BACHELOR OF SCIENCE
BIOCHEMISTRY

SYLLABUS 2017-18 Onwards

Dr. N.G.P ARTS AND SCIENCE COLLEGE (Autonomous)
(Re-Accredited with A Grade by NAAC)
(Affiliated to Bharathiar University,)
Dr. N.G.P. Nagar - Kalapatti Road
Coimbatore - 641 048

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 the programme of study of three academic years.

PROGRAMME EDUCATIONAL OBJECTIVES:

1. Offer students a thorough understanding on basic principles of biochemistry at the molecular and cellular levels.
2. Empower students to comprehend the occurrence of varied bio-molecular types with unique chemical characteristics that make them indispensible for life.
3. Provide students a detailed understanding on basic energy requirement of living cells, and how cells meet this prerequisite adequately through varied metabolic processes.
4. Capacitate students to grasp intricate influence of DNA and RNA structures in preserving and transferring information of cell function for generations.
5. Enable students to understand how multiple biological reactions with differing kinetics are performed in a small cell volume at a given time.
6. Entitle students to appreciate the prominence of Biochemistry in basic and applied research in varied branches of industry,medicine, agriculture, pharmacy, food technology, biotechnology, etc.

SCHEME OF EXAMINATIONS

(Choice Based Credit System- CBCS)

Course Code	Course	Hours of Instruction	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
PART-I							
17UTL11T 17UHL11H 17UML11M 17UFL11F	Tamil-I Hindi-I Malayalam-I French-I	5	3	25	75	100	3
PART-II							
17UEG12G	English-I	5	3	25	75	100	3
PART-III							
17UBC13A	**Core-I:** Biomolecules	4	3	25	75	100	3
17UBC13B	**Core-II:** Cell Biology	3	3	25	75	100	3
17UBC13P	**Core Practical-I:** Biochemistry-I	4	3	30	45	75	2
17UCY1AB	**Allied-I:** Chemistry for Biologist's	3	3	20	55	75	3
17UCY1AP	**Allied Practical-I:** Chemistry	4	2	20	30	50	2
PART-IV							
17UFC1FA	Environmental Studies	2	2	-	50	50	2
		30				**650**	**21**
Second Semester							
PART-I							
17UTL21T 17UHL21H 17UML21M 17UFL21F	Tamil-II Hindi-II Malayalam-II French-II	5	3	25	75	100	3
PART-II							
17UEG22G	English-II	5	3	25	75	100	3
PART-III							
17UBC23A	**Core-III:** Enzymology	5	3	25	75	100	5

BoS Chairman/HoD
Department of Biochemistry
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048

Dr. R. R. MUTHUSWAMY
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Dr. NGP - Kalapatti Road
Coimbatore - 641 048
Tamilnadu, India

17UBC23P	**Core Practical–II:** Biochemistry-II	6	6	30	45	75	3
17UPY2AB	**Allied-II:** Physics	3	3	20	55	75	3
17UPY2AP	**Allied Practical-II:** Physics	4	2	20	30	50	2
PART–IV							
17UFC2FA	**Value Education:** Human Rights	2	2	-	50	50	2
		30				**550**	**21**
Third Semester							
PART–I							
17UTL31T 17UHL31H 17UML31M 17UFL31F	Tamil-III Hindi-III Malayalam-III French-III	4	3	25	75	100	3
PART–II							
17UEG32G	English-III	4	3	25	75	100	3
PART–III							
17UBC33A	**Core-IV:** Analytical Biochemistry	4	3	20	55	75	4
17UBC33P	**Core Practical-III** Biochemistry-III	4	3	30	45	75	2
17UCS3AB	**Allied-III:** Basics of computers	3	3	20	55	75	2
17UCS3AP	**Allied Practical-III:** Fundamentals of Computers	4	2	20	30	50	2
17UBC3SA	**Skill based Course-I:** Bioinformatics	3	3	20	55	75	3
PART–IV							
	NMEC-I:	2	2	-	50	50	2
17UFC3FA 17UFC3FB 17UFC3FC 17UFC3FD 17UFC3FE	Tamil/ Advanced Tamil (OR) Yoga for Human Excellence/	2	2	-	50	50	2

	Women's Rights/ Constitution of India						
		30				**650**	**23**
Fourth Semester							
PART-I							
17UTL41T 17UHL41H 17UML41M 17UFL41F	Tamil-IV Hindi-IV Malayalam-IV French-IV	4	3	25	75	100	3
PART-II							
17UEG42G	English-IV	4	3	25	75	100	3
PART–III							
17UBC43A	**Core-V:** Intermediary Metabolism	5	3	20	55	75	5
17UBC43P	**Core Practical-IV:** Biochemistry-IV	6	6	30	45	75	3
17UBC4SP	**Skill based Practical-I**: Bioinformatics	4	3	30	45	75	2
17UMT4AC	**Allied-IV:** Mathematics	3	3	20	55	75	2
PART–IV							
	NMEC-II:	2	2	-	50	50	2
17UFC4FA 17UFC4FB 17UFC4FC	Tamil/Advanced Tamil (OR) General Awareness	2	2	-	50	50	2
		30				**600**	**22**
Fifth Semester							
PART–III							
17UBC53A	**Core-VI:** Genetics and MolecularBiology	5	3	20	55	75	5
17UBC53B	**Core-VII:** Human	5	3	20	55	75	5

	Physiology						
17UBC53C	**Core-VIII:** Nutritional Biochemistry	5	3	20	55	75	4
17UBC53P	**Core Practical-V:** Biochemistry-V	6	6	40	60	100	3
	Elective-I	4	3	20	55	75	4
17UBC5SA	**Skill based Course-II:** Clinical Biochemistry	5	3	20	55	75	4
PART–IV							
17UBC53T	Industrial Training	Grade A-C					
		30				**475**	**25**
Sixth Semester							
PART–III							
17UBC63A	**Core-IX:** General Microbiology	4	3	20	55	75	4
17UBC63B	**Core-X:** Introductory Immunology	4	3	20	55	75	4
17UBC63C	**Core-XI:** Plant physiology and Biochemistry	5	3	20	55	75	4
17UBC63P	**Core Practical-VI:** Biochemistry-VI	6	6	30	45	75	3
	Elective-II	4	3	20	55	75	4
	Elective-III	4	3	20	55	75	4
17UBC6SA	**Skill based Course-III:** Research Methodology	3	3	20	55	75	3
PART-IV							
17UEX65A	Extension Activity	-	-	50	-	50	2
		30				**575**	**28**
Grand Total		**180**				**3500**	**140**

ELECTIVE-I

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

S.No	Course Code	Name of the Course
1.	17UBC5EA	A. Genetic Engineering
2.	17UBC5EB	B. Principles of Genetics
3.	17UBC5EC	C. Genetics of Clinical Disorders

ELECTIVE-II

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

S.No	Course Code	Name of the Course
1.	17UBC6EA	A. Concepts in Drug Discovery
2.	17UBC6EB	B. Concepts in Clinical Trials
3.	17UBC6EC	C. Plant Therapeutics and Medicinal Chemistry

ELECTIVE-III

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

S.No	Course Code	Name of the Course
1.	17UBC6EV	A. Mini project
2.	17UBC6ED	B. Mini Project

3.	17UBC6EE	C. Mini Project

NON-MAJOR ELECTIVE COURSES (NMEC)

- The Department offers following two papers as NMEC for other than Biochemistry students.
- Student shall select any one of the following subjects as NMEC during their III- and IV-semester.

S. No.	Semester	Course Code	Course Title
1.	III	17UED34C	Biochemistry and Health
2.	IV	17UED44C	Organic farming: principles and practices

FOR PROGRAMME 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 III- and IV-semester.
7. Extension activity in V-semester.
8. Elective papers in V- and VI-semesters.
9. Students must undergo Industrial training for 15-30 days during IV-Semester Summer Vacation. Report evaluation by Internal and External Examiners will be completed in V-Semester. Student's performance will be graded 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

Course	Credits	Total		Credits	Cumulative Total
Part-I: Tamil	3	4 x 100	400	12	24
Part-II: English	3	4 x 100	400	12	
Part-III:					
Core	5	1 x 100 3 x 075	325	20	102
Core	4	5 x 075	375	20	
Core	3	2 x 100	200	06	
Core Practical	3	1 x 100 3 x 075	325	12	
Core Practical	2	2 x 075	150	04	
Allied Theory	3	2 x 075	150	06	
Allied Theory	2	2 x 075	150	04	
Allied Practical	2	3 x 050	150	06	
Skill Based Course	4	1 x 075	075	04	
Skill Based Course	3	2 x 075	150	06	
Skill Based Practical	2	1 x 075	075	02	
Elective	4	3 x 075	225	12	
Part-IV:					
NMEC	2	2 x 050	100	04	14
Environmental Studies	2	1 x 050	050	02	
Value Education	2	2 x 050	100	04	
General Awareness	2	1 x 050	050	02	
Extension Activity	2	1 x 050	050	02	

Total			**3500**	**140**	**140**

Earning Extra credits is not mandatory for programme completion

Extra credits

S.No	Course	Credit	Total credits
1	BEC/ Self study courses	1	1
2	Hindi/ French/ Other foreign Language approved by certified Institutions	1	1
3	Type Writing/ Short Hand Course	1	1
4	Diploma/certificate/CPT/ ACS Foundation/ NPTEL Course	1	1
5	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 programme period (I- to V-semester), 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 programme completion)

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

Self study paper offered by Biochemistry Department

S. No.	Semester	Course Code	Course Title
1.	III	17UBCSS1	Ecological Principles
2.		17UBCSS2	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 programme period (**I- to V-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 programme period to obtain certificate through **Tamil Nadu Board of Technical Education.**

4. Student can opt for Diploma/certificate/CPT/ACS Foundation / 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.

PROGRAMME OUTCOMES (PO):

On successful completion of the programme, following are expected outcomes.

PO Number	PO Statement
PO1	Graduates are cognizant of basic principles and concepts in diverse branches of biological and allied sciences that govern mechanisms of bio-molecular unity in varied life existences. Alumni are expressive of assimilated wisdom to peers and public at ease with language of their choice through discussion and debate.
PO2	Graduates are comprehensive of intricacies in biological organization, and they have acquired and developed primary and secondary experimental competencies and technical skills to address, investigate, design, develop and demonstrate solutions to life's important issues.
PO3	Graduates are advantaged to the pivotal and functional importance of major and allied subjects, and combine it with modern tools to investigate both basic and applied research questions in areas of industry, medicine, agriculture, pharmacy, food technology, biotechnology, etc. Alumni are valuable performers as an individual or in a team.
PO4	Graduates are competent to enroll in higher education

	programs, and successful in placements of vast career options in core and allied areas of the study (scholars, managers, counselors, writers, technical experts, field experts, teachers, entrepreneur and a responsible citizen). Alumni have acquired and developed skills to manage projects and finances. While discharging duties at varied capacities, graduates are inculcated to keep sustainable environment as a goal, and follow ethics of professional stature.
PO5	Graduates are infused with metamorphic qualities of education, and inspired to develop scientific temperament and lead a scientific way of life in facing socio-economical challenges that will benefit the society. Alumni are adept at connecting their learning's to worldwide events. Thereby, they continue the learning's lifelong.

17UBC13A	CORE-I: BIOMOLECULES	SEMESTER-I

PREAMBLE:

- The course gives an overview of structural organization and functional properties of Macromolecules.
- Students can gain basic knowledge and understanding of atoms, carbohydrates, proteins, lipids, nucleic acids, vitamins and minerals.

COURSE OUTCOMES (CO):

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Define the basic concepts of water, pH and Buffers. Explain the role of buffers system in our body fluids and classification, importance of carbohydrates.	K_1 & K_2
CO2.	Define lipids. Illustrate the role of structural and storage lipids.	K_1 & K_2
CO3.	Classification the amino acids. Compare the different structural levels & Organization of proteins with suitable examples.	K_2 & K_3
CO4.	Define Nucleic acids. Classification and identification different forms of DNA and RNA.	K_1, K_2 & K_3
CO5.	Define and classify the vitamins and minerals. Compare and contrast the deficiencies of Vitamins and Minerals.	K_2 & K_3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	M	M
CO3	S	S	M	M	M
CO4	S	S	S	M	M
CO5	S	S	S	M	M

L-Low; M-Medium and S-Strong.

17UBC13A	CORE-I: BIOMOLECULES	SEMESTER-I

Total Credits: 3
Hours per week: 4

CONTENTS

UNIT–I Water and Introduction to Carbohydrates

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.

UNIT-II Lipids

Definition & classification of lipids, physico-chemical properties. Storage lipids- fatty acids- types. Structural lipids- phospholipids, glycolipids & sphingolipids. Structure and function of steroids- cholesterol and phytosterols.

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, Physico-chemical properties of proteins. Organization of protein Structure– Primary (Insulin), Secondary (Keratin, Collagen), Tertiary (Myoglobin), Quaternary structure (Hemoglobin). Denaturation & Renaturation.

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. Types, structure and functions-RNA and microRNA.

UNIT-V Minerals & Vitamins

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

TEXT BOOKS:

1. *Nelson, D.L., Cox, M.M.* 2008. Lehninger **Principles of Biochemistry**, 5th edition, W.H. Freeman and Company, New York.

2. Berg, J.M., Tymoczko, J.L., Gatto Jr, G.J. and Stryer, L. 2015. Biochemistry, 8th edition, W.H. Freeman and Company, New York.

3. *Jain, J.L., Jain, N. and Jain, S.* 2014. **Fundamentals of Biochemistry**, 7th revised edition, S. Chand and Company publication.

4. *Deb A.C* 2001. **Fundamentals of Biochemistry,** 9th edition, New Central Book Agency, Kolkatta.

REFERENCE BOOKS:

1. *Rodwell, V.W., Bender, D.A., Botham, K.M., Kennelly, P. and Weil, P.A*. 2015. **Harper's Illustrated Biochemistry**, 30th edition. The McGraw-Hill Inc.
2. *Voet, D. and Voe*t, J.G. 2011. **Biochemistry**, 4th edition.*John Wiley and Sons (Asia) pvt ltd.*

17UBC13B	CORE-II: CELL BIOLOGY	SEMESTER-I

PREAMBLE:

- This course gives an overview of biology of cells; internal and external cellular organelles, and cell division and renewal.
- Students can gain basic knowledge and key understanding on ultra-structural organization of cellular components and their importance in cellular function.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	List various cellular types based on origin and evolution. Compare and contrast structural and functional differences of microbial, plant and animal cells. Build a concept to employ a cell as an experimental model.	K1, K2 & K3
CO2.	Define the structural and functional importance of various internal and external cellular organelles in pro- and eukaryotic cells. Classify various internal and external cellular organelles in pro- and eukaryotic cells based on their structure and functions. Develop a disease model of a cell without peroxisomes.	K1, K2 & K3
CO3.	Recall various cytoskeletal proteins. Demonstrate microfilament polymerization, assembly and intracellular organization of intermediate filament proteins. Construct a model of cilia and flagella movement.	K1, K2 & K3
CO4.	Label cell membrane, cell wall and extracellular matrix in a cell. Outline various cell-matrix and cell-cell interactions.	K1, K2 & K3

	Build a diffusion model for transport mechanism.	
CO5.	Matching structure and functions of nucleus and chromosomes of eukaryotic cell. Summarizing stages in cell division cycle and cell death process. Identifying features of transformed cells.	K1, K2 & K3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**M**	**M**
CO2	**S**	**S**	**S**	**M**	**M**
CO3	**S**	**S**	**S**	**M**	**M**
CO4	**S**	**S**	**S**	**M**	**M**
CO5	**S**	**S**	**S**	**M**	**M**

L-Low; M-Medium and S-Strong.

17UBC13B	CORE-II: CELL BIOLOGY	SEMESTER-I

Total Credits: 3
Hours per week: 3

CONTENTS

UNIT–I Introduction to cell biology

An overview of cells: origin and evolution of cells and cell theory. Classification of cells: Prokaryotic (archaea and eubacteria) and eukaryotic cells (animal and plant cells). Comparison of cells: microbial, plant, and animal cells. Cells as experimental models: prokaryotic and eukaryotic cells.

UNIT- II Structure and Functions of different cell organelles

Structure and functions: Endoplasmic reticulum, Golgi apparatus, Ribosome's, Nuclear envelope, Nuclear-pore complex, Lysosomes, Glyoxysomes, Mitochondria, Chloroplast and Peroxisomes. Zellweger syndrome.

UNIT- III Cytoskeletal proteins

Structure and organization: actin filaments. Microfilament polymerization: tread milling and role of ATP. Non-muscle myosin. Intermediate filament proteins: assembly and intracellular organization. Assembly, organization and movement: cilia and flagella.

UNIT- IV Cell wall, extracellular matrix, cell membrane and transport

Cell wall and cell matrix proteins: prokaryotic and eukaryotic cells. Structure and function: capsule. Interactions: Cell-matrix and cell-cell. Junctions: adherence, tight and gap, desmosomes, hemi-desmosomes, focal adhesions and plasmodesmata. Cell signaling and receptors

(overview). Cell membrane: fluid mosaic model. Transport across membrane: diffusion, active and passive transport, and ion channels.

UNIT- V Nucleus, chromosome, cell cycle, cell death and cell renewal

Structure and function: Nucleus and Chromosomes. Cell division: Mitosis and Meiosis (prokaryotes and eukaryotes). Cell cycle: phases of cell cycle (eukaryotic cell cycle, restriction point, and checkpoints). Cell death: apoptosis and necrosis. Transformed cells: salient features.

TEXT BOOKS:

1. *Verma, P.S.* and *Agarwal, V.K.* 2014. **Cell Biology, Genetics, Molecular Biology**, **Evolution and Ecology**, 1st edition, S. Chand Publications, New Delhi.
2. *Kar, G., Iwasa, J. and Marshall, M. 2016*. **Karp's Cell and Molecular Biology: Concepts and Experiments,** 8th edition, John Wiley and Sons, USA.

REFERENCE BOOKS:

1. *Cooper G.M.* and *Hausman*, R.E. 2007. **The cell, A Molecular approach**, 4th edition, ASM Press, Washington D.C, USA.
2. *Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walltre, P.* 2015. **Molecular Biology of the cell**, 6th edition, Taylor and Francis Company.
3. *Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Lawrence Zipursky, and James Darnell*. 2016. **Molecular Cell Biology** 8th edition, WH Freeman and Company, New York.

17UBC13P	CORE PRACTICAL-I: BIOCHEMISTRY-I	SEMESTER-I

Total Credits: 2
Hours per week: 4

PREAMBLE:

- This course gives a basic overview of structural and functional aspects of bio-molecules.
- Students can gain basic knowledge and key understanding of buffers, expression of concentrations of solutions.

CONTENTS

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:

    Carbohydrates

    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

TEXT BOOKS:

1. *Plummer, D.T.,* 1998. An introduction to Practical Bio-chemistry, 3rd edition, Tata McGraw-Hill Education, New Delhi.
2. *Varley, H.,* 2005. Practical, Clinical Biochemistry, 4th edition, CBS publishers & Distributors Pvt Ltd.

REFERENCE BOOKS:

1. *Wilson,K and Walker, J.,* 2000. Practical Biochemistry- Principles and Techniques, 5th edition, Cambridge University press publications.

2. *Kent Lewandrowski* (2002). Clinical Chemistry,1st edition Lippincott Williams & Wilkins publication .

17UCY1AB	ALLIED-I: CHEMISTRY FOR BIOLOGIST'S	Semester-I

PREAMBLE:

- This course gives an overview on basics of chemistry.
- Students can gain basic knowledge and key understanding on chemical bonding in bio-molecules, IUPAC nomenclature of organic compounds, enzyme kinetics and chemical principles that underlie techniques employed in biochemistry.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Recall basics of chemistry, which helps students to understand bonding in molecules, crystals structures and evaluate their bonding characteristics.	K1 & K2
CO2.	Design a demonstration that enables the students to prepare laboratory solutions.	K1 & K2
CO3.	Understand and apply concepts involved in naming organic compounds. Understand the substitution reactions of aromatic heterocyclic compounds.	K1, K2 & K3
CO4.	Recall spontaneity of the reaction, the nature of catalyst and reaction pathway.	K1 & K2
CO5.	Understand and apply concepts of bonding in organic molecules, and relate their displacement reactions with mechanism.	K2 & K3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	M	M	M
CO3	S	S	S	M	M
CO4	S	S	S	M	M
CO5	S	S	S	M	M

L-Low; M-Medium and S-Strong.

17UCY1AB	ALLIED-I: CHEMISTRY FOR BIOLOGIST'S	SEMESTER-I

Total Credits: 3
Hours per week: 3

CONTENTS

UNIT–I Periodic Table

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 atomic and ionic radii, electron affinity, ionization energy and electro-negativity.

UNIT–II Chemical bonding

1. Molecular Orbital Theory- bonding, anti-bonding and non-bonding 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-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 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-V 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.

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.

17UCY1AP	ALLIED PRACTICAL-I: CHEMISTRY	SEMESTER-I

Total Credits: 2
Hours per week: 4

PREAMBLE:

- This course gives a basic overview on volumetric and organic analysis of chemical substances.
- Students can gain basic knowledge and key understanding on principles underlying volumetric and organic analytic methods.

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.

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.

17UBC23A	CORE-III: ENZYMOLOGY	SEMESTER-II

PREAMBLE:

- This course gives an overview of the structure, functions and reactions mediated by enzymes in a cell.
- Students can gain basic knowledge and key understanding of enzymes, features of enzyme catalysis and kinetics, mechanism of action of selected enzymes and co-enzymes, regulation of enzyme activity, inhibitors and applications of enzymes.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Define and classify enzymes. Explain active site and specificity of enzymes. Illustrate theories of enzyme catalysis.	K_1 & K_2
CO2.	Define and compare co-enzymes. Explain regulatory enzymes with an example. Define zymogen and demonstrate its activation. Outline on ribozymes and abzymes	K_1 & K_2
CO3.	Illustrate factors that affect enzyme activity. Construction of MM plot, LB plot, Eadie-Hofstee and Hanes plot. Employ MM and LB plot for determination of Km, V-max and Kcat. Solve simple problems related to enzyme kinetics.	K_2 & K_3

CO4.	Compare and contrast different types of enzyme inhibition. Build models of bi-substrate reactions. Compare and interpret different enzyme mediated catalysis.	K_2 & K_3
CO5.	Acquiring knowledge about isolation and purification of enzymes. Utilization of different methods to develop immobilized enzymes. Explain the application of enzymes industry. Summarize the uses of enzymes in diagnosis and therapy.	K_2 & K_3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**M**	**M**
CO2	**S**	**S**	**S**	**M**	**M**
CO3	**S**	**S**	**S**	**S**	**M**
CO4	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**S**	**S**	**S**	**S**

L-Low; M-Medium and S-Strong.

17UBC23A	CORE-III: ENZYMOLOGY	SEMESTER-II

Total Credits: 5
Hours per week: 5

CONTENTS

UNIT-I Introduction to Enzymes

Introduction to enzymes, holoenzyme, apoenzyme and prosthetic groups. General characteristics of enzymes. IUB Classification of enzymes, numbering and nomenclature (Class and subclass with one example). Enzyme unit; kcat/katal, turnover number. Concept of active sites, enzyme specificity. Theories of enzyme catalysis- Lock and Key or template model and induced fit model.

UNIT-II Coenzymes and Regulatory enzymes

Coenzymes: Definition, Structure and functions of TPP, NAD, NADP, FAD, FMN, Coenzyme A, Lipoic acid, Biotin, Pyridoxal phosphate, Tetrahydrofolate and Metal cofactors. Regulatory enzymes: Isoenzymes- Lactate dehydrogenase and creatine phosphokinase. Allosteric enzymes- properties, types, models, Aspartate transcarbamylase, Ribozymes, Abzymes. Zymogen form of enzyme and zymogen activation. Multienzyme Complex: Pyruvate dehydrogenase.

UNIT-III Enzyme Kinetics

Enzyme Kinetics: Effect of pH, Temperature, substrate concentration, product concentration and enzyme concentration on enzyme activity. Michalies-Menten equation. Lineweaver-Burk plot (only for single substrate catalyzed reaction), Eadie-Hofstee and Hanes plot. Determination of Km and Vmax, Kcat/katal and its significance.

UNIT-IV Enzyme Inhibition, Bi-substrate reactions and Enzymatic catalysis

Enzyme Inhibition: Reversible-competitive, non-competitive and un-competitive inhibition. Irreversible inhibition and feedback inhibition. Bisubstrate reactions: sequential- ordered and random, ping-pong reactions. Enzymatic catalysis: General acid base catalysis, covalent catalysis (chymotrypsin and lysozyme), metal ion catalysis.

UNIT-V Enzymes Applications

Isolation of enzymes, criteria of purity. Immobilized Enzymes- methods & applications. Industrial uses of enzymes: production of glucose from starch, cellulose and dextrans, use of lactase in dairy industry, production of glucose and fructose syrup from sucrose, use of proteases in food, leather and detergent industry. Diagnostic (SGPT, SGOT, creatine kinase, alkaline and acid phosphatases), Enzyme immunoassay (HRPO), and Therapeutic (Streptokinase) application of enzymes.

TEXT BOOKS:

1. *Palmar, T., 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. *Palmer, T and Bonner, P.L., 2004.* **Enzymes: Biochemistry, Biotechnology, Clinical chemistry**, 1st edition, Affiliated East West press private limited, New Delhi.
4. *Asokan, P.* 2006. **Enzymes**, 1st edition, Chinnaa publications.

REFERENCE BOOKS:

1. *Price, N.C. and Stevens, L., 1999*. **Fundamentals of Enzymology**, 3rd edition, Oxford University Press.
2. *Choudhary, N.L. and Singh, A., 2012.* **Fundamentals of Enzymology**, 1st edition, Oxford Book Company.
3. *Nelson, D.L., Cox, M.M.,* 2008. Lehninger **Principles of Biochemistry**, 5th edition, W.H. Freeman and Company, New York.

17UBC23P	CORE PRACTICAL-II: BIOCHEMISTRY-II	SEMESTER-II

Total Credits: 3
Hours per week: 6

PREAMBLE:

- This course gives a basic overview on morphological features of various cell types.
- Students can gain basic knowledge and key understanding on enzyme biology and kinetics.

CONTENTS

I. CELL BIOLOGY:

1. Cell Types - Microbial, Animal and Plant Morphometric measurements.
2. Fractionation of cellular components.
3. Cell membrane, Separation and analysis of membrane components.
4. Mitosis in Onion root tip squash.
5. Meiosis in grasshopper testis squash.
6. Staining and visualization of mitochondria by Janus green stain.
7. Study of cell viability/ death using Tryphan blue and MTT assay
8. Effect of lipid composition on the permeability of a lipid monolayer
9. RBC ghost cell preparation and to study the effect of detergents on membranes.

II. ENZYMOLOGY:

1. Effect of pH, temperature and substrate concentration for
   a). Acid phosphatase,
   b). Amylase
   c). Urease.
2. Linearity curve of enzyme.

3. Assay of activity of alkaline phosphatase in serum.
4. Assay of serum Transaminases (SGOT, SGPT).
5. Determination of Km, V-max and Ki of acid phosphatase (with respect to inorganic phosphate).
6. Purification of enzyme
7. Separation of enzymes by natural-PAGE.

REFERENCE:

1. Becker's **The World of the Cell**, 2012. Kleinsmit, LJ., Hardin, J. and Bertoni, GP. Pearson/Benjamin-Cummings, Boston, USA.
2. **Practical Enzymology, 2nd edition, 2012**. By Bisswanger H. John Wiley & Sons.

17UPY2AB	ALLIED-II: PHYSICS	SEMESTER-II

PREAMBLE:

- This course gives an overview on principles, theories and concepts in physics.
- Students can gain basic knowledge and key understanding on how to apply these principles, theories and concepts of physics in a biological environment.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Explain concepts of Gravitation and Elasticity, and their applications in real time examples.	K2
CO2.	Interpret different modes of vibrations and acoustical applications. Explain types of Magnetic materials, and their industrial applications.	K3
CO3.	Acquire introductory knowledge on Semiconductor fundamentals, and Semiconductor devices.	K2
CO4.	Compare and realize principles of Laser Physics, and types of optical instruments.	K2
CO5.	Apply Radiation and Nano-principles in Biology.	K3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	M	M
CO3	S	S	S	M	M
CO4	S	S	S	M	M
CO5	S	S	S	M	M

L-Low; M-Medium and S-Strong.

17UPY2AB	ALLIED-II: ALLIED PHYSICS	SEMESTER-II

Total Credits: 3
Hours per week: 3

CONTENTS

UNIT-I

Gravitation: Newton's law of Gravitation-Determination of 'G' by Boy's method-Mass and density of earth – Acceleration due to gravity-Determination of 'g' by compound pendulum.

Elasticity: Basic concepts – bending of beams – depression of cantilever-Determination of Y by uniform and non- uniform bending methods-Torsion in a wire- Determination of rigidity modulus by torsional pendulum.

UNIT-II

Acoustics: Doppler effect– applications – determination of frequency of alternating current by Sonometer– Ultrasonics– production, properties and applications.

Magnetism: Basic concepts of magnetic materials– magnetic properties of Dia, Para and Ferro magnetic materials– Area of B-H loop– Curie temperature– applications of magnetic materials.

UNIT-III

Semiconductor Fundamentals and devices:

Energy band in solids– Types of semiconductors– majority and minority charge carriers.

Diodes, Rectifiers and Filters Characteristics of PN Junction-Zener diode-Zener diode as voltage regulator– Half wave and Full wave rectifiers– Bridge rectifier and ripple factor.

Special purpose diodes: LED, Photodiode and Tunnel diode, SCR.

UNIT-IV

Laser Physics: Spontaneous and Stimulated emission– Einstein's coefficient– Optical Pumping and Population Inversion– Lasing action- He-Ne, CO_2, Nd: YAG laser. Applications of lasers.

Optical Instruments: Microscopes- Electron Microscope, SEM, TEM, STEM.

UNIT-V

Radiation Biology: Radioactivity- Natural radioactivity- Artificial or induced radioactivity– Radioactive disintegration- Units of Radioactivity.

Nano materials: Introduction– Properties- Application of Nano materials. Metallic glasses– Shape Memory Alloys- Biomaterials- Applications.

TEXT BOOKS:

1. *Murugeshan R and Kiruthiga Sivaprasath Er.* 2008. **Modern Physics**. S Chand and Co, New Delhi.
2. *Brij Lal and Subrahmanyam N. 2003.* **Properties of Matter**, *S.Chand and Co, New Delhi Metha V.K. and Mehta R.* 2010, **Principles of Electronics**, [11th Edition], S Chand and Co, New Delhi.
3. *Brij Lal and Subrahmanyam N.* 2006. **A Textbook of Optics.** S Chand and Co, New Delhi.
4. *Raghavan, V.* 1990. **Materials Science and Engineering – A first course.** [3rd Edition] Prentice Hall, New Delhi.

REFERENCE BOOKS:

1. *Millman J. Halkias C. and Chetan Parikh.* 2009, **Integrated Electronics**, [2nd Edition] Tata McGraw Hill Publishing Company Ltd, New York.
2. *Robert Resnick, David Halliday and Kenneth S.Krane. 2001.* ***Physics.*** *[10th Edition] Wiley India, New Delhi.*
3. *B L Theraja.* 2006. **Basic Electronics.** S Chand and Co, New Delhi.

17UPY2AP	ALLIED PRACTICAL-II: PHYSICS	SEMESTER-II

Total Credits: 2
Hours per week: 4

PREAMBLE:

- This course gives a basic overview on experimental aspects of principles, theories and concepts in physics.
- Students can gain basic knowledge and key understanding on working principles of various biophysical techniques employed in Biochemistry field.

CONTENTS

Any 6 Experiments

1. Young's Modulus-Uniform Bending (Microscopic Method)
2. Young's Modulus-Non-uniform Bending (Microscopic Method)
3. Compound Pendulum– determination of 'g' and 'K'
4. Torsional Pendulum– Rigidity Modulus
5. Spectrometer– Refractive Index of a glass Prism
6. Spectrometer– Grating- Minimum deviation & Normal Incidence
7. Moment of a Magnet– Tan C position
8. Sonometer– Frequency of a tuning fork
9. Zener diode– Characteristics
10. Characteristics of a Junction Diode

REFERENCE:

1. *Murugeshan R and Kiruthiga Sivaprasath Er.* 2008. **Modern Physics**. S Chand and Co, New Delhi.

17UBC33A	CORE-IV: ANALYTICAL BIOCHEMISTRY	SEMESTER-III

PREAMBLE:

- This course gives an overview of the different separation, chromatographic and electrophoresis techniques.
- Students can also gain basic knowledge and understanding of centrifugation, spectroscopic and radioisotopic techniques.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Explain the various methods of protein precipitation. Compare and contrast the separation techniques like Dialysis and Ultrafiltration.	K2
CO2.	Identify the importance of the various chromatographic techniques.	K3
CO3.	Apply the various electrophoretic and blotting techniques.	K3
CO4.	Choose the different types of rotors and centrifuges. Make use of a Colorimeter, Spectrophotometer and Fluorimeter.	K3
CO5.	Identify the differences between a Geiger Muller and Scintillation counter. Summarize the usefulness of autoradiography and the applications of radioisotopes.	K2 & K3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	S	M	S	S
CO5	S	S	M	S	S

L-Low; M-Medium and S-Strong.

17UBC33A	CORE-IV: ANALYTICAL BIOCHEMISTRY	SEMESTER-III

Total Credits:
Hours per week: 4

CONTENTS

UNIT–I Separation Techniques

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

UNIT- II Chromatography

Principle, materials, methods and applications of paper chromatography, TLC, GLC, Adsorption, Ion-exchange, Affinity and Molecular sieve chromatography. Principle and applications of HPLC, FPLC. GC-MS, NMR and Mass spectroscopy at introductory level.

UNIT- III Electrophoresis

Principle, technique and applications of paper electrophoresis, gel electrophoresis, discontinuous gel electrophoresis, PAGE, SDS-PAGE, Native gels, agarose gel electrophoresis, capillary electrophoresis, detection and identification (staining procedures) of proteins and nucleic acids, Isoelectric focusing of proteins, Protein and nucleic acid blotting.

UNIT- IV Centrifugation and Spectroscopic techniques

Principle of centrifugation, basic rules of sedimentation, sedimentation coefficient, various types of centrifuges, different types of rotors, differential centrifugation, density gradient centrifugation, Ultracentrifugation.

Electromagnetic spectrum. Principle, instrumentation and applications of UV-Visible spectrophotometry and Colorimetry. Flourimetry: Phenomena of fluorescence, intrinsic and extrinsic fluorescence, instrumentation and applications.

UNIT- V Radio isotopic techniques

Introduction to radioisotopes. Radioactive decay, Units of Radioactivity, Detection and measurement of Radioactivity – Geiger-Muller counter, Scintillation counter, Auto-radiography. Applications of Radio-isotopes in biological and medical sciences. Safety and disposal of radioisotopes.

TEXT BOOKS:

1. *Sawhney and Singh*, 2015. **Introductory Practical Biochemistry**, 11th edition, Narosa Publishing house.
2. *Srivastava S*, 2010. **Molecular techniques in Biochemistry and Biotechnology**, 1st edition, New Central Book Publishers.

REFERENCE BOOKS:

1. *Wilson and Walker*, 2010. **Principles and techniques of Biochemistry and Molecular Biology,** 7th edition, Cambridge University Press.
2. *Boyer R. F*, 2000. **Modern experimental Biochemistry,** 3rd edition, Pearson Education Inc and Dorling Kindersley Publishers.

17UBC33P	CORE PRACTICAL-III BIOCHEMISTRY-III	SEMESTER-III

Total Credit: 2
Hours per week: 4

PREAMBLE:

- Students can explain the techniques used for the analysis of samples.
- Students can gain knowledge about the chromatography and electrophoresis techniques.

CONTENTS

ANALYTICAL BIOCHEMISTRY:

1. Verification of Beer's law
   (Use KMnO4, K2CrO4 or similar coloured solution for this experiment)
2. Experimental verification of molar extinction coefficient of any known compound.
3. Amino acid estimation by ninhydrin method
4. Protein estimation by Biuret method.
5. Fractional precipitation of protein from crude tissue extracts (Avoid plant tissue with phenolics in it. May use pulses or animal tissues)
6. Separation of sugars and amino acids by paper chromatography
7. Separation of lipids and amino acids by thin layer chromatography (TLC)
8. Separation of serum protein by agarose gel electrophoresis (Demonstration)
9. Dialysis using dialysis membrane
10. Ultraviolet absorption spectrum of DNA and RNA.

TEXT BOOKS:

1. Friefelder D. **Physical Biochemistry Application to Biochemistry and Molecular Biology**,WH Freeman and Company
2. Ed. K. Wilson and J. Walker, **Principles and Techniques of Biochemistry and Molecular Biology**, Cambridge Univerity Press.
3. Cooper T.G.,**The Tools of Biochemistry**, John Wiley and Sons Publication.

REFERENCE BOOKS:

1. Cark Jr J. M. and Switze r R.L., **Experimental Biochemistry**, W.H. Freeman and Company.
2. Chatwal.G and Anand.S., **Instrumental Methods of Chemical Analysis** Himalaya Publishing House, Mumbai, India.
3. Williams. B.L. and Wilson. K. (ed.)**A Biologist's Guide to Principles and Techniques of Practical Biochemistry**, Edward , Arnold Ltd. London

17UCS3AB	ALLIED-III: BASICS OF COMPUTERS	SEMESTER-III

PREAMBLE:

- Students can enrich information on basics of computer science.
- Students can gain knowledge about the applications of computer science in biosciences.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Explain various methods of classification and representation of numbers.	K2
CO2.	Identify the importance of information technology fundamentals.	K3
CO3.	Apply various internet protocol systems.	K3
CO4.	Choose different types of databases.	K3
CO5.	Identify differences between various networking architectures.	K2 & K3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**M**	**M**
CO2	**S**	**S**	**S**	**M**	**M**
CO3	**S**	**S**	**S**	**M**	**M**
CO4	**S**	**S**	**S**	**M**	**M**
CO5	**S**	**S**	**S**	**M**	**M**

L-Low; M-Medium and S-Strong.

17UCS3AB	ALLIED-III: BASICS OF COMPUTERS	SEMESTER-III

Total Credits: 2
Hours per week: 3

CONTENTS

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.

17UCS3AP	ALLIED PRACTICAL-III: FUNDAMENTALS OF COMPUTERS	SEMESTER-III

Total Credits: 2
Hours per week: 4

PREAMBLE:

- Students can enrich information on hard ware components of computer system.
- Students can gain knowledge about operating systems, programming languages
  and basics of internet usage.

1. To create an email id, compose and send a mail.
2. To send a mail with an attachment and download the attached document of mail received.
3. Create a resume in MS Word and format it.
4. Create company letter head in MS Word.
5. Create a cover page of a project report using MS Word.
6. Create a simple News letter using MS Word.
7. Create a macro which creates a line chart using the data in the worksheet in
   MS Excel.
8. Prepare Class Time-Table using MS Excel
9. Prepare student mark sheet using MS Excel.
10. Prepare a mark list for the following conditions in MS Excel

a) Data Filter

b) Data sort

11. Create a website to display a message using basic HTML tags
12. Create a web page using HTML Tags &change its back ground.

13. Design a time-table using HTML Tags.
14. Prepare a presentation using MS power point to advertise a product
15. Create a database for employee payroll using MS Access

TEXT BOOK:

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

REFERENCE BOOK:

1. *Patrick Naughton,* Internet complete reference

17UBC3SA	SKILL BASED SUBJECT–I: BIOINFORMATICS	SEMESTER–III

PREAMBLE:

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

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Explain the basic concepts and scope of bioinformatics Provide an elementary knowledge of Bioinformatics and Biological Information on the web.	**K2**
CO2.	List and compare the various protein and nucleotide sequence databases.	**K1 & K2**
CO3.	Construct global and local alignment search tool using BLAST and FASTA programs.	**K3**
CO4.	Analyze protein structure prediction using laboratory-based approaches.	**K4**
CO5.	Explain the basic concepts of drug designing.	**K2**

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	S	M
CO3	S	M	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	M

L-Low; M-Medium and S-Strong.

17UBC3SA	SKILL BASED SUBJECT–I: BIOINFORMATICS	SEMESTER–III

Total Credit: 3
Hours per week: 3

CONTENTS

UNIT- I HISTORY AND SCOPE OF BIOINFORMATICS

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

UNIT –II DATABASES - TOOLS AND THEIR USES

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 SEQUENCE ALLIGNMENT

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 STRUCTURE PREDICTION

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 and *In-situ* hybridization.

UNIT- V DRUG DISCOVERY

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,** Ist Edition, Viva Books Private limited, New Delhi.
2. *Attwood.T.K. Parry D.J. and Smith* (2001). **Introduction to Bioinformatics**, Ist Indian Report, Pearson Education, New Delhi.

17UED34C	NMEC–I: BIOCHEMISTRY AND HEALTH	SEMESTER–III

PREAMBLE:

- Understand the importance of bioorganic macromolecules in living systems.
- Students can understand the consequences of deficiency in these macromolecules in living systems.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Provide an elementary knowledge of bioorganic molecules. Explain the basics of bioorganic molecules.	**K2**
CO2.	List and compare various types of macromolecules.	**K1 & K2**
CO3.	Construct deficiency and pathological picture of macromolecules in living cells.	**K3**
CO4.	Analyze the role of macromolecules in living organisms.	**K4**
CO5.	Explain the basic constituents of living organisms.	**K2**

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	S	M
CO3	S	M	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	M

L-Low; M-Medium and S-Strong

17UED34C	NMEC–I: BIOCHEMISTRY AND HEALTH	SEMESTER–III

Total Credits: 2
Hours per week: 2

CONTENTS

UNIT – I

Carbohydrate – Source of carbohydrates, Importance of carbohydrates in living organisms, Normal level of sugar in humans, Diabetes mellitus and its complications in human. Control and prevention of diabetes mellitus.

UNIT – II

Proteins–Sources of proteins and amino acids. Importance of proteins in living organisms. Normal level of proteins in human. Protein deficiency disease- Kwashiorkor, Marasmus, protein C & S deficiency and Cachexia.

UNIT – III

Fatty acids- Source of fats and importance of fats and lipids in living organism. Normal levels of cholesterol, hypercholesterolemia and role of cholesterol in Blood pressure. Atherosclerosis and Heart attack. Prevention and control of heart related diseases

UNIT – IV

Vitamins–Source of water soluble and fat-soluble vitamins. Deficiency disorders of Vitamins and importance of vitamins in humans.

UNIT – V

Minerals– Source and deficiency disorders of calcium, magnesium, sodium, potassium, phosphorus, Iron, Iodine in humans.

TEXT BOOKS:

1. Text book of Medical Physiology –Guyton.A.C
2. Human Physiology by Chatterjee
3. Food facts and principles, Shakuntala Manay
4. Deb.A.C., Fundamentals of Biochemistry, Books and allied (p) Ltd, 2002.
5. Essentials of Biochemistry Sathyanarayanan.U. Books and allied (p) Ltd, 2002.
6. Biochemistry Ambika shanmugam

17UBC43A	CORE-V: INTERMEDIARY METABOLISM	SEMESTER-IV

PREAMBLE:

- This course is concerned with how living things synthesize and degrade carbohydrates, lipids, amino acids and nucleotides with emphasis on energy generation, consumption and related disorders and the combined activities of all the metabolic pathways that interconvert precursors, metabolites and products of Low Molecular Weight substances.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Illustrate the general design of metabolic pathways based on bioenergetics principle	**K1 & K2**
CO2.	Describe what happens during carbohydrate digestion, glycolysis, glycogenesis, and glycogenolysis. Explain the events that make up the process of aerobic cellular respiration and interpret how the Electron Transport Chain and Chemiosmosis function in production of ATP	**K1 & K2**
CO3.	Understand the chemical logic of lipid metabolic pathways and can interpret the case studies in lipid disorders.	**K2 & K4**
CO4.	Explain how nitrogenous compounds (amino acids) are synthesized and degraded and justify the biochemical basis of some diseases arising in amino acid metabolism.	**K2 & K4**
CO5.	Outline basics of nucleic acid metabolic pathways and compare different metabolic pathways and evaluate their interrelations.	**K2 & K4**

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	S	M
CO3	S	M	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	M

L-Low; M-Medium and S-Strong.

17UBC43A	CORE-V: INTERMEDIARY METABOLISM	SEMESTER-IV

Total Credits: 5
Hours per week: 5

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- Duodorfi 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 fate 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 pyramidines - 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.

17UBC43P	CORE PRACTICAL-IV BIOCHEMISTRY-IV	SEMESTER IV

Total Credits: 3
Hours Per Week: 6

PREAMBLE:

- This course gives a basic understanding on metabolism and related abnormalities.
- Students can gain basic knowledge and key understanding of abnormal constituents of urine and liver marker enzymes.

CONTENTS

INTERMEDIARY METABOLISM:

I. Estimation of the following in unknown samples

a. Urea by DAM TSC method
b. Uric acid by Caraway's method
c. Creatinine by Picric acid method
d. Phosphorus by Fiske Subbarow method
e. Glucose by O-Toluidine Method
f. Cholesterol by Zak's method
g. Hemoglobin by Cyanmethhemoglobin method
h. Calcium by permanganate method
i. Iron by Wongs method
j. Protein by lowry's method

II. Qualitative analysis of abnormal constituents in urine - glucose, albumin, bile Pigments, bile salts and ketone bodies.

III. H_2S production, Indole production and ammonia production by bacteria

IV. Induction of Hydrolytic enzymes proteinases/ amylases/lipases during germination.

REFERENCE BOOKS:

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

17UBC4SP	SKILL BASED PRACTICAL-I: BIOINFORMATICS	SEMESTER–IV

Total Credit: 2
Hours Per Week: 4

PREAMBLE:

- Understand the nature of biological data and need for biological databases.
- Understand and explore major bio-molecular sequence databases (organization and contents); search and retrieve data from the databases using their respective search engines.
- Understand algorithms for sequence analysis.
- Understand Genomic data acquisition and analysis, comparative and predictive analysis of DNA and protein sequence, Phylogenetic inference etc.

CONTENTS

1. Working with MS-Office Packages One exercise each in Word, Excel, Power point and Access.
2. Working with HTML Tags and HTML Forms. Creating HTML Pages.
3. Biological Databanks Sequence Databases, Structure Databases, Specialized Databases.
4. Data retrieval tools and methods.
5. Database file formats.
6. Molecular visualization (RASMOL).
7. Gene structure and function prediction (using Gen Scan, GeneMark).
8. Sequence similarity searching (NCBI BLAST).
9. Protein sequence analysis (ExPASy proteomics tools).
10. Multiple sequence alignment (Clustal).

11. Molecular phylogeny (PHYLIP).
12. Analysis of protein and nucleic acids sequences
13. Sequence analysis using EMBOSS or GCG Wisconsin Package

REFERENCE BOOK:

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.

17UMT4AC	ALLIED-IV: MATHEMATICS	SEMESTER-IV

PREAMBLE:

- On successful completion of this subject the students should have Understand the basic concepts of Mathematics.
- To know about the applications of Statistical and Numerical Techniques of Mathematics.

COURSE OUTCOMES

On the successful completion of the course, student will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Learn about Set Theory	**K1**
CO 2	Learn about Matrices	**K1**
CO 3	Apply Statistical Techniques for data collection	**K2**
CO 4	Solve the problems related to Measures of central tendency	**K2**
CO 5	Solve the problems related to Probability	**K3**

MAPPING WITH PROGRAMME OUTCOMES

COS/POS	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	**S**	**S**	**S**	**M**	**M**
CO 2	**S**	**S**	**S**	**M**	**M**
CO 3	**S**	**S**	**S**	**M**	**M**
CO 4	**S**	**S**	**S**	**M**	**M**
CO 5	**S**	**S**	**S**	**M**	**M**

S- Strong; M-Medium; L-Low

17UMT4AC	ALLIED-IV: MATHEMATICS	SEMESTER-IV

Total Credits: 2
Hours per week: 3

CONTENTS

UNIT -I

Set Theory - Definition - Notations - Description of sets- Types of sets - Venn Diagrams - Set operations - Laws and properties of sets - Number of elements (Sums involved in two sets only) –Permutation – Combination.

UNIT -II

Matrix: Basic Concepts - Types of Matrices - Addition and Multiplication of Matrices – Determinants - Crammer's Rule - Inverse of a Matrix - Matrix Method - Rank of Matrix.

UNIT-III

Statistics: Meaning - Definition – Collection of data - Classification and Tabulation – Diagrammatic Representation and Graphical Representation.

UNIT-IV

Measures of Central Tendency: Mean – Median – Mode - Measures of dispersion : Range – Standard deviation.

UNIT-IV

Interpolation – Binomial, Newton's and Lagrange's methods **-** Probability - Concept and Definition – Addition and Multiplication theorems of Probability (Statement only) - Simple problems based on Addition and Multiplication theorems only.

TEXT BOOKS:

1. *Navnitham, P.A*. 2013. **Business Mathematics & Statistics.** Jai Publishers,Trichy

REFERENCE BOOKS:

1. *Gupta, S.P. and Gupta, M.P* . 2002. **Business Statistics .** Sultan Chand and Sons.
2. *Venkataraman , M.K*. 2004. **Numerical Methods in Science & Engineering**. NPC. Revised Edition.

17UED44C	NMEC-II ORGANIC FARMING: PRINCIPLES AND PRACTICES	SEMESTER–IV

PREAMBLE:

- This course gives a basic understanding on organic farming methods.
- Students can gain basic knowledge and key understanding of socio-economic importance of organic farming.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Explain the basic concepts and scope of organic farming.	**K2**
CO2.	List and compare the various methods and approaches of organic farming.	**K1 & K2**
CO3.	Construct a prototypic organic farming model.	**K3**
CO4.	Analyze advantages and disadvantages of organic farming.	**K4**
CO5.	Explain the basic concepts in organic farming.	**K2**

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**M**	**M**
CO2	**S**	**S**	**S**	**S**	**M**
CO3	**S**	**M**	**S**	**S**	**M**
CO4	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**S**	**S**	**S**	**M**

L-Low; M-Medium and S-Strong.

17UED44C	**NMEC-II ORGANIC FARMING: PRINCIPLES AND PRACTICES**	**SEMESTER –IV**

Total Credits: 2
Hours per week: 2

CONTENTS

UNIT I

Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; land and water management - land use, minimum tillage; shelter zones, hedges, pasture management, agro-forestry.

UNIT II

Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers.

UNIT III

Farming systems, crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.

UNIT IV

Control of weeds, diseases and insect pest management, biological agents and pheromones, biopesticides.

UNIT V

Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.

TEXT BOOKS:

1. Ananthakrishnan, T. N. (ed.). 1992. Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH.
2. Gaur, A.C. 1982. A Manual of Rural Composting, FAO/UNDP Regional Project Document, FAO.
3. Lampkin, N. 1990. Organic Farming. Press Books, lpswitch, UK.
4. Palaniappan, S.P and Anandurai, K. 1999. Organic Farming – Theory and Practice. Scientific Publ.
5. Rao, B.V.V. 1995. Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective: Publ.3, Parisaraprajna Parishtana, Bangalore.
6. Reddy M.V. (ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH.
7. Sharma, A. 2002. Hand Book of Organic Farming. Agrobios.
8. Singh, S. P. (ed.) 1994. Technology for Production of Natural Enemies. PDBC, Bangalore.
9. Subba Rao, N.S. 2002. Soil Microbiology. Oxford & IBH.
10. Trivedi, R. N.1993. A Text Book of Environmental Sciences, Anmol Publ.

17UBC53A	CORE-VI: GENETICS AND MOLECULAR BIOLOGY	SEMESTER-V

PREAMBLE:

- This course gives an overview of Genetics of cells.
- Students can gain basic knowledge and key understanding on mechanism of Central dogma of Molecular biology.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge level
CO1	Recall the basics of genetics, laws of inheritance.	K1 & K3
CO2	Outline the basics of gene cloning and restriction endonucleases. Explain that DNA is the genetic material. Define replication and enzymes involved. Compare the enzymes in transcription. Distinguish the general and specific characteristics of replication of prokaryotes and eukaryotes.	K1, K3 & K4
CO3	Explain the transcription and central dogma of prokaryotic cell, selection and identification of recombinants. Examine and understand the different factors like Rho dependent and Rho independent transcription, Outline the basic concept of the gene.	K2, K4 & K5
CO4	Explain the concept of protein synthesis and posttranslational modifications. Comparison of Prokaryotic and eukaryotic ribosome. Justify the definition and silent features of Genetic code.	K3, K4 & K5
CO5	Explain the application of repair mechanism of DNA repair. Evaluate the prokaryotic gene regulation. Explain the types of gene mutation.	K4 & K5

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	M	M
CO3	S	S	M	M	M
CO4	S	S	S	M	M
CO5	S	S	S	M	M

L-Low; M-Medium and S-Strong.

17UBC53A	CORE-VI: GENETICS AND MOLECULAR BIOLOGY	SEMESTER-V

Total Credits: 5
Hours per week: 5

CONTENTS

UNIT - I

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

UNIT - II

DNA as genetic material, highly repetitive, moderately repetitive and unique DNA sequences. Types of replication, evidence for semi conservative replication. Replication in prokaryotes and inhibitors of replication. DNA polymerases I, II, III, topoisomerases, Okazaki fragments, DNA ligases. RNA as genetic material. Reverse transcriptase, retroviruses, satellite DNA and Cot value.

UNIT - III

Prokaryotic transcription central dogma, RNA polymerases, role of sigma factor, initiation, elongation and termination. (Rho-dependent and independent). Inhibitors of transcription, post transcriptional modification of prokaryotes and eukaryotes. Basic concept of one gene-one enzyme hypothesis.

UNIT - IV

Translational activation of amino acids, initiation, elongation and termination of protein synthesis in prokaryotes. Inhibitors of protein

synthesis. Posttranslational modification of proteins. Genetic code-definition, deciphering and salient features of genetic code, composition of pro and eukaryotic ribosome, structure of t-RNA, coding and non coding strands of DNA role of signal peptides.

UNIT - V

DNA repair mechanism-excision, SOS and UV repair. Prokaryotic gene regulation-Operon, Lac operon, positive and negative control. Gene mutation types, point mutation, transition transversion frame shift, insertion and deletion.

REFERENCES:

1. Genes VIII 2004. Benjamin Lewin, Oxford Univ press.
2. Cell and Molecular Biology - 3rd Editioin (2002).G Karp. John Wiley and Sons N.Y
3. Molecular cell biology - David Freifielder 2nd Edition, Narosa publishing House.
4. Lehinger's principle of Biochemistry (2000), Nelson and Cox.
5. Harper's Biochemistry - Rober K. Murray, Daryl K.Grammer, McGrawHill, Lange Medical Books
6. Biochemistry of Nucleicacids - Adam et al
7. Molecular biology - SC Rastogi CBS publishing 2nd Edition
8. Cell biology and Genetics - P.S. Verma and V.K.Agarwal, S. Chand publication
9. Advance molecular cell biology - R.M.Twyman.W.wisden Viva book House Yadav - Ist Edition 1998.
10. Genetics - Manju yadav Ist Edition 2003, Discovery publishing House.

17UBC53B	CORE-VII: HUMAN PHYSIOLOGY	SEMESTER-V

PREAMBLE:

- This course gives an overview of the key physiological systems of the human body.
- Students can gain basic knowledge and understanding of the complex physiological principles.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Explain about the composition of blood and lymph. Compare and contrast the transport of Oxygen and Carbon-di-oxide through blood.	K2 & K3
CO2.	Explain about the mechanism of muscle contraction in skeletal and smooth muscle. Identify the structures of neuron, synapse and neuromuscular junction.	K2 & K3
CO3.	Summarize the physiological processes of the cardiovascular system.	K3
CO4.	Identify the different enzymes involved in the digestion of carbohydrates, proteins and fats.	K3
CO5.	Outline the composition of urine. Identify the various diseases associated with the hyper and hypo secretion of hormones.	K2 & K3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	S	M	S	S
CO5	S	S	M	S	S

L-Low; M-Medium and S-Strong.

17UBC53B	CORE-VII: HUMAN PHYSIOLOGY	SEMESTER-V

Total Credits:
Hours per week: 5

CONTENTS

UNIT–I

Blood and Body fluids: Composition and functions of RBCs, WBCs and Platelets. Hemoglobin– Structure and function. Mechanism of blood coagulation, Anticoagulants, Blood types and blood transfusion. Formation and functions of lymph.

Respiratory system: Diffusion of gases in lungs, transport of oxygen from lungs to tissues through blood, factors influencing the transport of oxygen. Transport of CO_2 from tissues to lungs through blood, factors influencing the transport of CO_2.

UNIT- II

Muscle system: Skeletal muscles - Properties of skeletal muscles, Muscular contraction and relaxation, Smooth muscle - mechanism of contraction

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, neurotransmitters.

UNIT- III

Cardiovascular system: Anatomy of heart, Properties of cardiac muscles, Conducting system of the heart, Cardiac cycle – Diastole and Systole. Chemical energy required for cardiac contraction, Pressure changes during cardiac cycles, Regulation of heart pumping– Effect of temperature, potassium and calcium ions on heart function. Overview of circulation– Capillary circulation, Blood volume, Blood flow, Arterial and venous blood pressure.

UNIT- IV

Gastrointestinal physiology: Anatomy and histology of alimentary canal. Digestive glands – histological structures of salivary glands, pancreas, liver. Movements of alimentary canal. Composition and functions of saliva, gastric, pancreatic, intestinal juices and bile. Synthesis of Bile acids. Enterohepatic circulation. Digestion and absorption of carbohydrates, proteins and fats.

UNIT- V

Excretory System: Mechanism of urine formation, Composition of urine, Micturition, Renal regulation of acid balance.

Endocrine system: Definition and role of hormones. Chemical nature of hormones, gastrointestinal and kidney 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.

TEXT BOOKS:

1. *Guyton and Hall*, 2011. **Text Book of Medical Physiology**, 12th Edition, Elsevier Inc.
2. *Pal G. K*, 2015. **Textbook of Medical Physiology**, Ahuja Publishing House.
3. *Dee Unglaub Silverthorn,* 2016. **Human Physiology: An Integrated Approach**, 7th Edition, Pearson.

REFERENCE BOOKS:

1. *Chatterjee C. C,* 2017. **Human Physiology - Vol I and II,** 11th Edition, CBS Publishers.
2. *Barrett, Barman, Boitano and Brooks*, 2016. **Ganong's Review of Medical Physiology**, 25th Edition, McGraw Hill.
3. *Eric Widmaier, Hershel Raff and Kevin Strang*, 2016. **Vander's Human Physiology: The Mechanisms of Body Function**, 14th Edition, McGraw Hill

17UBC53C	CORE–VIII: NUTRITIONAL BIOCHEMISTRY	SEMESTER–V

PREAMBLE:

- This course gives an overview of human nutrition and nutritional disorders.
- Students can gain basic knowledge and understanding of the nutritional requirements of the human body and nutritional diseases.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1	Explain the composition of food and how foods are grouped Construct a dietary chart.	K_2 & K_3
CO2	Outline the physiological and nutritive values of carbohydrates, lipids and proteins. Apply the nutritive values of macromolecules in a dietary chart.	K_2 & K_3
CO3	Define BMR and SDA and how to measure the energy content in food. Relate the factors, which influence the BMR and SDA.	K_1 & K_2
CO4	Identify the various primary nutritional diseases and conditional nutritional disorders.	K_3
CO5	Plan a diet for the prevention and treatment of a number of diseases.	K_3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	S	M	S	S
CO5	S	S	M	S	S

L-Low; M-Medium and S-Strong.

17UBC53C	CORE–VIII: NUTRITIONAL BIOCHEMISTRY	SEMESTER–V

Total Credits: 4
Hours Per Week: 5

CONTENTS

UNIT-I

Introduction to nutrition – Function of foods and its relation to nutrition and health, essential nutrients, analysis of food composition, food habits and food groups. Role of water and fat soluble vitamins, minerals and antioxidants in health. Required dietary allowance for an average adult.

UNIT-II

Nutrition - Physiological role and nutritional significance of carbohydrates, lipids and protein. Carbohydrates - Chemical composition and importance, Glycemic index of foods and its uses, Artificial sweeteners. Sources and physiological functions of Essential fatty acids, Saturated fatty acids, Monounsaturated fatty acids and Polyunsaturated fatty acids. Essential and non-essential amino acids – their role in growth and development.

UNIT-III

Energy content of foods: Measurement of energy expenditure: Direct & Indirect calorimetry. Definition of BMR and factors affecting BMR. Thermogenic effects of foods and factors affecting thermogenic effect. Energy requirements of men and women and factors affecting energy requirements. Role of dietary fibers in nutrition.

UNIT-IV

Primary nutritional diseases: Protein energy malnutrition (Marasmus and Kwashiorkar), 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. Obesity, Vitamin deficiency disorders, Hypervitaminosis, Nutritional anaemias.

Conditional nutritional disorders: Disorders of gastrointestinal tract, liver, biliary tract, pancreas, heart and Diabetes.

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. *Smolin and Grosvenor*, 2016. **Nutrition: Science and Applications**, 4th Edition, Wiley
2. *Gibney*, *Lanham-New, Cassidy and Vorster*, 2013. **Introduction to Human Nutrition**, 2nd Edition, Wiley-Blackwell.
3. *Trueman P,* 2011. **Nutritional Biochemistry**, 5th Edition, MJP Publishers.

REFERENCE BOOKS:

1. *Swaminathan M. S*, 1985. **Essentials of food and Nutrition**, 2nd Edition, Bangalore Press.
2. *Gibney, Margetts and Kearney,* 2013. **Public health Nutrition**, The Nutrition Society, Blackwell Science.
3. *Joshi Y K*, 2010. **Basic Clinical Nutrition**, 2nd Edition, Jaypee Brothers, New Delhi.

17UBC53P	CORE PRACTICAL-V: BIOCHEMISTRY-V	SEMESTER-V

Total Credits: 3
Hours per week: 6

PREAMBLE:

- This course gives a basic understanding on molecular biology and DNA recombinant technology.
- Students can gain basic knowledge and key understanding of clinical biochemistry.

CONTENTS

GENETICS & MOLECULAR BIOLOGY:

1. Preparation of Polytene chromosome from *Chironomous* larva/*Drosophila* larva
2. Demonstration of mammalian sex chromatin.
3. PTC tasting in a population and calculation of allele and genotype frequencies
4. Isolation of plasmid and chromosomal DNA from E.coli (or) Extraction of total nucleic acids from plant tissue.
5. Restriction digestion, fragment size estimation (RFLP) and Southern blot hybridization
6. Demonstration of Northern Blotting.
7. Separation of plasma proteins by electrophoresis and Western Blotting.
8. Designing of primers for any selected genes and Amplification of a DNA fragments by PCR
9. Isolation of total RNA from yeast cells.
10. Transformation of E.coli cells with plasmid DNA
11. Comet assay

12. Hyper expression of poly histidine-tagged recombinant protein and purification using Ni- affinity resin.
13. Effect of inhibitors on protein synthesis and proteasome inhibitors.

HUMAN PHYSIOLOGY:

Measurement of blood pressures

Pulmonary function tests: Spirometry

Estimation of electrolytes (Na, K, Ca) in samples by flame photometry

SUGGESTED BOOKS

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring Harbour Lab. Press, Pearson Pub.

17UBC5EA	ELECTIVE–I: GENETIC ENGINEERING	SEMESTER-V

PREAMBLE:

- This course gives an overview of biology of enzymes and vectors in genetic engineering and its application.
- Students can gain basic knowledge and key understanding on basics of gene cloning and its application.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

Co Number	CO Statement	Knowledge level
CO1	Explain the basics of genetics, restriction enzymes and expression vectors.	K1 &K3
CO2	Recall the basics of gene cloning and restriction endonucleases. Identify the basic features of expression vectors and recombinant DNA technology. Examine the general and specific characteristics of vectors used in gene cloning.	K1, K3 & K4
CO3	Summarize the transformation, selection and identification of recombinants. Compare the different recombinant identification techniques, nucleic acid and protein blotting methods.	K2, K4 & K5
CO4	Evaluate the concept of protein engineering and DNA sequencing methods.	K3, K4 & K5
CO5	Explain the application of gene technology. Compare the production of recombinant products like insulin and growth hormones Explain the safety aspects and hazards of genetic engineering	K4 & K5

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	M	M
CO3	S	S	M	M	M
CO4	S	S	S	M	M
CO5	S	S	S	M	M

L-Low; M-Medium and S-Strong.

17UBC5EA	ELECTIVE–I: GENETIC ENGINEERING	SEMESTER-V

Total Credits: 4
Hours per week: 4

CONTENTS

UNIT-I

Genes within the cells, genetic elements that control gene expression, restriction and modification enzymes (Restriction enzymes, DNA ligases, Klenowfragment, T4DNA polymerase, Polynucleotide kinase, Alkaline phosphatase), safety guidelines of recombinant DNA research.

UNIT-II

Construction of genomic DNA and BSC libraries, BSC-Y libraries, design of linkers and adaptors. Characteristics of plasmid and phage vectors, prokaryotic and eukaryotic expression vectors, Insect, yeast and mammalian vectors.

UNIT-III

DNA sequencing (Maxum and Gilbert, Sangers, Pyro-sequencing, Shotgun sequencing method), Protein sequencing, RNA sequencing, Southern and northern and western blotting, *In-situ* hybridization, Site-directed mutagenesis, DNA labelling, DNA fingerprinting (RAPD,RFLP, AFLP).

UNIT-IV

Isolation of DNA, mRNA and total RNA, polymerase chain reactions (PCR) and modified PCR, gene isolation, gene cloning, gene mapping, gene bank, screening and expression of cloned gene, transposons and gene targeting.

UNIT-V

Production of insulin, human growth factor, gene therapy (antisense and ribozyme technology), human genome project and its application. Large scale gene expression analysis (Microarray for DNA and protein), strategies for genome sequencing.

REFERENCES

1. Old and Primrose, Principles of Gene Manipulation, 3rd Ed, Blackwell Scientific Publishers.
2. Genetic Engineering by S. Rastogi and N. Pathak, Oxford Univ. Pub.
3. Recombinant DNA Technology: Setubal: Introduction to computational Molecular Biology. Cengage Learning India (P) Limited.
4. D.M. Glover, Genetic Engineering, Cloning DNA, Chapman and Hall, New York, 1980.
5. B. R. Glick and J.J. Pasternak, MolecularBiotechnology: Principles and Applications of Recombinant DNA, ASM press.
6. Watson, J.D., Gilman, M., Witkowski, J., Zoller, M.,Recombinant DNA, ScientificAmerican Books, New York, 1992.
7. H.K. Das, Text Book of Biotechnology, 1st ed, 2004, Wiley Publishers.
8. Brown, T.A., Genetics a Molecular Approach, 4th Ed. Chapman and Hall, 1992.
9. D. M. Glover and B.D. Hames,DNA cloning: A Practical Approach,
10. Brown TA, Genomes, 3rd ed. Garland Science 2006.

17UBC5EB	ELECTIVE-I: PRINCIPLES OF GENETICS	SEMESTER–V

PREAMBLE:

- This course is concerned with the Mendelian principles, chromosomal organizations and variations in chromosomal structure.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Explain fundamental laws of genetics	**K2**
CO2.	Recall and Illustrate the roles of mitosis and meiosis in reproduction and explain how meiosis leads to genetic variability Explain patterns of Mendelian, Epistatic, and quantitative (polygenic) inheritance	**K1 & K2**
CO3.	Explain the structural organization of chromosomes	**K5**
CO4.	Explain linkage analysis and recombination mapping and infer the chromosomal basis of inheritance, linkage and crossing over, and mapping of linked genes.	**K2 & K4**
CO5.	Outline and interpret phenotype to changes in chromosome structure and number	**K2 & K5**

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	S	M
CO3	S	M	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	M

L-Low; M-Medium and S-Strong.

17UBC5EB	ELECTIVE-I: PRINCIPLES OF GENETICS	SEMESTER–V

Total Credits: 4
Hours per week: 4

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. Ltc., Singapore
2. *Gupta Pk,* 2007.**Genetics classical to modern**. *Rastogi Publication.*
3. *Robert T Brooker,* 1999. **Genetics, Analaysis 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.

17UBC5EC	ELECTIVE-I: GENETICS OF CLINICAL DISORDERS	SEMESTER-V

PREAMBLE:

- This course gives an overview of genetic changes in clinical disorders.
- Students can gain basic knowledge about the human disease at GENETIC LEVEL.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Illustrate the role of mutations in genetic and analysis Understand variation in Chromosome number and structure	K2 & K3
CO2.	Demonstrate the Patterns of Single Gene Inheritance	K2 & K3
CO3.	Analyze the Genetic Variation in Health and Diseases	K3 & K4
CO4.	Understand the epigenetics in human diseases Analyze the Polymorphisms and Disease	K2 & K3
CO5.	Explain the Chromosomal disorders, Analyze the Inborn errors of metabolism	K3 & K4

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	S
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	S	M	S	S
CO5	S	S	M	S	S

L-Low; M-Medium and S-Strong.

17UBC5EC	ELECTIVE-I: GENETICS OF CLINICAL DISORDERS	SEMESTER-V

Total Credits: 4
Hours per week: 4

CONTENTS

UNIT I

Mutation – Classification, mechanism, repair, role in genetic analysis and evolution-Changes in Chromosome number and structure: Polyploidy, aneuploidy, chromosomal rearrangements - deletion, duplication, inversion, and translocation. Meiotic consequences in structural heterozygotes, role in speciation and evolution

UNIT II

Patterns of Single Gene Inheritance- Autosomal recessive -Autosomal dominant -X-linked -Atypical patterns of inheritance -Hardy-Weinberg law -Calculation of carrier incidence -Concept of heterozygote advantage

UNIT III

Genetic Variation in Health and Diseases: Human genetic diversity-Methods of study- Biochemical/molecular genetic markers, some examples-Tracing human migrations with autosomal, Y-chromosomal and mitochondrial markers

UNIT IV

Epigenetics in gene expression, human diseases, and X-inactivation-Telomeres, genome stability and aging-Polymorphisms and Disease-Polymorphisms and SNPs -Coronary Disease – Apo E-Alzheimer's

Disease – Apo E-COPD – Antitrypsin alleles -HLA Antigens And Disease Association-Ankylosing spondilitis-Reiter's syndrome

UNIT V

Diseases and Disorder: Chromosomal disorders: Structural and numerical, Autosomal/sex chromosomal/sex reversal, Mechanisms-mitotic/meiotic non dysfunction/chromosomal rearrangement, some examples (syndromes/cancer/infertility), Inborn errors of metabolism-Hemoglobinopathies, multifactorial disorders-Introduction, Methods of study (Epidemiological, Twin/adoption and family studies), Etiology-genetic and non genetic determinants, common examples.

TEXT BOOKS

1. *Primrose S.B and Twyman R.M*, (2012) **Principles of Gene Manipulation and Genomics**, Seventh Edition, Blackwell Publishers.
2. *Gardner, Simmons, Snustad, (*1991), **Principles of Genetics, Eighth Edition**, John Wiley and Sons, Inc, Canada

REFERENCE BOOKS:

1. *TVogel F. and Motulsky* A, **Human genetics: Problems and Approches**, Springer
2. *Pasternak J*, An Introduction to Human **Molecular Genetics: Mechanism of Inherited Diseases**, Fitzgerald Science Press

17UBC5SA	SKILL BASED SUBJECT-II: CLINICAL BIOCHEMISTRY	SEMESTER-V

PREAMBLE:

- to provide students a sound knowledge of the clinical principles underlying the application of clinical biochemistry investigations in human disease.
- Students can understand the disorders of metabolism.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Understand blood sugar regulation. Illustrate about the disease Diabetes mellitus and carbohydrate related disorders and lipid disorders Analyse to diagnose Diabetes Mellitus	K2 **&** K4
CO2.	Explain the disorders of amino acid metabolism Illustrate the disorders of purine, pyrimidine and porphyrin metabolism	K2 & K3
CO3.	Compare normal and abnormal constituents of urine and blood Demonstrate the handling of samples and their units	K3 & K4
CO4.	Demonstrate the gastric function test, Renal function tests and Thyroid function test and analyze the results	K3 & K4
CO5.	Examine the Gastric function and illustrate the function tests Analyze the enzymes in disease	K3 & K4

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	M	S
CO5	S	S	S	M	S

L-Low; M-Medium and S-Strong.

17UBC5SA	SKILL BASED SUBJECT-II: CLINICAL BIOCHEMISTRY	SEMESTER-V

Total Credits: 4
Hours per week: 5

CONTENTS

UNIT–I

Disorders of Carbohydrate metabolism and lipid metabolism

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

Disorders in lipid metabolism: Plasma lipoproteins-lipoproteinemias, lipid metabolism in liver and adipose tissue. Fatty liver-. Hypo and hypercholesterolemia. Atherosclerosis – aetiology, clinical features and complication.

UNIT–II

Disorders of aminoacids metabolism purine, pyrimidine and porphyrin metabolism

Disorders of aminoacids metabolism -Etiology and clinical manifestation of phenyl ketonuria, cystinuria, alkaptonuria, Fanconi's syndrome, albinism and tyrosinemia

Disorders of purine, pyrimidine and porphyrin metabolism- Hyperuricemia and gout. Lesch- Nyhan syndrome. Orotic aciduria, porphyrias.

UNIT–III

Urine and blood analysis

Urine:Normal composition of urine– Volume,pH,colour,specific gravity. Constituents-urea, uric acid, creatinine, pigment. Abnormal constituents – glucose, albumin, ketone bodies, variations in urea, creatinine, pigments and their clinical significance in brief. Blood: Normal constituents of blood and their variation in pathological conditions - urea, uric acid, creatinine, glucose, bilirubin, total protein, albumin/globulin ratio. A brief review of units and abbreviations used in expressing concentrations and standard solutions. Specimen collection and processing (blood, urine and feaces), anti-coagulant and preservatives for blood and urine. Transport of biological samples.

UNIT–IV

Liver Function tests, Renal function tests and Thyroid function test

Liver Function tests-Metabolism of bilirubin, jaundice-types, clinical features and test based on bile pigments level in bipod and urine, plasma changes, PT, differentiation of three types of jaundice-Renal function tests-Clearance tests-urea, creatinine, PAH test, concentration and dilution tests. Thyroid function test-Significane of T3, T4 and TSH-values, hypo-and hyper thyroidism.

UNIT–V

Gastric function tests and Clinical enzymology

Gastric function tests-Collection of gastric contents, examination of gastric residium, stimulation tests, tubeless gastric analysis

Clinical enzymology-Definition of functional and non-functional plasma enzymes. Isozymes and diagnostic tests, enzyme patterns in acute

pancreatitis, liver damages, bone disorders, myocardial infarction and muscle wasting

TEXT BOOKS:

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

REFERENCE BOOKS:

1. *William J Marshal*, (2008) **Clinical Biochemistry**, Metabolic and clinical aspects - 1st edition-, Elseveir Publication, new York.
2. *Allengaw C.* (1999) **Clinical Biochemistry**, Churchill Livingstone-London.
3. *Longo, Fauci, Kasper, Hause, jamenson, Loscalzo*, (2012) **Harrison's Internal Medicine**, MC Graw Hill Publishers. 18th Edition.
4. T.M. Delvin (editor), (1982), **Text book of biochemistry with clinical correlation**, John wiley & Sons Inc. USA

17UBC63A	CORE-IX: GENERAL MICROBIOLOGY	SEMESTER-VI

PREAMBLE:

- This course gives an overview of the key Microbiological techniques, Microbial nutrition and growth and Microscopy.
- Students can gain basic knowledge and understanding of the principles and methods of sterilization & disinfection, Microbial diseases and the mode of action of antibiotics.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Explain about the difference between prokaryotes and eukaryotes. Identify and Illustrate different types of microscopes.	K2 & K3
CO2.	Plan and choose a suitable nutritional media required for microbial growth. Compare and contrast different types of nutritional uptake. Apply and experiment with the different microbiological techniques learnt.	K2 & K3
CO3.	Outline and apply the physical and chemical sterilization methods.	K2 & K3
CO4.	Identify the mode of action of antibiotics.	K3
CO5.	Compare and contrast the various microbial diseases.	K3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

L-Low; M-Medium and S-Strong.

17UBC63A	CORE-IX: GENERAL MICROBIOLOGY	SEMESTER-VI

Total Credits: 4
Hours per week: 4

CONTENTS

UNIT–I

Introduction: 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

Microbial Nutrition and Growth: 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, Mclntosh 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

Antibiotics and Mode of action:

Antimicrobial spectrum of antibiotics and mode of action of the following antibiotics: a) Antibacterial - Penicillin, streptomycin and tetracyclines b) Antifungal - Nystatin and cycloheximide c) Antiviral - Acycloguanosine (nucleoside).

UNIT- V

Microbes & Diseases:

Normal human micro flora, host - parasitic interaction, epidemics, exo and endotoxins. Air borne diseases: Aetiology, symptoms and prevention of Tuberculosis, Diphtheria, Poliomyelitis 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 and Panicker*, 2017. **Text Book of Microbiology**, 10th Edition, Universities Press.
2. *Dubay and Maheswari*, 2014. **Textbook of Microbiology**, S. Chand and Company Pvt Ltd.
3. *Arora and Arora*, 2012. **Textbook of Microbiology**, 4th Edition CBS Publishers.
4. *Pelczer*, *Chan and Krieg*, 2012. **Microbiology**, 5th Edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. *Ronald. M,* 2004. **Microbiology–Fundamentals and Applications,** Macmillan Publishing Company, New York.
2. *Prescott, Harley and Klein,* 2016. **Microbiology**, 10th Edition, McGraw Hill.

17UBC63B	CORE-X: INTRODUCTORY IMMUNOLOGY	SEMESTER-VI

PREAMBLE:

- This course gives an overview of biology of immune cells.
- Students can gain basic knowledge and key understanding on applications of immunological techniques.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge level
CO1	Explain the Innate and Acquired immunity and antibody. Examine the differentiation of antigen and antibody and the application of antigen antibody interaction.	K2, K4 & K5
CO2	Identify the complement activation mechanisms.	K3
CO3	Examine the immune response to infections.	K4
CO4	Distinguish the types of hypersensitivity reactions. Explain the pathogenicity of autoimmune diseases.	K3, K4 & K5
CO5	Explain the application of transplantation immunology. Examine the applications of immunological techniques.	K4 & K5

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	M	M
CO3	S	S	M	M	M
CO4	S	S	S	M	M
CO5	S	S	S	M	M

L-Low; M-Medium and S-Strong.

17UBC63B	CORE-X: INTRODUCTORY IMMUNOLOGY	SEMESTER-VI

Total Credits: 4
Hours per week: 4

CONTENTS

UNIT - I

Innate and Acquired immunity, antibody and cell mediated immune response, primary and secondary lymphoid organs, structure of T, B and NK cell, structure and function of Neutrophils, Eosinophils and Basophiles, Macrophages-Phagocytosis and inflammation. Antigen-properties, specificity, cross reactivity, antigenecity, Immunogenicity, antigen determinants, Haptens, adjuvants, self-antigen [MHC].

UNIT - II

Antibodies- properties, classes, sub classes of Immuno-globulins-structure, specificity and distribution. Antigen and antibody interaction, precipitation and agglutination.

Complement activation: complement activation pathways, Biological consequences of complement activation. Cytokines, IFN, TNF, CSF role in immune regulation.

UNIT - III

Immune responses to infections: Bacteria and parasites and viruses, Primary and secondary immune-deficiency diseases, AIDS; Structure, destruction of T cells, immunity to HIV virus, AIDS vaccine, gene therapy for treatment, Vaccine, cancer immunology, cancer immune theraphy, tumor antigens.

UNIT - IV

Allergy and Hypersensitivity – type – I, II, III and IV their clinical manifestation. Auto Immune diseases – Rheumatoid arthritis - Myasthenia gravis. Immunity to bacteria & Virus.

UNIT - V

Transplantation– Allograft rejection, graft Vs Host reaction, Immuno-suppressors– mechanism of graft rejection.

Precipitation in gel: Oudin, and Oahley-Fulthope procedure; Immune diffusion- Ouchterlony procedure, radial immune-diffusion, Immuno-electrophoresis and Electro immune-diffusion; Agglutination: Widal test; RIA and ELISA.

BOOKS RECOMMENDED:

1. Immunology - J. kannan, MJP Publishers, Chennai-5
2. Immunology - Riot Ivanna, Jonathan Brastoff, David Male, 1993.
3. Immunology - Janis Kuby, 4th edition, 2000.
4. Immunology - An introduction, Tizarrd, r. Jan 1995.
5. Fundamental of Immunology - Lippincot praven publications, 4th edition.
6. Essential and clinical Immunology - Halen chapel, Mansal Haney, Siraj misbah & Nial Snowdan.
7. Immunology - Geoffrey zubay, W.M.C, Brown publishers, 4th edition 1992.
8. Immunology - The immune system in health & disease, 3rd edition.

17UBC63C	CORE-XI: PLANT PHYSIOLOGY AND BIOCHEMISTRY	SEMESTER– VI

PREAMBLE:

- This course gives an overview of diverse physiological and biochemical processes that occur in plants and their implications for plant interactions in the environment.
- Students can gain basic knowledge and understanding of metabolic processes in plants and the role of different biosynthetic pathways in plant growth and development.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Compare and contrast structural and functional differences in plant cell organelles. Show plant water relations. Outline the physiological processes that occur in plants.	K1 & K2
CO2.	List the components of photosynthetic apparatus. Summarize and construct a model for transport processes, light and dark reactions in photosynthesis, respiration in plants, including photorespiration.	K1, K2 & K3
CO3.	Experiment with nitrogen cycle and nitrogen fixation. Demonstrate specific roles of macro and microelements in plant growth and their deficiency symptoms.	K1, K2 & K3
CO4.	Label the plant growth regulators. Illustrate plant hormone biochemistry and mode of action.	K1, K2 & K3

	Experiment with seed germination, dormancy, fruit ripening and senescence. Explain Phytochrome, photoperiodism and vernilization.	
CO5.	Classify secondary metabolites. Identify a method for extraction of secondary metabolites. Relate secondary metabolites with plant defense mechanism.	K1, K2 & K3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**M**	**M**	**M**	**M**
CO2	**S**	**M**	**S**	**M**	**M**
CO3	**S**	**M**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

L-Low; M-Medium and S-Strong.

17UBC63C	CORE-XI: PLANT PHYSIOLOGY AND BIOCHEMISTRY	SEMESTER– VI

Total Credits: 4
Hours per week: 5

CONTENTS

UNIT –I

Plant Cell and Physiology of Plants:

Plant cell – Structure and functions of subcellular organelles. Diffusion and Osmosis in plants and their significance. Mechanism of water absorption, Ascent of sap. Basics of stress physiology. Transpiration-types, mechanism of transpiration and factors affecting transpiration.

UNIT –II

Photo synthesis:

Photosynthetic apparatus, pigments–chlorophyll, carotenoids and phycobillin. Light reactions– two kinds of chemical system– photo system I and II, cyclic and non cyclic phosphorylation, evidences in support of light reaction – Hill's reaction, Arnon' s work and Emerson effect. Calvin's cycle (C_3 plants), Hatch – Slack cycle (C_4 cycle) and CAM plants. Photorespiration.

UNIT - III

Cycles of elements and Plant Nutrition:

Nitrogen cycle: Ammonification, nitrification, nitrate reduction and denitrification. Nitrogen fixation- symbiotic and non-symbiotic nitrogen fixation. Sulphur cycle, phosphorus cycle. Biological functions of essential elements and their deficiency symptoms in plants: Macronutrients-Carbon, Hydrogen, Oxygen, Nitrogen, Sulfur,

Phosphorus, Calcium, Potassium, Magnesium and Iron. Micronutrients-Manganese, Boron, Copper, Zinc, Molybdenum and Chlorine.

UNIT –IV

Plant growth regulators and Biochemistry of Plant Growth:

Chemistry, biosynthesis, mode of action and physiological effects of auxins, gibberellins, cytokinins, abscicic acid and ethylene. Plant growth inhibitors and retardants. Biochemistry of seed dormancy, seed germination. Fruit ripening and Senescence. Phytochrome, photoperiodism and vernilization.

UNIT –V

Secondary metabolites:

Nature, distribution and biological functions of alkaloids, terpenes, flavonoids, poly phenols, tannins and steroids. Basic methods to identify the secondary metabolites. Secondary metabolites in defense mechanism-Polyamines, Brassionsteriods, Jasmonic acid and Salicylic acid - structural and functional characteristics.

TEXT BOOKS:

1. Lea, P.J. and Leegood, R.C. (1999), **Plant Biochemistry and Molecular Biology**, Second edition, John Wiley and Sons, Chichester, England.
2. *Devlin N. Robert and Francis H.Witham*, (2001), **Plant Physiology**, First edition, CBS, New Delhi.
3. Goodwin Y.W. and Mercer E.I. (2003). **Introduction to Plant Biochemistry**. 2nd edition. CBS Publishers and distributors.

4. Harborne, J.B. (1998), **Phytochemical Methods A Guide to Modern Techniques of Plant Analysis.** Springer**.**
5. Verma, (2001), **Plant physiology**. 7th Revised edition, Emkay Publications.

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.
3. Buchanan, B., Gruissem, W. and Jones, R (2002), **Biochemistry & Molecular Biology of Plants**. John Wiley & Sons, 2002.
4. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A. (2015), **Plant Physiology and Development**, 5th Edition. Sinauer Associates, Sunderland, MA.
5. Dey, P.M. and Harborne, J.B. (1997), **Plant Biochemistry**. Academic Press.

17UBC63P	CORE PRACTICAL-VI BIOCHEMISTRY-VI	SEMESTER–VI

Total Credits: 3
Hours per week: 6

PREAMBLE:

- This course gives a basic overview on pigments and nutrition in plant parts and techniques in immunology.
- Students can gain basic knowledge and key understanding on presence of phytochemicals in plants and diagnostic techniques.

PLANT BIOCHEMISTRY:

1. Isolation, Estimation of Chlorophyll, and separation by TLC
2. Isolation and estimation of ascorbic acid from fruit
3. Estimation of β-carotene from carrot
4. Estimation of thiamine from cereals/fruits
5. Qualitative Analysis of phyto-constituents.
6. Preparation of Media and sterilization
7. Initiation of Callus culture

IMMUNOLOGY:

1. Immuno-diffusion: single radial and double diffusion
2. Rocket Immuno-electrophoresis: Kit method
3. Estimation of Immuno-globulins
4. Identifying blood group and Rh typing
5. Pregnancy test
6. Widal test

MICROBIOLOGY:

1. Observation of permanent slides of pathogens: Mycobacterium tuberculosis, Leishmania, Plasmodium falciparum.
2. PCR based diagnosis of pathogens
3. Dot Blot ELISA
4. Effect of osmotic pressure on bacterial growth
5. Antibiotic sensitivity of bacterial pure culture
6. Identification of Lac+ by blue white screening using IPTG.

ANIMAL TISSUE CULTURE:

1. Study of apoptosis through analysis of DNA fragmentation pattern in mitochondria
2. Study of abnormal human karyotype and pedigrees (dry lab)
3. Identification and study of cancerous cells using permanent slides and photomicrographs
4. Histology of connective tissue, liver and brain permanent slides.

TEXT BOOK:

1. *Rober Switzer*, Iliam Grarity, 1999. **Experimental Biochemistry,** 3rd Edition, WH Freeman and company.
2. *John M.Clark. Jr*. 1994. **Experimental Biochemistry**, WH Freeman and Company.

REFERENCE BOOK:

1. *David T.Plummer,* 1998. **An Introduction to Practical Biochemistry**, 3rd Edition, Tata McGraw Hill Publishing company ltd.
2. *Keith Wilson, John Walker*, 2010. **Principle of Practical Biochemistry**, 7th edition, Cambridge University Press.

17UBC6EA	ELECTIVE- II: CONCEPTS IN DRUG DISCOVERY	SEMESTER–VI

PREAMBLE:

- This course provides an overview of phases of clinical trials and the basis of approval of new drugs.
- Students can gain basic knowledge and key understanding of the clinical data management for drug efficacy.

COURSE OUTCOME:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Outline the general pathway for drug discovery and development. Understand important concepts and challenges in each step of drug discovery. Summarize the methods used to identify and validate drug targets.	K1 & K2
CO2.	Explain key technologies in every aspect of drug discovery. Demonstrate and critically appraise the effectiveness of the drug discovery and development process.	K1 & K2
CO3.	List and describe the steps required for a new drug to be approved for human use. Define the major types of clinical research studies, the clinical phases in the drug and device development processes, and their rationale. Apply rules and regulations for developing a new drug.	K1, K2 & K3
CO4.	Relate clinical *in vivo* imaging techniques with diagnosis. Illustrate the use of mass spectroscopy in drug discovery.	K1 & K2

CO5.	Understand and apply epigenetic concepts of drug discovery in drug development. Solve drug discovery related problems in his/her research. Experiment with stem cell therapy.	K2 & K3

MAPPING WITH PROGRAMME OUTCOMES

:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**S**	**M**	**M**	**M**

L-Low; M-Medium and S-Strong.

17UBC6EA	ELECTIVE- II: CONCEPTS IN DRUG DISCOVERY	SEMESTER–VI

Total Credits: 4
Hours Per Week: 4

CONTENTS

UNIT–I

Drug Discovery

Drug discovery process–target identification and validation, screen design and implementation, hit to lead (or alternate means for lead generation), lead optimization, clinical candidate selection. Molecular Docking for drug design: Chemi-informatics– Role of computational chemistry in therapeutic drug design.

UNIT-II

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-III

Drug development process

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–IV

Fluorescence technique for bioimaging and diagnosis. Clinical *in vivo* imaging techniques I - PET, SPECT. Clinical *in vivo* imaging techniques II– X-ray, MRI. Mass Spectrometry application to drug discovery.

UNIT–V

Epigenetics for new concept for Drug Discovery. Stem cell therapy. Personalized Drugs, Essential Drugs, and Orphan Drugs.

TEXT BOOKS:

1. Waldmann, H. & Janning, P., (2009), Chemical Biology: learning through case studies. Wiley-VCH.
2. Wiley encyclopedia of chemical biology (2009), John Wiley & Sons,
3. Ed. Schreiber, S. L. & Kapoor, T. M. Wess, (2007), Chemical Biology: from small molecules to systems biology and drug design. G. Wiley-VCH.
4. Walsh, D. P.; Chang, Y. T. (2006), Chemical Genetics, *Chem. Rev.*, *106*, 2476-2530.
5. Kang, N. Y.; Ha, H. H.; Yun, S. W.; Yu, Y. H.; Chang, Y. T. (2011), Diversity-driven chemical probe development for biomolecules: beyond hypothesis-driven approach, *Chem. Soc. Rev.*, *40*, 3613-3626.

17UBC6EB	ELECTIVE- II: CONCEPTS IN CLINICAL TRIALS	SEMESTER–VI

PREAMBLE:

- This course provides an overview on basic concepts and processes in clinical trial practices.
- Students can gain basic knowledge and key understanding on the importance of clinical trials.

COURSE OUTCOME:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Outline various clinical trial types.	K1 & K2
CO2.	Apply Indian clinical trial rules and regulations.	K1 & K2
CO3.	Relate role of Indian pharmaceutical companies.	K1, K2 & K3
CO4.	Understand ICMR ethical guide lines on clinical research in India.	K1 & K2
CO5.	Understand and apply regulations concerning animals in scientific research.	K2 & K3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**M**
CO5	**S**	**S**	**M**	**M**	**M**

L-Low; M-Medium and S-Strong.

17UBC6EB	ELECTIVE- II: CONCEPTS IN CLINICAL TRIALS	SEMESTER–VI

Total Credits: 4
Hours Per Week: 4

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 Ornizations (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.

17UBC6EC	ELECTIVE-II: PLANT THERAPEUTICS AND MEDICINAL CHEMISTRY	SEMESTER-VI

PREAMBLE:

- This course gives an overview on drug absorption, distribution, metabolism, elimination and plant derived drugs.
- This course gives basic knowledge about drug-receptor interaction, mode of action of various drugs and role of natural products in new drug development.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Define and classify drugs. Explain absorption and distribution of drugs. Summarize passage of drugs cross membrane Illustrate drug-receptor interactions.	K_1 & K_2
CO2.	Define and compare various ways of drug metabolism. Explain elimination of drugs.	K_1 & K_2
CO3.	Outline chemotherapy. Illustrate mode of action of sulfonamides. Build models for mechanism of action of antibiotics. Interpret the mode of action of drugs acting on CNS and cardiovascular system.	K_2 & K_3
CO4.	Develop method for the production of pharmaceutically important secondary metabolite. Experiment with nanoparticle synthesis from phytochemicals. Recall medicinal plants with antioxidant activity.	K_2 & K_3
CO5.	Demonstrate plant-derived drugs for various diseases. Identify medicinal plants for development of new drug leads.	K_2 & K_3

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	M
CO2	S	S	S	S	M
CO3	S	S	S	M	M
CO4	S	S	S	S	S
CO5	S	S	S	S	S

L-Low; M-Medium and S-Strong.

17UBC6EC	ELECTIVE-II: PLANT THERAPEUTICS AND MEDICINAL CHEMISTRY	SEMESTER-VI

Total Credit: 4
Hours Per Week: 4

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

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. Antibiotics - mode of action with an example. Antiviral, antimalarial and antiTB drugs.

Drugs acting on CNS and cardio-vascular system:

CNS – structure and mode of action of barbiturates and MAO inhibitors.

Cardio-vascular system: Structure and mode of action of cardiac glycosides and heparin.

UNIT – IV

Production of secondary metabolite in plants: Applications of plant tissue culture in pharmacognosy, elicitation, biotransformation-production of pharmaceutical compounds.

Medicinal plants as a source of Direct and Indirect antioxidant activity. Products of phytochemicals as nanoparticles for drug delivery, Clinical application in selected diseases.

UNIT – V

Drugs of plant origin: Drugs acting on nervous system, antihypertensives, antitussives, antirheumatics, antitumour, antileprotics, antidysenterics, antiseptics, antimalarials, anti-diabetic, antimicrobial, hepatoprotective, diuretic, anti-diarrhocal, antiulcer, wound healing, cardiovascular, anti-inflammatory, analgesic, antipyretic, antifertility, anti-oxidant, anti-viral and cyto-toxic properties.

TEXT BOOKS:

1. *Satoskar, R.S. Bhandarkar, S.D and Ainapure S.S.,* 16th edition, (1999) **Pharmcology 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**, 2ndEdition, John Wiley, New Delhi, 2003.
4. *Williams M Southerland*, **Foundation of Medicine Biochemistry**, 1st Edition, Churchill Livingstone, London, 1990.

17UBC6SA	SKILL BASED SUBJECT–III: RESEARCH METHODOLOGY	SEMESTER–VI

PREAMBLE:

- Understand the basic concepts of research identify scope of research and frame objectives to be addressed in the project through a work plan.
- Able to collect literature for writing a good report.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Explain the basic concepts of research and its applications	**K2**
CO2.	Identify the research problem and develop an experimental design	**K3**
CO3.	List various sampling techniques and outline methods for collecting data	**K1,K2**
CO4.	Apply statistical analysis for interpreting data	**K3**
CO5.	Explain to formulate a research paper	**K2**

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	S	M	S	S	S
CO4	S	S	M	S	S
CO5	S	S	M	S	S

L-Low; M-Medium and S-Strong

17UBC6SA	SKILL BASED SUBJECT–III: RESEARCH METHODOLOGY	SEMESTER–VI

Total Credit: 3
Hours per week: 3

CONTENTS

UNIT I

Concept of Research

Definition, Importance and Meaning of research, Characteristics of research, Types of Research, Steps in research- Identification, Selection and formulation of research problem. Features of good research study. Research applications.

UNIT II

Defining the Research Problem

Research problem - components of research problem, formulation of research problem, Research Design - Classification of research designs, need for research design, features of good research design, experimental research design.

UNIT III

Sampling techniques

Sampling theory, types of sampling, Steps in sampling- Sampling and Non-sampling error -Sample size- Advantages and limitations of sampling. Collection of Data: Primary Data- Meaning- Data Collection methods - Secondary data - Meaning -Relevance, limitations and cautions.

UNIT IV

Statistics in Research

Measure of central tendency, dispersion, asymmetry (skewness, kurtosis), Normal distribution (p-value), Statistical tests and hypothesis (Standard error, t-test, chi-square test), and regression analysis.

UNIT V

Research Report

Research report - Structure and components of scientific reports, types of report, styles of reporting, writing and documentation of research report, developing successful research proposals.

TEXT BOOKS

1. *Kothari C.R.*, **Research Methodology - Methods and Techniques** (2004) 2nd ed., New Age International Publishers. ISBN – 81-224-1522-9
2. *Kumar R.*, **Research Methodology: A Step by Step Guide for Beginners** (2005) 2nd ed., Pearson Education. ISBN: 978-1-4129-6467-8.

REFERENCE BOOKS

1. *Daniel W.W.*, **Biostatistics: A Foundation for Analysis in the Health Sciences** (2013) 10th ed., John Wiley and Sons Inc. ISBN-13: 978-1118302798 ISBN-10: 1118302796
2. *Bremer, M. and Doerge, R.W.,* **Statistics at the Bench: A Step-by-Step Handbook for Biologists (**2010), Cold Spring Harbor Laboratory Press (New York), ISBN: 978-0-879698-57- 7.

17UBCSS1	SELF STUDY: ECOLOGICAL PRINCIPLES	SEMESTER-I TO V

PREAMBLE:

- The course demonstrates an understanding of ecological relationships between organisms and their environment.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Describe the Structural adaptations and functional adjustments of organisms to their physical environment.	**K1**
CO2.	Explain why population density, dispersion, and demographics are influenced by dynamic biological processes.	**K2**
CO3.	Organize the trophic levels of communities and describe how dominant and keystone species influence community structure.	**K3**
CO4.	Illustrate the local and geographical distribution and abundance of organisms in ecosystem	**K2**
CO5.	Apply the strategies for conservation and management of natural resources and pollution.	**K3**

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**M**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**M**	**S**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**S**

L-Low; M-Medium and S-Strong

17UBCSS1	SELF STUDY: ECOLOGICAL PRINCIPLES	SEMESTER-I TO V

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; resourcepartitioning; 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, interdemic 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: RastogiPublications, 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.

17UBCSS2	SELF STUDY: HERBAL TECHNOLOGY	SEMESTER-I TO V

PREAMBLE:

- The course gives an understanding of medicinal plants
- Students can gain basic knowledge about plant based medicine and healing.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1.	Classify the Indian system of Medicine Understand about the crude drugs	**K_1 & K_2**
CO2.	Illustrate the medicinal plant used in herbalism.	**K_1 & K_2**
CO3.	Explains the examples of medicinal plants used in herbal medicine.	**K1 & K2**
CO4.	Discuss the Herbal medicines for Human ailments	**K_1, K_2 & K_3**
CO5.	Illustrate the propagation of medicinal plants Describe Drug adulteration, Herbal food & sales	**K_2 & K_3**

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**M**	**M**	**M**	**S**
CO2	**S**	**S**	**M**	**M**	**S**
CO3	**S**	**M**	**M**	**M**	**S**
CO4	**S**	**S**	**S**	**M**	**S**
CO5	**M**	**M**	**S**	**S**	**S**

L-Low; M-Medium and S-Strong

17UBCSS2	SELF STUDY: HERBAL TECHNOLOGY	SEMESTER-I TO V

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 - Belladona - Aerial parts - Bark - Cinchona.

UNIT – III

Leaves - Adathoda, Eucalyptus - Flower - Clove fruits seeds – Nux vomica 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: Baillie`re 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, 1975. Print.

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