

BACHELOR OF SCIENCE IN BIOCHEMISTRY

ELIGIBILITY

A pass in Higher Secondary Examination conducted by the Government of Tamil Nadu with Physics /Biology /Chemistry /Biochemistry /Microbiology /Home science as one of the paper are only eligible for Examinations accepted as equivalent there by Academic Council, subject to such conditions as may be prescribed there to are permitted to appear and qualify for the **Bachelor of Science in Biochemistry Degree Examination** of this College after a course of study of three academic years.

OBJECTIVES OF THE COURSE

1. Offers the students a good understanding of the basic principles of biochemistry at the molecular and cellular levels
2. The students will be able to immediately recognize the different types of biochemical molecules and know their essential chemical characteristics that make them indispensable for life
3. Understand basic energy metabolism of cells
4. Know the structure of DNA and RNA and why these molecules have different roles in the storage and decoding of the information of heredity and cell function
5. Describe how enzymes work and know how to determine basic enzyme kinetics
6. Make students appreciate that Biochemistry is a subject of central and practical importance, contributing to both basic and applied research in industry, medicine, agriculture, pharmacy, food technology, biotechnology, etc.

B.Sc- Biochemistry (Students admitted from 2016-2017 onwards)

Subject Code	Subject	Hrs of Instruction	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
PART - I							
16UTL11U 15UHL11H 15UML11M 15UFL11F	Tamil -I Hindi-I Malayalam-I French - I	6	3	25	75	100	4
PART - II							
16UEG12E	English-I	6	3	25	75	100	4
PART - III							
16UBC13A	Core -I : Biomolecules	4	3	25	75	100	4
15UBC13B	Core- II : Cell Biology	4	3	25	75	100	4
	Core Practical -I: Biochemistry-I	2	-	-	-	-	-
16UCY1AA	Allied -I : Chemistry-I	4	3	20	55	75	3
	Allied Practical-I: Chemistry	2		-	-	-	-
PART - IV							
15UFC1FA	Environmental Studies	2	3	-	50	50	2
		30				525	21
Second Semester							
PART - I							
16UTL21U 15UHL21H 15UML21M 15UFL21F	Tamil -II Hindi-II Malayalam-II French - II	6	3	25	75	100	4
PART - II							
16UEG22E	English-II	6	3	25	75	100	4
PART - III							
15UBC23A	Core- III : Basic Microbiology	5	3	25	75	100	4
16UBC23P	Core Practical -I: Biochemistry	5	3	30	45	75	3

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24/6/16
BdS Chairman/HOD
Department of Biochemistry
Dr. D. G. D. Arts and Science College
Coimbatore - 641 048

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Dr. P. R. MUTHUSWAMY
PRINCIPAL
Dr. NGP Arts and Science College
Dr. NGP - Kalapatti Road
Coimbatore - 641 048
Tamilnadu, India

B.Sc- Biochemistry (Students admitted from 2016-2017 onwards)

16UCY2AA	Allied- II : Chemistry- II	4	3	20	55	75	3
16UCY2AP	Allied Practical-I: Chemistry	2	2	20	30	50	2
PART - IV							
15UFC2FA	Value Education: Human Rights	2	3	-	50	50	2
		30				550	22
Third Semester							
PART - I							
15UTL31U 15UHL31H 15UML31M 15UFL31F	Tamil -III Hindi-III Malayalam-III French - III	5	3	25	75	100	4
PART - II							
16UEG32E	English-III	5	3	25	75	100	4
PART - III							
16UBC33A	Core -IV : Enzyme and Enzyme Technology	3	3	25	75	100	4
16UBC33B	Core- V : Bioinstrumentation	3	3	25	75	100	4
16UCS3AA/ 15UCS4AA	Allied- IV: Basics of computers	3	3	20	55	75	3
16UCS3AP	Allied Practical-II: Fundamentals of Computers	2	2	20	30	50	2
PART - IV							
	NMEC- I:	2	2	-	50	50	2
15UBC3SA	Skill based Subject -I: Bioinformatics	3	3	20	55	75	3
	Skill based Practical-I : Bioinformatics	2	-	-	-	-	-
15UFC3FA 15UFC3FB 15UFC3FC 15UFC3FD 15UFC3FE	Tamil / Advanced Tamil (OR) Yoga for Human Excellence / Women's Rights/ Constitution of India	2	3	-	50	50	2
		30				700	28

B.Sc- Biochemistry (Students admitted from 2016-2017 onwards)

Fourth Semester							
PART - I							
15UTL41U 15UHL41H 15UML41M 15UFL41F	Tamil -IV Hindi-IV Malayalam-IV French - IV	5	3	25	75	100	4
PART - II							
16UEG42E	English-IV	5	3	25	75	100	4
PART - III							
15UBC43A	Core -VI : Intermediary Metabolism	4	3	25	75	100	4
16UBC43P	Core Practical- II: Biochemistry-II	4	6	30	45	75	3
16UMA4AC	Allied -III : Basic Mathematics and Statistics	5	3	20	55	75	3
PART - IV							
	NMEC-II:	2	3	-	50	50	2
16UBC4SA	Skill based Practical-I : Bioinformatics	3	6	30	45	75	3
15UFC4FA 15UFC4FB 15UFC4FC	Tamil /Advanced Tamil (OR) General Awareness	2	3	-	50	50	2
		30				625	25
Fifth Semester							
PART - III							
15UBC53A	Core- VII: Molecular Biology	6	3	25	75	100	4
16UBC53B	Core- VIII: Human Physiology	5	3	25	75	100	4
16UBC53C	Core- IX: Clinical Biochemistry	6	3	25	75	100	4
16UBC53P	Core Practical- III: Biochemistry-III	5	6	30	45	75	3
	Elective - I	5	3	25	75	100	4
PART - IV							
16UBC5SA	Skill based Subject- II: Nutritional Biochemistry	3	3	20	55	75	3

B.Sc- Biochemistry (Students admitted from 2016-2017 onwards)

16UBC53T	Industrial Training	Grade A-C					
		30				550	22
Sixth Semester							
PART - III							
16UBC63A	Core -X : Immunology	6	3	20	55	75	3
16UBC63B	Core -XI: Genetic Engineering	6	3	20	55	75	3
16UBC63P	Core Practical- IV: Biochemistry-IV	5	6	30	45	75	3
	Elective - II	5	3	25	75	100	4
	Elective - III	5	3	25	75	100	4
PART IV							
15UBC6SP	Skill based Subject - III: Plant Physiology and Biochemistry	3	3	20	55	75	3
PART - V							
16UEX65A	Extension Activity	-	-	50	-	50	2
		30				550	22
GRAND TOTAL						3500	140

ELECTIVE - I

(Student shall select any one of the following subject as Elective-I in fifth semester)

S.No.	Subject Code	Name of the subject
1	15UBC5EA	A. Plant andAnimal Biotechnology
2	15UBC5EB	B. Principles of Genetics
3	16UBC5EC	C. Basic Concepts of Health

ELECTIVE - II

(Student shall select any one of the following subject as Elective-II in sixth semester)

S.No.	Subject Code	Name of the subject
1	15UBC6EA	A. Medicinal Chemistry
2	15UBC6EB	B. Concepts in Drug discovery
3	15UBC6EC	C. Concepts in Clinical Trials

ELECTIVE - III

(Student shall select any one of the following subject as Elective-III in sixth semester)

S.No.	Subject Code	Name of the subject
1	15UBC6EV	A. Biochemistry- Mini project
2	15UBC6ED	B.Endocrinology
3	15UBC6EE	C.Diagnostic biochemistry

NON MAJOR ELECTIVE COURSES

- The Department offers the following two papers as Non Major Elective Course for other than the Biochemistry students.
- Student shall select any one of the following subject as Non Major Elective Course during their fourth semester

S. No.	Semester	Course Code	Course Title
1.	III	15UED34C	Bioinstrumentation for Employability
2.	IV	15UED44C	Antioxidants and Phytochemistry

FOR COURSE COMPLETION

Students have to complete the following Subjects:

1. Language papers (Tamil/Malayalam/French/Hindi, English) in I and II semester.
2. Environmental Studies in I semester.
3. Value Education in II and III semester respectively.
4. General Awareness in IV semester.
5. Allied papers in I, II, III and IV semesters.
6. Two Non Major Elective Course in the third and fourth semester.
7. Extension activity in VI semester.
8. Elective papers⁸ in the fifth and sixth semesters.
9. Students must undergo Industrial training for 15 – 30 days during

IV Semester Summer Vacation. Evaluation of the Report done by the Internal and external Examiner in the V Semester. Based on their performance Grade will be Awarded as A To C.

A- 75marks and above

B- 60-74 marks

C- 40-59 marks

Below 40 marks - Re appear (RA)

Total Credit Distribution

Subjects	Credits	Total		Credits	Cumulative Total
Part I: Tamil	4	4 x 100	400	16	32
Part II: English	4	4 x 100	400	16	
Part III:					
Core	4	9 x 100	900	36	82
Core	3	2 x 75	150	06	
Core Practical	3	4 x 75	300	12	
Allied	3	4 x 75	300	12	
Allied Practical	2	2 x 50	100	4	
Electives	4	3 x 100	300	12	
Part IV:					
Skill Based Subject	3	3 x 75	225	9	24
Skill Based Practical	3	1 x 75	75	3	
NMEC	2	2 x 50	100	4	
Environmental studies	2	1 x 50	50	2	
Value Education	2	2x 50	100	4	
General Awareness	2	1x 50	50	2	
Part V:					
Extension Activity	2	1 x 50	50	2	2
Total			3500	140	140

Earning Extra credits is not mandatory for course completion

Extra credits

Part	Subject	Credit	Total credits
	BEC/ Self study courses	1	1
	Hindi / French/ Other foreign Language approved by certified Institutions	1	1
	Type Writing / Short Hand Course	1	1
	Diploma/certificate/CPT/ ACS Inter/ NPTEL Course	1	1
	Representation – Academic/Sports /Social Activities/ Extra Curricular / Co-Curricular activities at University/ District/ State/ National/ International	1	1
Total			5

Rules:

The students can earn extra credits only if they complete the above during the course period (I to V sem) and based on the following criteria. Proof of Completion must be submitted in the office of the Controller of Examinations before the commencement of the VI Semester. (Earning Extra credits are not mandatory for Course completion)

1. Student can opt BEC course/ Self study course to earn one credit. They have to Enroll and complete any one of the course during their course period before fifth semester (I sem to V sem).

Self study paper offered by Biochemistry Department

S. No.	Semester	Course Code	Course Title
1.	III	16UBCSS1	Ecological Principles
2.	IV	16UBCSS2	Herbal Technology

2. Student can opt Hindi/ French/ Other foreign Language approved by certified Institutions to earn one credit. The certificate(Hindi) must be obtained from **Dakshina Bharat Hindi Prachar Sabha** and He/ she has to enroll and complete during their course period (**first to fifth semester**)
3. Student can opt for Type writing /short hand course to earn one extra credit. He/she has to enroll and complete the course during their course period to obtain certificate through **Tamil Nadu Board of Technical Education**
4. Student can opt for Diploma/certificate/CPT/ACS Inter/ NPTEL Course to earn one extra credit. Student who opt for Diploma/ Certificate course have to enroll any diploma/certificate course offered by Bharathiar University through our Institution. Student who opt for CPT/ ACS/CMA have to enroll and complete the foundation level during the course period. Students who opt for NPTEL course should complete the course certificate through NPTEL.
5. Award Winners in Academic/ Representation in Sports /Social Activities/ Extra Curricular/ Co-Curricular Activities at University/ District/ State/ National/ International level can earn one extra credit.

16UBC13A	CORE -I: BIOMOLECULES	SEMESTER – I
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Total Credit: 4
Hours per week:4

OBJECTIVES:

On successful completion of the course, the students should have understood the significance of the complex bio-molecules, polysaccharides, lipids, proteins, nucleic acids, vitamins and minerals.

CONTENTS

UNIT - I

Water: Structure, Physical properties of water. Weak interaction in aqueous solutions. pH – Introduction, , buffers, Henderson Hasselbalch equation, biological buffer system. Introduction to biological macromolecules - Carbohydrate classification structure, properties & chemical reactions of monosaccharides. Structure, Properties of disaccharides – Maltose, Lactose and Sucrose. Polysaccharides – structure & biological functions of Homo & Hetero polysaccharides. Biological importance of sugar derivatives – glycosaminoglycans, proteoglycans & glycoproteins

UNIT - II

Lipids: Definition classification of lipids, physiochemical properties. Storage lipids – fatty acids – types. Structural lipids – phospholipids, glycolipids & sphingolipids. Structure & Biological role of cholesterol, Steroid Hormones

UNIT - III

Amino acids & Proteins: Classification of amino acids, general properties, Chemical reactions of amino acids due to carbonyl groups and aminogroups. Peptide structure and properties. Protein classification, Physiochemical properties of proteins. Organization of protein Structure – Primary (Insulin), Secondary (Keratin, Collagen) Tertiary (Myoglobin), Quaternary structure (Hemoglobin). Denaturation & Renaturation. Peptide Hormones and Enzymes.

UNIT - IV

Nucleic Acids : Structures of Purines, pyrimidines, Nucleosides and Nucleotides. Properties of nucleic acids. DNA double helical structure, A, B & Z forms. Denaturation & Renaturation of DNA. RNA - Types, structure and function.

UNIT - V

Minerals & Vitamins: Minerals in biological system and their importance - Iron, Calcium, Phosphorous, Iodine, Copper, Zinc. Vitamins - Definition, classification: Fat soluble (Vit A, D, E, K) and Water Soluble vitamins (Vit B Complex & C)-Sources, functions and deficiencies. Role of vitamins as antioxidants and cofactors.

TEXT BOOKS:

1. *Lehninger, A.L., Nelson, D.L., Cox, M.M.* 1993. **Principles of Biochemistry** (Second Edition), CBS Publishers.
2. *Lubert stryer.* (1995). **Biochemistry** (Forth Edition), *Freeman and company*

REFERENCE BOOKS:

1. *Jain J L* (2014) **Fundamentals of Biochemistry**, 7th edition, *S. Chand and Company publication*
2. *Deb A C* (1989) **Fundamentals of Biochemistry** (Third Edition), *New Central Agency, Calcutta.*
3. *Zubay* (2008) **Biochemistry** (First edition) *William.C.Brain publishers.*
4. *Voet D and Voet J G* (2008) **Biochemistry** (Third edition). *John Wiley and Sons (Asia) pvt ltd.*
5. *E. S. West, W. R. Todd, H. S.* **Textbook of biochemistry** (4th edition). *Mason, and J. T. Van Bruggen. MacMillan, New York, 1966.*

15UBC13B	CORE- II: CELL BIOLOGY	SEMESTER - I
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Total Credit: 4
Hours per week:4

OBJECTIVES:

The subject aims to build the concepts regarding:

1. Understanding the structural and functional aspects of the cell to provide the student with strong foundation in the molecular mechanisms underlying cellular function
2. Learn on the various cell organelles with their functions.

CONTENTS

UNIT -I

An overview of cells: Origin and evolution of cells, cell theory, Classification of cells: Prokaryotic and eukaryotic cells. Comparison of microbial, plant, and animal cells.

UNIT- II

Structure and function of Cell wall, Fluid mosaic model of cell membrane, structure and function of capsule. Transport across membranes: Diffusion, active and passive transport, Ion channels.

UNIT- III

Structure and function of Endoplasmic reticulum, Golgi apparatus, Ribosomes, Lysosomes, Peroxisomes and Glyoxysomes.

UNIT- IV

Structure and function of Mitochondria, Chloroplast, Cytoskeleton: Types, Microtubules, Actin and Myosin, Intermediate filaments - structure and functions. Cilia and Flagella.

UNIT- V

Structure and function of Nucleus and Chromosomes, Cell division in Prokaryotes and Eukaryotes; Mitosis and Meiosis; Cell cycle: Phases of cell cycle, Apoptosis and cell death.

TEXT BOOKS:

1. *Verma P.S. and Agarwal V.K. (2014) Cell Biology, Genetics, Molecular Biology, Evolution and Ecology.* S. Chand Publications, New Delhi.
2. *Gerald Karp, (2008) Cell and Molecular Biology, Concepts and Experiments. (Fifth Edition), John Wiley and Sons , USA*

REFERENCE BOOKS:

1. *Geoffrey M. Cooper, Robert E Hausman, (2004) The cell, A Molecular approach (Third Edition), ASM Press, Washington D.C. USA*
2. *De Robertis E.D.P and De Robertis E.M.F. (2005) Cell and Molecular Biology. (Eighth Edition) Indian Edition, Lippincott Williams and Wilkins, USA*
3. *Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Lawrence Zipursky, and James Darnell (2008) Molecular Cell Biology (Sixth Edition), WH Freeman and Company, New York.*

16UCY1AA	ALLIED PAPER - CHEMISTRY I	SEMESTER- I
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Total Credits:3

Hours per Week:4

OBJECTIVES:

On successful completion of this course the students shall gain knowledge in the basics of chemistry which helps bioscience students to understand chemical bonding in the biomolecules and the techniques involved in the biochemistry.

CONTENTS

UNIT - I

CHEMICAL BONDING:

1. Molecular Orbital Theory - bonding, antibonding and nonbonding orbitals. MO configuration of H_2 , N_2 , O_2 , F_2 - bond order - diamagnetism and paramagnetism.
2. Ionic Bond: Nature of ionic bond, structure of NaCl and CsCl, factors influencing the formation of ionic bond.
3. Covalent Bond: Nature of covalent bond, structure of CH_4 , NH_3 , H_2O , shapes of $BeCl_2$, BF_3 , based on VSEPR theory and hybridization.

UNIT - II

SOLUTIONS:

1. Normality, molarity, molality, mole fraction, mole concept.
2. Preparation of standard solutions - primary and secondary standards.
3. Principle of Volumetric analysis.
4. Strong and weak acids and bases - Ionic product of water- pH, pKa, pKb, Buffer solution, pH and pOH simple calculations.

UNIT-III

BASIC ORGANIC CHEMISTRY:

1. Electron displacement effect in organic compounds - Inductive effect - Electromeric effect - Resonance effect, Hyperconjugation and Steric effect.
2. Isomerism, Symmetry of elements (Plane, Centre and Axis of symmetry), Molecules with one chiral carbon and two adjacent chiral carbons -Optical isomerism of lactic acid and tartaric acid, Enantiomers, Diastereomers, Separation of racemic mixture (chemical, mechanical, biochemical and kinetic), Geometrical isomerism (maleic and fumaric acid).

UNIT - IV

1. SURFACE CHEMISTRY:

Adsorption – adsorbent and adsorbate, adsorption and absorption - chemisorption - physisorption - Difference between chemisorption and physisorption - applications of adsorption - Factors influencing adsorption, adsorption isobar, adsorption isostere.

2. Chromatography - Principles and applications of column, paper and thin layer Chromatography.

UNIT - V

DYES:

1. Terms used – chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift. Classification of dyes based on chemical structure and application- Preparation of azo (Methyl orange) and triphenyl methane (Malachite green) dyes.

TEXT BOOKS:

1. *R. D. Madan. 2001. **Modern Inorganic Chemistry**. S. Chand & Company, New Delhi.*
2. *Puri, Sharma, Pathania. 2004. **Principles of Physical Chemistry**, Vishal Publishing Company, Jalandhar.*
3. *B.S.Bhal , Arun Bhal,1997. **Advanced Organic Chemistry**, S. Chand & Co Limited, New Delhi.*
4. *M. K. Jain, S. C. Sharma. 2001. **Organic Chemistry**, Shoban Lal Nayin Chand, Jalandhar.*
5. *Gopalan R. 1991.**Elements of Analytical Chemistry**, Sultan Chand & Sons, New Delhi.*

15UBC23A	CORE- III: BASIC MICROBIOLOGY	SEMESTER - II
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Total Credit:4
Hours per week: 5

OBJECTIVES:

At the end of the course, the students should be able to establish good clinical microbiological services in a hospital and in the community, plan, execute, analyze and present the research work in microbiology

CONTENTS

UNIT-I

Definition, History and scope of Microbiology. Differentiation of Prokaryotes (Bacteria) and Eukaryotes (Fungi). Classification of microorganism. Microscopy – Principles of Microscope- Simple and compound microscope- Dark field, phase contrast Fluorescence and electron microscopy.

UNIT- II

Nutritional requirements – carbon, nitrogen, hydrogen, oxygen, sulfur, and phosphorous, nutritional classification of microorganism. Nutritional uptake by cell- facilitated diffusion, active transport, group translocation. Media preparation - solid. and liquid. Types of media – crude, semi synthetic, synthetic, enriched, enrichment, selective, differential and special purpose media (one example for each) physical conditions required for microorganisms – temperature, atmosphere. pH pressure. Microbial growth and measurement. Pure culture techniques – tube dilution, pour plate, spread and streak plate method. Anaerobic culture technique – wright's tube, roll tube, mcIntost fildes jar method.

UNIT- III

Sterilization and disinfection – Principles – methods of sterilization– dry heat, moist heat, filtration, Radiation, Tyndallization, Chemical sterilization- Chemical agents: mode of action (Phenol, detergents, Aldehydes, Gaseous agents) Phenol coefficient test – Sterility testing.

UNIT- IV

Antimicrobial spectrum of antibiotics and mode of action of the following antibiotics: a) Antibacterial- Penicillin, Streptomycin, and tetracyclines b) Antifungal- Nystatin and cyclohexamide, c) Antiviral- Acyclovir (nucleoside)

UNIT- V

Microbial diseases: - Normal human micro flora; host - parasitic interaction; epidemics; exo Endotoxins. Air borne diseases: - Aetiology, symptoms and prevention of Tuberculosis, Diphtheria, Polio - myelitis and Influenza. Food and Waterborne diseases:- Aetiology, symptoms and pathogenesis of Typhoid, Cholera, Bacillary dysentery and Hepatitis. Direct contact disease: - Aetiology and symptoms of Rabies.

TEXT BOOKS:

1. *Anantha Narayanan R, C .K Jayaram panicker* (1992), **Text Book of Microbiology**, 4th edition, Orient Longman Publication.
2. *Dubay R C, and Maheswari D.K* (2014) **Text Book of Microbiology**, S.Chand and Company Pvt Ltd.
3. *Arora R, Arora B*, (2008). **Text Book of Microbiology**, 3rd Edition.

REFERENCE BOOKS:

1. *Pelczar J, R E. C .S John Noel R Krieg* (1986) **Microbiology**: MC Graw Hill Book Company,
2. *Prescott L. M, Harley J .Hand D. Klein D.A* (1993), **Microbiology**, C. Brown Publishers, 1993.
3. *Ronald M.* (1993) **Microbiology-Fundamentals and Applications**, Macmillan Publishing Company, New York,.

16UBC23P	CORE PRACTICAL - I : BIOCHEMISTRY-I	SEMESTER - I & II
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Total Credit: 3
Hours per week: 2+5 = 7

OBJECTIVES:

At the end of this practical, the students will be able to:

1. Understand structures and the properties of basic biomolecules.
2. Understand and use of buffers, calculating the pH of a buffer and the concentration of the solution.

BIOMOLECULES:

1. Preparation of Normal and Molar solutions
2. Preparation of Buffer Solutions
 - a. Phosphate
 - b. Citrate
 - c. Tris
 - d. Acetate
3. Determination of pH using pH paper and pH meter.
4. Adjustment and Change of pH using Acid and Alkaline solutions
5. Qualitative Analysis

Carbohydrate

Monosaccharides: Glucose, Fructose, Galactose
Disaccharides: Sucrose, Lactose, Maltose
Polysaccharides: Starch

Amino Acids

Glycine, Tyrosine, Tryptophan, Cysteine and Arginine
6. Estimation of amino acids by formal titration

7. Analysis of Oils:

- a. Determination of Saponification number of edible oil
- b. Determination of acid number of edible oil
- c. Determination of Iodine number of oil

MICROBIOLOGY:

8. Culture media preparation –liquid and solid medium
9. Selective and differential medium
10. Methods of sterilization and testing of sterility
11. Staining of bacteria-simple, gram, negative, fungal, endospore.
12. Motility test – hanging drop
13. Growth curve – turbidity method
14. Isolation and Serial of dilution of microbes from soil.

TEXT BOOKS:

1. *David T. Plummer* (2002) An introduction to practical biochemistry, First Edition, TMH- New Delhi
2. *Varley* (2005) practical, clinical Biochemistry, Harold 4th edition, CBS publishers & Distributors Pvt Ltd.

REFERENCE BOOKS:

1. *Keith Wilson, John Walker* (2004) Practical Biochemistry, 5th edition, Cambridge University press publications.
2. *Kent Lewandrowski* (2002) Clinical Chemistry, 1st edition Lippincott Williams & Wilkins publication .

16UCY2AA	ALLIED PAPER – CHEMISTRY II	SEMESTER II
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Total Credits:3
Hours per Week: 4

OBJECTIVES:

On successful completion of this course the students shall gain knowledge in the basics of chemistry which helps bioscience students to understand the periodic table, IUPAC nomenclature of organic compounds, enzyme kinetics and water technology.

CONTENTS

UNIT - I

PERIODIC TABLE:

1. Long form of periodic table – Classification of elements on the basis of electronic configuration – Periodicity in properties – Causes of periodicity- and factors affecting the magnitude of electron affinity, ionization energy, electronegativity, atomic radii and ionic radii.

UNIT - II

1. Carbohydrates - Classification, preparation, properties and structure of glucose, fructose, inter conversion of glucose to fructose and fructose to glucose, mutarotation.
2. Vitamins - Sources of vitamins, diseases caused by the deficiency of vitamins.

UNIT - III

1. IUPAC Nomenclature of organic compounds – alkanes, alkenes, alcohols, aldehydes, ketones, carboxylic acids (mono and dicarboxylic), benzene and naphthalene derivatives.
2. Heterocyclic Compounds – Preparation and properties (physical, chemical and electrophilic substitution reactions) of furan, pyrrole, pyridine and thiophene.

UNIT - IV

CHEMICAL KINETICS:

1. Rate of reaction, rate law, order, molecularity, first order rate law, half life period of first order equation, pseudo first order reaction, zero and second order reactions. Derivation of rate expression for I and II order kinetics.
2. Catalysis - homogenous, heterogeneous and enzyme catalysis (definition only), enzymes used in industry, characteristics of catalytic reactions.

UNIT - V

WATER TECHNOLOGY:

1. Introduction- dissolved impurities in water - hard water - disadvantages of hard water, hardness, estimation of hardness by EDTA titration.
2. Softening methods - zeolite ,demineralization process, reverse osmosis - purification of drinking water, biological oxygen demand (BOD) and chemical oxygen demand (COD).

TEXT BOOKS:

1. R. D. Madan. 2001.**Modern Inorganic Chemistry**. S. Chand & Company, New Delhi,.
2. Puri , Sharma, Pathania. 2004.**Principles of Physical Chemistry**, Vishal Publishing Company, Jalandhar.
3. M. K. Jain, S. C. Sharma. 2001. **Organic Chemistry**, Shoban Lal Nayin Chand, Jalandhar.
4. Gopalan R. 1991.**Elements of Analytical Chemistry**, Sultan Chand & Sons, New Delhi.
5. N Krishnamurthy, K Jeyasubramanian, P Vallinayagam.2000. **Applied chemistry**, Tata McGraw-Hill Publishing Company limited, New Delhi.

16UCY2AP	ALLIED PRACTICAL - I : CHEMISTRY	SEMESTER II
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Total Credits: 2
Hours per Week: 2

CONTENTS

I VOLUMETRIC ANALYSIS:

1. Estimation of Sodium Hydroxide using standard Sodium Carbonate.
2. Estimation of Hydrochloric acid using standard Oxalic acid.
3. Estimation of Oxalic acid using standard Sulphuric acid.
4. Estimation of Ferrous sulphate using standard Mohr salt solution.
5. Estimation of Oxalic acid using standard Ferrous sulphate solution.
6. Estimation of Ferrous ions using Mohr salt solution.

II ORGANIC ANALYSIS:

1. To distinguish between aliphatic & aromatic.
2. To distinguish between saturated & unsaturated.
3. Detection of Elements (N, S, Halogens).
4. Functional group tests for phenols, acids (mono & di), aromatic primary amine, monoamide, diamide, carbohydrate.
Functional group characterized by Confirmatory test.

TEXT BOOK:

1. V. Venkateswaran, R. Veeraswamy & A. R. Kulandaivelu. 2004. **Basic Principles of practical chemistry**, Sultan Chand & Co.

16UBC33A	CORE -IV: ENZYME AND ENZYME TECHNOLOGY	SEMESTER - III
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Total Credit: 4
Hours per week: 3

OBJECTIVES:

On successful completion of the course the students will acquire knowledge about

1. Techniques of isolation & purification of the enzymes
2. Kinetics of the enzymes
3. Enzymes that are used in medicine and industry

CONTENTS

UNIT - I

Enzymes: Introduction, Definition, International Classification of enzymes, Numbering and nomenclature. Enzyme units. Definition of active sites. Theories proposed – Lock and Key or template model and induced fit model, ordered and random binding of substrate.

UNIT - II

Enzyme Kinetics: Derivation of Michaelis-Menten's equation. Effect of pH, Temperature, substrate concentration and enzyme concentration on enzyme activity. **Enzyme Inhibition:** Competitive, non-competitive and un-competitive inhibition. Regulatory enzymes, allosteric enzymes with reference to aspartate transcarbamylase, Isoenzymes. Ribozymes, Abzymes. Simple problems related with enzyme kinetics.

UNIT - III

Coenzymes: Definition, Structure and functions of TPP, NAD, NADP, FAD, FMN, Coenzyme A, Metal cofactors. Multienzyme Complex: Pyruvate dehydrogenase. Mechanism of enzyme action: General acid base catalysis, covalent catalysis. Mechanism of action of Lysozyme and chymotrypsin.

UNIT - IV

Enzyme Technology: Immobilized enzymes: Source and techniques of immobilization. Effect of immobilization on enzyme activity. Application of immobilized enzymes. Industrial uses of enzymes.

UNIT -V

Enzymes as Biosensors – Calorimetric biosensors, Potentiometric biosensors, Amperometric biosensors, Optical biosensors and immunosensors. Enzymes used in diagnosis and various diseases with normal and abnormal values.

TEXT BOOKS:

1. *Trevor Palmer (2001) Understanding enzymes*, 1st edition, Horwood publishing house, Chichesper
2. *Bhatt S.M. (2014) Enzymology and Enzyme technology*, 15th edition, S. Chand publishers, New Delhi
3. *Trevor Palmer (2004) Enzymes: Biochemistry, Biotechnology, Clinical chemistry*, 1st edition, Affiliated East West press private limited, New Delhi.

REFERENCES BOOKS:

1. *Nicholas C Price and Lewis stevens (1999), Fundamentals of Enzymology*, 3rd edition, Oxford University Press.
2. *Choudhary and Anjana Singh (2012), Fundamentals of Enzymology*, 1st edition, Oxford Book Company.

16UBC33B	CORE-V: BIOINSTRUMENTATION	SEMESTER - III
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Total Credit: 4
Hours per week: 3

OBJECTIVES:

On successful completion of the course, the students would understand the principles, procedures and applications of various biochemical techniques and instrumentation required for conducting analysis and research.

CONTENTS

UNIT-I

Separation Techniques. Different methods of protein precipitation: Precipitation using inorganic salts (salting out) and organic solvents, isoelectric precipitation, Dialysis, Ultrafiltration, Lyophilization

UNIT-II

Chromatography-principle, materials, methods and applications of paper chromatography, TLC, GLC, Adsorption, Ion-exchange, Affinity chromatography and Molecular sieve. HPLC, FPLC and GC-MS, NMR, Atomic absorption spectroscopy, [principles only].

UNIT-III

Electrophoresis. Basic Principle of electrophoresis, Paper electrophoresis, Gel electrophoresis, discontinuous gel electrophoresis, PAGE, SDS-PAGE, Native gels, denaturing gels, agarose gel electrophoresis, buffer systems in electrophoresis, electrophoresis of proteins and nucleic acids, protein and nucleic acid blotting, detection and identification (staining procedures), molecular weight determination, Isoelectric Focusing of proteins

UNIT-IV

1.Centrifugation: Principle of centrifugation, basic rules of sedimentation, sedimentation coefficient, various types of centrifuges, different types of rotors, differential centrifugation, density gradient centrifugation, RPG and G-Value.

2. Colorimetry: Principle, Instrumentation and Applications

3. Spectrophotometry: Principle of UV-Visible absorption spectrophotometry, instrumentation and applications.

4. Fluorimetry: Phenomena of fluorescence, intrinsic and extrinsic fluorescence, instrumentation and applications

UNIT-V

Radio isotopic techniques-Radioactive decay, units of Radioactivity, detection and measurement of Radioactivity, GM counter, Scintillation counter, Auto radiography. Applications of Radio isotopes in biological and medical sciences.

TEXT BOOKS:

1. *Sharma B.K. (1982). Instrumental method of chemical analysis*, 5th Edition Mc Grawhill, New Delhi
2. *David T. Plummer. (1998.) An Introduction to Practical Biochemistry* (Third Edition)

REFERENCE BOOKS:

1. Keith Wilson, Kenneth H. Goulding, (1992) **A Biologists guide to Principles and Techniques of practical Biochemistry** (Third Edition). Cambridge University Press.
2. Freifelder, D. (1982) **Physical Biochemistry** 2nd edition, W.H. Freeman and Co., N.Y. USA.
3. Cooper, T.G. (1977) **The Tools of Biochemistry** John Wiley and Sons, N.Y. USA.

16UCS3AA/ 15UCS4AA	ALLIED - IV: BASICS OF COMPUTERS	SEMESTER - III
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Total Credits:3
Hours Per Week:3

CONTENTS

OBJECTIVES:

On successful completion of this course, the students shall enrich the knowledge in the applications of internet in biosciences which helps them to gather updated information.

UNIT-I

General format of representing a number-Classification of number system: Positional and Non-positional number system. Decimal, Binary, Octal and Hexadecimal. Conversion from one system to another.

UNIT-II

Fundamentals of Information technology: History and Generations of computers-classification of programming languages- Operating systems and their types. Definitions of Compilers, Linker, Loaders, Assembler and Interpreter. Algorithms Flowchart and its components.

UNIT-III

Internet: Evolution of Internet-Internet terminologies: WWW, FTP, HTML, HTTP, Gopher, E-mail browsers, protocol Archie Telnet, Search engines. Application of Computers in education, business, entertainment, science, engineering and medicine

UNIT- IV

Database systems; Definitions: Data abstraction, Instances, Schemes, Entity, Entity set: Strong and weak entity sets, Primary key, Foreign key, Super key. Database models: Basic concepts of E-R model, Hierarchical model.

UNIT-V

Networking: Network architectures, Topologies, LAN, WAN, MAN AND Components of a network: Hubs, Routers, Repeaters, Bridges, Modems and cables. Linux: Installation-Basic commands.

TEXT BOOKS:

1. *Leon A and Leon M*, 2009. **Fundamentals of Information technology**, second edition, Vikas publishing House Pvt. Ltd.
2. *Date C.J.* 2003. **Introduction to Database systems**. 8th edition, Pearson publisher.

REFERENCES BOOKS:

1. *Andrew S. Tanenbaum*, 2002, **Computer networks**, Fourth edition, Prentice Hall.

16UCS3AP	ALLIED PRACTICAL- II: FUNDAMENTALS OF COMPUTERS	SEMESTER -III
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Total Credits:2
Hours Per Week:2

CONTENTS

OBJECTIVES:

Upon completion of this practical the students will gain knowledge on the hard ware components, operating systems, programming languages and basics of internet usage

COMPUTER FUNDAMENTALS:

Computers: Desktop, Laptop and Servers. Parts of Computers and computer peripherals, Demo on Assembling of Computer.

Operating systems: UNIX, Windows 2000, XP and Redhead Linux.

Important Programs of Windows OS: Microsoft Office 2003 and its modules, media player

Other Programs: Acrobat files and readers, Paint brush, Corel Draw, Quicktime player, and Photo shop.

www, IP, HTTP, FTP, Internet explorer and Its components, Browsing of web pages and Downloading files.

Email, POP3, Creation of email ID in g.mail, sending, receiving of emails, attaching of files to emails and configuring outlook express/outlook.

TEXT BOOK:

1. *Balagurusamy .E*, 2004, **Programming In Basics**, 3rd edition, Tata McGraw-Hill Education

REFERENCE BOOK:

1. *Patrick Naughton*, Internet complete reference

15UBC3SA	SKILL BASED SUBJECT- I: BIOINFORMATICS	SEMESTER -III
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Total Credit: 3
Hours per week: 3

CONTENTS

OBJECTIVES:

1. Understand the theories used to build tools and their relationship and basic concepts involved in drug design.
2. Understand Genomic data acquisition and analysis, comparative and predictive analysis of DNA and protein sequence, Phylogenetic inference etc.

UNIT- I

BioInformatics:Introduction, definition, objectives and scope. BioInformatics and Internet.Useful BioInformatics sites on www. Application of BioInformatics.

UNIT -II

Biological databases:Primary protein database – SWISS PROT, TrEMBL, PIR, PDB.

Primary nucleic acid database – EMBL, GEN BANK, DDBJ.Data mining of biological databases.

UNIT -III

Tools for database search:FASTA- Histogram, Sequence listing, Search and Programs.

BLAST – Algorithm, Services, MEGABLAST, PHI BLAST, PROTEIN BLAST, GRAPPED BLAST, PSI BLAST

UNIT- IV

Protein Primary structure analyses and prediction: Identification and characterization.

Gene Identification and prediction – pattern recognition, prediction method – laboratory based approaches – southern blotting, northern blotting, zoo blot, *In situ* hybridization.

UNIT- V

BioInformatics and drug design: Introduction, approaches – ligand based, target based. Methods of drug designing – CAMD, docking program

TEXT BOOKS:

1. *Westhead D.R, Parish J.H and Twyman R.M.* (2003) **Instant notes in BioInformatics**, 1st Edition, Viva Books Private limited, New Delhi.
2. *Attwood.T.K. Parry D.J. and Smith* (2001). **Introduction to BioInformatics**, 1st Indian Report, Pearson Education, New Delhi.

REFERENCES:

1. *Rastogi.S.C, Namita – Mendiratta and Parag Rastogi*, (2004) **BioInformatics – Concepts, Skills and applications**. CBS publishers, New Delhi.
2. *Mani K and Vijayraja* (2004), **BioInformatics – A Practical Approach**, Aparna Publishing House, First Edition, Coimbatore

15UBC43A	CORE -VI : INTERMEDIARY METABOLISM	SEMESTER - IV
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Total Credit: 4

Hours per week: 4

OBJECTIVES:

Upon completion of this course the students will gain knowledge on

1. Information related to carbohydrate, fat, protein and Nucleic acid metabolism that takes place in our body.
2. The Interrelationship between carbohydrate, fat and protein metabolism.

CONTENTS

UNIT -I

Bioenergetics: - Free energy and the laws of thermodynamics; Role of high energy compounds as energy currency of the cell; free energy of hydrolysis of ATP and other organophosphates. The basic metabolic pathways, anabolic, catabolic and amphibolic pathways.

UNIT- II

Fate of absorbed carbohydrates. Glycolysis: - Pathways and energetics; Oxidation of pyruvate to acetyl CoA. TCA Cycle: - Pathway and energetics; anaplerotic reaction. Gluconeogenesis; Pasteur effect. Glycogenesis and glycogenolysis. Pentose Phosphate Pathway (HMP shunt). Glucuronic Acid Cycle and glyoxylate cycle (Entner- Doudorff pathway). Metabolism of other hexoses: - Fructose and galactose.

Electron transport chain: - Role of respiratory chain in mitochondria; in energy capture; respiratory control. Oxidative phosphorylation: - Mechanism of oxidative phosphorylation; Chemiosmotic theory; uncouplers of oxidative phosphorylation.

UNIT- III

Blood lipids and phase of dietary lipids. Oxidation of fatty acids: - Carnitine cycle; beta oxidation. Alpha oxidation and omega oxidation. Biosynthesis of propionyl CoA. Biosynthesis of saturated fatty acids: - Extra - mitochondrial in a microsomal system for synthesis of fatty acids. Biosynthesis of unsaturated fatty acids: - Monounsaturated and polyunsaturated fatty acids. Biosynthesis and degradation: - Lecithin, cephalin, inositol, phosphatidyl serine, cholesterol.

UNIT -IV

Fate of dietary proteins, metabolic nitrogen pool. Catabolism of amino acid: Oxidative deamination, non - oxidative deamination, transamination, amino - acid decarboxylation, catabolism of carbon skeleton of amino acids. Catabolism of glycine, phenylalanine and tyrosine.

UNIT -V

Interrelation between carbohydrates, fat and protein metabolism. Nucleic acid :Metabolism of purines: - de novo synthesis, salvage pathways; catabolism. Metabolism of pyrimidines - de novo synthesis, salvage pathways; catabolism. Metabolism of micronutrients

TEXT BOOKS:

1. *Reginald H Garret and Charles M Grisham, 1995. **Biochemistry**, Sounders College Publishers*
2. *Robert K Murray, 2005. **Harpers Illustrated Biochemistry**, 26th Edition, 2003, Lange Medical Publications*
3. *Donald Voet, Judith G. Voet and Charlotte W. Pratt, 1999. **Fundamentals of Biochemistry**, John Wiley and Sons, Inc .*

REFERENCE BOOKS:

1. *Mathews, C.K., Vanholde K.E., Ahern K.G., 1999. **Biochemistry**, 3rd Edition, Pearson Education.*
2. *David L. Nelson and Michael M. Cox (2005) **Lehninger Principles of Biochemistry**. 4th edition. W.H. Freeman and company.*

16UBC43P	CORE PRACTICAL - II: BIOCHEMISTRY-II	SEMESTER - IV
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Total Credit: 3
Hours per week: 4

OBJECTIVES:

Upon completion of this practical the students will gain.

1. Knowledge on the estimation of chemical constituents with the standard solution.
2. Practical skill on colorimetry techniques.

I. COLORIMETRY:

1. Estimation of Glucose by O-Toluidine
2. Estimation of phosphorus by Fiske-Subbarow method
3. Estimation of Urea by DAM-TSC method
4. Estimation of Uric acid by Carraway method
5. Estimation of Iron by Wong's method
6. Estimation of Protein by Lowry's method
7. Estimation of Creatinine by Picric acid method
8. Estimation of RNA by Orcinol method.

II. TITRIMETRY:

1. Estimation of Ascorbic acid – Dye method
2. Estimation of Chloride – Vanslyke's method
3. Estimation of reducing sugar by Benedict's method

REFERENCE BOOKS:

1. *David T. Plummer (1998). An Introduction to Practical Biochemistry, 1998. 3rd Edition, Tata McGraw Hill Publishing company ltd.*
2. *Varley, 1980. Practical clinical biochemistry, volume I and II, 5th edition– CBS Publishers, New Delhi*

16UMA4AC	ALLIED- III: BASIC MATHEMATICS AND STATISTICS	SEMESTER -IV
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Total Credit: 3
Hours per week: 5

OBJECTIVES:

On successful completion of this course, the students shall enrich to solve various problems in bioscience which helps the students to do research problems.

UNIT - I

Binomial, Exponential and Logarithmic series (Statement only) - Application to Summation of series only.

UNIT - II

Quadratic equation - Matrices - Determinant of a matrix - Inverse of a matrix - Characteristic equation of a matrix - Eigen values - Solutions of simultaneous linear equations in three variables using matrices.

UNIT - III

Differentiation of algebraic - Exponential logarithmic and trigonometric functions - Physical interpretations of derivatives with reference to velocity and acceleration - Application of differentiation to maxima and minima (Simple problems).

UNIT - IV

Partial differentiations (Simple problems) - Integration of Simple algebraic , exponential and trigonometric functions - substitution method - Integration by parts.

UNIT - V

Measures of central tendency - Mean , Median , Mode - Measures of dispersion - Quartile deviation - Mean deviation - Standard deviation - Correlation - Karl Pearson's Coefficient of correlation - Rank correlation.

TEXT BOOKS:

1. *Manichavasagam Pillai, T.K and Narayanan,S. 2002. **Calculus - Volume I and II.**Viswanathan Publishers and Printers Pvt.Ltd.*
2. *Manichavasagam Pillai, T.K and Narayanan,S. 2002. **Algebra.**Viswanathan Publishers and Printers Pvt.Ltd.*
3. *Gupta.S.P. **Statistical Methods.** 2004. Sultan Chand and Sons.*

16UBC4SA	SKILL BASED PRACTICAL -I: BIOINFORMATICS	SEMESTER - III & IV
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Total Credit: 3

Hours Per Week: 2+3 = 5

CONTENTS

- Working with MS-Office Packages One exercise each in Word, Excel, Power point and Access.
- Working with HTML Tags and HTML Forms. Creating HTML Pages.
- Biological Databanks Sequence Databases, Structure Databases, Specialised Databases.
- Data retrieval tools and methods.
- Database file formats.
- Molecular visualization.
- Gene structure and function prediction (using Gen Scan, GeneMark).
- Sequence similarity searching (NCBI BLAST).
- Protein sequence analysis (ExPASy proteomics tools).
- Multiple sequence alignment (Clustal).
- Molecular phylogeny (PHYLP).
- Analysis of protein and nucleic acids sequences
- Sequence analysis using EMBOSS or GCG Wisconsin Package

REFERENCE BOOKS:

1. *Rastogi S.C*, 2003. **Bioinformatics - concepts, skills and applications**, 1st edition. CBS publishers.
2. *Lesk A M*, 2002. **Introduction to bioinformatics**, Oxford University Press.

15UBC53A	CORE- VII: MOLECULAR BIOLOGY	SEMESTER - V
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Total Credit: 4
Hours per week:6

OBJECTIVE:

On successful completion of the course the student should have

1. Understood the synthesis of genetic material, RNA and proteins and Learn about gene repair mechanism and gene mutation.

CONTENTS

UNIT - I

Evidences for DNA as genetic material: Experimental proof DNA replication in prokaryotes; Formation of DNA from nucleotides; Semiconservative mechanism and experimental proof; RNA priming; Bidirectional replication; theta mode, rolling circle model. Enzymology of DNA replication; Initiation, elongation and termination; Fidelity of replication. Differences in eukaryotic replication; DNA repair mechanism: Excision repair, mismatch repair, photo activation and SOS repair.

UNIT -II

Prokaryotic transcription: Central dogma; RNA polymerases Initiation, elongation and termination of transcription. Role of eukaryotic RNA polymerases. RNA splicing and processing of mRNA, tRNA and rRNA. Reverse transcription.

UNIT - III

Genetic code: Experimental evidences; Features of genetic code. Composition of prokaryotic and eukaryotic ribosomes. tRNA - structure; activation of amino acids, coding and non - coding strands of DNA. Translation - Initiation, elongation and termination of protein synthesis; Inhibitors of protein synthesis. Post - Translational modifications of proteins.

UNIT - IV

Recombination in bacteria: Transformation, Transduction and Conjugation. Recombination: - Mechanism; forms of recombination, Holliday model for homologous recombination. Prokaryotic gene

regulation: Operon model; lac operon - positive and negative control; trp operon - repression and attenuation.

UNIT - V

Gene mutations:- Types - Nutritional, Lethal, Conditional mutants. Missense mutation and other point mutations. Spontaneous mutations; chemical and radiation- induced mutations - Ames test; reversion techniques; selection of mutants; Auxotrophs; Replica plating; Penicillin cycling. Bacterial transposons:- Insertion sequences; Mechanism of transposition in bacteria.

TEXT BOOKS:

1. *Eldon John Gardner, Michael J. Simmons and Peter Snustad, D. (2006), Principles of Genetics*, 8th Edition. John Wiley and Sons, New Delhi
2. *David Freifelder, (2008), Molecular Biology*, 2nd Edition, Narosa Publishing House, New Delhi

REFERENCE BOOK:

1. *Robert. F. Weaver (1999), Molecular Biology*, 1st Edition , Mc Craw Hill book company, New York

16UBC53B	CORE -VIII: HUMAN PHYSIOLOGY	SEMESTER - V
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TotalCredit:4
Hours Per Week:5

OBJECTIVES:

On successful completion of the course, the students should have to understood the general structure and functions of various systems and organs in the body.

CONTENTS

UNIT-I

The body fluid compartments: Intracellular, extracellular and interstitial fluid. Plasma as an extracellular fluid; plasma composition; plasma proteins; Blood cellular components; RBC; Hemostasis and molecular mechanism of Blood coagulation; Role of Vitamin K in coagulation; Anti coagulant and fibrinolytic systems. Anemias, Polycythemia, Haemophilia and Thrombosis.

Gastrointestinal physiology: Secretory functions of the gastrointestinal tract; Digestion and absorption of macro and micronutrients.

UNIT-II

Physiology of vision: Structure of eye, image formation and defects of the eye, Receptor mechanism of the eye, photopigments, Visual cycle and colour adaptation **Skeletal Muscle system:** Structure of skeletal muscle, Physiology of muscle contraction in striated and nonstriated muscle.

UNIT-III

Respiratory system: Diffusion of gases in lungs, transport of oxygen from lungs to tissues through blood, factors influencing the transport of oxygen. Transport of CO₂ from tissues to lungs through blood, factors influencing the transport of CO₂.

Excretory System: Mechanism of formation of urine, composition of urine, Micturition. Renal regulation of acid balance, hormone of the kidney.

UNIT-IV

Nervous system: Structure of neuron, resting potential and action potential, Propagation of nerve – impulses, Structure of synapse, synaptic transmission (electrical and chemical theory). Structure of Neuro muscular junction and mechanism of neuro muscular transmission, neuro transmitters.

Endocrine system: Chemical nature of hormones, mechanism of action of hormones – intracellular receptor mechanism and second messenger mechanism (cAMP, cGMP, Ca^{2+}) Structure function and deficiency symptoms of hormones of pituitary, thyroid, parathyroid and adrenal glands. Functions of pancreatic hormones.

UNIT-V

Reproductive physiology: Male Reproductive system: Structure of testis, Spermatogenesis, functions of testis. Female Reproductive system: Ovarian cycle, Structure and hormones of ovaries, menstrual cycle, menopause, pregnancy and lactation. Steroids as contraceptives

TEXT BOOK:

1. *Arthur C.Guyton and John.E.Hall (2000) Text Book of Medical Physiology*, 10th Edition, Elsevier India Pvt Ltd.

REFERENCE BOOKS:

1. *Chatterjee C.C (2007) Human Physiology-Vol I and II*, 11th Edition, Medical Allied Agency.
2. *Elaine. N.Marieb (1999) Essentials of Human Anatomy & Physiology*, 6th edition, Addison Wesley Longman.Inc
3. *Elaine N.Marieb (2004) Human Anatomy and Physiology*, 6th Edition, Pearson Education.

16UBC53C	CORE- IX: CLINICAL BIOCHEMISTRY	SEMESTER - V
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Total Credit: 4
Hours per week: 6

OBJECTIVES:

This course would make the students understand the significance of diagnostic bio chemistry.

CONTENTS

UNIT-I

Disorders of Carbohydrate metabolism. Normal sugar level in blood, renal threshold and regulation of blood glucose concentration. Hypoglycemia; Definition and causes. Hyperglycemia; Definition and causes. Diabetes mellitus; Introduction, aetiology, types of diabetes mellitus, clinical pathology and diagnosis. Urine testing, random blood sugar and GTT. Acute and chronic complications of Diabetes mellitus. Glycosuria- Differential diagnosis of glycosuria, Fructosuria, Pentosouria, Galactosemia and Glycogen storage diseases

UNIT-II

Disorders of Lipid metabolism. Plasma lipids and lipoproteins. Introduction Hyperlipoproteinemia-Types I, II, III, IV and V. Alpha lipoproteinemia. Hypolipoproteinemia- A beta lipoproteinemia, Hypo beta lipoproteinemia. Tangier's disease and LCAT deficiency. Atherosclerosis, Fatty liver and hyper lipidemia. Hypercholesterolemia, Lipidosis and Xanthomatosis, Tay-Sach's disease, Niemann-Pick disease.

UNIT-III

Disorders of Amino acid metabolism, Plasma protein abnormalities; Total plasma (Serum) protein, Fibrinogen, Albumin, Pre-albumin and Globulins. Abnormal non-protein nitrogen; Urea, Uric acid, Creatinine and Ammonia, Porphyria. Amino acid metabolism: Cystinuria, phenylketonuria, maple syrup disease, alkaptonuria, Albinism and Hartnup disease. Disorders of Purine and pyrimidine metabolism Disorders of Purine metabolism: Normal level of uric acid in blood and urine, miscible uric acid pool, hyper uricemia and Gout; Hypouricemia – Xanthinuria and Liathiasis. Disorders of pyrimidine metabolism: Orotic acid urea.

UNIT-IV

Gastric, pancreatic and intestinal functions. Gastric function: Introduction, tests of gastric function – The insulin stimulation test, determination of Gastrin in serum and Tubeless gastric analysis.

Pancreatic Function: Introduction, pancreatic function tests, serum amylase and lipase. Intestinal function: Introduction, test of monosaccharide absorption (xylose excretion test) and determination of total protein (Lowry's method).

UNIT-V

Liver disease and liver function tests: Introduction, bilirubin metabolism and jaundice, liver function tests. Estimation of conjugated and total bilirubin in serum (Diazotization method). Detection of bilirubin and bile salts in urine (Fouchet's test and Hay's sulphur test). Thymol turbidity test, prothrombin time, serum enzymes in liver disease – serum transaminases (SGPT & SGOT) and lactate dehydrogenase (LDH). **Kidney function test:** Introduction, Physical examination of urine, elimination tests, clearance tests; inulin clearance, Creatinine clearance test and urea clearance test, Renal blood flow and filtration fraction.

TEXT BOOKS:

1. *Burtis A. Carl and Edward R. Ashwood*, (1994) **Tietz text book of clinical chemistry**, 2nd edition W.B.Saunders Company.
2. *Philip D. Mayne*, (2002) **Clinical Chemistry in diagnosis and treatment**. 6th edition, Arnold Association, New Delhi, Publication.
3. *Kumar, Abbas, Fausto, Saunders* (2010). **Rabbits and Corins Pathological Basics of disease**. an Imprint of Elsevier. 7th Edition.

REFERENCE BOOKS:

1. *William J Marshall*, (2008) **Clinical Biochemistry**, Metabolic and clinical aspects - 1st edition-, Elsevier Publication, New York.
2. *Allengaw C.* (1999) **Clinical Biochemistry**, Churchill Livingstone-London.
3. *Longo, Fauci, Kasper, Haase, Jamerson, Loscalzo*, (2012) **Harrison's Internal Medicine**, MC Graw Hill Publishers. 18th Edition.

16UBC53P	CORE PRACTICAL - III: BIOCHEMISTRY-III	SEMESTER - V
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Total Credit: 3
Hours per week: 5

OBJECTIVES:

Upon completion of this practical the students will gain

1. Knowledge on the estimation of constituents in the urine and serum.
2. Knowledge in the assay of liver marker enzymes

I. Estimation of the following in urine

- a. Urea by DAM TSC method
- b. Uric acid by Caraway's method
- c. Creatinine by Picric acid method
- d. Calcium by permanganate method
- e. Phosphorus by Fiske and Subbarow method

II . Estimation of the following in serum

- a. Urea by DAM TSC method
- b. Uric acid by Caraway's method
- c. Phosphorus by Fiske Subbarow method
- d. Glucose by O-Toluidine Method
- e. Cholesterol by Zak's method
- f. Hemoglobin by Cyanmethemoglobin method

III . Determination of the following enzymes in serum

- a. Acid phosphatase
- b. Alkaline phosphatase
- c. SGOT
- d. SGPT

REFERENCE BOOKS:

1. *David T.Plummer (1998).An Introduction to Practical Biochemistry,* 3rd EditionTata McGraw Hill Publishing Company Ltd.
2. *H. Varley(1998)Practical Clinical Biochemistry,* Fourth edition.

15UBC5EA	ELECTIVE-I : PLANT AND ANIMAL BIOTECHNOLOGY	SEMESTER -V
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Total Credit:4
Hours Per Week:5

OBJECTIVES:

On successful completion of the course the students would have

1. Understood the components of culture media and various tissue culture techniques
2. Learn about the technique of genetic engineering in plants and animals.

CONTENTS

UNIT - I

Plant tissue culture: - Media composition, nutrients and growth regulators, MS medium & B₅ medium. Callus and suspension culture. Initiation and differentiation of PTC. Micropropagation:- Methods, Production of haploid plants, phytochemicals from plant tissue culture.

UNIT - II

Protoplast technology:- Isolation, fusion of protoplasts, Electroporation, Biolistics, Regeneration of plants from protoplasts. Gene Transfer in plants:- Ti plasmid vectors, mechanism of T- DNA transfer, Vir genes. Transgenic plants:- Herbicide, Virus, Pest resistance plants, Male infertility, Genetic engineering of plant oils.

UNIT - III

Mammalian cell culture:- Establishment of cell in culture: Requirements for invitro growth; importance of serum. Cell-lines; cell transformation – properties of transformed cells, cell separation, Mass cultivation of cells: suspension culture; immobilized cultivation.

UNIT - IV

Genetic Engineering of Animal cells: - Mammalian cell culture in protein production. Gene transfer into mammalian cells, Selectable markers pSV plasmids; retroviral vectors; Expression vectors; reporter genes.

UNIT - V

Animal Biotechnology:- Artificial insemination and embryo transfer, Invitro fertilization (IVF): embryo cloning. Human embryo research, transgenic mice, Gene therapy; the Human Genome Project. Recombinant proteins from cell cultures: - Interferons, Viral vaccines, Hybridoma technology- Monoclonal antibodies- production and applications.

TEXT BOOKS:

1. *Satheesh K.M*, (2010). **Biotechnology**, 2nd edition, New Age International Ltd Publishers.
2. *Dubey R.C*, (2003). **A Text book of Biotechnology**, 3rd edition, S. Chand and Company publications
3. *Singh B.D*, (2014). **Plant Biotechnology**, 2nd edition, Kalyani publishers

REFERENCE BOOKS:

1. *Adrian Slater, Nigel W.Scott* , (2008). **Plant Biotechnology**, 2nd edition, Oxford University press publication.
2. *Ranga M.M*, (2003). **Animal Biotechnology**, 2nd edition Dr.Updeshpurchit for agrobios (India)

15UBC5EB	ELECTIVE-I: PRINCIPLES OF GENETICS	SEMESTER -V
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Total Credit: 4
Hours per week: 5

OBJECTIVES:

On successful completion of the course, the students have to understand the Mendelian principles, chromosomal organizations and variations in chromosomal structure.

CONTENTS

UNIT - I

Mendel's Experiments – principle of segregation – monohybrid crosses – dominance – recessiveness – lethal – principle of independent assortment – gene interaction – genetic versus environmental effects – multiple alleles.

UNIT -II

Cell cycle – mitosis – meiosis – meiosis and Mendel's principles – mechanism of sex determination – environmental factors and sex determination – sex differentiation – sex-linked inheritance

UNIT -III

Chemical composition of eukaryotic chromosomes – packing the giant DNA molecules into chromosomes – euchromatin and heterochromatin – repetitive DNA and sequence organization – Satellite DNAs – telomere structure – replication of eukaryotic chromosomes

UNIT -IV

Linkage and crossing over – chromosome mapping – two factor crosses – three factor crosses – somatic-cell hybridization – molecular mechanism of crossing-over – gene conversion – Discovery of transposable elements – transposable elements in bacteria – transposable elements in eukaryotes

UNIT -V

Variations in chromosome structure – duplications – inversions – translocations – position effects – variations in chromosome number – trisomy in humans – chromosomal mosaics – euploidy – induced polyploidy – applications of polyploidy

TEXT BOOKS:

1. *Eldon John Gardner, M.J. Simmons and D.P. Snustad*, 2005. **Principles of Genetics**, eighth edition, John Wiley & Sons (Asia) Pvt. Ltd., Singapore
2. *Gupta Pk*, 2007. **Genetics classical to modern**. Rastogi Publication.
3. *Robert T Brooker*, 1999. **Genetics, Analysis of and Principles**. Addison's Wesley publishers.
4. *Varma P.A. Agarwal V.K*, 2009. **Genetics**, Schand and Company Pvt Ltd. Multicolour Edition,

REFERENCE BOOKS:

1. *S.B. Primrose, R.M. Twyman and R.W. Old*, **Principles of Gene Manipulation**, Sixth edition, Blackwell science limited, Oxford.
2. *Brown, TA*, 1999. **Genome**. Wiley Bios, John Wiley and sons (Asia) PTE Ltd.

16UBC5EC	ELECTIVE-I: BASIC CONCEPTS OF HEALTH	SEMESTER -V
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Total Credit: 4
Hours per week: 5

OBJECTIVES:

1. To enable students to have an awareness on health
2. To make them aware of the health oriented diseases, its prevention and management.

CONTENTS

UNIT -I

Health: Definition. Concept of health, quality of life, Hygiene. Food factors for human beings and their requirements. Calorific value of food. Obesity: Definition and classification, Genetic and environmental factors leading to obesity, Obesity related diseases and management of obesity.

UNIT- II

Diabetes: Normal level of Blood sugar. Insulin and Glucagons. Types of Diabetes, etiology and pathogen city, Management of Diabetes.

UNIT- III

Cardiovascular diseases: Normal level of Cholesterol, Lipoproteins, Cardiac arrest, Myocardial infarction, Signs and Symptoms, Risk factors, Management of Heart diseases.

UNIT- IV

Kidney Stones : Diet and Prevention, Cancer – Types, Food habits and its preventive measures.

UNIT -V

Health Insurance: Individual mediclaim policy, domiciliary hospitalization, Cancer Insurance, Group Mediclaim Policy.

TEXT BOOKS:

1. *Varley* , (2005) **Practical Clinical Biochemistry** Harold, 4th edition, CBS publishers and Distributors Pvt Ltd
2. *David. T.Plummer*, (2002) **An Introduction to Practical Biochemistry**,3rd edition, Tata MC Graw-Hill publications.
3. *Shauna C. Anderson*-(1993) **Clinical Chemistry**, First Edition, , W.B.Saunders Company- London.

REFERENCE BOOKS:

1. *Carl A Burtis* (2008) **Text book of Clinical Chemistry**, first Edition, 2008, Elseveir Publication, New delhi.
2. *Shauna C. Anderson*-(1993) **Clinical Chemistry**, First Edition, , W.B.Saunders Company- London.
3. *Philip D. Mayne*,(2002) **Clinical Chemistry in Diagnosis and Treatment**, Sixth Edition, Arnold Associations, New Delhi.

16UBC5SA	SKILL BASED SUBJECT -II: NUTRITIONAL BIOCHEMISTRY	SEMESTER -V
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Total Credit: 3
Hours per week: 3

OBJECTIVES:

Upon completion of this course the students will gain knowledge on

1. the requirement of nutrition for human health
2. the actions of nutrition related processes

CONTENTS

UNIT-I

Introduction to nutrition – function of foods and its relation to nutritional and health, essential nutrients, analysis of food, composition, food habits and food groups.

UNIT-II

Physiological role and nutritional significance of carbohydrates, protein, lipids, vitamins and minerals.

UNIT-III

Energy content of foods. Measurements of energy expenditure: Direct & Indirect calorimetry. Definition of BMR and SDA and factors affecting these. Thermogenic effects of foods. Energy requirements of man and woman and factors affecting energy requirements. Role of dietary fibers in nutrition.

UNIT-IV

Starvation:

Techniques for the study of starvation. Protein metabolism in prolonged fasting. Protein sparing treatments during fasting. Basic concept of High protein low caloric weight reduction diets. Protein Calorie Malnutrition, Marasmus and Kwashiorkor.

UNIT-V

Clinical Nutrition: Role of diet and nutrition in prevention and treatment of diseases: Dental Caries, Fluorosis, Atherosclerosis and Rheumatic disorders. Inherited metabolic Disorders: Phenylketonuria, Maple Syrup disease, Homocystinuria & Alkaptonuria.

TEXT BOOKS:

1. *Patricia Trueman*, (2007). **Nutritional Biochemistry**, 1st Edition, MJP-Chennai.
2. *Maria c Linder*, (1991). **Nutritional Biochemistry and Metabolism**, 1st Edition, PHI-New Delhi.

REFERENCE BOOKS:

1. Joshi Y K (2003) **Basic Clinical Nutrition**, 1st Edition, Jaypee Brothers, New Delhi.
2. Swaminathan M (1989) **Principles of Nutrition Dietetics**, Bangalore printing Publishing Company

16UBC63A	CORE- X: IMMUNOLOGY	SEMESTER -VI
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Total Credit: 3
Hours per week: 6

OBJECTIVES:

Upon completion of this course the students will gain knowledge on

1. the structural features of the components of the immune system as well as their functions
2. the mechanisms involved in immune system development and responsiveness

CONTENTS

UNIT - I

Historical development of immunology. Innate and acquired immunity, Antibody mediated and cell mediated response tolerance. Primary and secondary lymphoid organs. Structure of T, B and NK cells. Receptors on the surface of lymphocytes. Structure and functions of neutrophils, Macrophages -phagocytosis and inflammation, eosinophils and basophils.

UNIT - II

Antigen: Properties, antigenicity, immunogenicity, antigen determinants, Haptens, Cross reactivity, adjuvants, Self antigens (MHC) an outline only. Antibodies: Properties, classes and subclasses of immunoglobulins: Structure, specificity and distribution, Clonal selection theory of antibody formation. Complement component. Cytokines and their junctions.

UNIT - III

Antigen-antibody interaction - Precipitation and agglutination - Definition and mechanism of formation, Precipitation in gel- Oudin procedure, oahley - Fulthope procedure, immune diffusion, Ouchterlony procedure, Immuno electrophoresis and electro immuno diffusion. Agglutination: Slide agglutination, Tube agglutination, Widal test. Principle and application: RIA, ELISA, Flouresent antibody technique.

UNIT - IV

Allergy and Hypersensitivity - Type I, II, III and IV, their clinical manifestations.

Immuno Disease: Rheumatoid arthritis, Myasthenia gravis. Immunity to bacteria and viruses. Skin Test: Mantoux and Penicillin test.

UNIT - V

Transplantation: Allograft rejection: Graft Vs Host Diseases: Immuno suppressors: mechanism of graft rejection.

Tumor: Lymphoid tumors, Resistant to tumors: NK Cells, Tumor immuno therapy Vaccination: Passive and active immunization: Recombinant vaccines: DNA vaccines. Benefits and adverse effects of vaccination. Monoclonal antibodies.

AIDS: CD4 and CD-8 Cell count in HIV infection.

TEXT BOOKS:

1. *Richard A Goldsby, Thomas J. Kindt, Barbara A Osborne and Janis Kuby (2003) Immunology, 5th Edition, W.H. Freeman & Company.*
2. *Ananthanarayanan R and Yayaraman Panikar (2013) Text book of microbiology, 9th Edition, University Press (India) Private Ltd.*

REFERENCE BOOK:

1. *Nandini Shetty (2005) Immunology Revised 2nd Edition, New Age International Publishers.*

16UBC63B	CORE -XI: GENETIC ENGINEERING	SEMESTER -VI
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Total Credit: 3
Hours per week: 6

OBJECTIVES:

Upon completion of this course the students will understand the basic principles of genetics, cloning and sequencing methods.

CONTENTS

UNIT-I

Introduction to genetics. Mendelian genetics. Mendel's laws. Linkage – definition, simple measurement and salient features. Salient features of autosomal dominant, recessive, codominance; X-linked recessive, codominant and dominance; Y-linked characters.

UNIT - II

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 from bacteria.

UNIT - III

Introduction of DNA into bacterial cells: Transformation of E. coli, selection of transformed cells, Identification of recombinants. Introduction of phage DNA into bacterial cell, Identification of recombinant phage. Genomic library and cDNA library. Hybridization probes; Southern, Northern and Western blotting techniques.

UNIT - IV

DNA sequencing methods: Sanger's method, Maxam and Gilbert method – Applications. Genetic Finger Printing, Protein engineering. PCR – Technique and Applications

UNIT - V

Expression vectors for E.Coli:- Constituents; Examples of promoters - Expression cassettes - 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.

TEXT BOOKS:

1. *Primrose SB and Twyman RM*, (2012) Principles of Gene Manipulation and Genomics, Seventh Edition, Blackwell Publishers.
2. *Satyanarayana.V*, (2000) Biotechnology, Panama Publishing corporations, New Delhi - Publisher Interlinks, First Edition.
3. *Brown T.A*, (2001) Gene cloning and DNA analysis and introduction. Blackwell Sciences, 4th Edition.

REFERENCE BOOKS:

1. *Ranga M.M* (2012). Animal Biotechnology, ab Agrobios (India). Third Edition.
2. *Brown T.A* (1998) Gene cloning an Introduction, Third Edition, Stanley Thornes (Publishers) Ltd.

16UBC63P	CORE PRACTICAL - IV: BIOCHEMISTRY-IV	SEMESTER -VI
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Total Credit: 3
Hours per week : 5

OBJECTIVES:

Upon completion of this practical the students will gain Knowledge and practical skill in the areas of microbiology, enzyme kinetics, Immunology, plant tissue culture and haematology

CONTENTS

ENZYME KINETICS:

1. Assay of acid phosphatase activity, specific activity from germinating mungbean seeds.
2. Linearity curve of enzyme.
3. Effect of substrate concentration on acid phosphatase activity and determination of its K_m , V_{max} and K_i (with respect to inorganic phosphate).
4. Effect of pH and temperature on enzyme activity.
5. Purification of enzyme
6. Separation by SDS PAGE.

IMMUNOLOGY:

7. Isolation of peripheral blood mononuclear cells (PBMC) from whole blood
8. Antibody-antigen reactions in gels-Double Immuno diffusion, Single radial Immuno diffusion and immunoelectrophoresis.
9. ELISA test

PLANT BIOCHEMISTRY:

10. Estimation of Chlorophyll
11. Estimation of Starch

DEMONSTRATION ON PLANT TISSUE CULTURE:

12. Preparation of media; sterilization
13. Initiation of callus culture

HAEMATOLOGY:

14. Separation and isolation of serum and plasma from blood.
15. Determination of (i) blood group and Rh factor.
16. Determination of (i) Hemoglobin content, (ii) total count and differential count(TC/DC), (iii) erythrocyte sedimentation rate (ESR), (iv) packed cell volume (PCV).
17. Determination of RBC number, bleeding time and clotting time

REFERENCE BOOKS:

1. *David T.Plummer*, (1998). **An Introduction to Practical Biochemistry**, 3rd Edition. Tata McGraw Hill Publishing company ltd.
2. *Robert H Smith*, (2005). **Plant Tissue Culture Techniques and Experiments**, Academic press - New Delhi
3. *Raja S and Selvi R*, (2011). **Experimental procedures in life sciences**, Anjana Book House.
4. *James G*, (2010). **Microbiology laboratory manual**, 7th Edition, Metalic schemen publishers.

15UBC6EA	ELECTIVE- II: MEDICINAL CHEMISTRY	SEMESTER - VI
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Total Credit: 4
Hours Per Week: 5

OBJECTIVES:

Upon completion of this course the students will

1. Understand the development of the traditional and modern methods used for drug discovery and about how molecules interact.
2. Know the fact that the pharmaceutical industry is by far the largest employer of medicine

CONTENTS

UNIT -I

Introduction and receptor concept: Introduction to drugs, classification of drugs, passage of drugs across biological membrane; absorption and distribution of drugs; binding of drugs to plasma proteins.

Drug receptor interaction, binding forces in drug receptor interaction, types of receptors. Receptor theories, isolation of receptors, consequences of drug receptor interaction

UNIT -II

Drug metabolism and elimination: Drug metabolism, methods of study of drug metabolism, microsomal drug metabolism, metabolism via hydroxylation, conjugation deamination, N-Oxidation, azo and nitro reduction, non-microsomal oxidation, Oxidative deamination, purine oxidation, dehalogenation, hydrolysis, action of choline esterase. Elimination of drugs from the body with reference to renal system

UNIT - III

Chemotherapy: Mode of action of sulfonamides, anti-metabolites of folate, purines and pyrimidines. Antibacterials - mode of action and resistance to penicillin, streptomycin, tetracycline and chloramphenicol. Antiviral, antimalarial and antiTB drugs.

UNIT - IV

Drugs acting on CNS and cardio-vascular system:

CNS – structure and mode of action of barbiturates, salicylates, MAO inhibitors and drugs for Parkinson's disease. Alzheimer's disease and other neurodegenerative disorders. Cardio-vascular disease: Structure and mode of action of cardiac glycosides, heparin and coumarin.

UNIT - V

Drugs of plant origin: Drug dependents and abuse – management of self-poisoning. Cancer chemotherapy- cytotoxic drugs. Immunosuppressive drug therapy.

TEXT BOOKS:

1. *Satoskar, R.S. Bhandarkar, S.D and Ainapure S.S.*, 16th edition, (1999) **Pharmacology and pharamacotherapeutics**. Popular Prakashnan Bombay.
2. K.D.Tripathi, (2003) **Essentials of Medical Pharmacology**, 5th Edition, Jaypee Brothers medical Publishers Private Limited, New Delhi.

REFERENCE BOOKS:

1. K.D.Tripathi, (2003) **Essentials of Medical Pharmacology**, 5th Edition, Jaypee Brothers medical Publishers Private Limited, New Delhi.
2. *Rang and Dale's Pharmacology*, 6th Edition, Churchill Livingstone, Elsevier, 2007.
3. *Gary Walsh, Biopharmaceuticals, Biochemistry and Biotechnology*, 2nd Edition, John Wiley, New Delhi, 2003.
4. *Williams M Southerland, Foundation of Medicine Biochemistry*, 1st Edition, Churchill Livingstone, London, 1990.

15UBC6EB	ELECTIVE- II: CONCEPTS IN DRUG DISCOVERY	SEMESTER -VI
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Total Credits:4
Hours Per Week:5

OBJECTIVES:

On successful completion of the course the students should have

1. Understood the phases of clinical trials and the basis of approval of new drugs
2. Understood the clinical data management for drug efficacy.

CONTENTS

UNIT-I

Biopharmaceutical Product Pipeline: Drug Discovery - Combinatorial chemistry and molecular diversity. Therapeutic targets for drug discovery.

UNIT-II

Molecular Docking Drug design: Cheminformatics - Role of computational chemistry in therapeutic drug design.

UNIT-III

Peptide and peptidomimetic engineering. Structure activity relationship (SAR and QSAR). Applications of pharmacophore-based and structure-based drug design. Use of X-ray, NMR, computer aided drug design (CADD)

UNIT-IV

Biopharmaceutical Product Pipeline: Drug Development - Drug Regulation, Phases in Drug Development. PK and ADME (Absorption, Distribution, Metabolism, Elimination) studies - cell-based permeability, uptake and cytotoxicity studies. Animal Toxicity Studies. Regulatory processes in New Drug Development (IND; ANDA)

UNIT-V

Overview of Drug Prescribing, Personalized Drugs, Essential Drugs, and Orphan Drugs.

TEXT BOOKS:

1. Guidelines for Good Clinical Practice, Central Drugs Standard Control Organization (CDSCO), Govt. of India
2. Draft Guidelines For Industry on Reporting Serious Adverse Events occurring in Clinical Trials, Central Drugs Standard Control Organization (CDSCO), Govt. of India

REFERENCE BOOKS:

1. Ethical Guidelines for Biomedical Research on Human Participants, 2006. ICMR, New Delhi
2. Intellectual Property Rights Policy, ICMR, New Delhi
3. Guidelines for care and use of Animals in Scientific Research. Revised Edition, 2000. INSA, New Delhi
4. Guidelines for Laboratory Animal Facility, Committee for the Purpose of Control and Supervision on Experiments on Animals (CPCSEA - India). 2001. CPCSEA, Chennai.

15UBC6EC	ELECTIVE-II: CONCEPTS IN CLINICAL TRIALS	SEMESTER -VI
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Total Credits: 4
Hours Per Week: 5

OBJECTIVES:

Upon completion of this course the students will understand the basic concepts, processes in clinical trial practices.

CONTENTS

UNIT-I

Types of clinical trials, observational studies and patient-centered therapeutics. Overview of Phase I (Human/ Clinical Pharmacology), Phase II (Exploratory), Phase III (Confirmatory), and Phase IV Clinical Trials. Adverse drug reactions (events) and therapeutic drug monitoring. Draft Guidelines for Industry on Reporting Serious Adverse Events Occurring in Clinical Trials (CDSCO, Government of India)

UNIT-II

Clinical Research in India: Clinical Research Organizational Chart (key functions of Data Management, Pharmacovigilance, Regulatory affairs, Biostatistics and SAS), Contract Research Organizations (CROs).

UNIT-III

The role of MNCs and Indian Pharma companies in Clinical Trials in India. Concepts of cGMP, IPR and Patenting

UNIT-IV

ICMR Ethical Guidelines for Biomedical Research on Human Participants, Chapter I (General Principles), Chapter II (Basic Responsibilities, Composition, Review Procedures only of Institutional Ethics Committee), Chapter III (Informed Consent Process, Compensation, Conflict of Interest, Special Groups, Post-Trial Access, International Collaboration), Chapter IV (Drug Trials only). Also, Definitions, and Declaration of Helsinki from Guidelines of the CDSCO on Good Clinical Practice.

UNIT-V

Care and use of Animals in Scientific Research (INSA and CPCSEA Guidelines) only with reference to - sourcing of experimental animals, housing & environment, breeding and genetics, transgenics, nutrition and feeding, hygiene & disease control, personnel and training, recordkeeping and SOPs, anaesthesia and euthanasia, and Institutional Biosafety Committee

TEXT BOOKS:

1. Guidelines for Good Clinical Practice, Central Drugs Standard Control Organization (CDSCO), Govt. of India
2. Draft Guidelines For Industry on Reporting Serious Adverse Events occurring in Clinical Trials, Central Drugs Standard Control Organization (CDSCO), Govt. of India

REFERENCE BOOKS:

1. Ethical Guidelines for Biomedical Research on Human Participants, 2006. ICMR, New Delhi
2. Intellectual Property Rights Policy, ICMR, New Delhi
3. Guidelines for care and use of Animals in Scientific Research. Revised Edition, 2000. INSA, New Delhi
4. Guidelines for Laboratory Animal Facility, Committee for the Purpose of Control and Supervision on Experiments on Animals (CPCSEA - India). 2001. CPCSEA, Chennai

15UBC6ED	ELECTIVE- III: ENDOCRINOLOGY	SEMESTER -VI
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TotalCredit:4
Hours per week: 5

OBJECTIVES:

Upon completion of this course the student should be knowledgeable about various hormones and its functions

CONTENTS

UNIT -I

Hormones- definition, classification, biosynthesis and circulation in blood. Mechanism of hormone action. Plasma membrane receptors. Adenylate cyclase, Role of G-proteins. Protein kinases, tyrosine kinase, Inositol phosphate.

UNIT-II

Hormones of the thyroid, Biosynthesis and biological actions of thyroid hormones. Antithyroid agents. Thyroid disease- thyrotoxicosis, Goiter, Grave's disease, Hashimoto's thyroiditis. Parathyroid hormone- Biological actions regulation of calcium and phosphorous metabolism.

UNIT-III

Vasopressin and oxytocin- synthesis and biological effects. Hypothalamic releasing factors. Anterior pituitary hormones- actions. Growth promoting and lactogenic hormones

UNIT -IV

Pancreatic hormones- Insulin- Biosynthesis, regulation of secretion and biological actions. Mechanism of action of insulin. Glucagon, somatostatin and pancreatic polypeptide. Insulin like growth factors.

UNIT -V

Adrenal hormones- Glucocorticoids, Mineralocorticoids- synthesis and biological effects. Catecholamines: biosynthesis and biological effects. Gonadal hormones- Androgens and estrogens.. Abnormal secretion of adrenal hormones- Addison's disease. Cushing's syndrome

TEXT BOOK:

1. *Guyton*, (1991) **Text book of medical physiology** 8th edition, Hall, Saunders Publishing Co.,

REFERENCE BOOK:

1. *Mac E Handley* (1984) **Endocrinology**, 4th edition, Hadley, Prentice Hall.

15UBC6EE	ELECTIVE -III: DIAGNOSTIC BIOCHEMISTRY	SEMESTER -VI
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Total Credit: 4
Hours per week: 5

OBJECTIVES:

Upon completion of this course the students will have an awareness on disease diagnostic methods

CONTENTS

UNIT -I

Introduction: General health, syndrome and common diseases - communicable and non-communicable diseases - Samples for analysis: Blood, urine, pleural fluid, synovial fluid, cerebrospinal fluid and tissues and histology.

UNIT -II

General check up: Blood group, Hb, height and weight, waist to hip ratio, , urine analysis - routine analysis (protein, sugar, pigments and cells). Blood: Total cell count, differential count, erythrocyte sedimentation rate - Test for Surgery: Bleeding time, clotting time.

UNIT -III

Tests for liver function: Enzyme assay (SGOT, SGPT, Alkaline phosphatase, GGT), Total protein, albumin /globulin ratio and their significance- Test for kidney function: Urea and creatinine estimation and their significance

UNIT -IV

Disorders of Lipid metabolism. Plasma lipids and lipoproteins. Introduction Hyperlipoproteinemia-Types I, II, III, IV and V . Test for heart function: Blood pressure (cystolic and diastolic), lipid profile (cholesterol, triglycerides, HDL, LDL estimation) and their importance.

UNIT -V

Non communicable diseases: Diabetes: Blood sugar, urine sugar, glucose tolerance test, HbA1c -Hyper tension: Lipid profile, electrolyte (sodium, potassium, chloride and biocarbonate) investigation.

TEXT BOOKS:

1. *Philip.D.Mayne*, (2002) **Clinical Chemistry** in diagnosis and treatment. Arnold Association, New Delhi, Publication, 6th edition,.
2. Burtis A. Carl and Edward R. Ashwood, (1994) **Tietz text book of clinical chemistry**, 2nd edition, W.B. Saunders company,.

REFERENCE BOOK:

1. *William J Marshal* (2008) **Clinical Biochemistry- Metabolic and clinical aspects**, 1st edition, Elsevier Publication, New York.

15UBC6SP	SKILL BASED SUBJECT-IV: PLANT PHYSIOLOGY AND BIOCHEMISTRY	SEMESTER -VI
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Total Credit: 3
Hours per week: 3

OBJECTIVES:

On successful completion of the course the students should have understood the key physiological, biochemical and molecular biological processes that occur in plants

UNIT -I

PLANT CELL: - STRUCTURE AND FUNCTIONS.

Photo synthesis: Photo synthetic pigments – chlorophyll, carotenoids and phycobillin. Light reactions – two kinds of chemical system – photo system I and II –evidences in support of light reaction – Hill's reaction, Arnon's work and Emerson effect. Dark reaction – Calvin's cycle (C₃ plants). Hatch – Slack cycle (C₄ cycle) and CAM plants. Photorespiration. Aerobic - anaerobic, Glycolysis, Krebs's cycle, oxidation-reduction potential, ATP synthesis, Factors affecting respiration. Transpiration in plants.

UNIT -II

CYCLES OF ELEMENTS:

Nitrogen cycle: Ammonification, nitrification, nitrate reduction and denitrification, nitrogen fixation- symbiotic and non-symbiotic nitrogen fixation. Sulphur cycle, phosphorus cycle and carbon cycle. Plant nutrition: Specific roles of essential elements and their deficiency symptoms in plants. Macro nutrients: - Carbon, Hydrogen, Oxygen, Nitrogen, Sulfur, Phosphorus, Calcium, Potassium, Magnesium and Iron. Micro nutrients: - Manganese, Boron, Copper, Zinc, Molybdenum and Chlorine.

UNIT -III

PLANT GROWTH REGULATORS:

Chemistry, biosynthesis, mode of action and Practical applications of auxins, gibberellins, cytokinins, abscisic acid and Ethylene. Plant growth inhibitors and retardants.

UNIT -IV

PHOTO MORPHOGENESIS:

Photo periodism. Phytochrome - Function in growth and development of plant. Biochemistry of seed germination. Senescence: Biochemical changes during senescence. Senescence process in life cycle of plants.

UNIT -V

SECONDARY METABOLITES:

Nature, distribution and biological functions of alkaloids, terpenes, flavonoids, poly phenols, tannins and steroids. Role of secondary metabolites in pathogens, insects, animals and mankind.

TEXT BOOKS:

1. *Peter Lea* (1997), **Plant Biochemistry and Molecular Biology**, Second edition, John Wiley and Sons, New York
2. *Devlin N. Robert and Francis H. Witham*, (2001), **Plant Physiology**, First edition, CBS, New Delhi.

REFERENCE BOOKS:

1. *William G. Hopkins* (1999), **Introduction to Plant Physiology**, Second edition, John Wiley and sons, New York.
2. *John C.K, Rajani, S. Nadyanda A.F* (1997), **Tissue culture of economic plants**, First edition, Niscom, New Delhi.

15UED34C	NMEC-I : BASICS OF BIOINSTRUMENTATION FOR EMPLOYABILITY	SEMESTER – III
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Total Credit: 2
Hours per week: 2

OBJECTIVES:

On successful completion of the course the students would have to understand Principles, procedures and applications of various biochemical techniques and instrumentation required for conducting analysis focused towards employability in corporate institutions of repute in Biological sciences

CONTENTS

UNIT-I

Spectroscopy techniques Principle and applications of UV-Visible Spectroscopy, IR Spectroscopy, Circular Dichroism, Mass Spectroscopy, Nuclear Magnetic Resonance, Electron Spin Resonance.

UNIT-II

Chromatography techniques- Principle and applications of paper chromatography, Thin layer chromatography, Gel permeation Chromatography, Ion-exchange Chromatography, Affinity chromatography, High performance Liquid Chromatography, Gas Chromatography.

UNIT-III

Electrophoretic techniques: Principle and application of SDS PAGE, Agarose gel electrophoresis; Capillary electrophoresis; Pulsed field gel electrophoresis

UNIT-IV

Centrifugation. Principle of centrifugation, basic rules of sedimentation, various types of centrifuges, different types of rotors. Differential & density gradient centrifugation;

UNIT-V

Radio isotopic techniques-Radioactive decay, units of Radioactivity, detection and measurement of Radioactivity, Auto radiography, Applications of Radio isotopes in biological and medical sciences.

TEXT BOOKS:

1. *Wilson K and Goulding Kenneth H.* A Biologists guide to Principles and Techniques of practical Biochemistry. New York: Cambridge University Press.1992.Print.
2. *Plummer David T.* An Introduction to Practical Biochemistry. New Delhi: Tata McGraw-Hill Education.1988.Print.

REFERENCE BOOKS:

1. *Sharma B.K.* **Instrumental method of chemical analysis.** New Delhi: McGraw-Hill Education. 1982.Print
2. Cooper, T.G. **The Tools of Biochemistry.** USA: John Wiley and Sons.1977.Print

15UED44C	NMEC - II: ANTIOXIDANTS AND PHYTOCHEMISTRY	SEMESTER -IV
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Total Credit: 2
Hours per week: 2

OBJECTIVES:

The course will provide knowledge for the students on the free radicals, antioxidants, secondary metabolites and its uses in therapy

CONTENTS

UNIT - I

Free radicals -types, free radicals induced damages, lipid peroxidation , reactive oxygen species. Disease caused by radicals, free radicals and cancer.

UNIT - II

Antioxidants - antioxidant defence system - Enzymic antioxidants- antioxidant effect of SOD, catalase, Glutathione Peroxidase. Non Enzymic antioxidants- antioxidant effect of Vit A, Vit C, Vit E, glutathione and selenium.

UNIT - III

Secondary metabolites: Phytochemicals, terpenes, polyphenols, procyanidins, flavonoids, xanthenes, alkaloids and pigments - Occurrence ,distribution & functions.

UNIT - IV

Terpenes, phenols, flavonoids and nitrogenous compounds and their roles alternative medicine

UNIT - V

Plant Therapeutics : plants with hepatoprotective , nephroprotective, hypoglycemic, anticancer, antimicrobial ,anti-inflammatory properties.

TEXT BOOKS:

1. *Dey P.M, Harborne J..* .(2000) **Plant Biochemistry**, Harcourt Asia PTE LTD.
2. *Malik C.P, Srivastava A.K* (2010) **Text Book of Plant Physiology**, Kalyani Publishers.
3. *Kumar G.S.* (2014) **Text book of Pharmacognosy and phytochemistry**, 1st Edition, S Chand, New Delhi
4. *Horborne J.B.* (2008). **Phytochemical method A guide to Modern technique of Plant Analysis**. Springer, New Delhi.

16UBCSS1	ECOLOGICAL PRINCIPLES	SEMESTER- I to V
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Total Credit: 1

OBJECTIVES:

To understand the

- Local and geographical distribution and abundance of organisms
- Structural adaptations and functional adjustments of organisms to their physical environment.
- Behavior of organisms 'under natural conditions.
- Conservation and management of natural resources and pollution.

CONTENTS

UNIT- I

The Environment: Physical environment; biotic environment; biotic and abiotic interactions. Habitat and Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

UNIT- II

Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemec extinctions, age structured populations. Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

UNIT- III

Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

UNIT- IV

Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine). Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

UNIT -V

Applied Ecology: Environmental pollution; global environmental change; biodiversity: status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. Conservation Biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

REFERENCE BOOKS:

1. *Odum, Eugene P.* Fundamentals of Ecology. Philadelphia: Saunders, 1971. Print
2. *Sharma, P. D.* Ecology and Environment. Meerut, India: Rastogi Publications, 2009. Print.
3. *Stiling, Peter.* Ecology: Theories and Applications. Upper Saddle River, NJ: Prentice Hall, 1998. Print.
4. *Mackenzie, A., S. R. Virdee, and A. S. Ball.* Instant Notes in Ecology. Oxford, UK: BIOS Scientific, 1998. Print.

16UBCSS2	HERBAL TECHNOLOGY	Semester I-V
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Total Credit: 1

OBJECTIVES:

To provide graduates with a basic knowledge in herbal science and technology and possible application of medicinal plants and derivatives as health products.

CONTENTS

UNIT - I

Pharmacognosy - Definition and history, Indian systems of medicine - Siddha, ayurvedha, and Unani systems. Taxonomy of locally available medicinal plants, their chemical constituents and medicinal uses - Classification of Crude drugs - Chemistry of Drugs - Future of pharmacognosy.

UNIT - II

Classification of medicinal plants - Vernacular name and family - Geographical source, cultivation, collection, and processing for market and commerce in crude drugs. Morphological and histological studies, chemical constituents - Therapeutic and other pharmaceutical uses. Underground stem - ginger, Alpinia - Roots - Rauolfia - Belladonna - Aerial parts - Bark - Cinchona.

UNIT - III

Leaves - Adathoda, Eucalyptus - Flower - Clove fruits seeds - Nuxvomica Nutmegs, Gooseberry - unorganized drugs - Gum - Acacia - Resin - Turpentine, fixed oil - castor oil.

UNIT - IV

Herbal medicines for Human ailments - Drugs Acting On Cardiac Diseases, Cerebral Diseases, Nasal, diseases - Blood pressure Drugs acting on Nervous system - Depressants. - Stimulants - Respiration and Drugs - Urogenital system and drugs - Psychoactive plants.

UNIT - V

Propagation of medicinal plants - Micro and macro propagation
conservation of rare medicinal plants Role of biotechnology in medicinal
plants banks - cultivation of medicinal and aromatic plants - Drug
adulteration - methods of Drug evaluation, Herbal food - Food processing
- packaging - Herbal sale and Export of medicinal plants - marketing -
Intellectual property rights - Export laws.

REFERENCE BOOKS:

1. Trease, George Edward, and William Charles Evans. Pharmacognosy.
London: Baillière Tindall, 1972. Print..
2. Handa, S.S. and Kapoor, V.K. Pharamcognosy by 2nd Edition, Vallabh
Prakashan Publishers, New Delhi.
3. Jain, S. K. Medicinal Plants. New Delhi: National Book Trust, India,
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havi
24/6/16
BoS Chairman/HoD
Department of Biochemistry
Dr. N. G. P. Arts and Science College
Coimbatore - 641 048

DR. P. R. MUTHUSWAMY
DR. P. R. MUTHUSWAMY
PRINCIPAL
Dr. N.G.P. Arts and Science College
Dr. N.G.P. - Kalapatti Road
Coimbatore - 641 048
Tamilnadu, India