various organs control metabolism.
- CO3: Discuss the basics of enzymes, transporters, signal transduction, and mitochondrial structure.
- CO4: Explain glucose homeostasis (pathways and hormonal regulation). Discuss Krebs cycle, electron transport, and the pentose phosphate pathway.
- CO5: Analyze the role of fat in energy production, membrane synthesis, and **production of bioactive molecules**.
- CO6: Describe the structure, **biosynthesis**, oxidation and storage of fatty acids.
- CO7: Describe the basic metabolic pathways of cholesterol and lipoproteins.
- CO8: Describe common pathways of amino acid catabolism to release ammonia (handled by the urea cycle) and carbon skeletons.
- CO9: Differentiate between ketogenic and glucogenic amino acids, and diseases resulting from defective catabolism (phenylketonuria, maple syrup urine disease) and biosynthesis of non-essential amino acids.
- CO10: Explain nucleotide biosynthetic pathways. Describe diseases associated with **defective nucleotide biosynthesis and therapies** that utilize the biosynthetic pathways

Unit 1 Carbohydrate metabolism (12)

Fate of dietary carbohydrates. Glycolysis with energetic & regulation, Cori cycle, Futile cycles in carbohydrate metabolism. Metabolism of Glycogen, **TCA cycle - Energetics and its regulation**. Pentose phosphate pathway. Uronic acid pathway. Gluconeogenesis pathway and significance. Glycerate cycle.

Unit 2 Lipid Metabolism (12)

Oxidation of fatty acids - Beta oxidation, alpha oxidation and omega oxidation. **Metabolism of Ketone bodies - Formation, Utilization, Excretion and significance**. Metabolism of Triglyceride, Phospholipids and cholesterol. Biosynthesis of saturated and unsaturated fatty acids.

Unit 3 Protein Metabolism (12)

Introduction, fate of dietary proteins, catabolism of amino acids - transamination, oxidative and non-oxidative deamination, decarboxylation- **urea cycle and its regulation**.

Unit 4 Nucleic acid Metabolism (12)

Introduction, fate of dietary nucleic acids, catabolism of purine and biosynthesis of purine nucleotides- **denovo synthesis and salvage pathways**. Regulation of purine biosynthesis. Catabolism of pyrimidines and biosynthesis of pyrimidine nucleotides. De novo synthesis and salvage pathways, regulation of pyrimidine synthesis.

Unit 5 Biological Oxidation (12)

Introduction -free energy - free energy of hydrolysis of ATP and other organophosphates. Role of High energy compounds - **Electron transport chain**- Components and reactions of ETC. Role of ETC - Oxidative Phosphorylation - Chemiosmotic hypothesis. **P/O ratio**, uncouplers of oxidative phosphorylation.

Total : 60 hours

Text Books

1. David Nelson and Michael Cox, Lehninger Principles of Biochemistry, 4th edition; 2005
2. JL Jain, Sanjay Jain and Nitin Jain, Fundamentals of Biochemistry, 6th edition; 2005
3. Donald Voet and Judith Voet, Fundamentals of Biochemistry, 2nd edition; 2006
4. Lubert Stryer, Jeremy M Berg and John L Tymoczko, Biochemistry 5th edition; 2005

Reference Books

1. Malcolm Dixon and Edwin Clifford Webb, Enzymes (Volume 6), 1964
2. Robert K Murray , Daryl Granner and Victor W Rodwell, Harper's illustrated biochemistry, 27th edition; 2006
3. BD Hames, NM Hooper and JD Houghton, Instant Notes in Biochemistry, 1st ed, 1997

Course objectives

To Understand and perform, the most recent and important methods in Molecular Biology and also understand the molecular approach used in research relevant for understanding the development and treatment of human diseases.

Course outcomes (Employability)

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

CO1: Understand the basic principle involved in isolation of biomolecules from various biological sources

CO2: Isolate DNA from various sources – viz plant, microbes and animals

CO3: Purify DNA, RNA

CO4: Separate DNA, RNA

CO5: Separating Proteins by SDS PAGE

CO6: Understanding the mobility differences of macromolecules in electrophoresis

CO7: Understand the optimal conditions essential for protein/nucleic acid separation and purification

CO8: Determine molecular weight of protein

CO9: Determine molecular size

CO10: understand the application of these techniques

List of Experiments

1. Separation of proteins by SDS PAGE.
2. Determination of molecular weight of serum proteins by SDS PAGE
3. Study of enzyme activity on Native PAGE.
4. Isolation of plasmid DNA.
5. Isolation of genomic DNA from plant source.
6. Separation of DNA by Agarose gel electrophoresis.
7. Determination of size of DNA by agarose gel electrophoresis
8. RFLP.
9. Gene amplification by PCR.
10. RT-PCR (Demonstration)
11. Southern hybridization (Demonstration).
12. Western blotting (Demonstration).

References

1. Michael R. Green, Joseph Sambrook. Molecular Cloning: A Laboratory Manual, 4th Ed.
2. S.K.Sawhney and Randhir Singh. Introductory practical biochemistry. 2nd edition.2005. .
3. Roger L. Lundblad, Fiona Macdonald. Handbook of Biochemistry and Molecular Biology, 4th Edition. CRC Press, 2010
4. Leland J. Cseke, Ara Kirakosyan, Peter B. Kaufman, Margaret V. Westfall. Handbook of Molecular and Cellular Methods in Biology and Medicine, 3rd Edition, CRC Press, 2011

Course objectives

To Understand and perform, the most recent and important methods in Molecular Biology and also understand the molecular approach used in research relevant for understanding the development and treatment of human diseases.

Course outcomes (Employability)

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

CO1: Develop skill in the preparation and sterilization of microbial medias.

CO2: Demonstrates proficiency and use of following in isolation of cultures by various methods (Serial dilution, Pour plate, Spread plate and Streak plate methods)

CO3: Perform **Slab culture technique** for enabling long term storage of culture medias.

CO4: Identify different types of microbes by various staining techniques (Simple and Differential, Negative and Acid fast staining techniques).

CO5: Explain and perform Spore and **capsule staining techniques**.

CO6: know the different types of Fungal staining.

CO7: Perform Antibody sensitivity disc-phenol coefficient method.

CO8: Understand and **estimate the growth kinetics curve of bacteria**.

CO9: Ability to utilize microbiological concepts to summarize, analyse and develop results in study of microorganisms.

CO10: Demonstrates skill in taking up basic research projects and findings by employing microbiological concepts and principles.

List of Experiments

1. Preparation of media
2. **Sterilization techniques**
3. Isolation of pure culture- serial dilution and pour plate method
4. Isolation by Spread plate method
5. Isolation by streak plate methods
6. **Slab culture techniques** for long term storage.
7. Simple and differential Staining techniques
8. Negative and acid fast Staining techniques
9. Spore and capsule staining
10. Fungal staining.
11. **Antibiotic sensitivity disc- phenol coefficient method**.
12. Estimation of growth curve of bacteria.

Reference Books

1. Michael R. Green, Joseph Sambrook. Molecular Cloning: A Laboratory Manual, 4th Ed.
2. S.K.Sawhney and Randhir Singh. Introductory practical biochemistry. 2nd edition.2005. .
3. Mehra, N. K. and Gupta S. K., A Handbook of Practical and Clinical Immunology, 2nd ed., 3 vols., CBS Publishers, New Delhi, (1993).
4. Leland J. Cseke, Ara Kirakosyan, Peter B. Kaufman, Margaret V. Westfall. Handbook of Molecular and Cellular Methods in Biology and Medicine, 3rd Edition, CRC Press, 2011

18CMBC31 GENETICS AND MOLECULAR BIOLOGY

5 0 0 4

Course objectives

Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It is a large and ever-changing discipline. This course will emphasize the molecular mechanisms of DNA replication, repair, transcription, protein synthesis, and gene regulation in different organisms.

Course outcomes (**Employability**)

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

- CO1: Understand the basics of heredity population genetics and master fundamental genetic calculation
- CO2: Understand the **synthesis of DNA and Post replication processes**
- CO3: Understand the **synthesis of RNA and post transcriptional modifications**
- CO4: Understand the synthesis of protein and its post translational modifications
- CO5: Describe how gene expression is regulated at different levels, how tissue-specific expression is achieved and exemplify how gene expression can be manipulated and studied experimentally
- CO6: Account for the molecular mechanisms regulating and controlling cell division and the cell cycle and exemplify how extracellular signals affect cell division
- CO7: Describe the **molecular mechanisms** behind DNA damage and repair
- CO8: Describe and compare different molecular mechanisms to bring about cell death and explain how this is linked to DNA damage
- CO9: Explain how molecular defects in a cell can lead to its development into a cancer cell
- CO10: Explain and compare different principles of how extracellular signals can reach the cell interior, be amplified, transmitted and terminated, and exemplify how signal routes are integrated and how specificity can be achieved

Unit 1 Genetics (12)

Gene concept and interaction of genes. Molecular structure of genes and chromosomes. Mendel's work on heredity, Mendel's mono and dihybrid experiments. Mendel's Laws, Linkage and crossing over, coupling and repulsion hypothesis, sex linked inheritance. Non-chromosomal inheritance.

Unit 2 Replication (12)

Evidences for DNA as the genetic material. Structural organization and functional elements of eukaryotic chromosomes. Prokaryotic and Eukaryotic replication, Regulation of replication, Mutation, DNA Repair, Recombination.

Unit 3 Prokaryotic Transcription (12)

Prokaryotic transcription. Inhibitors of transcription. Post transcriptional processing of rRNA and tRNA. Regulation of transcription in prokaryotes– the lac operon, negative and positive regulation and tryptophan operon.

Unit 4 Eukaryotic Transcription (12)

Eukaryotic transcription and regulation. RNA polymerase I,II and III, promoters, transcription factors, Transcription factor motifs, Activators, repressors and enhancers, transcription complex assembly and mechanism of transcription. Post transcriptional processing of mRNA, rRNA and tRNA. Splicing, Alternative splicing, catalytic RNA (ribozymes), RNA editing, Antisense RNA.

Unit 5 Translation (12)

Genetic code and translation. The genetic code – general features, Deciphering the code, Wobble Hypothesis. Translation- activation of aminoacids, initiation, elongation, termination in prokaryotes and eukaryotes. Regulation of gene expression in eukaryotes. DNA methylation, chromatin remodelling, DNA response elements, degradation of proteins. Protein sorting, targeting of proteins to mitochondria, chloroplast and nucleus, Receptor mediated endocytosis

Total : 60 hours

Text Books

1. De Robertis, Cell and molecular biology. Dhanpat Rai Publisher, 8th Edition, 2001.
Nalini Chandar, Susan Viselli, Lippincott Illustrated Reviews: Cell and Molecular Biology. LWW : North American Edition (2010).
2. Robert Franklin Weaver, Molecular Biology. Mc-Graw Hill science, 5th edition, 2011.

Reference Books

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Molecular biology of the cell. Garland Science, 6th edition (2014).
2. Benjamin Lewin, Genes IX. Jones & Bartlett Learning; 9 edition (2007).
3. Harvey Lodish, Arnold Berk & Chris A. Kaiser, Molecular Cell Biology. W. H. Freeman; 6th edition (2007).

Course objectives

The course aims to provide an advanced understanding of the biochemical mechanisms and pathophysiological processes responsible for common biochemical disorders. The course provides an overview of normal and abnormal metabolic functions, the impact of disorders on metabolic processes, an overall picture about the molecular basis of diseases and novel strategies to prevent the diseases.

Course outcomes (Employability)**After the completion of this course, the student will be able to**

- CO1: Understand the Basic concepts and principles of Clinical Biochemistry, detail on the various biological specimens including the process of collection, preservation and storage.
- CO2: Gain Knowledge on the collection, and analysis of Amniotic fluid and on the Immunological tests related to diagnosis of anomalies during pregnancy.
- CO3: Understand the Blood groups, Blood banking and adverse reactions of blood transfusions.
- CO4: Describe of the blood clotting pathways and the blood clotting disorders.
- CO5: Enumerate of the different types of anemias based on aetiology.
- CO6: Understand the pathophysiological processes responsible for common biochemical disorders such as jaundice, Pancreatitis, Fatty liver etc.
- CO7: Differentiate three types of jaundice and their systematic analysis. Detailed study of Jaundice, Cirrhosis, Hepatitis, Fatty liver and gall stones. Serum enzyme activities in diseases.
- CO8: Understand Formation of urine and gain perception on the various renal function tests and renal disorders
- CO9: Gain understanding of the need for Gastric function tests, Collection of gastric contents, their examination.
- CO10: Appreciate the Clinical application of enzymes in diagnosis, Discussion on Isozymes and understanding their role in diagnosis. Understanding the enzyme patterns in diseases of various organs such as pancreas, liver, bones, heart and muscle.
- CO11: Understand the aetiology, types, clinical manifestations and treatment of Diabetes mellitus and various disorders of carbohydrate metabolic pathways.
- CO12: Understand on the etiology, types, clinical manifestations, diagnosis and treatment of various aminoacidurias.

Unit 1 Introduction and Diseases of the new-born**(12)**

Introduction to Basic concepts and principles of Clinical Biochemistry .Standard values for important constituents in blood and urine. Specimen collection and Processing of blood and urine. Anticoagulants. Blood groups, Blood banking and adverse reactions of blood transfusions.

Hemolytic diseases of the new born. Hemoglobinopathies, Thalassemias Haemophilias. Anaemias.

Amniotic fluid-origin, collection, composition and analysis. Immunological tests of pregnancy. Prenatal detection of inborn errors of metabolism in the fetus by enzyme assays in amniotic fluid.

Unit 2 Liver function tests and related disorders. (12)

Jaundice, Cirrhosis, Hepatitis, Fatty liver and gall stones. Serum enzyme activities in diseases. Renal function tests and related disorders - Acute and chronic renal failure, glomerular diseases and tubular diseases, urinary tract obstruction and analysis of urinary calculi. .

Unit 3 Other organ function tests (12)

Assessment of Gastric function Tests, Pancreatic function test and Intestinal function tests. Enzyme parameters in these pathological conditions.

Unit 4 Metabolic disorders (12)

Disorders of carbohydrate metabolism nucleic acid metabolism and lipid metabolism and their diagnosis. Aminoacidurias.

Unit 5 Cancer (12)

Diagnosis of Cancer – cancer cells, difference between cancer and normal cells. Diagnosis – Tumor markers, classification, functions. Medical imaging techniques – CT, MRI, PET and SPECT.

Total : 60 hours

Text Books

1. M.N. Chatterjee & Ranashinde, Text Book of Medical Biochemistry. Jaypee Publisher. 6th edition, 2006.
2. Nanda Maheshwari, Clinical Biochemistry. JPB. First edition, 2008.
3. Nessar Ahmed, Clinical Biochemistry, . Oxford University Press. 1st Edition, 2011.

Reference Books

1. Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds), Tietz Textbook of Clinical Chemistry and Molecular Diagnosis. 5th edition, 2012.
2. Thomas M. Devlin, Biochemistry with clinical correlation. John Wiley & Sons. 7th Edition, 2010.
3. Allan Gaw, Michael J. Murphy, Rajeev Srivastava, Robert A. Cowan, Denis St. J. O'Reilly, Clinical Biochemistry. 5th edition, 2013.
4. Graham Basten, Introduction to Clinical Biochemistry, Interpreting Blood Results. BookBoon. 2nd edition, 2011.
5. Lawrence A. Kaplan, Amadeo J. Pesce, Clinical Chemistry: Theory, Analysis, Correlation .Mosby. 5 edition, 2009.

Course objectives

Clinical biochemistry is a scientific discipline within medicine. It includes the analysis of body fluids, cells and tissues and interpretation of the results in relation to health and disease. The discipline encompasses fundamental and applied research into the biochemical and physiological processes of human and animal life, and application of the resulting knowledge and understanding to the diagnosis, treatment and prevention of disease.

Course outcomes Skill Development

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

CO1: Gain knowledge of biological samples and their collection procedures

CO2: Perform biochemical laboratory analysis in blood and urine samples and interpret the generated results after analysis in order to determine the likely diagnosis

CO3: Distinguish serum, plasma and whole blood emphasizing the role of anticoagulants

CO4: Assess presence and absence of normal and abnormal constituents in urine by performing qualitative urine analysis

CO5: Analyze blood for RBC, WBC, TC/DC, ESR and hemoglobin by performing hematological assays

CO6: Determine activity of enzymes such as SOD, catalase, GPx, creatine kinase, LDH, Na K ATPase, SGOT and SGPT.

CO7: Determine blood urea, uric acid and creatinine which acts as renal indices

CO8: Analyze serum for cholesterol, bilirubin and A/G ratio

CO9: Analyze blood for glucose level

CO10: Assess calcium and vitamin A and E in blood

List of Experiments

Analysis of Biological Samples

1. Hematological analysis-RBC, WBC-TC/DC, Hemoglobin content and ESR
2. Analysis of normal and abnormal urine constituents
3. Estimation of Calcium

Enzyme assays

4. Assay of Enzymic antioxidants-SOD, Catalase and GPx
5. Assay of Creatine kinase, LDH and Na K ATPase
6. Assay of SGOT/ SGPT

Biochemical Studies

7. Estimation of renal indices-Urea, Uric acid and Creatinine.
8. Estimation of Blood Glucose
9. Estimation of Serum Bilirubin
10. Estimation of A:G ratio in serum
11. Estimation of serum Cholesterol.
12. Estimation of Vitamins-A & E

Text Books

- 1 J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).
- 2 [S. Sadasivam](#), [A. Manickam](#), Biochemical Methods. New age publishers. 2009
- 3 S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2 edition, 2005.

Reference Books

- 1 Harold Varley, Practical Clinical Biochemistry, CBS. 6 edition, 2006.
- 2 Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.
- 3 Robert Eisenthal, Enzyme Assays: A Practical Approach (Practical Approach Series). Oxford University Press, U.S.A. 2 edition, 2002.

18CMBC41

TOXICOLOGY AND FORENSIC BIOCHEMISTRY

5 0 0 4

Course objectives

This paper provides a complete understanding of the responses of the human body to toxic agents and the therapeutic approaches to toxicity. The paper also deals with the forensic aspects like legal procedures and types of trauma.

Course outcomes (**Employability**)

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

CO1: Understand the basic concepts of toxins and the biochemical basis of their toxicity

CO2: Know the different types of poisons and their effects

CO3: Know the poison associated effects under **Forensic Science**

CO4: Have the knowledge about legal procedures in India and the **proceedings involved in criminal cases**

CO5: Have basic understanding of identification procedures **employed under Forensic toxicology**

CO6: Have knowledge about identification of different types of injuries

CO7: Gain knowledge about the medico-legal implications associated with different types of injuries

CO8: Have knowledge about causes of death by different means and the associated medico-legal aspects

CO9: Basic understanding of **fingerprint analysis and interpretations**

CO10: Basic understanding of isolation of DNA from available **biological samples and its analysis by DNA fingerprinting** method

Unit 1 Introduction to toxicology

(12)

Fundamentals of Toxicology and **dose-Response Relationships**. Factors Affecting Toxic Responses: Disposition : Absorption ,Sites of absorption, distribution, Excretion; Metabolism:

types of Metabolic change phase I reactions; Phase 2 reactions; control of Metabolism, Toxication vs. Detoxication.

Biochemical basis of toxicity: Mechanism of toxicity: Disturbance of excitable membrane function, Altered Calcium homeostasis, Covalent binding to cellular macromolecules & genotoxicity, Tissue specific toxicity

Unit 2 Clinical toxicology (12)

Types of poison, Clinical signs and Symptoms, diagnosis, management and medicolegal aspects of corrosive poisons; irritant poisons; neural poisons; somniferous; inebriant; deliriant; spinal; peripheral; cardiac poisons; asphyxiants; drug abuse.

Unit 3 Introduction to forensics (12)

Legal procedures in India; medical and medico Legal documents; evidences, witnesses; laws related to medical profession. Medical Council of India, State Medical Council: structure, functions, powers; duties of medical practitioners towards patients and relatives, medical negligence: civil, criminal; Consumer Protection Act: rights and liabilities of doctors, medical indemnity insurance; human rights and violation; duties of medical practitioners to victims of torture; Human organ transplantation Act.

Unit 4 Identification procedures (12)

Identification of the living and the dead. Forensic thanatology; death; causes of death; mechanism and manner of death; changes after death; artifacts; medico-legal death investigation; exhumation. Forensic science; Locard's exchange principle; lie detector; superimposition; DNA finger printing, HLA typing.

Unit 5 Pathology (12)

Injuries - mechanical injuries; injuries; injuries; injuries due to electricity, lightning and radiation; train and road traffic accidents; firearm and explosion injuries; medico legal aspects of wounds.

General aspects; patho-physiology and classification ;mechanical asphyxia; hanging; strangulation; drowning; smothering, choking, garroting, burking, yoking.

Total : 60 hours

Text Books

1. Narayanareddy K. S., The Essentials of Forensic Medicine & Toxicology, 2007Published by K. Sugana Devi, 26th Edition, Hyderabad.
2. Basu, R. Fundamentals of forensic medicine and toxicology. 2009. 2nd Edition. Books and Allied(P) Ltd. Kolkata.

Reference Books

1. Parikh C.K. Parikh 's Textbook of Medical Jurisprudence and Toxicology, Publishers Bangalore . 6th Edition 1999, Reprint 2007
2. Franklin, C.A Modi's medical Jurisprudence and Toxicology, published by M. Tripathi Private Limited,.21st Edition. Bombay.
3. Keith Simpson, Bernard Knight, 1988, Forensic Medicine, ELBS. 9th Edition

DISCIPLINE SPECIFIC ELECTIVES

Course objectives

The objective is to impart knowledge and understanding of the human body. To understand the inter relationships within and between anatomical and physiological systems of the human body.

Course outcomes (Employability)**After the completion of this course, the student will be able to**

CO1: Understand the inter relationships within and between anatomical and physiological systems of the human body

CO2: Describe the structure of major human organs and explain their role in the maintenance of healthy individuals.

CO3: Understand the role of Membranes and its transport mechanism.

CO4: Know in detail about the 4 levels of biological tissues.

CO5: Describe the general function of each organ system.

CO6: Explain how the activities of organs are integrated for maximum efficiency

CO7: Have in-depth understanding of neurophysiology

CO8: Have in-depth understanding of anatomy and physiology of respiratory, digestive, and vascular system

CO9: Have in-depth understanding of anatomy and physiology of muscle physiology

CO10: Identify how changes in normal physiology lead to disease

Unit 1 Basics of Human anatomy**(09)**

Definition and scope of anatomy, physiology and related sciences. Anatomical terms in relation to parts of the body, system and organs.. Cell- Structures and their functions. Tissues of the Body- Types of tissues and their functions. Muscles – structure, types and functions.

Unit 2 Digestive system**(09)**

Structure and functions of alimentary canal - mouth, oesophagus, stomach, small intestine, large intestine. Digestive enzymes, zymogens – salivary gland, gastric gland, liver, pancreas and intestinal glands. Digestion and absorption of carbohydrates, fats and proteins. Defaecation.

Unit 3 Blood and Respiratory system**(10)**

Composition of blood. Structure, of RBC, WBC and platelets. Blood clotting – blood clotting factors and mechanism of blood clotting. Haemostasis. Blood groups- ABO system and Rhesus

system. Structure of Respiratory system. Functions of pharynx, larynx, trachea, bronchi and bronchioles and lungs. Physiological and biochemical events of respiration – Breathing, exchange of gases and regulation of respiration- Bohr effect and role of 2,4 DPG.

Unit 4 Nervous system (10)

Nervous System - General physiology of neurons, synapses, neurohumoral transmission.

Central nervous system, its various parts and their functions. Structure and functions of the urinary system - kidneys, ureter, urinary bladder and urethra. Micturition. Mechanism of urine formation – **GFR, tubular reabsorption and tubular secretion.** Role of ADH.

Unit 5 Reproductive system (10)

Structure and functions of male reproductive system`. Structure and functions of female reproductive system – **Ovulation, menstrual cycle. Spermatogenesis** and factors influencing sperm count and viability. **Biochemistry of fertilization.** Physiological changes during pregnancy, parturition and lactation.

Total : 48 hours

Text books

1. Guyton AC. Text book of Medical Physiology, 8th Edition. Prism books (pvt), Bangalore, India. ... TATA McGraw-hill publishing Company, 1991.
2. C.C. Chatterjee, "Human Physiology"(Vol. I & Vol. II), Medical Allied Agency, Calcutta, 11th edition, 1985.

Reference books

1. Ganong (Williams) Review of medical physiology 25th edition. 2015. McGraw-Hill/Appleton & Lange.
2. Ross and Wilson. Anatomy and physiology. In health and illness. 12th edition, 2014. Churchill livingstone Elsevier.

Course objectives

The course was designed in such a way to get hands on training in the Biochemical methods in the aspect of doing research and to impart the knowledge of Statistics and Design of Experiments to the students. This will help the students to have focused idea about the research methodologies and how to write research findings with the help of biostatistics and computer.

Course outcomes (Employability)**After the completion of this course, the student will be able to**

CO1: Explore the basic components of computer and methods of protecting system from virus.

CO2: Learn the applications of packages like WORD, EXCEL, Power Point in entering data, preparing tables, graphs, charts etc.,

CO3: Study applications of statistical tools like Mean, Median, Mode, Standard deviation, Standard error, 't' test and ANOVA in biological research.

CO4: Learn usage of statistical software like SPSS, Graph pad

CO5: Understand the general principle, Instrumentation and applications of PCR RAPD, RFLP, blotting in molecular biology research.

CO6: Understand the general principle, Instrumentation and applications of RAPD, RFLP

CO7: Understand the general principle, Instrumentation and applications of blotting techniques

CO8: Gain some knowledge on principle, instrumentation and applications of immunological techniques like ELISA, RIA, CRYOPRESERVATION.

CO9: Explore selection of test material, designing an experiment, different methods of literature collection.

CO10: Learn how to prepare a dissertation, preparation of articles, communication of articles to journals

Unit 1 Fundamentals of Computers**(10)**

Computer in Biological Research - Components of Computer - storage device, computer peripherals, Computer virus Protection. Word Basics- Creating and working with documents, working with text Tables, Using EXCEL-working with work sheet, Creating chart- working with

formula and functions, Using power point-working with power point user interface, Using templates and wizard for Slide Presentation, Creating charts and tables, Internet and WWW, Electronic mail- internet browsing.

Unit 2 Biostatistics and Research - I (10)

Steps in Scientific research, Sample - Variables, Graphic Representation, Frequency Distribution- Types, Mean, Mode and Median and measures of central tendencies, **Standard Deviation and Related measures**

Unit 3 Biostatistics and Research - II (10)

Biostatistics and Research- Probability- Hypothesis testing for Significance. Chi Square and Students Test, Regression and correlation- ANOVA, TUKEY's TEST and DUNCUN's TEST. Introduction to statistical softwares.

Unit 4 Molecular Techniques (09)

PCR, RAPD, RFLP, BLOTTING Techniques, Immunological techniques - ELISA, RIA. Basic concepts of cryopreservation,.

Unit 5 Thesis Preparation and Writing (09)

Basics Steps in research –Problem Selection- Experimental design- Review of Literature- Types of Literature- Reprint requisition, Preparation of **Research Report/ Dissertation/Review-Abstract**, Short notes, Contents of **Dissertation** (Introduction, Methodology, Results, Discussion, Summary, References/ Bibliography), Citation of Reference- Presenting Tables, Figures, Plates, Annexure, Acknowledgement, **Formatting and Typing- Proof Reading.**

Total : 48 hours

TextBooks

1. Levin and Rubin, Statistics for Management, 1998, 7th Edition, Prentice hall of India.
2. N. Gurumani, Research Methodology for Biological Science,2006, MJP Publisher

Reference Books

1. Anderson.j.et al, Thesis and assignment writing, 1970, Wiley eastern Pvt. Ltd. Delhi
2. Alexis Lcon and Mathew's icon, Fundamentals of Information Technology, 1999, Wikas Publisher.
3. C. R. Kothari, Research Methodology: Methods and Techniques, 2005. 2nd Edition, New Age international(P) Limited, India,

Course objectives

This paper assures that Biochemists should have strong ideas about Microbes and their applications, immunity, antigens, antibodies against them, mechanism of action of immune system.

Course outcomes (Employability)

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

CO1: Demonstrate various classes and structure of microbes. Applications of microbes in food industry and pharma industry.

CO2: Discuss preparation and applications of products from industries. Role of microbes in nitrogen fixation, purification of water,

CO3: Discuss the classification of immunity, cell mediated immune response, humoral immune response.

CO4: Explain the structure, types of antigens and antibodies.

CO5: Explain active and passive immunity

CO6: Elaborate the method of monoclonal antibodies synthesis and various theories adopted for production of antibody.

CO7: Discuss different types of vaccines synthesized and applications.

CO8: Be aware on immune deficiency disorder and its types, AIDS.

CO9: Explore knowledge on autoimmune disorder, hypersensitivity and its types.

CO10: Learn about transplantation, acceptance and rejection of graft.

Unit 1 Basics of Microbiology**(09)**

History and scope of Microbiology. Classification of microbes. Ultra structure of Bacteria , Fungi , virus , Algae. Food and dairy Microbiology: Role of Microorganism in food production – Dairy and non dairy products, fermented and alcoholic beverages. Antimicrobial agents – physical and chemical agents. Antiseptics and sterilants. Pharmaceutical Microbiology: Production of antibodies , Vaccines, antisera.

Unit 2 Industrial Microbiology (10)

Products of Industrial Microbiology- Penicillin, ethanol, Vitamin-B12, Citric acid, Amylase, Protease. Soil & Environmental Microbiology: Nitrogen fixation – symbiotic, asymbiotic. Pollution of water by microbes – sewage treatment, Bioremediation.

Clinical Microbiology: Infection – types of infection, method of infection, factors influencing infection. Normal microbial flora and pathogenic microbes. Bacterial diseases - typhoid, cholera. Viral diseases - Hepatitis, HIV.

Unit 3 Immunity (10)

Immunity and its types- innate immunity, acquired immunity, active and passive immunity, Humoral and cellular immunity. Cells of the immune system. Complement pathway.

Immunoglobulins- structure, function and types. Antigens- nature, immunogenicity, haptens. Molecular mechanism of generation of antibody diversity. Monoclonal antibody – preparation and application in clinical research. Antigen-antibody reactions: precipitation, agglutination, Complement fixation test, tissue typing, ELISA, RIA, immunofluorescence, Immunodiffusion; Immunoblot.

Unit 4 Hypersensitivity (10)

Hypersensitivity reactions- type I, II, III, IV. Immunological tolerance & autoimmunity. Vaccines- active and passive immunization, commonly used toxoid vaccines, killed vaccines, live attenuated vaccines and bacterial polysaccharide vaccines.

Unit 5 Transplantation and cancer immunology (09)

Transplantation immunology- clinical manifestation, therapy, bone marrow and organ transplants. Cancer immunology- tumor antigens, immune response to tumors, immunotherapy. Structure and functions of MHC, association of MHC with disease susceptibility. Immunodeficiency disorders.

Total : 48 hours

Textbooks

1. Microbiology- Prescott 2003 , 3rd edition, Magraw hill , Boston.
2. Roitt, Brostoff, Mal, Immunology, 6th edition, 2001

Reference Books

1. Panicker , Microbiology, orient Longman , Hyderabad, 6th edition, 2005.
2. M.J.Pelzar, Microbiology, Tata mac hran, Hill New Delhi, 5th edition, 2005.
3. Donald.M.Weir, Immunology, John Stewart, 7th edition, 1993
4. P.M.Lydyard, A.Whelan, M.W. Fanger, Immunology, 2003

Course objectives

The content of the syllabus consist of basic biotechnology and its application such as new tools , products developed by biotechnologists such as cell culture, transgenic animals, Genetic engineering are useful in research, agriculture, industry and the clinic. It also helps to understand the Basic principles involved in Intellectual properties rights , scope and importance of marketing and its systems.

Course outcomes (Employability)**After the completion of this course, the student will be able to**

CO1: Explain the general principles of generating transgenic plants, animals and microbes.

CO2: Identify and debate the ethical, legal, professional, and social issues in the field of biotechnology and design and deliver useful modern biotechnology products to the Society.

CO3: Understand the role of vectors, plasmids in gene technology

CO4: Understand the gene transfer methods

CO5: Understand the DNA sequencing methods

CO6: Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.

CO7: Identify, apply and assess issues relating to each of the relevant areas of intellectual property in various fields of scientific research.

CO8: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.

CO9: Understand the potential role of ownership rights and marketing protection in encouraging, or discouraging, scientific research.

CO10: Be familiar with the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing and explain how IP can be managed as a strategic resource and suggest IPM strategy.

Unit 1 Vectors**(10)**

Restriction enzymes and joining DNA molecules by DNA ligase, double linkers, adaptors, homopolymer tailing. Plasmids vectors (pBR322, pUC 18), phage vectors (M13), cosmids,

expression vectors, yeast vectors –YAC. Selection and screening of recombinants by genetic methods, immunochemical methods, nucleic acid hybridization methods. Synthesis of probes by radioactive and non–radioactive labeling. Analyzing DNA sequences by Maxam and Gilbert method and Sanger’s methods.

Unit 2 Gene transfer methods (09)

Introduction of Foreign Genes into Cells using direct gene transfer methods - electroporation, biolistic transfer, transfection, microinjection, lipofection and ultrasonication. Genomic DNA libraries, chromosome walking, cDNA cloning, PCR, RAPD and RFLP.

Unit 3 Cell culture (10)

Cell and organ culture, primary cell culture, serum and serum free media, transfer of genes into animal cells in culture. Viral vectors: SV40, retrovirus and adenovirus. In vitro fertilization and embryo transfer. Selectable markers and reporter transgenes. Gene therapy and Antisense therapy.

Unit 4 Transgenic animals (10)

Production of medically important biomolecules - insulin, growth hormone, interferons, blood proteins, vaccines, lymphokines and monoclonal antibodies. Production of transgenic animals – transgenics and knock-outs. Production of transgenic sheep, cattle, pigs, fish etc. Development and applications of transgenic animals.

Unit 5 IPR (09)

Intellectual Property Rights (IPR) and Protection, Intellectual Property rights for Plant Breeding, Biosafety in biotechnology and Bioethics. Biotechnology Entrepreneurship.

Total : 48 hours

Text Books

1. Sathyanarayana, Biotechnology, Books and allied Publishers, 3rd edition, 2006
2. RC Dubey, Text book of Biotechnology , S. Chand & Co, 2009

Reference Books

1. Brown TA “Gene cloning: An introduction” Nelson Thornes, 3rd edition, 1995
2. SS Purohit. Biotechnology Fundamentals and applications. Agrobios Publication. 4th edition. 2007
3. SB Primrose & R Twyman. Principles of gene manipulation and genomics. Blackwell publishing. 7th edition. 2006.
4. PK Gupta, Biotechnology and genomics. Rastogi Publication. 2nd reprint. 2006.

Course objectives:

The objective is to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.

Course outcomes (Employability)

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

CO1: Gain knowledge about the human anatomy and physiology

CO2: Gain insights about the current lifestyle as a consequence of industrialization

CO3: Understand global scenario on sedentary lifestyle nutrition

CO4: Understand Basics of nutrition, RDA, balanced diet and BMR

CO5: Gain knowledge about cardiovascular system and associated disorders

CO6: Gain knowledge about gastro-intestinal tract and associated disorders

CO7: Gains knowledge about structure/ function of kidney and associated disorders

CO8: Have basic understanding of the pathophysiology of addictions (alcohol, smoking, drugs)

CO9: Understand the socio-economic implications associated with alcohol and drug abuse

CO10: Understand the functioning of global (Government and NGOs) working against alcohol and drug abuse

Unit 1 Modern lifestyles and habits (09)

Modern lifestyles - Sedentary habits, Junk food, Polluted environment, Sleeping habits, Smoking, Alcoholism, Drugs, Stress.

Unit 2 Food (09)

Elementary knowledge of balanced food. Obesity, Acidity, Dieting, Anorexia, Food poisoning. Deficiency of nutrients- Vitamins, Minerals, Beverages- hot and cold.

Unit 3 Cardiovascular complications (10)

Elementary knowledge of cardiovascular system: Atherosclerosis, Ischemia, Myocardial infarction (Heart attack), Hypertension.

Unit 4 Diseases of the Digestive system (10)

Elementary knowledge of digestive system and liver- Hepatitis, Fatty liver, Cirrhosis, Gallstones. Stomach- Gastritis, Acidity, Ulcer, Amoebiasis, Constipation, Piles.

Unit 5 Diseases of the Digestive system (10)

Elementary knowledge of Respiratory system- Common cold, Asthma, Wheezing, Allergic sinusitis. Elementary knowledge of Excretory system, Hypertension, Uncontrolled **Diabetes**, **Kidney Stones**.

Total : 48 hours

Text Books

1. Carl A. Burtis and Edward R. Ashwood . Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 5th edition, 2012. Saunders Publication.
2. M N Chatterjee and Rana shinde. Textbook of Medical Biochemistry-,8th edition, 2011. Jaypee Publishers.

Reference Books

1. Thomas M. Devlin. Biochemistry with Clinical Correlation, 7th edition, John Wiley & Sons. 2004.
2. Harold Varley, Practical Clinical Biochemistry, fourth edition, 2005. CBS Publisher
3. Dennis L. Kasper, Anthony S. Fauci, Stephen L. Hauser, Dan L. Longo. Harrison Principles of Internal Medicine- 19th edition, 2015

18DMBC31

ENDOCRINOLOGY

4 0 0 4

Course objectives

This paper ascertains that the biochemists get an accurate information about various hormones, functions, mechanism of action, and related disorders.

Course outcomes (Employability**)**

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

CO1: Understand the basic terminologies of hormones, classification of hormones based on its chemistry.

CO2: Deduce the structure of amino acid derived, protein and steroid hormones.

CO3: Understand the **synthesis of various hormones** by respective gland.

CO4: Understand the **regulation of hormones action** by feedback mechanism.

CO5: Understand the mechanism of action of **steroid hormones**,

CO6: Understand the mechanism of action of pancreatic hormones,

CO7: Understand the mechanism of action of thyroid hormones

CO8: Understand the mechanism of action of sex hormones.

Unit 1 Pituitary Hormones (10)

Hormones – Classification, biosynthesis, transport, modification and degradation. Structure of receptors, Feedback regulation. Mechanism of hormone action. Hypothalamic and pituitary hormones. Hypothalamic releasing factors. Hypothalamic hypophyseal portal system. Anterior pituitary hormones- GH, TSH, ACTH, LH, FSH and PRL biological role, feedback regulation and related disorders of hypo and hyper secretion. Posterior pituitary hormones- oxytocin and vasopressin – biological actions, regulation and related disorders.

Unit 2 Thyroid hormones (09)

Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Hyper and hypothyroidism. Hormonal regulation of calcium and phosphate metabolism. Parathyroid hormones-Parathormone and Calcitonin -biological actions, and related disorders-. Hypercalcemia and hypocalcemia, Rickets and osteomalacia.

Unit 3 Adrenal Hormones (10)

Hormones of Adrenal cortex- Synthesis, action, biological role, regulation, transport and metabolism. Adrenal function tests. Disorders of adrenal cortex-Cushing's syndrome, aldosteronism, Congenital adrenal hyperplasia, Adrenal cortical insufficiency. Hormones of Adrenal medulla synthesis, biological role, metabolism, regulation and related disorder- Pheochromocytoma.

Unit 4 Pancreatic hormones (10)

Pancreatic hormones – synthesis, regulation, biological effects and mechanism of action of glucagon, somatostatin and insulin. Insulin receptors. Related Disorders – Diabetes mellitus. Brief account of gastrointestinal Hormones.

Unit 5 Gonadal hormones (09)

Gonadal hormones - Biosynthesis, biological actions, transport, regulation and metabolism of androgens, oestrogen and progesterone., The menstrual cycle. Pregnancy –Biochemical changes and diagnostic tests. Gonadal Disorders.

Total : 48 hours

Text Books

1. Prakash.S.Lohar, Endocrinology, MJP Publishers, 2005
2. R.Radheshyam, Textbook of Endocrinology, Neha Publishers, 2012

