BACHELOR OF SCIENCE (BIOCHEMISTRY)

REGULATIONS

ELIGIBILITY

Candidates for admission to the first year of the Degree of Bachelor of Science under B.Sc. Biochemistry course are required to have passed the Higher Secondary Examination (Academic stream) conducted by the Government of Tamilnadu or an Examination as equivalent to 10 +2 courses including CBSE, which have been recognized by the Periyar University.

DURATION OF THE COURSE

The course shall extend over a period of three years comprising of six semesters with two semesters in one academic year. There shall not be less than 90 working days for each semester. Examination shall be conducted at the end of every semester for the respective subjects.

OBJECTIVE OF THE COURSE

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

- The three year B.Sc., Programme is intended to help the students to be the innovative and versatile personalities in the field of Life Science with quality education and provide the skilled manpower required by Research and Development, Institutions of higher learning and Industry.
- The programme deals with the chemical language of life (Human, animal, plant and microorganisms)
- It is designed to develop a sustained interest among the students and enthusiasm to learn and develop the concepts in Biochemistry in logical and stepwise manner.
- After completion of the course, the students can able to acquire the necessary theoretical and practical competencies in Biochemistry to enable them to undertake higher studies in recognized Institutions of higher learning and engage gainful self-employment.

SCHEME OF EXAMINATION

Subject Code	Subject	Hours of Instruction	Exam Duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
First Semester							
Part I							
15UTALA101/ 15UHILA101/ 15UMMLA101/ 15UFRLA101	Tamil I/ Hindi I/ Malayalam I/ French I	5	3	25	75	100	3
Part II							
15UENLA101	Foundation English I	5	3	25	75	100	3
Part III							
15UBCM101	Core I: Biomolecules	5	3	25	75	100	5
15UBCM102	Core II: Cell Biology	3	3	25	75	100	2
15UCHBCA101	Allied I: Chemistry I	3	3	25	75	100	3
15UBCMP101	Core Practical I: Biomolecules	3	6	40	60	100	2
15UCHBCAP101	Allied Practical I: Organic Analysis	2	3	40	60	100	2
Part IV							
15UVE101	Value Education I: Yoga	2	3	25	75	100	2
Total		**28**				**800**	**22**
Second Semester							
Part I							
15UTALA201/ 15UHILA201/ 15UMMLA201/ 15UFRLA201	Tamil II/ Hindi II / Malayalam II/ French II	5	3	25	75	100	3
Part II							
15UENLA201	Foundation English II	5	3	25	75	100	3
Part III							
15UBCM201	Core III: Biochemical Techniques	5	3	25	75	100	5
15UBCM202	Core IV: Biophysical Chemistry (100 % Internal Evaluation)	3	3	100	-	100	2

15UCHBCA201	Allied II: Chemistry II	3	3	25	75	100	3
15UBCMP201	Core Practical II: Biochemical Techniques	3	6	40	60	100	2
15UCHBCAP201	Allied Practical II: Volumetric Analysis	2	3	40	60	100	2
Part IV							
15UVE201	Value Education II: Environmental Studies	2	3	25	75	100	2
Total		**28**				**800**	**22**
Third Semester							
Part I							
15UTALA301/ 15UHILA301/ 15UMMLA301/ 15UFRLA301	Tamil III/ Hindi III/ Malayalam III/ French III	5	3	25	75	100	3
Part II							
15UENLA301	Foundation English III	5	3	25	75	100	3
Part III							
15UBCM301	Core V: Enzymology	4	3	25	75	100	4
15UBCM302	Core VI: Human Physiology	3	3	25	75	100	2
15UMBBCA301	Allied III: Microbiology	3	3	25	75	100	3
15UBCMP301	Core Practical III: Enzymology	3	6	40	60	100	2
15UMBBCAP301	Allied Practical III: Microbiology	3	3	40	60	100	2
Part IV							
15UBCSBC301	SBC I: Fundamentals of Biochemical calculations (100 % Internal Evaluation)	1	3	100	-	100	2
	NMEC I	2	3	25	75	100	2
Non Credit							
15ULS301	Career Competency Skills I	1	-	**-**	**-**	**-**	**-**
Total		**30**				**900**	**23**
Diploma*							

Fourth Semester							
Part I							
15UTALA401/ 15UHILA401/ 15UMMLA401/ 15UFRLA401	Tamil IV/ Hindi IV/ Malayalam IV/ French IV	5	3	25	75	100	3
Part II							
15UENLA401	Foundation English IV	5	3	25	75	100	3
Part III							
15UBCM401	Core VII: Bioenergetics and Intermediary Metabolism	5	3	25	75	100	5
15UCSBCA401	Allied IV: Computer for Biology	2	3	25	75	100	2
15UMABCA401/ 15UMABCA402	Allied V: Mathematics for Biology/Biostatistics	4	3	25	75	100	4
15UBCMP401	Core Practical IV: Intermediary Metabolism	3	6	40	60	100	2
15UCSBCAP401	Allied Practical IV: Office Package For Biology	2	3	40	60	100	2
Part IV							
15UBCSBC401	SBC II: Pharmacognosy (100 % Internal Evaluation)	1	3	100	-	100	2
	NMEC II	2	3	25	75	100	2
Non - Credit							
15ULS401	Career Competency Skills II	1	-	-	-	-	-
	Total	**30**				**900**	**25**
Diploma*							
Fifth Semester							
Part III							
15UBCM501	Core VIII: Fundamentals of Immunology	5	3	25	75	100	4
15UBCM502	Core IX: Molecular Biology	5	3	25	75	100	5
15UBCM503	Core X: Endocrinology	5	3	25	75	100	4

15UBCM504	Core XI: : Nutritional Biochemistry (Self Study & 100% External Evaluation)	-	3	-	100	100	3
15UBCEL501	Elective I: Clinical Biochemistry	5	3	25	75	100	5
15UBCMP501	Core Practical V: Immunology and Clinical Biochemistry	5	6	40	60	100	3
15UBCPR601	Project & Viva-Voce	2	-	-	-	-	-
Part IV							
15UBCSBC501	SBC III : Phytochemistry	2	3	25	75	100	2
Part V							
15UBCE501	Extension Activity	-	-	-	-		2
	Total	**29**				**700**	**28**
Sixth Semester							
Part III							
15UBCM601	Core XII: Plant Biochemistry	4	3	25	75	100	4
15UBCM602	Core XIII: Microbial Biochemistry	3	3	25	75	100	3
15UBCM603	Core XIV: Pharmaceutical Biochemistry	4	3	25	75	100	4
15UBCM604	Core XV: Genetic Engineering	5	3	25	75	100	5
	Elective II	4	3	25	75	100	4
15UBCMP601	Core Practical VI: Plant Biochemistry, Microbial Biochemistry and Genetic Engineering	4	6	40	60	100	2
15UBCPR601	Project & Viva-Voce	3	-	40	60	100	2
Part IV							
15UBCSBC601	SBC IV : Food Biochemistry	2	3	25	75	100	2
	Total	**29**				**800**	**26**
	Grand Total					**4900**	**146**

*** Students have to complete their diploma course during their second year (III & IV Semester)**

ELECTIVE SUBJECT

The elective subject given in fifth semester is compulsory.

The students shall choose any one of the following elective subjects in sixth semester.

S.No	Subject code	Subject
1.	15UBCEL601	Computational Biology
2.	15UBCEL602	Biomedical Instrumentation
3.	15UBCEL603	Soil Biochemistry

NON MAJOR ELECTIVE COURSE (NMEC)

Non Major Elective Course is conducted for the Students of other Departments.

S.No	Course Code	Semester	Subject
1	15UBCN301	III	Biochemistry in Health and Diseases
2	15UBCN401	IV	Functional Biology

DIPLOMA COURSE:

Students shall do the following Diploma Course during their Third semester and complete the course at the end of Fourth semester.

Third & Fourth Semester			
S.No	**Subject Code**	**Subject**	**Duration**
1	15UBCD401	Diploma Course: Clinical Laboratory Techniques	90 Hours (45 Hours in each semester)
2	15UBCDP401	Diploma Course Practical: Clinical Laboratory Techniques	

FOR COURSE COMPLETION

Student shall complete:

- Language subjects (Tamil/Hindi/Malayalam/French, English) in I, II, III and IV semester.
- Value Education: Yoga and Environmental Studies in I and II semester respectively.
- Allied subjects in I, II, III and IV semester.
- One Diploma Course in second year of their course of study.
- Two Non Major Elective Courses in III and IV semesters
- Four Skill Based Courses in III, IV, V and VI semesters
- Self study and external evaluation subject in V semester and papers by internal evaluation from the core subjects in II, III and IV Semesters.
- Extension activity in V semester.
- Elective subjects in the V and VI semesters.
- Group project at the end of VI semester, but they have to carry out their Project work from V Semester onwards.

TOTAL CREDIT DISTRIBUTION

S.NO	PART	Total Marks	Total Credits
1.	PART I: Language	400	12
2.	PART II: Foundation English	400	12
3.	PART III : Major, Allied, Elective, Project	3300	104
4.	PART IV: Value Education, SBC, NMEC	800	16
5.	PART V: Extension Activity	-	2
TOTAL		**4900**	**146**

15UBCM101	CORE I: BIOMOLECULES	SEMESTER – I

Total Hours: 50

OBJECTIVE:

To enable the students to learn the basic structures, functions and biological importance of complex biomolecules - polysaccharides, lipids, proteins and nucleic acids.

CONTENTS

UNIT – I **(10 Hours)**

Carbohydrates-I. Nomenclature - Classification. Structure (Fischer and Haworth structure), Stereo isomers and structural isomers. Structure and Properties of Monosaccharides – Glucose, fructose, Galactose. Mutarotation and chemical reactions related to functional groups - Enolisation, oxidation, reduction, glycoside formation, ester formation, aldol condensation, cyanohydrin synthesis and osazone formation. Derivatives of carbohydrates – Structure of deoxy sugars, amino sugars and glycosides.

UNIT - II **(10 Hours)**

Carbohydrates-II Oligosaccharides – Disaccharides - Structure and importance of sucrose, lactose and maltose. Trisaccharide - Structure and importance of raffinose. Polysaccharides – Structure, properties and importance of homopolysaccharides (starch, glycogen, cellulose, pectin, chitin and inulin) and heteropolysaccharides-glycosaminoglycans (hyaluronic acid, chondroitin sulfate and heparin).

UNIT-III **(10 Hours)**

Amino acids: Nomenclature. Classification (including newly identified amino acids) and structure with single letter codes. Properties - Physical and chemical. Essential and non essential amino acids – Definition and structure. Non protein amino acids - Definition, structure of Ornithine, Beta alanine, DOPA and GABA. Colour reactions of amino acids.

Proteins – Classification, structural organization of Proteins – Primary (insulin), secondary (α helix and β pleated sheet), tertiary and quaternary structure (Hb). Contribution of Ramachandran to protein chemistry. Forces involved in stabilization of tertiary structure. Protein denaturation and renaturation.

UNIT - IV **(10 Hours)**

Lipids: Classification, Physical and chemical properties of fats and oils. Structure and importance of Phospholipids (Lecithin, Cephalins, Phosphatidyl serine) Glycolipids,

Sphingolipids, Gangliosides. Nomenclature, Structure and functions of saturated, unsaturated fatty acid and sterols (cholesterol, stigmasterol and ergosterol). Essential fatty acids and PUFA - Definition, structure and importance. Lipoproteins - Types, composition and functions (Elementary details).

UNIT - V **(10 Hours)**

Nucleic acids: Chemistry of nitrogenous bases, nucleosides and nucleotides. Nucleic acids - DNA - Double helical structure - Watson and Crick model. Types of DNA - A, B, C and Z DNA. Properties of DNA – density, absorption maxima, Tm, denaturation and renaturation. RNA – Types - rRNA, mRNA, tRNA - Structure and functions.

TEXT BOOKS:

1. *Conn Erice, E.* and *Stumpf Paul, K.* 2007. **Outlines of Biochemistry**. [Fifth Edition]. John Wiley & Sons, New Delhi **(UNIT - I)**.
2. *Jain, J. L.* 2002. **Fundamentals of Biochemistry.** [Fifth Edition]. S. Chand & Company Ltd., New Delhi **(UNIT II, III, IV & V)**.

REFERENCE BOOKS:

1. *Nelson David, L.* and *Cox, M.M.* 2011. **Lehninger Principles of Biochemistry**. [Fifth Edition]. Macmillan/ Worth, New York.
2. *Lubert Stryer*, *Jermy M. Berg* and *John L. Tymoczko.* 2007. **Biochemistry.** [Sixth Edition]. W. H Freeman and Co, New York.
3. *Garrette Grisham*. 2005. **Principles of Biochemistry**. Thomson Brooks/Cole, Australia.

15UBCM102	CORE II: CELL BIOLOGY	SEMESTER – I

Total Hours: 35

OBJECTIVE:

1. To understand the relationship between organization and functions of cell and subcellular organelles.

CONTENTS

UNIT - I **(7 Hours)**

Cell and Cell Cycle: Origin and evolution of cell. Cell classification- Prokaryotic and Eukaryotic cell. Cell variability (size, shape, complexity and functions). Mitotic and meiotic cell division. Overview of Cell Cycle.

UNIT - II **(7 Hours)**

Nucleus, Mitochondria & Cytoskeleton: Nucleus and Mitochondria – Structure and functions. Cytoskeleton: Types of filaments and their functions. Microtubules– Chemistry and functions - Cilia and flagella: Structure and function.

UNIT - III **(7 Hours)**

GERL: Golgi apparatus – Structure and functions. Endoplasmic reticulum and Ribosomes – Types, structure and functions. Lysosome, Peroxisomes and Glyoxisomes – Structure and functions.

UNIT - IV **(7 Hours)**

Plasma membrane & Membrane transport: Structure, composition and functions of the plasma membrane - Fluid mosaic model, Membrane lipids and proteins. Cell permeability: Passive diffusion - Transport of small molecules across biomembranes. Active transport by ATP-Powered Pumps: Na^+/K^+ ATPase.

UNIT - V **(7 Hours)**

Cellular interactions: Tight junctions, desmosomes, gap junctions - organization and functions (Elementary details).

Cancer Biology - Properties of cancer cell. Difference between normal and cancer cell. Carcinogenic agents - physical, chemical and biological agents.

TEXTBOOKS:

1. *Ajoy Paul*. 2009. **Text book of Cell and Molecular Biology.** [Second Edition]. Books and Allied (P) Ltd., Kolkata.
2. *Robert K. Murray*. 2002. **Harper's Biochemistry**. [Twenty Fifth Edition]. McGraw-Hill Publishers, New York **(Cancer Biology).**

REFERENCE BOOK:

1. *De Robertis* and *De Robertis*. 2005. **Cell and Molecular Biology.** [Eighth Edition]. Lippincott Williams & Walkins, USA.

15UCHBCA101	ALLIED I: CHEMISTRY I (For B.Sc., Biochemistry)	SEMESTER – I

Total Hours: 40

OBJECTIVES:

- To understand the chemical bonding in Inorganic and organic compounds.
- To understand the basics of aromaticity stereochemistry of simple organic compounds.
- To understand the purification process and properties of solutions and colloids.
- To understand the basic concept of titrimetry.

CONTENTS

UNIT I **(8 Hours)**

Covalent Bond-Orbital Overlap-Hybridisation (sp, sp^2 & sp^3)-Electron displacement-Inductive effects-resonance-hyperconjucation- steric effects- Their effect on the properties of compounds. Stereoisomerism- optical isomerisim- elements of symmetry-causes of optical activity- Tartaric acid; Geometrical isomerism of Maleic acid & Fumaric acids.

UNIT II **(8 Hours)**

Aliphatic nucleophilic substitutions-mechanisms of SN^1 and SN^2 reactions-effects of structure-substrate-solvents-nucleophiles-leveing groups. Aromatic compounds-aromaticity-Huckel's rule-Electrophilic substitution in benzene-mechanism of nitration-halogenation-alkylation-acylation.

UNIT III **(8 Hours)**

Purification techniques-purification solid organic compounds-crystallization-fractional crystallization- sublimation-purification of liquids-experimental techniques of distillations-fractional distillation-vacuum distillation-steam distillation-test for purity.

UNIT IV **(8 Hours)**

Solutions-types- solubility (saturation,unsaturation, misicible, immisicible)-liquid in liquid type- Raoult's law for ideal solutions- positive and negative deviations from Raoult's law-reasons and examples. Colloids: classifications-properties (optical & electrical properties)-coagulations-emulsions-gels (elementary ideas)-applications.

UNIT V **(8 Hours)**

Ttitrimetry,Terminology- basic requirements of a titration reaction- standard solution- primary standard- expressing concentration of standard solution- p-function- acid-base titration - their indicators. Statistical Evaluation-Determinate-Indeterminate errors- Normal error curve- Accuracy – Precision- relative and standard deviation- Methods for minimizing errors- Significant figures - computation rules.

TEXT BOOK:

1. *Madan, R.L*. 2010. **Chemistry for degree students**, S. Chand and Co., New Delhi.

REFERENCE BOOKS:

1. *Lee, J.D.* 1996. **A New Concise Inorganic Chemistry.** [Fifth Edition]. Chapman and Hall, London.
2. *Morrison, R.T. and Boyd, R.N*. 1992. **Organic Chemistry.** [Sixth Edition]. Prentice - Hall of India (P) Ltd., New Delhi.
3. *Mukherjee, S.M. Singh, S.P. and Kapoor, R.P.* 1985. **Organic Chemistry.** [First Edition]. New Age International (P) Ltd. Publishers, New Delhi.
4. *Puri, B.R., Sharma, L.R. and Pathania, M.S.* 1998. **Principles of Physical Chemistry.** [Thirty seventh Edition]. Shoban Lal Nagin Chand and Co., Jalandhar.

15UBCMP101	CORE PRACTICAL I: BIOMOLECULES	SEMESTER - I

LIST OF EXPERIMENT

I. Qualitative Analysis

1. Carbohydrates : Glucose, fructose, xylose, galactose, sucrose, lactose, maltose and starch.
2. Amino acids : Tyrosine, phenylalanine , tryptophan, histidine, methionine, arginine and cysteine.
3. Proteins : Solubility test, coagulation test, ninhydrin test, biuret test, folin's phenol, precipitation by metals.
4. Lipids : Solubility, grease spot, Oil spot, emulsification, halogenations, colour reactions.

II. Biochemical Preparation

1. Starch from Potato.
2. Casein from milk.

III. Quantitative Analysis

1. Estimation of Reducing Sugar (Glucose) - Benedict's method.
2. Estimation of Amino acid (Glycine) - Formal titration.
3. Determination of Saponification Number (Group Experiment).
4. Determination of Acid Number (Group Experiment).

REFERENCE BOOKS:

1. *Sadasivam, S.* and *Manickam, A*. 2010. **Biochemical Methods.** [Third Edition]. New Age International (P) Ltd., New Delhi.
2. *Jayaraman, J*. 2008. **Laboratory Manual in Biochemistry**. [First Edition Reprint]. New Age International (P) Ltd., New Delhi.

15UCHBCAP101	**ALLIED PRACTICAL I: Organic analysis (For B.Sc., Biochemistry)**	**SEMESTER –I**

OBJECTIVE:

- To elucidate the functional group of organic compounds by qualitative analysis.

LIST OF EXPERIMENT

Organic Analysis

Systematic analysis of organic compounds containing one functional group and characterization by confirmatory tests. The functional groups to be analysed are,

- Aldehyde (Aromatic)
- Carbohydrate
- Carboxylic acid
- Phenol
- Aromatic primary amine
- Amide
- Diamide

REFERNCE BOOK:

1. *Kamboj, P.C.* 1999. **University practical chemistry**. Vishal Publications.

15UVE101	VALUE EDUCATION I: YOGA மனவளக்கலை யோகா	SEMESTER - I

Total Hours: 30

CONTENTS

UNIT - I **(6 Hours)**

YOGA AND PHYSICAL HEALTH

1:1 Physical Structure-Three bodies- Five limitations
1:2 Simplified Physical Exercises - Hand Exercises - Leg Exercises- Breathing Exercises – eye Exercises - Kapalapathi
1:3 Maharasanas 1-2– massages – acu-puncture – Relaxation
1:4 Yogasanas-Suriya Namaskar – Padamasana –Vajrasanas – Chakrasanas (Side) – Viruchasanas –Yoga muthra –Patchimothasanas-Ustrasanas–Vakkarasanas Salabasanas.

UNIT - II **(6 Hours)**

ART OF NURTURING THE LIFE FORCE AND MIND

2:1Maintaining the youthfulness - postponing the ageing process
2:2 Sex and spirituality– significance of sexual vital fluid – Married Life–Chastity.
2:3 Ten Stages of Mind
2:4 Mental Frequency – Methods for Concentration

UNIT - III **(6 Hours)**

SUBLIMATION

3:1 Purpose and Philosophy of life
3:2 Introspection – Analysis of Thought
3:3 Moralization of Desires
3:4 Neutralization of Anger

UNIT - IV **(6 Hours)**

HUMAN RESOURCESDEVELOPMENT

4:1 Eradication of worries
4:2 Benefits of Blessings
4:3 Greatness of Friendship
4:4 Individual Peaceand World Peace

UNIT - V **(6 Hours)**

LAWOF NATURE

5:1 Unified Force – Cause and Effect System
5:2 Purity of thought and Deed and Genetic Centre
5:3 Love and Compassion
5:4 Cultural Education –Five fold Culture

TEXT BOOKS:

1. Manavalakalai Yoga – World Community Service Center
   VethathiriPathippagam,
   156, Gandhij Road, Erode – 638 001.
   PH: 0424 – 2263845.

REFERENCE BOOKS:

1. Yoga for Modern Age
2. Journey of Consciousness
2. Simplified Physical Exercises – World Community Service Center
   VethathiriPathippagam,
   156, Gandhij Road, Erode – 638 001.
   PH: 0424 – 2263845.

15UBCM201	CORE III: BIOCHEMICAL TECHNIQUES	SEMESTER – II

Total Hours: 50

OBJECTIVES:

1. To enable the students to have a deep knowledge on the techniques for measurement of biophysical factors in living organisms.
2. To enable the students to get an insight on the usage of various techniques and their applications in industry and R&D.

CONTENTS

UNIT - I **(11 Hours)**

Centrifugation Techniques: Cell disruption and homogenization-Media for homogenization, methods of cell distruption. Centrifugation - principle-sedimentation coefficient, RCF. Types of centrifuges and rotors. Preparative centrifugation-differential, density gradient centrifugation. Analytical ultracentrifugation – instrumentation and applications- Determination of molecular weight.

UNIT - II **(10 Hours)**

Chromatographic Techniques: Chromatography - Principle, method and applications of paper, thin layer, ion exchange, affinity chromatography, gel permeation chromatography and Gas liquid chromatography.

UNIT - III **(10 Hours)**

Electrophoretic techniques: Electrophoresis **-** Principles and applications of electrophoresis, Factors affecting electrophoretic mobility. Types of electrophoretic techniques – zonal, capillary, paper and agarose gel. PAGE- Native- PAGE and SDS-PAGE. (Staining method used in electrophoretic technique.) Isoelectricfocusing.

UNIT - IV **(10 Hours)**

Colorimetry: Beer Lambert's Law, Light absorption and its transmittance, Absorption Spectroscopy - Principle, instrumentation and applications of colorimetry and UV-Vis spectrophotometer. Emission Spectroscopy – Spectrofluorimeter - Principle, instrumentation and applications. Flame photometry - principle and applications.

UNIT - V **(9 Hours)**

Radio isotopic techniques: Types of radioactive decay, rate of radioactive decay, decay constant, Units of radio activity, measurement of radioactivity based on ionization- GM counter and excitation- Scintillation counter. Autoradiography. Applications of radio isotopes in biology. Hazards of radioactivity.

TEXT BOOK:

1. *Avinash Upadhyay*, *Kakoli Upadhyay* and *Nirmalendu Nath.* 2006**. Biophysical Chemistry: Principles and Techniques.** Himalaya Publishers, Mumbai.

REFERENCE BOOK:

1. *Keith Wilson* and *John Walker*. 2006. **Principles and Techniques of Biochemistry and Molecular Biology.** [Sixth Edition]. Cambridge University Press, New York.

15UBCM202	CORE IV: BIOPHYSICAL CHEMISTRY (100% INTERNAL EVALUATION)	SEMESTER – II

Total Hours: 30

OBJECTIVE:

1. Biophysical chemistry is the supportive subject to understand the concept of biochemical techniques and functions of Biomolecules.

CONTENTS

UNIT – I **(6 Hours)**

Water and its interaction: Structure and physical properties of water molecule, Weak interactions in aqueous system-Hydrogen bonding between water molecules, Types of hydrogen bond in biological system, interaction of water with charged solute, Interaction of water with non polar compound. Vander Waal's interaction. Role of weak interactions in biological system.

UNIT – II **(6 Hours)**

pH and buffers: pH - Definition, H-H equation and its derivation. Measurement of pH - use of indicators and pH electrode- Reference electrodes – Standard hydrogen electrode, Calomel electrodes, Silver/ Silver Chloride electrode and glass electrodes. pH meter. Buffers - Definition and importance of buffers in biological system.

UNIT - III **(6 Hours)**

Osmosis – Definition. Osmotic pressure. Measurement of osmotic pressure, osmotic behavior of cell- isotonic, hypertonic and hypotonic solutions. (Determination of molecular weight.) Significance of osmosis in biology. Dialysis – Definition, process and biological applications.

UNIT - IV **(6 Hours)**

Viscosity: Definition, factors affecting viscosity (Temperature, pH, pressure, chemical composition and specific volume. Significance of viscosity in biological system. Application of viscometry – size and shape of macromolecules, protein denaturation, native structure of protein.

Diffusion-Definition, factors affecting diffusion (electrical gradient of ions, solubility, temperature, size and shape of solute, viscosity, partition coefficient) Significance of diffusion in biological system.

UNIT - V **(6 Hours)**

Surface Tension: Definition, factors affecting surface tension (Temperature, solutes, hydrogen ion concentration). Significance of surface tension in biological systems.
Colloids: Definition. Donnan membrane equilibrium and its biological significance.

TEXT BOOKS:

1. *Nelson David, L.* and *Cox, M.M*. 2011. **Lehninger Principles of Biochemistry**. [Fifth Edition]. Macmillan/ Worth, New York. (UNIT - I)
2. *Padmini, E.* 2006. **Biochemical Calculations and Biostatistics.** Books and Allied (P) Ltd., Kolkatta. (UNIT - II)
3. *Avinash Upadhyay, Kakoli Upadhyay* and *Nirmalendu Nath*. 2006. **Biophysical Chemistry (Principles and Techniques)**. Himalaya Publishing House, New Delhi. (UNIT - III, IV & V)

REFERENCE BOOK:

1. *Deb, A. C.* 2000. **Fundamentals of Biochemistry**. New Central Book Agency. Calcutta.

15UCHBCA201	ALLIED II : CHEMISTRY II (for B.Sc., Biochemistry)	SEMESTER – II

Total Hours: 40

OBJECTIVES:

- To understand the chemical bonding, molecular orbital theory and reducing agent.
- To understand the basics principles of nuclear chemistry.
- To understand the theories involved in coordination chemistry.
- To understand the basic concept of photochemistry and electrochemistry.

CONTENTS

UNIT -I **(8 Hours)**

Chemical Bonding- Molecular Orbital Theory bonding- antibonding - nonbonding orbitals- M.O. diagrams of Hydrogen- Helium- Nitrogen - Discussion of bond order-magnetic properties- Hydrides-classification – characteristics-preparation-properties - uses of $NaBH_4$ - $LiAlH_4$.

UNIT -II **(8 Hours)**

Fundamental particles of Nucleus – nuclides-isotopes- isobars – isotones- Natural radioactivity-radioactive series including Neptunium series-Group displacement law-Nuclear Binding energy- mass defect-Calculations-Nuclear Fission - Nuclear Fusion-differences -Stellar energy- Artificial Radioactivity.

UNIT -III **(8 Hours)**

Co-ordination chemistry- Definition- classification of ligands- nomenclature- chelation, chelate effect - Werner's theory- Sidgwick's theory- effective atomic number concept. Pauling's theory (VB theory)- Hemoglobin –definition-biological role-Chlorophyll-definition-biological role- EDTA - its application.

UNIT -IV **(8 Hours)**

Photochemistry: Grotthus-Draper law - Stark-Einstien's law of photochemical equivalence- Quantum yield- Example for photochemical reactions- Hydrogen-Chlorine

reaction (elementary idea only) – photosynthesis- Phosphorescence- Fluorescence- Chemiluminescence - Photosensitisation - definition with examples.
Phase Rule –definition- application of phase rule (water system only)- Eutectic point(definition only)

UNIT -V **(8 Hours)**

Electro Chemistry- Kohlrausch law -measurement of conductance- determination of pH - Conductometic titrations- Hydrolysis of salts. Derivation of Kh.- Galvanic cells-EMF- standard electrode potentials- electrochemical series - its applications - Principles of electroplating-corrosion- corrosion prevention.

TEXT BOOK:

1. *Madan, R.L.* **Chemistry for degree students**, S.Chand and Company Ltd, New Delhi

REFERENCE BOOKS:

1. *Lee, J.D.* 1996, **A New Concise Inorganic Chemistry,** [Fifth Edition]. Chapman and Hall, London.
2. *Morrison, R.T. and Boyd, R.N.* 1992. **Organic Chemistry.** [Sixth Edition]. Prentice – Hall of India (P)Ltd., New Delhi.
3. *Mukherjee, S.M. Singh, S.P. and Kapoor, R.P.* 1985. **Organic Chemistry.** [First Edition]. New Age International (P) Ltd. Publishers, New Delhi.
4. *Puri, B.R., Sharma, L.R. and Pathania, M.S.* 1998. **Principles of Physical Chemistry.** [Thirty seventh Edition]. Shoban Lal Nagin Chand and Co., Jalandhar.

15UBCMP201	CORE PRACTICAL II: BIOCHEMICAL TECHNIQUES	SEMESTER - II

LIST OF EXPERIMENT

1. Preparation of Buffers and Determination of pH using pH meter
2. Principle and handling of Centrifuge.
3. Separation of amino acid by Ascending paper chromatography.
4. Separation of amino acid by descending paper chromatography.
5. Separation of amino acid by circular paper chromatography.
6. Separation of Leaf pigments by Adsorption chromatography.
7. Separation of lipids by Thin layer chromatography.
8. Separation of proteins by agarose gel electrophoresis/SDS PAGE (Demonstration/Group Experiment)
9. Principle & handling of Colorimeter - Demonstration of Beer-Lambert's law using Bromophenol blue.
10. Preparation of Calibration curve-Colorimetric estimation of creatinine.

REFERENCE BOOK:

1. *David T. Plummer*. 1988. **Practical Biochemistry**. [Third Edition]. Tata McGraw Hill Publishers, New Delhi.

15UCHBCAP201	ALLIED PRACTICAL II : Volumetric analysis (for B.Sc Biochemistry)	SEMESTER – II

OBJECTIVE:

To provide basic knowledge in titrimetric analysis

LIST OF EXPERIMENT

Volumetric Analysis

1. Estimation of Sodium hydroxide using standard Carbonate.

2. Estimation of HCl using standard oxalic acid.

3. Estimation of Borax - using standard Na_2Co_3.

4. Estimation of Ferrous Sulphate - standard Mohr salt solution.

5. Estimation of oxalic acid - standard oxalic acid.

6. Estimation of $KMnO_4$ using standard oxalic acid.

7. Estimation of ferrous ion using Diphenyl - amine as internal indicator.

REFERENCE BOOK:

1. *Kamboj, P.C* .1999. **University practical Chemistry.** Vishal Publications.

15UVE201	VALUE EDUCATION II: ENVIRONMENTAL STUDIES	SEMESTER -II

Total Hours: 30

CONTENTS

UNIT - I **(6 Hours)**

Environment– Definition– Scope– Structure and function of ecosystems- producers, consumers and decomposers- Energy flow in the ecosystem- Ecological succession– food chain, food webs and ecological pyramids– Concept of sustainabledevelopment.

UNIT - II **(6 Hours)**

Natural resources: Renewable- air, water, soil, land and wildlife resources. Non–renewable – Mineral coal, oil and gas. Environmental problems related to the extraction and use of naturalresources.

UNIT - III **(6 Hours)**

Biodiversity– Definition– Values– Consumption use, productive social, ethical, aesthetic and option values threats to bio diversity – hotspots of bio diversity– conservation of bio- diversity: in– situ Ex– situ. Bio– wealth - National and Global level .

UNIT - IV **(6 Hours)**

Environmental Pollution :Definition– causes, effects and mitigation measures– Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution– Nuclear hazards – Solid wastes acid rain–Climate change and global warming environmental laws and regulations in India– Earth summit

UNIT - V **(6 Hours)**

Population and environment – Population explosion – Environment and human health – HIV/AIDS – Women and Child welfare – Resettlement and Rehabilitation of people, Role of information technology in environmental health – Environmental awareness.

TEXT BOOK:

1. Department of Biochemistry. Environmental Studies (Study Material). Published by K.S.Rangasamy College of Arts & Science (Autonomous). Tiruchengode.

REFERENCE BOOK:

1. *Erach Bharucha*. 2005. **Textbook of Environmental studies**. Universities press. PVT. Ltd.

15UBCM301	CORE V: ENZYMOLOGY	SEMESTER – III

Total Hours: 40

OBJECTIVES:

To enable the students to acquire knowledge about

1. Techniques of isolation & purification of the enzymes
2. Kinetics of the enzymes and enzyme regulation
3. Elucidation of enzymatic application in industry and medicine

CONTENTS

UNIT - I **(8 Hours)**

Introduction: IUB Classification and nomenclature of enzymes, Enzyme units - International units, Katal. Specific activity. The active site - General features. Theories of enzyme action - lock and key and induced fit hypothesis. Enzyme specificity-Definition and Types. Isoenzymes – LDH. Ribozymes, Abzymes, DNAzymes (elementary details). Isolation and purification of enzymes**-** Affinity and ion exchange chromatography. Criteria of purity.

UNIT - II **(8 Hours)**

Enzyme kinetics: MM equation & MM plot – significance of Km and Vmax, reciprocal plots- LB plot. Factors affecting enzyme activity (pH, Temperature, Substrate concentration and enzyme concentration).

Enzyme Inhibition: Reversible - Competitive, non-competitive and un-competitive inhibition (kinetics not required). Irreversible inhibition- Inhibition by DFP and Iodoacetamide.

UNIT - III **(8 Hours)**

Coenzymes: Apoenzyme, holoenzyme. Structure and functions of TPP, NAD, NADP, FAD, FMN and Coenzyme A (Synthesis not required). Metal cofactors. Mechanism of enzyme Catalysis: General acid base catalysis, covalent catalysis -Mechanism of action of Chymotrypsin.

UNIT - IV **(8 Hours)**

Regulation of Enzymes: Allosteric regulation-allosteric enzymes –allosteric site-modulators. Multi subunits-regulatory and catalytic subunits. Feedback inhibition. Allosteric regulation of aspartate transcarbamylase. Regulation by covalent

modification (phosphorylation), Multi enzyme Complex- Mechanism of action of Pyruvate dehydrogenase.

UNIT - V **(8 Hours)**

Immobilized enzymes: Techniques of immobilization (entrapment, carrier binding and cross linking). Enzymes as Biosensors – Principle of Colorimetric biosensors, Potentiometric biosensors, Amperometric biosensors, Optical biosensors and immunosensors. Application of enzymes in industries - medicine, textile and food.

TEXT BOOKS:

1. *Palmer, T.* 2004. **Understanding Enzymes (Biochemistry, Biotechnology, Clinical Chemistry).** [First edition]. East-West Press Pvt. Ltd., New Delhi **(UNIT – I, II, III & IV).**
2. *Devasena, T.* 2010. **Enzymology**. Oxford University Press, New Delhi **(UNIT V).**

REFERENCE BOOKS:

1. *Nicholas Price, C.* and *Stevens, L.* 1999. **Fundamentals of Enzymology.** [Third Edition]. Oxford University Press, New Delhi.
2. *Meena, M.* and *Chauhan, D.* 2009. **Fundamentals of Enzymology.** [First Edition]. Aavishkar Publishers, Jaipur.

15UBCM302	CORE VI: HUMAN PHYSIOLOGY	SEMESTER - III

Total Hours: 36

OBJECTIVE:

1. To enable the students to understand the anatomy of major organs and their correlation to the physiological processes within the organ systems of the human body.

CONTENTS

UNIT – I **(7 Hours)**

Cardio Vascular system: Anatomy of heart. Cardiac conduction system and cardiac cycle. Blood pressure and control of blood pressure.

Blood: Composition and functions of blood, blood coagulation-intrinsic and extrinsic pathways.

UNIT – II **(8 Hours)**

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

Muscles:Classification of muscles. A brief account on the contractile elements of muscle - myosin, actin, tropomyosin and troponin. Physiology of muscle contraction.

UNIT – III **(7 Hours)**

Digestive system: Structure and function of different components of digestive system-stomach, pancreas, liver, gall bladder and intestine. Absorption of carbohydrates, lipids and proteins. Mechanism of HCl formation in stomach.

UNIT – IV **(7 Hours)**

Nervous system: Classification of nervous system. Classification and structure of neuron. Properties-excitability, action potential, conductivity. Synapse-classification and function. Neurotransmitters- Excitatory and inhibitory neurotransmitters with special reference to acetylcholine and GABA.

UNIT – V **(7 Hours)**

Excretory system: Anatomy and histology of the kidneys, renal physiology - Glomerular filtration, tubular reabsorption and tubular secretion. Mechanism of urine formation.

Electrolytes- Normal water and electrolyte balance and its regulation. Acid-base balance -respiratory and renal mechanism of acid - base balance. Acidosis and alkalosis.

TEXT BOOKS:

1. *Gerald J. Tortora* and *Sandra Reynolds.* 2003. **Principles of Anatomy and Physiology.** [Tenth Edition]. John Wiley and Sons. Inc. Pub., New York. **(UNIT - I, II & V).**
2. *Sembulingam, K.* and *Prema Sembulingam*. 2000. **Essentials of Medical Physiology.** [Second Edition]. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi. **(UNIT - III & IV).**

REFERENCE BOOK:

1. *Kathleen, J. W., Wilson, O.B.E.* and *Anne Waugh.* 1998. **Ross and Wilson Anatomy and Physiology in Health and Illness.** [Eighth Edition]. Churchill Livingston, New York.

15UMBBCA301/ 15UMBBTA301	ALLIED III: MICROBIOLOGY (For B.Sc Biochemistry and Biotechnology)	SEMESTER III

Total Hours: 45

OBJECTIVES:

1. To learn the basics of Microbiology.
2. To acquire the basic knowledge on staining, sterilization and antimicrobial chemotherapy.

CONTENTS

UNIT – I **(9 Hours)**

Definition of Microbiology – Scope and Branches of Microbiology – Contributions – Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming.

UNIT - II **(10 Hours)**

Microscopy – Simple and compound microscope – Dark field microscope – Phase contrast microscope – Fluorescence microscope – Electron microscope. Principles and types of stain – Simple, differential and special staining (Endospore, Capsular).

UNIT - III **(9 Hours)**

Media preparation – Liquid media, Solid Media, Selective Media, enriched, enrichment and Differential Media; Isolation of pure culture – Pour plate, Spread plate and Streak plate methods.

UNIT - IV **(8Hours)**

Sterilization – Principles – dry heat – moist heat – Radiation - UV rays – gamma rays Filtration- Depth, membrane and HEPA filters. Disinfection and disinfective agents. Chemicals – Alcohol, Aldehydes, Phenol.

UNIT - V **(9Hours)**

Antimicrobial chemotherapy-Antibiotics-mode of action of cell wall, Protein and nucleic acid synthesis inhibitors - antibiotic susceptibility test – Kirby-Bauer & Stokes methods.

TEXT BOOK:

1. *Pelczar Jr .M.J. Chan, E.C.S and N.R. Kreig.* 1995. **Microbiology**. Tata Mc Graw Hill New Delhi.

REFERENCE BOOKS:

1. *Lansing, M. Prescott., John P. Harley, Donald A. Klein.* 2005. **Microbiology**. [Sixth Edition]. Mc Graw Hill Inc. New York.
2. *Sale, A.J.* 1992. **Fundamental Principles of Bacteriology.** [Seventh Edition]. Mc Graw Hill Inc, New York.

15UBCMP301	CORE PRACTICAL III: ENZYMOLOGY	SEMESTER - III

LIST OF EXPERIMENT

ENZYMOLOGY

1. Extraction of ALP from green gram.
2. Partial purification of ALP by ammonium sulphate precipitation.
3. Desalting of ammonium sulphate enzyme fraction by dialysis.
4. Determination of specific activity of ALP.
5. Effect of pH on the activity of ALP.
6. Effect of temperature on the activity of ALP.
7. Effect of substrate concentration on the activity of ALP.
8. Determination of specific activity of catalase.
9. Effect of pH on the activity of catalase.
10. Effect of temperature on the activity of catalase.
11. Effect of substrate concentration on the activity of catalase.
12. Immobilization technique - Gel Entrapment

REFERENCE BOOKS:

1. *Sadasivam, S.* and *Manickam, A*. 2010. **Biochemical Methods.** [Third Edition]. New Age International (P) Ltd., New Delhi.
2. *Harold Varley.* 1988. **Practical Clinical Biochemistry.** [Fourth Edition]. CBS Publishers. New Delhi.

15UMBBCAP301/ 15UMBBTAP301	**ALLIED PRACTICAL III : MICROBIOLOGY**	**SEMESTER - III**

LIST OF EXPERIMENT

1. Handling and maintenance of bright field Microscopy.
2. Staining methods – Simple staining.
3. Gram's staining.
4. Acid – fast staining.
5. Spore staining.
6. Media preparation – Liquid and Solid Media.
7. Pure Culture Techniques: Streak Plate Method.
8. Pour plate method.
9. Spread plate method.
10. Antibiotic Susceptibility test – Kirby-- Bauer method.

REFERENCE BOOKS:

1. *Sundararaj, T.***Microbiology Laboratory Manual.** Dr.A.L.Mudaliyar Post Graduate Institute of Basic Medical Sciences, Chennai.
2. *Kannan, N.* **Laboratory manual in General Microbiology.** Panima publishing corporation, New Delhi.
3. *Cappucino, J.G and Sherman, N.* 2012. **Microbiology – A laboratory manual.** [Seventh Edition]. Pearson Education Inc.

15UBCSBC301	SBC I: FUNDAMENTALS OF BIOCHEMICAL CALCULATIONS (100% INTERNAL EVALUATION)	SEMESTER - III

Total Hours: 15

OBJECTIVE:

To make the students to understand the basic calculations in biochemistry

CONTENTS

UNIT - I **(3 Hours)**

Unit of Measurements: SI Units. Strength of the solutions - Percentage solutions, part dilutions, molar solutions and normal solutions.

UNIT - II **(3 Hours)**

pH and pKa calculations, preparation of buffers

UNIT - III **(3 Hours)**

Half life and disintegration time – simple problems. Percentage transmittance and absorbance conversion.

UNIT - IV **(3 Hours)**

Enzyme kinetics - Km, Turn over, Vmax

UNIT - V **(3 Hours)**

Dilutions and graphing

TEXT BOOKS:

1. *Jain, J. L.* 2002. **Fundamentals of Biochemistry.** [Fifth Edition]. S.Chand & Company Ltd., New Delhi.
2. *Nelson David, L.* and *Cox, M.M.* 2011. **Lehninger Principles of Biochemistry**. [Fifth Edition]. Macmillan/ Worth, New York.

15ULS301	CAREER COMPETENCY SKILLS I	SEMESTER – III

Total Hours: 15

OBJECTIVE:

To enhance employability skills and to develop career competency

CONTENTS

UNIT – I **(3 Hours)**

Speed Maths: Squaring of Numbers - Multiplication of Numbers - Finding Square Roots - Finding Cube Roots - HCF, LCM - Decimals - - Averages - Powers and Roots.

UNIT – II **(3 Hours)**

Problems on ages- Ratio and proportion- Chain rule-Percentages- Simple and Compound Interest.

UNIT – III **(3 Hours)**

Time and Work- Time and Distance- Problems on Trains

UNIT – IV **(3 Hours)**

Analogies - Sentence Formation - Sentence Completion - Sentence Correction - Idioms & Phrases - Jumbled Sentences-- Reading Comprehension –Deriving conclusions

UNIT – V **(3 Hours)**

Tenses- Articles and Preposition - Change of Voice - Change of Speech - Synonyms & Antonyms - Phrasal Verbs-One Word Substitution- Odd Man Out - Spelling & Punctuation

15UBCM401	CORE VII: BIOENERGETICS AND INTERMEDIARY METABOLISM	SEMESTER - IV

Total Hours: 50

OBJECTIVE:

To make the students to:

1. Understand the metabolic pathways and their physiological significance.
2. Learn the energetic of the metabolic pathways.

CONTENTS

UNIT - I **(10 Hours)**

Thermodynamics: Laws of Thermodynamics, Enthalpy, Entropy, Exothermic and Endothermic reactions. Free energy.

Biological oxidation - Redox potential. Role of high energy compounds in biological system. ATP as energy currency of cell. Electron Transport Chain, Oxidative Phosphorylation – Mechanism of Oxidative Phosphorylation- Chemiosmotic hypothesis. ATP synthase. Inhibitors of ETC. Uncouplers.

UNIT - II **(10 Hours)**

Carbohydrate metabolism: Glycolysis: Reactions and energetics. Pasteur Effect. TCA cycle- reactions & energetics, Anaplerotic reactions. Pentose Phosphate Pathway – reactions and its significance. Gluconeogenesis and Glycogen metabolism. Mitochondrial Shuttle systems. (Malate-Aspartate and Glycerol-3- phosphate).

UNIT - III **(10 Hours)**

Lipid Metabolism: Fatty acid oxidation – α, β, ω oxidation. Oxidation of unsaturated & odd chain fatty acids. *De novo* synthesis of saturated fatty acids - Transfer of Mitochondrial acetyl Co-A to cytosol, Fatty acid synthase complex. Biosynthesis of unsaturated fatty acids. Ketone bodies - formation and utilization. Biosynthesis and degradation of cholesterol. Synthesis and degradation of phospholids (Lecithin).

UNIT - IV **(10 Hours)**

Amino acid metabolism: Biosynthesis of amino acids - Serine and Tyrosine. Catabolism of amino acids - Transamination, Deamination, Decarboxylation. Ammonia transport and urea formation. Catabolism of carbon skeleton of aminoacids - Ketogenic (Phenyalanine) and glucogenic (Methionine) amino acids. Integration of carbohydrate, protein and fat metabolism.

UNIT - V **(10 Hours)**

Nucleotide metabolism: Biosynthesis of purine nucleotides- *De novo* and salvage pathways. Catabolism of purine nucleotides. Biosynthesis of pyrimidine nucleotides – *De novo* and salvage pathways. Catabolism of pyrimidine nucleotides. Inhibitors of nucleotide biosynthesis.

TEXT BOOK:

1. *Jain, J. L.* 2002. **Fundamentals of Biochemistry.** [Fifth Edition]. S.Chand & Company Ltd., New Delhi.

REFERENCE BOOKS:

1. *Nelson David, L.* and *Cox, M.M.* 2011. **Lehninger Principles of Biochemistry**. [Fifth Edition]. W.H. Freemen & Co. New York.
2. *Robert K. Murray, Daryl K. Granner, Peter A. Mayer* and *Victor W. Rodwell*. 2006. **Harper's Biochemistry.** [Twenty Fifth Edition]. Lange book Publishers, New York.
3. *Stryer, L.* and *Berg, J. M.* 2003. **Biochemistry.** [Fifth Edition]. W. H. Freemen & Co. New York.

15UCSBCA401/ 15UCSMBA401	**ALLIED IV:COMPUTER FOR BIOLOGY (For the students of B.Sc., Biochemistry and Microbiology)**	**SEMESTER – IV**

Total hours: 30

OBJECTIVES:

On completion of the course the students shall have knowledge on:

1. Basics terminologies of Computer.
2. The importance of Office package in Biology.

CONTENTS

UNIT - I **(6 Hours)**

Introduction to Computers: History and Generations of Computers-Characteristics of Computers-Applications of Computers-Classification of Computers-Organization of Computer System-Computer Hardware-Software Definition, Role and Categories. The Processor: The Central Processing Unit. The Input-Output Media: Inputs and Outputs: CRT Monitors-Flat Panel Monitors-Keyboards-Graphics and Graphical Terminals-Printers.

UNIT - II **(6 Hours)**

Introduction to Microsoft Office Word 2007: Working with Documents in Microsoft Word 2007-Saving the File- Formatting the Text- Alignment of Text- Applying Fonts-Spell Checking- Consulting Thesaurus- Assign a Character Style- Borders and Shading-Closing of the File-Save as Option- Printing your Document- Editing the Document-Editing Tools- Auto Correct- AutoFormat- Find and Replace- Find- Replace Text- Page Numbering- Header and Footer- Foot Notes and End Notes.

UNIT - III **(6 Hours)**

Introduction to Microsoft Office Word 2007: Splitting Panes- Tiling of the Document-Using Mail Merge in Word 2007- Opening Screen of Microsoft Word Screen.

Introduction to Microsoft Office Excel 2007: Understanding Spreadsheets-Creating a Worksheet in Excel 2007-Copying Formula-Formulas that Make Decisions-Styles-Functions in Excel-Using Auto calculate-References-Sum Function-Average Function-Creating Charts in Excel-Auditing a Workbook-Comments Inserting-Outlines-Worksheet Fitting on a Page.

UNIT - IV **(6 Hours)**

Introduction to Microsoft Office Excel 2007: Function Wizard-Goal Seeking-Scenarios Manager-Creating a Pivot Table Report-Typing with AutoFill-Formatting Numbers and Labels-Changing the Size of Rows and Columns-Adding and Deleting Rows and Columns-Inserting (and Removing) Page Breaks-Applying Themes-Add or Remove a Sheet Background-Convert Text to Columns-Protect Worksheet or Workbook Elements-Functions in Excel.

UNIT - V **(6 Hours)**

Working with Microsoft Office PowerPoint 2007: Creating Presentation from Template-Creating a New Presentation-PowerPoint Views-Entering the Text-Moving the Text-Changing the Color-Adding Graphics to a Slide-Reordering Slides-Duplicating Slides-Deleting Slides-Adding a Animated Cartoon to a Slide-Adding Slide Transitions-Adding Text Transitions-Viewing a Presentation-Making Slide Shows-Hiding a Slide-Notes, Handouts and Masters for Presentation-Packing Presentation to Go-Add a Caption to a Picture in a Photo Album-Overview of Creating a Photo Album-Add a Picture to a Photo Album-Change the Appearance of a Picture in a Photo Album.

TEXT BOOKS:

1. *Atul Kahate.* 2008**. Information Technology. [**Third Edition]. Tata McGraw-Hill Edition Ltd, New Delhi. (UNIT I)
2. *Law Point.* 2008. **Microsoft Office 2007**. [First Edition]. Ashok Lodha Publication, Kolkata. (UNIT II, III, IV and V)

REFERENCE BOOKS:

1. *Alexis Leon and Mathews Leon***. 1999. Introduction to Computers.** [First Edition]**.** LeonTechworld, New Delhi.
2. *Dennis, P. Curtin, Kim Foley, Kunal Sen and Cathleen Morin.* 2001**. Information Technology: The Breaking Wave.** [Nineth Reprint]. Tata McGraw-Hill Edition, New Delhi.
3. *Sanjay Saxena.* 2007. **MS-Office 2000 for Everyone**. [Second Reprint]. Vikas Publishing House Pvt Ltd., New Delhi.

15UMABCA401	ALLIED V: MATHEMATICS FOR BIOLOGY (For B.Sc, Biochemistry)	SEMESTER - IV

Total Hours: 40

OBJECTIVE:

1. To understand the concepts of Mathematics and to apply the Mathematics concepts in Biology.

CONTENTS

UNIT – I **(8 Hours)**

Theory of Equations: Formation of quadratic and cubic equations and solution of quadratic and cubic equations (Statement and problems only)
(Chapter 6: Sections 1 to 10)

UNIT – II **(8 Hours)**

Matrix: Definition – Types of matrices – Equality of matrices – Addition of Matrices – Subtraction of matrices – Multiplication of matrices.
(Chapter 1: Sections 1 to 5, and 7)

UNIT – III **(8 Hours)**

Logarithm – Solving problems using the properties of Logarithm – Simplification of problems using BODMAS rule.
(Chapter 4 & 23)

UNIT – IV **(8 Hours)**

Ratio and Proportion – Solving Problems using Componendo and divendo rules.
(Chapter 12)

UNIT – V **(8 Hours)**

Sphere: Area of sphere – Surface area of sphere – Volume of sphere - Cone: Area of cone – Surface area of cone – Volume of cone – cylinder: Area of cylinder – Surface area of cylinder – Volume of cylinder. **(Chapter 25)**

TEXT BOOKS:

1. *ManicavachagomPillay, T.K., Natarajan, T. and Ganapathy, K.S.* [2007]. **Algebra Volume I**, S.Viswanathan (Printers and Publishers) Pvt. Ltd. (For UNIT - I)
2. *ManicavachagomPillay, T.K., Natarajan, T. and Ganapathy, K.S.* [2007]. **Algebra Volume II**, S.Viswanathan (Printers and Publishers) Pvt. Ltd. (For UNIT - II)
3. *Agarwal, R.S.* 2008. **Quantitative Techniques.** S. Chand and Company, New Delhi. (For UNITS - III, IV and V).

15UMABCA402	ALLIED V: BIOSTATISTICS (For B.Sc, Biochemistry)	SEMESTER IV

Total Hours: 40

OBJECTIVES:

1. To have the basic knowledge about Statistics.
2. To create the knowledge of analyzing the data using statistical tools.

CONTENTS

UNIT – I **(8 Hours)**

Statistics – Definition – Types of Data – Qualitative and Quantitative data – Sources of data in life science – Limitations and uses of Statistics – Data – Primary data – Methods of Collecting primary data - Secondary data – Sources of secondary data – Classification, Tabulation and Presentation of data.

UNIT – II **(8 Hours)**

Measures of Central Tendency: Mean, Median, and Mode only – Merits and demerits – Empirical relation.

UNIT – III **(8 Hours)**

Measures of Dispersion: Range, Standard Deviation and Co-efficient of variation only - Merits and Demerits.

UNIT-IV **(8 Hours)**

Correlation – Types of correlation – Karl Pearson's Correlation Coefficient - Rank correlation - Regression – simple regression equations.

UNIT-V **(8 Hours)**

Population and sample – Sampling Methods – Standard Error – Test of significance – Hypothesis – Simple Hypothesis – Small sample Tests based on t and F distribution with regard to mean, difference of mean and difference of variance - Chi-Square test of independent of attributes ANOVA(Concept only).

TEXT BOOK:

1. *Arora, P.N. and Malhan, P.K*. 2006. **BioStatistics**. Himalaya Publishing House, Mumbai.

REFERENCE BOOKS:

1. *Daniel, W.W*. 1987. **BioStatistics**. John Wiley and Sons, New York.
2. *SundarRao, P.S.S and Richand, J*. **An Introduction of Bio-Statistics**. [Third Edition]. Christian Medical College, Vellore.
3. *Sokal – Rohlf*. 1973. **Introduction to Bio-Statistics**. W.H. Freeman and Company, San – Francisco.

15UBCMP401	CORE PRACTICAL IV: INTERMEDIARY METABOLISM	SEMESTER - IV

LIST OF EXPERIMENT

1. Estimation of glucose - Nelson Somogyi method.
2. Estimation of Urea - DAM method.
3. Estimation of Uric Acid - Caraway method.
4. Estimation of Iron – Bipyridyl method.
5. Estimation of cholesterol – Zak's method.
6. Estimation of Total protein – Lowry's method.
7. Estimation of Pentose - Bial's method.
8. Estimation of RNA - Orcinol method.
9. Estimation DNA – Diphenylamine method.
10. Estimation of Pyruvate - DNPH method.

REFERENCE BOOK:

1. *Harold Varley*. 1988. **Practical Biochemistry,** Volume I & II. [Fourth Edition]. CBS Publishers, New Delhi.

15UCSBCAP401/ 15UCSMBAP401	ALLIED PRACTICAL IV: OFFICE PACKAGE FOR BIOLOGY	SEMESTER - IV

LIST OF PRACTICAL:

MS – Word

1. Creating a Personal Profile.
2. Designing a Document for Lab Requirements using following options
    - Font styles.
    - Page layout, Page Setup (Setting Margins, Changing Page Size, Changing Page Orientation and Applying Page Background).
    - Table.
3. Creating a Document for topic presentation with following options
    - Single and Double Column.
    - Page numbers.
    - Headers and Footers.
    - Date and time, Pictures and Shapes.
4. Mail Merge – Invitation to Multiple Recipients for Conducting Seminar in the Department.

MS-Excel

5. Entering Data for Stock Analysis and Formatting the Cells.
6. Working with Sorting and Filtering.
7. Creating a Chart for an Experiment with sample data.
8. Stock Maintenance for Lab Equipments.

MS- PowerPoint

9. Creating a Presentation for the given topic.
10. Creating a Presentation for the Department Profile.
11. Creating a Presentation with Animation effects.
12. Creating a photo album for the Department event.

15UBCSBC401	**SBC II: PHARMACOGNOSY (100% INTERNAL EVALUATION)**	**SEMESTER - IV**

Total Hours: 15

OBJECTIVE:

To enable the students to learn about the therapeutic applications of plants and their phytoconstituents.

CONTENTS

UNIT - I **(2 Hours)**

Histroy, Definiton and Scope of pharmacognosy.

UNIT - II **(3 Hours)**

Traditional and Alternative Systems of medicines - Ayruveda, siddha and Unnani.

UNIT - III **(3 Hours)**

Collection, cultivation, utilization and preservation of medicinal plants

UNIT - IV **(3 Hours)**

Preparation of plant extracts (Aqueous and methanol) - maceration, percolation and soxhlet methods.

UNIT - V **(4 Hours)**

Analytical pharmacognosy: Drug adulteration, Drug evaluation, physical and chemical evaluation.

TEXTBOOK:

1. *Kokate, C. K., Purohit, A. P.* and *Gokhale, S. B.* 2008. **Pharmacognosy.** Nirali Prakashan, Pune.

15ULS401	CAREER COMPETENCY SKILLS II	SEMESTER – IV

Total Hours: 15

OBJECTIVE:

To enhance employability skills and to develop career competency

CONTENTS

UNIT – I **(3 Hours)**

A to Z Placement Terms-Assertiveness and Self Confidence-Career Opportunities-Skill set (Industry Expectations)

UNIT – II **(3 Hours)**

Principles of Communication (LSRW)-Describing Objects / Situations / People-Information Transfer - Picture Talk - News Paper and Book Review

UNIT – III **(3 Hours)**

Self Introduction - Situational Dialogues / Role Play (Telephonic Skills) - Oral Presentations- Prepared -'Just A Minute' Sessions (JAM)

UNIT – IV **(3 Hours)**

Dress code- Body Language- - Manners and Etiquettes -Resume Writing

UNIT – V **(3 Hours)**

Presentation Skills **–** Group Discussion-Interviewing Techniques- Mock Interview

15UBCM501	CORE VIII: FUNDAMENTALS OF IMMUNOLOGY	SEMESTER - V

Total Hours: 50

OBJECTIVES:

To enable the students:

1. To study in detail about the organization and function of human immune system in health and disease.
2. To understand the principle of molecular interactions of immune cells with an antigen.

CONTENTS

UNIT - I **(10 Hours)**

Immunobiology: Immunity- Innate and acquired immunity, Primary and secondary lymphoid organs. Structure of T, B, NK and Killer cells. Macrophages – Phagocytosis and inflammation. Structure and functions of neutrophils, eosinophils and basophils. Cytokines and their functions. Immune response – Cell mediated and humoral.

UNIT - II **(10 Hours)**

Antigen: Properties, specificity and cross reactivity, immunogenicity, haptens, adjuvants, epitopes, mitogens, self antigens and MHC (elementary details). Antibody- Structure, classes, sub types and functions of IgG, IgM, IgA, IgE and IgD. Brief account on production and applications of monoclonal antibodies.

UNIT - III **(10 Hours)**

Antigen - Antibody interactions: Antibody affinity, antibody avidity; Precipitation – Slide test, tube test; immunodiffusion - Radial and double immuno diffusion. Immunoprecipitation. Immunoelectrophoresis - Principle and applications. Agglutination: slide and tube agglutination. Principle and applications – IF, RIA, ELISA.

UNIT - IV **(10 Hours)**

Complement system and Hypersensitive reactions: Complement cascade – Classical, alternative and lectin pathways of complement activation. Complement fixation test. Allergy and hypersensitive reactions - types- I, II, III & IV and their clinical manifestations.

UNIT - V **(10 Hours)**

Transplantation immunology: Mechanism of graft acceptance and rejection, immuno suppressive therapy. Auto immunity - Elementary nature, myasthenia gravis. Immuno deficiency diseases- immune system in AIDS. Vaccines – Active and passive immunization. Benefits and adverse effects of vaccination.

TEXT BOOK:

1. *Nandhini Shetty.* 2005. **Immunology: Introductory Text Book**. [Second Edition]. New Age International. New Delhi.

REFERENCE BOOKS:

1. *Roitt, I. M.* 1988. **Essential Immunology**. Blackwell Scientific Publishers, New York.
2. *Ian R. Tizard.* 1995. **Immunology: An Introduction**. Saunders College Publishing. New York.
3. *Charles A. Janeway*. 2005. **Immunobiology - The Immune Systems in Health and Disease.** [Sixth Edition]. Garlands Science Publishing, New York.

15UBCM502	CORE IX: MOLECULAR BIOLOGY	SEMESTER - V

Total Hours: 50

OBJECTIVE:

1. To enable the students to learn about the synthesis and functions of molecules that make up the living processes, mutations and DNA repair mechanism.

CONTENTS

UNIT - I **(10 Hours)**

Genetic Material: DNA as genetic information carriers- Experimental evidences – Griffith, Avery and McCarty and Hershey and Chase experiment. Basic concept of genetic information – Definition of gene. Differentiation of genes and genome. Structural Organization of Eukaryotic genome - Nucleosomes and chromatin structure. Brief account on the organization of genes in the genome (protein coding and protein non- coding genes, introns, exons) and special base sequences of DNA – Satellite DNA, SINEs, LINEs and transposons. Structural organization of Prokaryotic genome. Plasmids (Elementary details). Central dogma of Molecular Biology.

UNIT - II **(10 Hours)**

Replication: Mechanism of replication in Prokaryotes - Conservative, semi conservative and dispersive types. Experimental evidence for semi conservative replication; Enzymes and protein factors involved in replication; Initiation, elongation and termination of replication. Replication in eukaryotes (Elementary details). Inhibitors of replication.

UNIT - III **(10 Hours)**

Transcription: Prokaryotic transcription - RNA polymerase, promoters, initiation, elongation and termination of RNA synthesis. Eukaryotic transcription (Elementary details). Post transcriptional modifications of mRNA, tRNA and rRNA. Inhibitors of Prokaryotic & Eukaryotic transcription. Reverse transcription. Polynucleotide polymerase.

UNIT - IV **(10 Hours)**

Translation: Genetic code - Decipheration. Salient features of genetic code. Biological significance of degeneracy - Wobble hypothesis. Composition of Prokaryotic and Eukaryotic ribosomes. Role of tRNA in translation. Mechanism of translation in prokaryotes – Activation, initiation, elongation & termination in Prokaryotes. Translation in Eukaryotes (Elementary details). Post translational modification. Inhibitors of translation. **Regulation of Gene expression in Prokaryotes** - Basic concepts of gene Regulation. Operon concept. Lac operon - Enzyme induction and repression.

UNIT - V **(10 Hours)**

Mutation: Molecular basis of mutation, types of mutation (point mutation - transition, transversion, suppressor, backward and forward mutations), Nutritional, lethal and conditional mutation, spontaneous and induced mutations. Frame shift mutation - (insertion, deletion). Identification of mutants - Lederberg's replica plating experiment.
DNA repair mechanisms – Direct reversal, excision repair and SOS repair.

TEXT BOOKS:

1. *Nelson David, L.* and *Cox, M.M*. 2011. **Lehninger Principles of Biochemistry** Macmillan Worth, New York.
2. *William S. Klug* and *Michael R. Cummings.* 2000. **Concept of Genetics**. [Sixth Edition]. Prentice Hall, London.

REFERENCE BOOKS:

1. *Lewin, B.* 2010. **Genes IX**. Pearson Prentice Hall, London.
2. *Weaver, R. F.* 1999**. Molecular Biology.** McGraw Hill, Boston.

15UBCM503	CORE X: ENDOCRINOLOGY	SEMESTER - V

Total Hours: 50

OBJECTIVES:

To enable the students:

1. To learn about the chemistry, physiological roles and control of secretion of various classes of hormones.
2. To understand the mechanism of regulation of various physiological processes and the role of hormones in maintaining the homeostasis of the cellular systems.

CONTENTS

UNIT - I **(10 Hours)**

Hormones of Hypothalamus and Pituitary: Introduction: Hormones and Hormone receptors – Definition; classification of Hormones. Mechanism of action of Group I and Group II hormone. **Hypothalamic and Hypophysial hormones:** Hypothalamic hormones; Chemistry, metabolic role, control of secretion and pathophysiology of Anterior pituitary (ACTH, TSH, FSH, LH, MSH, Growth hormone) and posterior pituitary hormones (Vasopressin and Oxytocin). Controlling action of hypothalamus over Anterior pituitary hormones.

UNIT - II **(10 Hours)**

Thyroid Hormones and Parathormone: Chemistry, synthesis, physiological role, control of secretion and pathophysiology of Thyroid hormones and Parathormone. Vitamin D and its role in calcium homeostasis.

UNIT - III **(10 Hours)**

Pancreatic Hormones: Chemistry, Synthesis, physiological role, control of secretion and pathophysiology of Insulin, Glucagon. **GI Tract Hormones:** Chemistry, synthesis, physiological role, control of secretion and pathophysiology of Gastrin, Secretin, Cholecytokinin.

UNIT - IV **(10 Hours)**

Adrenal medullary hormones: Chemistry, synthesis, physiological role, regulation of secretion and pathophysiology of Adrenocorticol hormones (Glucocorticoid and Mineralocorticoid).

Catecholamine: Chemistry, synthesis, physiological role, control of secretion and pathophysiology of Adrenal medullary hormones.

UNIT - V **(10 Hours)**

Male reproductive hormones: Chemistry, synthesis, physiological role and regulation of secretion of Androgen. Disorders of Male reproductive system.

Female reproductive hormones: Chemistry, synthesis, physiological role and control of secretion of Estrogen and Progesterone. Role of Hormones in Menstrual cycle. Disorders of Female reproductive system.

TEXT BOOK:

1. *Robert, K. Murray, Peter A. Mayes* and *Victor W. Rodwell*. 2003. **Harper's Biochemistry.** [Twenty Fifth Edition]. Mc Graw Hill, New York.

REFERENCE BOOKS:

1. *Rana Shinde* and *Chatterjee M. N.* 2000. **Text Book of Medical Biochemistry.** [Sixth Edition]. Jaypee Publishers. New Delhi.
2. *Mac E. Hadley*. 2008**. Endocrinology.** [Fifth Edition]. Pearson Education, Inc. & Dorling Kindersley Publishing, Inc.

15UBCM504	CORE XI: : NUTRITIONAL BIOCHEMISTRY (SELF STUDY & 100% EXTERNAL EVALUATION)	SEMESTER - V

OBJECTIVE:

1. To enable the learners to understand the major role in the Nutrition and Diet for the maintenance of normal health.

CONTENTS

UNIT - I

Nutrition- Concepts, Role of nutrition in maintaining health. Nutritional problems in India. Food Safety and Standards. **Energy** -Unit of Energy -kcal, Measurements of energy- Direct and Indirect calorimetry. Definition and factors affecting- Specific Dynamic action (SDA), Respiratory quotient (RQ), Basal metabolic rate (BMR), Body mass index (BMI).

UNIT - II

Carbohydrates, Fats, Proteins - Classification, calorific value, recommended daily allowances, Dietary sources. Functions, digestion, absorption, storage and metabolism. Malnutrition: Deficiencies and Over consumption. **Obesity**- Definition, etiology, complications, prevention and treatment.

UNIT - III

Vitamins: Classification. Recommended daily allowances, dietary sources, functions and deficiencies of water and fat soluble vitamins. **Minerals**: Macro elements - recommended daily allowances, dietary sources, functions and deficiencies of Ca, Mg, Na, P, K, S and Cl. Microelements - recommended daily allowances, dietary sources, functions and deficiencies of Cu, Zn, I, Fe, Mn, Co, Mo, Se, Cr and F. Over consumption and toxicity.

UNIT - IV

Diet and Physiological Status: Protein energy malnutrition (PEM) (Kwashiorkor and Marasmus). Human milk and its viruses, Breast Vs formulated milk feeding. Nutritional requirements in pregnancy and lactation.

UNIT - V

Food allergy – Definition. Food allergy. Effect of drugs on food. Drug nutrient interactions. Nutritional therapy. Role of diet and nutrition in the prevention and treatment of diseases in various ailments – Diabetes mellitus, cardiovascular diseases, kidney disorders.

TEXTBOOK:

1. *Swaminathan,* M. 2004. **Essentials of Food and Nutrition**. The Bangalore Printing and Publishing Co. Ltd., Bangalore.

REFERENCE BOOKS:

1. *Garrow, J. S.* and *James, W. P. T.* 2000. **Human Nutrition and Dietetics**. [Tenth Edition]. Churchill Livingstone Publishers, UK.
2. *Wong, D. W. S*. 1996. **Mechanism and Theory in Food Chemistry.** CBS, New Delhi.

15UBCEL501	ELECTIVE I: CLINICAL BIOCHEMISTRY	SEMESTER - V

Total Hours: 50

OBJECTIVE:

1. To enable the students to learn the mechanism behind the disorder of metabolic pathways and the various diagnostic methodologies available for diseases and disorders.

CONTENTS

UNIT - I **(10 Hours)**

Clinical Lab: Collection and preservation of blood and urine. Automation in the lab

Disorders of Carbohydrate Metabolism: Sugar levels in blood and its regulation, Renal threshold for glucose, Factors influencing blood glucose level. Diabetes mellitus- Classification, Complications and Diagnosis- glucose tolerance tests. Inborn errors of Carbohydrate metabolism- glycogen storage disease, galactose, fructose, pentose metabolism.

UNIT - II **(10 Hours)**

Amino acid metabolism: Inborn errors of amino acid metabolism - Aromatic aminoacids - phenylketonuria, tyrosinemia, albinism, alkaptonuria, S- containing aminoacids - cystinuria and homocystinuria, Branched chain aminoacids - Maple Syrup urine disease. **Protein metabolism**: Plasma proteins-their significance and variation in health and diseases. Proteinuria.

UNIT - III **(10 Hours)**

Lipid metabolism- Cholesterol, triglycerides and phospholipids in health and disease-hyperlipidemia, hypercholesterolemia, atherosclerosis, hypertriglycerdemia, fatty liver, Gaucher's disease, Tay-Sach's and Niemann-Pick disease. Obesity-causes, types and metabolic changes. Steatorrhoea. **Nucleic acid metabolism**-Gout and Lesch Nyhan syndrome.

UNIT - IV **(10 Hours)**

Gastric function tests: Introduction, Collection and examination of gastric contents, tests of gastric function –stimulation test. **Liver disease**: Introduction, bilirubin metabolism and jaundice - classification. **Liver function test** – tests based on abnormalities of bile pigments (Estimation of conjugated and total bilirubin in serum - Diazo method), based on changes in plasma proteins (Estimation of total plasma proteins, albumin and globulin and determination of A:G ratio, plasma fibrinogen,

various flocculation tests, prothrombin time), based on carbohydrate metabolism (galactose and fructose tolerance test), based on abnormalities of lipids (determination of serum cholesterol and feacal fat). Serum enzymes in liver disease – Serum transaminases (SGOT & SGPT).

UNIT - V **(10 Hours)**

Kidney disorder: Overview of acute and chronic renal failure. Urinary calculi. Kidney function tests – Based on GFR (Clearance test-Creatinine, Urea and Inulin), based on renal plasma flow (Para amino hippurate and Filtration fraction), based on tubular function (Concentration and Dilution tests). Artificial kidney - Dialysis.

TEXT BOOK:

1. *Chatterjee, M. N.* and *Rana Shindae.* 2007. **Text Book of Medical Biochemistry**. Jaypee Brothers Medical Publishers. Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. *Carl A. Burtis.* 2011. **Tietz Text Book of Clinical Chemistry and Molecular Diagnostics** [Fifth Edition]. Elsevier Health Sciences. New York.
2. *Vasudevan, D.*M. and *Srikumari, S.* 2007. **Text Book of Biochemistry for Medical Students.** [Fifth Edition]. Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi.

15UBCMP501	CORE PRACTICAL V: IMMUNOLOGY AND CLINICAL BIOCHEMISTRY	SEMESTER - V

LIST OF EXPERIMENT

I. Immunology

1. Radial immunodiffusion.
2. Double immunodiffusion – Ouchterlony.
3. VDRL – Slide test.

II Clinical Biochemistry

(A) Analysis of blood

1. Separation of serum and plasma from blood.
2. Estimation of glucose - Nelson -Somogyi method.
3. Estimation of Urea - DAM method.
4. Estimation of Creatinine-Jaffe's method.
5. Estimation of Bilirubin (total, conjugated and unconjugated) - Diazo method.
6. Estimation of cholesterol – Zak's method.
7. Estimation of Total protein – Lowry's method.
8. Determination of SGOT-Mohun and Cook method.
9. Determination of SGPT- Mohun and Cook method.

(B) Analysis of urine

1. Estimation of Urea.
2. Estimation of Creatinine - Jaffe's method.
3. Qualitative analysis of urine- Analysis of normal and abnormal constituents in urine.

REFERENCE BOOK:

1. Harold Varley. 1988. **Practical Biochemistry,** Volume I & II. [Fourth Edition]. CBS Publishers, New Delhi.

15UBCSBC501	SBC III: PHYTOCHEMISTRY	SEMESTER - V

Total Hours: 30

OBJECTIVE:

To enable the students to learn about the biochemistry and therapeutic value of Phytoconstituents.

CONTENTS

UNIT - I **(6 Hours)**

Phytochemistry: Definition, history, scope and importance. Drugs- Definition, sources of drugs: Biological and mineral sources. Role of medicinal and aromatic plants in national economy. Medicinal value of Amla, Stevia, Aswagandha and Turmeric.

UNIT - II **(6 Hours)**

Secondary metabolites: Definition and classification. Screening of Phytoconstituents – Extraction of secondary metabolites from plant source (Aqueous, methanol and acetone). Screening of carbohydrates, phenols, tannins, flavonoids, alkaloids, terpenoids, , steroids and amino acids in plant extracts.

UNIT - III **(6 Hours)**

Carbohydrates and derived products: Source, structure and functions of agar, guargum, gum acacia. Chemical constituents and uses of honey. Functions of Lipids derived products- Bees wax, Castor oil, Cocoa butter.

UNIT - IV **(6 Hours)**

Tannin and Flavonoids: Source, structure and functions of tannin and tannin derived products (Gambier, black catechu, and myrobalan). Source, structure and functions of flavonoids (silymarin, gingko and buck-wheat).

UNIT - V **(6 Hours)**

Terpenoids and Alkaloids: Source, structure and functions of terpenoids and terpenoid containing drugs (Eucalyptus oil, turpentine oil and peppermint oil). Structure and functions of alkaloids and alkaloid containing drugs (atropine, quinine, morphine, ephedrine).

TEXTBOOKS:

1. *Kokate, C. K., Purohit, A. P.* and *Gokhale, S. B.* 2008. **Pharmacognosy.** Nirali Prakashan, Pune.
2. *Roseline, A*. 2011. **Pharmacognosy**. MJP Publishers, Chennai.

REFERENCE BOOK:

1. *Parthasarathy,* V. A., *John Zachariah*, T. and *Chempakam*, B. 2008. **Chemistry of Spices**. CABI Publications, London.

15UBCM601	CORE XII: PLANT BIOCHEMISTRY	SEMESTER - VI

Total Hours: 50

OBJECTIVE:

To enable the students:

1. To strengthen the base in fundamental aspects of biochemical basis of physiological processes in plants and their response to environment stress.

CONTENTS

UNIT - I **(10 Hours)**

Photosynthesis: Photosynthetic pigments-chlorophyll, carotenoid and phycobilin. Ultrastructure and organisation of chloroplast, Light reactions - Photo system I and II. Evidences in support of light reaction-Hill's reaction. Cyclic and non-cyclic phosphorylation. Dark reaction (C_3 plants), factors affecting photosynthesis. Hatch-slack cycle (C_4 plants) and CAM plants. Photorespiration.

UNIT - II **(10 Hours)**

Plant water relations: Structure and functions of plant cell wall. Transport mechanism-diffusion, osmosis and imbibitions. Absorption-active, passive, factors affecting absorption. Transpiration - types, mechanism of stomatal opening and factors affecting transpiration. Guttation.

UNIT - III **(10 Hours)**

Nitrogen assimilation: Nitrogen cycle – ammonification, nitrification and denitrification. Role of GS/GOGAT in ammonia assimilation. Biological nitrogen fixation - Symbiotic nitrogen fixation - Rhizobium, nodule formation. Non-symbiotic nitrogen fixation. Biochemistry of nitrogen fixation - Nitrogenase complex. Export of nitrogen in the form of asparagine and ureides.

UNIT - IV **(10 Hours)**

Plant growth regulators: Chemistry, biosynthesis and physiological effects of Auxins, Gibberllins, Cytokinins, ABA and Ethylene. Seed germination: Physiology, factors affecting seed germination, glyoxalate cycle, biochemistry of seed dormancy, fruit ripening and senescence.

UNIT - V **(10 Hours)**

Plant and Environment: Plant stress - definition. Types of stress - Abiotic and biotic. Abiotic – Deficit and responses of plants to water, temperature and salt stress. Biotic

stress – Insects and disease – Hypersensitive reaction and plant immune response with reference to jasmonates. Oxidative stress- oxidative stress caused by ozone. Role of Defence system in plants - enzymatic and non-enzymatic antioxidants in oxidative tolerance of plants.

TEXT BOOKS:

1. *William G. Hopkins.* 1999. **Introduction to Plant Physiology**. [Second Edition]. John Wiley & Sons. New York.
2. *Bob B. Buchanan, Wilhelm Gruissem* and *Russell L. Jones.* 2001. **Biochemistry and Molecular Biology of Plants.** American Society of Plant Biologists. New Delhi. **(Oxidative stress).**

REFERENCE BOOKS:

1. *Robert M. Devlin* and *Fracis H. Witham.* 1986. **Plant Physiology**. [Fourth Edition]. CBS Publishers, New Delhi.
2. *Pandey, S. N.* and *Sinha, B. K.* 1999. **Plant Physiology**. [Third Edition]. Vikas Publishing House Pvt. Ltd., Pune.
3. *Chawla, H. S.* 2002. **Introduction to Plant Biotechnology**. [Second Edition]. Science Publishers, USA.

15UBCM602	CORE XIII: MICROBIAL BIOCHEMISTRY	SEMESTER - VI

Total Hours: 40

OBJECTIVE:

1. To enable the students to gain knowledge about the biochemical basis of the physiological processes in microbes and exploitation of microbes for industrial purpose.

CONTENTS

UNIT - I **(8 Hours)**

Cell wall biosynthesis: Organisation of **p**rokaryotic cell surface, structure and synthesis of bacterial peptidoglycan, teichoic acids and lipoteichoicacids, lipo polysaccharides.

UNIT - II **(8 Hours)**

Energy production: Nutritional classification of microorganisms based on source of energy, carbon and electrons. Characteristics and metabolism of autotrophs - photosynthetic bacteria and cyanobacteria. Autotrophic CO_2 fixation and photosynthesis - Photosynthetic pigments, photosynthetic apparatus and mechanism of photosynthesis. Electron transport chain, oxidative phosporylation and energy yield in bacteria.

UNIT - III **(8 Hours)**

Carbohydrate metabolism: Central pathway - EMP pathway, Alternate pathway - Entner-Doudoroff (ED) pathway, Phosphoketolase pathway. Metabolism of lactose, mannitol, fucose and rhamnose. Degradation of pectin, cellulose and lignin.

UNIT - IV **(8 Hours)**

Fermentation technology: Fermentation – Definition – (Stickland reaction). Isolation of microorganism, strain development and screening of industrially important microbes. Methods - Batch, fed batch and continuous fermentation. Types – Solid substrate (SSF) and submerged fermentation. Fermentation process- Inoculum preservation, inoculum build up, prefermentor culture and production fermentation, Brief account on downstream processing.

UNIT - V **(8 Hours)**

Bioprocessing: Commercial production of enzymes- amylase, organic solvents - alcohol, alcoholic beverages-wine, organic acids- citric acid, antibiotics-penicillin, amino acids- glutamic acid, vitamins – vitamin B_{12} and polysaccharides –dextran.

TEXT BOOKS:

1. *Albert. G. Moat* and *John. W. Foster*. 1995. **Microbial Physiology.** [Third Edition]. John Wiley and Sons Publications, New York. **(UNIT – I, II & III).**
2. *Satyanarayana, U.* 2008. **Biotechnology.** Books and Allied Pvt. Ltd., Kolkata. **(UNIT - IV & V).**

REFERENCE BOOKS:

1. *Doelle, H. W.* 2005**. Bacterial Metabolism.** [Second Edition]. Academic Press**.** New Delhi.
2. *Wulf Crueger* and *Anneliese Crueger.* 2004. **A Text Book of Industrial Microbiology.** Panima Publishing Corporation, New Delhi.
3. *Casida, L. S.* 2007. **Industrial Microbiology.** New Age International, New Delhi.

15UBCM603	CORE XIV: PHARMACEUTICAL BIOCHEMISTRY	SEMESTER - VI

Total Hours: 40

OBJECTIVES:

1. To enable the students to learn about the pharmacokinetics and pharmacodynamics and toxicological aspects of drugs.
2. To make them to get job opportunity in pharmaceutical companies in both production and R&D.

CONTENTS

UNIT - I **(8 Hours)**

Pharmacodynamics and Kinetics: History of Drugs, Classification of drugs, routes of drug administration, absorption and distribution of drugs, factors influencing drug absorption and elimination of drugs. Toxicity assessment: acute, subchronic, chronic exposure, determination of ED_{50} and LD_{50} values.

UNIT - II **(8 Hours)**

Drug-Receptor interactions: Receptor- definition, Agonist and antagonist. Types of receptor - G-protein coupled receptor, Receptors with intrinsic ion channel, Enzymatic receptors, receptors regulating gene expression, involvements of binding forces in drug receptor interaction, drug action not mediated by receptors.

UNIT - III **(8 Hours)**

Drug metabolism: Phase I reactions - role of Cytochrome P_{450}. Microsomal and Non microsomal reactions. Phase II reactions-Conjugation reactions. Physiological importance of xenobiotic metabolism.

UNIT - IV **(8 Hours)**

Chemotherapy: Basic concept. Mode of action of antimicrobial drugs- antibacterial, antifungal, antiviral and antimalarial drugs.

Cancer chemotherapy: Cancer and principles of cancer chemotherapy. Mode of action of anti cancer drugs- antimetabolites, antibiotics, alkylating agents and other agents.

UNIT - V **(8 Hours)**

Drugs acting on various systems: CNS-sedative- hypnotic, GI tract- drugs for peptic ulcer, diarrhoea and constipation. Miscellaneous drugs - antiseptic, disinfectant, chelating

agents. Adverse drug reactions and drug induced side effects, biological effects of drug abuse and drug dependence, drug tolerance and intolerance.

TEXT BOOKS:

1. *Jayashree Ghosh***.** 2010. **A Textbook of Pharmaceutical Chemistry.** [Third Revised Edition]. S.Chand & Company Ltd., New Delhi (**UNIT I, II, IV & V**).
2. *Gordan Gibson, G.* and *Paul Skett.* 1999. **Introduction to Drug Metabolism.** [Third Edition]. Nelson Thornes. UK. (**UNIT - III).**

REFERENCE BOOKS:

1. *Satoskar, R. S.* and *Bhandarkar, S. D.* 1993. **Pharmacology and Pharmacotherapeutics**. Vol I & II. Popular Prakasam Pvt. Ltd., New Delhi.
2. *Robert K. Murray, Daryl K. Granner, Peter A. Mayer* and *Victor W. Rodwell*. 2006. **Harper's Biochemistry.** [Twenty Fifth Edition]. Mc Graw Hill, New York.

15UBCM604	CORE XV: GENETIC ENGINEERING	SEMESTER - VI

Total Hours: 50

OBJECTIVES:

To enable the learners:

1. To understand the basic techniques in Genetic Engineering.
2. To learn the applications of Genetic Manipulation.

CONTENTS

UNIT - I **(10 Hours)**

Basic techniques - Isolation and purification of genomic and plasmid DNA. Agarose gel electrophoresis, southern, northern and western blotting. Labeling of Nucleic acid probes- radioactive, non radioactive labels. PCR - Technique and applications.

DNA Sequencing – chemical degradation method- Maxam and Gilbert, Dideoxynucleotide sequencing- Sanger's method

UNIT - II **(10 Hours)**

Basic principles of gene cloning: Enzymes used in genetic engineering - Restriction enzymes - Nomenclature, Target sites and types. Isochizomers. Nuclease, Ligases, DNA polymerases, RNA polymerase, terminal deoxy nucleotidyl transferase, alkaline phosphatase, polynucleotide kinase, Reverse transcriptase. Linkers and adapters. Basic principle and steps of gene cloning.

UNIT - III **(10 Hours)**

Cloning Vectors: Plasmids - Basic features. Plasmid vectors-pBR 322 and pUC vectors. Phages- Basic features, Insertion vector, Replacement vectors, cosmids, phagemids.

Methods of gene transfer: Physical methods (Microinjection, Biolistic transformation, Electroporation, Electrofusion, Protoplast fusion) and chemical methods (calcium phosphate, polyethylene glycol (PEG), DEAE-Dextran, use of liposomes).

UNIT - IV **(10 Hours)**

Gene cloning & expression strategies: Construction of Genomic library. Screening and identification of recombinants. Selectable markers and reporter gene. Brief account on Expression Vectors: Promoters, cassettes. Viral expression vectors for animals – Retro virus.

UNIT - V **(10 Hours)**

Gene Transformation: Micro propagation, Callus formation. Somatic embryogenesis, protoplast culture, somatic hybridization. Transgenic plants - Production – Agro bacterium mediated transformation-Ti plasmid -T- DNA. Applications of transgenic plants - Production of pest and herbicide resistant plants. Plants as bioreactors - Production of edible vaccines.

Transgenic animals - Methods of production (microinjection) and applications - Animal bioreactors- Transgenic animals in xenotransplantation, transgenic organisms to interrupt disease cycle- transgenic snails, transgenic mosquitoes.

TEXTBOOK:

1. *Smita Rastogi* and *Neelam Pathak.* 2010. **Genetic Engineering**. Oxford University Press. New Delhi.

REFERENCE BOOKS:

1. *Glick R. Bernard* and *Pasternak J. Jack.* 1994. **Molecular Biotechnology**. ASM press, Washington D.C.
2. *Old, R. W.* and *Primrose, S. B.* 1994. **Principles of Gene Manipulation**. Black Well Scientific Publications. USA.

15UBCEL601	ELECTIVE II: COMPUTATIONAL BIOLOGY	SEMESTER - VI

Total Hours: 50

OBJECTIVE:

1. To enable the learners to understand the basic concept in Bioinformatics.

CONTENTS

UNIT - I **(10 Hours)**

Genomics – Definition. Hierarchical view of genome analysis. Subfields – Definition (structural, functional and comparative genomics). Genome mapping- Definition. Physical mapping. Expressed sequence tags (EST). Gene expression analysis - DNA microarray. DNA polymorphism – Definition. Single nucleotide polymorphism. RFLP and its applications.

UNIT - II **(10 Hours)**

Proteomics - Definition. Protein sequencing – Steps - End group analysis (Edman degradation), cleavage of disulfide bonds, separation, purification and characterization polypeptide chains, amino acid composition, specific peptide cleavage reactions, separation and purification of peptide fragments, sequence determination, ordering the peptide fragments, assignment of disulfide bond positions, peptide sequencing by MS, peptide mapping. Protein expression analysis - 2D PAGE and isoelectric focusing.

UNIT - III **(10 Hours)**

Nucleic acid database: Bioinformatics - Introduction, History and Applications. Internet concepts. Biological Database – types, classification and properties. Sequence Formats – FASTA. Nucleic acid Sequence Database – NCBI – Features and tools. GENBANK – format, divisions and retrieval system. Retrieving Human BRCA1 gene sequence. EMBL and DDBJ.

UNIT - IV **(10 Hours)**

Protein Database: Protein sequence database – SWISSPROT- format, features and sequence retrieval system. Retrieving Human myosin protein sequence. Features of PIR. Protein Structure database – SCOP, CATH and PDB. PDB - Database submission & retrieving tools. Retrieving Human insulin protein structure. Secondary structure

prediction - Neural network and Chou-fasman method. Analysis of casein secondary structural features by Chou- fasman method.

UNIT - V **(10 Hours)**

Comparative genomics and proteomics: Sequence alignment – Types. Local and Global alignment. Pair wise alignment. Study of similarities - BLOSUM, PAM and Gap (Elementary details). BLAST: principle & types. BRCA1 sequence analysis - Principle, methods, applications and similarity search with BLAST.

TEXT BOOKS:

1. *Attwood, T. K.* and *Parry Smith, D. J.* 2005. **Introduction to Bioinformatics**. [First Edition]. Pearson Education. New Delhi. **(UNIT - I, III, IV & V).**
2. *Donald Voet and Judith G.Voet*. 1995. **Biochemistry.** [Second Edition]. John Wiley & Sons, Inc. New York. **(UNIT - II).**

REFERENCE BOOK:

1. *David W. Mount.* 2004. **Bioinformatics: Sequence and Genome Analysis**. CSHL.

15UBCEL602	ELECTIVE II: BIOMEDICAL INSTRUMENTATION	SEMESTER - VI

Total Hours: 50

OBJECTIVE:

1. To enable the learners to understand the basic concept in Biomedical Instrumentation.

CONTENTS

UNIT I **(10 Hours)**

Biomedical Instrumentation: Definition, Classification of Biomedical instrumentation, sources of biomedical signals, components, design factors and characteristics. Difficulties in measuring living system.

UNIT II **(10 Hours)**

Electrodes- theory, types-biopotential, microelectrodes, metal plate and needle electrodes. Transducers – types - magnetic induction, piezoelectric, photovoltaic, thermoelectric, strain guage. Sensors.

UNIT III **(10 Hours)**

Biopotential Recorders: Resting and action potential, propagation of action potential, wave forms- ECG, EMG, EEG, EOG, EGG & ERG.

UNIT IV **(10 Hours)**

Physiological assist devices- pace makers, artificial heart valves, defibrillators, nerve and muscle stimulator (Galvanic and interrupted Galvanic current), heart-lung machine- mechanical functions, oxygenators- bubble, film. Kidney machine-hemo and peritoneal dialysis.

UNIT V **(10 Hours)**

Advances in biomedical instrumentation- Lasers, endoscopes-types. Cryogenic surgery. Gamma ray camera, computerized tomography, infra red thermography, ultrasonic imaging, magnetic resonance imaging.

TEXTBOOKS:

1. *Anandanatarajan*, R. 2013. **Biomedical Instrumentation and measurements**. PHI Learning Pvt., Ltd. New Delhi.
2. *Arumugam*, M. 2011. **Biomedical Instrumentation**. Anuradha publications, Chennai.

REFERENCE BOOK:

1. *Khandpur, R. S.* 1995. **Hand book of Biomedical instrumentation.** Tata Mc.Graw-Hill publishing company Ltd., New Delhi.

15UBCEL603	ELECTIVE II: SOIL BIOCHEMISTRY	SEMESTER - VI

Total Hours: 50

OBJECTIVE:

To enable the learners to understand the concepts of biofertilizers and its role in soil fertility.

CONTENTS

UNIT I **(10 Hours)**

Soil: Soil properties, composition. Factors influencing soil microbial population. Decomposition of organic matter in soil. Elements required in plant nutrition, functions of nutrients in plants- nitrogen, phosphorus, potassium, iron. Soil fertility evaluation: Nutrient deficiency symptoms of plants- hidden hunger, seasonal effects. Plant analysis-tissue test, total analysis.

UNIT II **(10 Hours)**

Fertilizers-Definition, method of placement- pre planting, at planting, after planting, movement of fertilizer, benefits and hazards. Biofertilizers- Definition and benefits. Biopesticidies –Types and advantages. Composting-types, advantages, decomposition stages in composting.

UNIT III **(10 Hours)**

Biomass and Bioenergy- sources and utilization of biomass, production of alcohol from biomass. Biofuel- Biohydrogen production. Bioleaching- mechanism, advantages. Biosorption, by fungi, algae, moss, bacteria. Mechanism, limiations and factors affecting biosorption.

UNIT IV **(10 Hours)**

Biogeochemical cycle- Sulphur, nitrogen, hydrogen cycle, carbon cycle, oxygen, phosphorus. Biodegradation – Definition, properties affecting biodegradation, degradation of hydrocarbons. Bioremediation - Definition, types – *In situ* and *Ex situ* bioremediation, types of reactions in bioremediation. Bioremediation of contaminated soils and waste lands.

UNIT V **(10 Hours)**

Remedial meseaures- Biosenors in environmental monitoring. Methods of managenment **-** carbondioxide reduction by photosynthesis, calcification. Sewage treatment by bacteria and algae, eutrophication and removal of phosphorus. Metal pollution management, Bioscavengers, role of immobilized cells in pollution management.

TEXT BOOKS:

1. Tisdale, S. L. 1997. **Soil fertility and fertilizers** [Fifth Edition] Prentice-Hall of India, NewDelhi (Unit I, II)
2. *Indu Shekhar Thakur*. 2011. **Environmental Biotechnology: Basic Concepts and Applications**. [Second Edition]. I.K. International Publishing House Pvt. Ltd., New Delhi. (Unit II, III)
3. *Satyanarayana, U.* 2008. **Biotechnology.** Books and Allied Pvt. Ltd., Kolkata. **(UNIT – III, IV& V).**

15UBCMP601	**CORE PRACTICAL VI : PLANT BIOCHEMISTRY, MICROBIAL BIOCHEMISTRY AND GENETIC ENGINEERING**	**SEMESTER - VI**

LIST OF EXPERIMENT

I. PLANT BIOCHEMISTRY

1. Estimation of chlorophyll.
2. Preparation of water and methanol extract from Neem - soxhlet method.
3. Screening of secondary metabolites – Phenols, Flavonoids, Tannins, Steroids and alkaloids.
4. Isolation and estimation of starch – Anthrone method.
5. Estimation of Vitamin C in plant source.
6. Media preparation for plant tissue culture.
7. Sterilization techniques for plant tissue culture.
8. Callus induction.

II. MICROBIAL BIOCHEMISTRY

1. Enumeration of Microbes from soil and water.
2. Identification of microbes by IMVIC Test.
3. Production of wine.
4. Estimation of alcohol from produced wine.

III. GENETIC ENGINEERING

1. Isolation of plant DNA.

REFERENCE BOOKS:

1. *Jayaraman, J.* 2008. **Laboratory Manual in Biochemistry**. [First Edition Reprint]. New Age International (P) Ltd., New Delhi.
2. *James Cappuccino* and *Matalie Sherman*. 2004. **Microbiology A laboratory Manual.** [Ninth Edition]. Pearson Education, New Delhi.

15UBCSBC601	SBC IV: FOOD BIOCHEMISTRY	SEMESTER - VI

Total Hours: 50

OBJECTIVES

- To make the students to understand the biochemical processes of food and the role of Food additives and colors in food.
- On successful completion of the paper the students will get an insight to become an entrepreneur.

CONTENTS

UNIT - I **(10 Hours)**

Water – Dietary sources, physical properties, water activity and food spoilage, control of water activity in foods. **Carbohydrates** – flavor and color production by carbohydrates, texturing characteristics of carbohydrates. **Lipids** - emulsifying properties of fats, rancidity and reversion of oils. **Proteins** – proteins of milk, meat, fish, eggs, cereals.

UNIT - II **(10 Hours)**

Microorganism in Food spoilage – Mold, yeast, bacteria. Factors responsible for spoilage, Spoilage of vegetable, Fruit, Meat, Poultry, Beverage and Other food products. Food poisoning, types of food poisoning – chemicals, microorganism (*Clostridium, Staphylococcus, Aspergillus*).

UNIT - III **(10 Hours)**

Food additives: Definition, Functional characteristics of chemical additives; Intentional food additives – Acids, Bases and their salts; Antioxidants; Desirable and undesirable aspects of additives.

UNIT – IV **(10 Hours)**

Food colors - chlorophyll, carotenoids, anthocyanins, betalaines, melanins. Natural and artificial food colorants. Flavour – sweetness, saltiness, sourness, bitterness, astringence, pungency, meatiness and fruity flavors, synthetic flavors. Natural flavor development in foods.

UNIT - V **(10 Hours)**

Food adulterants: Definition, types of adulterants, methods of detection (milk, meat, chilli powder, oil, turmeric powder, coffee, pepper, salt, sugar)

Food Preservation: Importance, principle, methods. Preservation by heat, cold, chemicals.

TEXT BOOK:

1. *Sivasankar, B*. 2005. **Food Processing and Preservation.** Prentice Hall of India Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. *Manoranjan Kalia* and *Sangeetha Sood*. 1999. **Food Preservation and Processing.** Kalyani Publishers, New Delhi.
2. *Sreelakshmi, B*. 1997. **Food Science.** New Age International Pvt. Ltd., New Delhi.

15UBCN301	NMEC I: BIOCHEMISTRY IN HEALTH AND DISEASES	SEMESTER - IV

Total Hours: 25

OBJECTIVES:

To enable the students to

1. Learn the functions of biomolecules.
2. Understand the physiological changes of various diseases.
3. Know about the nutritional requirements and dietary management of the diseases.

CONTENTS

UNIT - I **(5 Hours)**

Carbohydrates: Definition. Dietary sources and energy content. Classification (structure not necessary) and functions. Dietary fiber – Definition. Fiber content of foods and its importance. Disorder of carbohydrate metabolism - Diabetes mellitus - Definition, types (type I, type II and gestational) - Etiology, complications, diagnosis, prevention and treatment (elementary details). Obesity – Etiology with special reference to junk foods, complications and dietary management.

UN**IT - II** **(5 Hours)**

Amino acids: Definition. Essential and non-essential aminoacids. Protein – Definition. Classification based on shape and functions. Importance of proteins. Dietary sources and energy content. Difference between plant and animal proteins. Protein deficiency diseases - Kwashiorkar, Marasmus and Marasmic kwashiorkar. Overview of inborn errors of aminoacid metabolism with reference to albinism (Metabolic pathway not needed).

UNIT - III **(5 Hours)**

Lipids: Classification, Composition and functions. Dietary sources and energy content. Essential fatty acids and PUFA - Dietary sources and deficiency of essential fatty acids. Brief account on Lipoproteins – Types, composition and functions – Good and bad cholesterol. Atherosclerosis and Ischaemic heart disease - Role of dietary lipids (Elementary details).

UNIT - IV **(5 Hours)**

Mineral nutrition: Macro and micro elements – Definition. Brief account on macro (calcium, phosphorous, sodium and potassium, sulphur and chlorine) and micro (iron, copper, chromium, iodine and fluorine) mineral nutrients - Dietary sources, functions and abnormalities. Brief account on over consumption and toxicity.

UNIT - V **(5 Hours)**

Vitamins: Definition, classification. Fat soluble vitamins (A, D, E, K) and Water soluble vitamins (B and C) – Dietary sources, functions and abnormalities (Elementary details).

TEXTBOOK:

1. *Swaminathan, M*. 2004. **Essentials of Food and Nutrition**. The Bangalore Printing and Publishing Co. Ltd., Bangalore.

REFERENCE BOOKS:

1. *Jain, J. L.* 2002. **Fundamentals of Biochemistry.** [Fifth Edition]. S. Chand & Company Ltd., New Delhi.
2. *Garrow, J. S.* and *James, W. P. T.* 2000. **Human Nutrition and Dietetics**. [Tenth Edition]. Churchill Livingstone Publishers, UK.
3. *Wong, D. W. S*. 1996. **Mechanism and Theory in Food Chemistry.** CBS, New Delhi.

15UBCN401	NMEC II : FUNCTIONAL BIOLOGY	SEMESTER - IV

Total Hours: 25

OBJECTIVE:

1. To enable the students to understand the structure, function and disorders of functional system of human body.

CONTENTS

UNIT – I **(5 Hours)**

Biology, Cell, tissues, organs and body fluids: Biology- Definition. Different branches of Biology. Characteristic of living things. Cells - Definition and brief account on types of cells (Prokaryotes, Eukaryotes and Viruses -Structural details not needed). Tissues and organs – Introduction, types and functions. Internal environment and Homeostasis. Protection against the external environment -Skin and mucous membrane.

UNIT – II **(4 Hours)**

Respiratory system-Intake of oxygen and elimination of CO_2: Breathing - Definition. Brief account on the human breathing system - lungs, diaphragm, nose, throat, trachea, bronchi and alveoli. Gaseous exchange and control of breathing. Smoking and health.

UNIT – III **(5 Hours)**

Circulatory system-Internal transport system: General plan of human circulation. Structure of heart. Heart as a pump. Blood and plasma - composition. Blood cells - RBC, WBC and platelets. Blood vessels - Arterial and Venous system (Elementary details). Blood pressure (diastolic and systolic), stroke. Blood groups - ABO, Rh blood group systems. Brief account on artificial pacemaker.

UNIT – IV **(5 Hours)**

Digestive system- Intake of food and elimination of faeces: Gut- main parts of the gut. Brief account on digestion of food in mouth, throat, stomach, small intestine, large intestine, caecum and appendix. Role of liver in digestion. Digestive disorders - Constipation, Diarrhoea, vomitting, piles and appendicitis-etiology, complications and management (Elementary details).

UNIT – V **(6 Hours)**

Excretory system- Elimination of waste material: Overview of the structure of urinary system. Nephron - Cleaning of blood and formation of urine. Kidney failure - Dialysis and kidney transplantation (elementary details).

Nervous system (Communication with outside world) - Brief account on the organization of nervous system, nerve cell, conduction of nerve impulse, reflex arc and reflex action. Brief account on Coordination.

TEXT BOOK:

1. *Michael Roberts*. 1995. **Biology.** Thomas Nelson and Sons (P) Ltd., Canada.

REFERENCE BOOK:

1. *Kathleen J. W. Wilson* and *Anne Waugh.* 1998. **Ross and Wilson Anatomy and Physiology in health and illness**. [Eighth Edition]. Churchill Livingstone, London.

15UBCD401	DIPLOMA COURSE : CLINICAL LABORATORY TECHNIQUES	SEMESTER - IV

Total Hours: 55

OBJECTIVE:

1. To enable the students to gain knowledge about the routine clinical techniques in medical laboratories.

CONTENTS

UNIT – I **(11 Hours)**

Automation: Introduction - Classification of automated system, steps of automation in biochemical analysis. Autoanalyzer - Components and operation. Specimen processing: blood - Methods of collection, Anticoagulants – EDTA, Double oxalate, Sodium citrate, Sodium fluoride, Potassium oxalate, Heparin. Preparation of serum and protein free filtrate. Urine – Methods of collection. Storage - Preservatives.

UNIT – II **(11 Hours)**

Blood: Composition and functions of blood, difference between serum and plasma. Development of Blood cells - Erythropoiesis, Leucopoiesis, Thrombopoiesis. Blood cell count: Preparation of blood film – Thin blood film, making thick smears, fixing and staining of blood film. TC - Haemocytometry, DC, Platelet count. Estimation of Hemoglobin - Sahli's Method, PCV - Microhaematocrit method. ESR - Westergren's method, bleeding time – Duke's method. Clotting time - Capillary tube method. Clinical interpretation of haematological tests – Anemia, polycythemia and leukemia

UNIT – III **(10 Hours)**

Urine analysis: Gross examination of urine, chemical examination of urine. Reducing sugar – Benedict's test, Protein - Heat and acetic acid test, ketone bodies - Rothera's test, bile salts - Hay's test, bile pigments - Fouchet or Harrison test.

Stool examination – Specimen collection, Physical & chemical examination, Test for Occult blood - Benzidine method, Microscopic examination of stool.

Sputum Analysis: Specimen collection, macroscopic examination - Color, Volume, Odour. Microscopic examination**.**

Semen Analysis: Collection**,** Gross examination, Microscopic examination, Chemical examination of semen.

UNIT - IV **(11 Hours)**

Preparation of tissues: Fixation and decalcification. Processing of tissues. Preparation of sections. Routine staining procedures – Haematoxylin and Eosin. Special stains for connective tissues. Stains for carbohydrate and amyloids. Cytology: Preparation and fixation of specimen. Stains and staining techniques. Differentiation of normal and malignant cells.

UNIT - V **(12 Hours)**

Human blood group system: ABO, sub groups of ABO, variants of ABO and Rh blood group system. Significance and methods of blood grouping, Rh-typing and cross matching.

Blood transfusion: Definition and clinical significance. Complications - Adverse donor reactions - Mild, moderate and severe reactions.

Blood banking: Blood collection - Screening of donor. Criteria for rejecting donor. Blood collection procedure. Transportation of blood. Storage of blood and changes in the stored blood. Preparation and use of blood components. Laboratory procedure in blood component preparations.

TEXT BOOKS:

1. *Kanai L. Mukherjee.* 2005. **Medical Laboratory Technology, Volume III.** Tata McGraw- Hill Publishing Co. New Delhi. **(UNIT - I & IV).**
2. *Ramnik Sood*. 2006. **Medical Laboratory Technology**. Jaypee Brothers Medical Publishers Ltd., New Delhi. **(UNIT - II & III).**
3. *Kanai L. Mukherjee.* 2005. **Medical Laboratory Technology, Volume I.** Tata McGraw- Hill Publishing Co. New Delhi. **(UNIT - V).**

15UBCDP401	DIPLOMA COURSE PRACTICAL: CLINICAL LABORATORY TECHNIQUES	SEMESTER - IV

LIST OF EXPERIMENT

I. CLINICAL HAEMATOLOGY

1. Collection of venous blood.
2. Separation of serum.
3. Hemoglobin estimation - Sahli's method and Cyanmet Hb method.
4. Total RBC count.
5. Total WBC count.
6. Differential count.
7. ESR.
8. Bleeding time.
9. Clotting time.
10. Clot retraction.
11. Determination of PCV.

II. IMMUNO HAEMATOLOGY

1. ABO blood grouping and Rh typing.
2. Cross matching.

III. CLINICAL PATHOLOGY

1. Collection and preservation of urine.
2. Analysis of normal constituents of urine.
3. Analysis of abnormal constituents of urine.

REFERENCE BOOK:

1. *Ramnik Sood*. 2006. **Medical Laboratory Technology**. Jaypee Brothers Medical Publishers Ltd., New Delhi.

GUIDELINES

1. SUBMISSION OF RECORD NOTE BOOKS AND PROJECT DISSERTATION:

Candidates appearing for Practical Examinations and Project & Viva-Voce shall submit Bonafide Record Note Books/ Dissertation prescribed for Practical/ Project Viva-Voce Examinations, otherwise the candidates will not be permitted to appear for the Practical/ Project & Viva-Voce Examinations.

2. PASSING MINIMUM AND INTERNAL MARK DISTRIBUTION (Theory, Practical and Project)

I. (i) THEORY

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each theory paper with a passing minimum of 30 marks in External out of 75.

MARK DISTRIBUTION

Internal Marks Distribution [CA- Total Marks: 25]

Attendance	: 5 Marks
Assignment	: 5 Marks
Internal Examinations	: 15 Marks
Total	**: 25 Marks**

B. (i) THEORY (If Internal Evaluation is for 100 Marks)

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks out of 100 in the Comprehensive Examination (Internal Evaluation only).

Internal Marks Distribution [CA- Total Marks: 100]

Attendance	: 10 Marks
Assignment	: 30 Marks (3 Assignments compulsory)
Internal Examinations	: 60 Marks
Total	**: 100 Marks**

(ii) PRACTICAL

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Practical paper with a passing minimum of 24 marks in External out of 60.

Internal Marks Distribution [CA- Total Marks: 40]

Experiment	: 10 Marks (10-12 Experiments)
Attendance	: 5 Marks
Record	: 5 Marks
Internal Examinations	: 20 Marks
Total	**: 40 Marks**

ASSESSMENT OF SBC I: BIOCHEMICAL CALCULATIONS (Internal Evaluation only)

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks out of 100 in the internal evaluation.

Biochemical Calculations

Assignment (3)	: 30 Marks
Test (4)	: 50 Marks (1 On Line + 3 internal)
Workbook Submission	: 10 Marks
Attendance	: 10 Marks
Total	**: 100 Marks**

iii) PROJECT WORK

The project work shall be carried out by students in groups during the V semester and has to complete the work at the end of VI Semester.

- The student has to select their topics and complete their literature review at the end of fifth semester.
- The students has to attend 1 review at the end of fifth semester.
- The Student has to attend 2 reviews before completing his/her Project and it will be evaluated by an internal examiner.
- The assessment of student performance in a semester is calculated by Continuous Internal Assessment (CA) for 40 marks and External Assessment for 60 marks.
- Upon completion of the project work the candidate shall be required to appear for a Viva-Voce conducted by an external examiner.
- The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in Project with a passing minimum of 24 marks in External out of 60.

Mark Distribution Pattern

Internal Mark Distribution **Continuous Assessment (CA) Total Marks: 40**

1.	Attendance	:	10 Marks
2.	Review (3)	:	20 Marks
3.	Presentation	:	10 Marks
	Total	**:**	**40 Marks**

External Mark Distribution **Comprehensive Examination (CE) Total Marks: 60**

1.	Research work done	:	20 Marks
2.	Project report	:	20 Marks
3.	Presentation	:	10 Marks
4.	Viva-Voce	:	10 Marks
	Total	**:**	**60 Marks**

3. QUESTION PAPER PATTERN AND MARK DISTRIBUTION *THEORY*

Question Paper Pattern and Mark Distribution **(For 75 marks)**

1. PART – A (10 x 2 = 20 Marks)

Answer ALL questions

Two questions from each UNIT

2. PART – B (5 x 5 = 25 Marks)

Answer ALL questions

One question from each UNIT with Internal Choice

3. PART – C (3 x 10 = 30 Marks)

Answer ANY THREE questions

One question from each UNIT

Open Choice – 3 out of 5 questions

Question Paper Pattern and Mark Distribution **(For 100 marks)**

1. PART – A (10 x 2 = 20 Marks)

Answer ALL questions

Two questions from each UNIT

2. PART – B (5 x 7 = 35 Marks)

Answer ALL questions

One question from each UNIT with Internal Choice

3. PART – C (3 x 15 = 45 Marks)

Answer ANY THREE questions

One question from each UNIT

Open Choice – 3 out of 5 questions

QUESTION PAPER PATTERN FOR CORE PRACTICAL EXAMINATIONS
(MAXIMUM MARKS: 60) TIME: 6 HOURS

1. Two experiments (2x25) :50
2. Spotters (5x2) :10

Total **: 60 Marks**

KEY FOR EVALUATION OF PRACTICAL EXAMINATION

1. **Qualitative analysis (25 Marks)**
   - Procedure : 15
   - Result : 10

2. **Quantitative analysis (25 Marks)**
   - Principle : 05
   - Procedure : 05
   - Tabular Column : 03
   - Graph : 02
   - Result : 10

3. **For Separation technique (25 Marks)**
   - Principle : 05
   - Procedure : 05
   - Observation : 05
   - Result : 10

ALLIED PRACTICAL

Comprehensive Examination (CE) : 60 marks
Continuous Assessment (CA) : 40 marks

Question paper pattern for Allied practical (Maximum marks: 60) Time: 3 Hours

1. One experiment (1x40) : 40
2. Spotters (10x2) : 20

Total **: 60 Marks**

KEY FOR EVALUATION OF ALLIED PRACTICAL EXAMINATION

1. **Qualitative analysis (40 Marks)**

Procedure	: 20
Result	: 20

2. **Quantitative analysis (40 Marks)**

Principle	: 05
Procedure	: 05
Tabular Column	: 03
Graph	: 02
Result	: 25

Computer Practical Distribution

Internal Mark Distribution **Continuous Assessment (CA) Total Marks: 40**

Experiment	:	10 Marks (10-12 Experiments)
Attendance	:	05 Marks
Record	:	05 Marks
Internal Examinations	:	20 Marks
Total	**:**	**40 Marks**

External Mark Distribution **Comprehensive Examination (CE) Total Marks: 60**

For each practical question the marks shall be awarded as follows

Aim	:	05 Marks
Algorithm/Flowchart	:	10 Marks
Writing the Source Code	:	15 Marks
Test and debug the Source Code	:	15 Marks
Displaying the Output	:	10 Marks
Result Declaration	:	05 Marks
Total	**:**	**60 Marks**

CAREER COMPETENCY SKILLS
METHODOLOGY OF ASSESSMENT

1. On Line Objective Examination (Multiple Choice questions)- Semester III

- 100 questions-100 minutes
- Twenty questions from each UNIT.
- On line examination will be conducted at the end of the III Semester.

2. Viva Voce- Semester IV

- A Student has to come in proper dress code and he/she should bring 2 copies of Resume for the Viva-Voce.
- A student may be asked to
    - Give Self Introduction
    - Submit the resume to the examiner(s) and answer the questions based on it.
    - Speak on any given topic for at least two minutes.
    - Give a presentation for 10 minutes on a topic of their choice.
    - Sit with other students in a Group for a Discussion.

ALLIED COURSE OFFERED BY THE DEPARTMENT

S. No.	Course Code	Subject	Offered for the students of
SEMESTER – II			
1	15UBCMBA201	Allied II: Biochemistry I (Biomolecules)	B.Sc Microbiology
2	15UBCMBAP201	Allied Practical II: Biochemistry (Biomolecules)	
3	15UBCBTA201	Allied II: Biochemistry (Biomolecules and Metabolism)	B.Sc Biotechnology
4	15UBCBTAP201	Allied Practical II: Biochemistry (Biomolecules)	
SEMESTER – III			
5	15UBCMBA301	Allied III: Biochemistry II (Enzymes and Bioenergetics)	B.Sc Microbiology
6	15UBCMBAP301	Allied Practical III: Biochemistry (Quantitative Analysis)	