DHANALAKSHMI SRINIVASAN
COLLEGE OF ARTS AND SCIENCE FOR WOMEN (AUTONOMOUS)
Affiliated to Bharathidasan University, Tiruchirappalli
(Nationally Re-Accredited with A++ Grade by NAAC)
Perambalur – 621212.
B.Sc., BIOCHEMISTRY
Choice Based Credit System-Learning Outcomes Based Curriculum Framework (CBCS-LOCF)
(Applicable to the candidates admitted from the academic year 2024-25 onwards)

UG Science (BIOCHEMISTRY)

Programme Pattern

Sem	Part	Course	Course Title	Course Code	Ins.Hrs	Credit	Exam Hours	Marks		Total
								Internal	External	
I	I	Language Course - I	Cheyyul (ikkala ilakkiyam)Sirukathai ilakkiya varalaru	24U1LT1	6	3	3	25	75	100
	II	English Course-I	English for communication - I	24U1EL1	6	3	3	25	75	100
	III	Core Course-I	Biomolecules	24UBC1C1	5	5	3	25	75	100
	III	Core Course-II Practical	Lab in Biomolecules	24UBC1C2P	4	3		40	60	100
	III	Allied Course -I	Allied Chemistry - I	24UBC1A1	4	4	3	25	75	100
	III	Allied- I & II Practical	Lab in Volumetric and Organic qualitative analysis	24UBC1A1P	3	-	-	-	-	-
	IV	Value Education	Value Education	24U1VED	2	2	3	25	75	100
	Total				**30**	**20**		**-**	**-**	**600**
II	I	Language Course - II	Cheyyul (idaikkala ilakkiyam) Pudhinam	24U2LT2	6	3	3	25	75	100
			Hindi	24U2LH2						
			French	24U2LF2						
	II	English Course-II	English for communication - II	24U2EL2	6	3	3	25	75	100
	III	Core Course- III	Human Physiology	24UBC2C3	5	5	3	25	75	100
	III	Core Course-IV Practical	Lab in Human Physiology	24UBC2C4P	4	3		40	60	100
	III	Allied Course -II	Allied Chemistry - II	24UBC2A2	4	4	3	25	75	100
	III	Allied-I& II Practical	Lab in Volumetric and Organic qualitative analysis	24UBC1A1P	3	3	3	40	60	100
	IV	Environmental Studies	Environmental Studies	24U2EVS	2	2	3	25	75	100
	Total				**30**	**23**		**-**	**-**	**700**
III	I	Language Course - III	Cheyyul (kappiyangal) urainadai aluval murai madalgal ilakkiya varalaru	24U3LT3	6	3	3	25	75	100
			Hindi	24U3LH3						
			French	24U3LF3						
	II	English Course-III	English through literature - I	24U3EL3	6	3	3	25	75	100
	III	Core Course-V	Biochemical techniques	24UBC3C5	5	5	3	25	75	100
	III	Core Course-VI Practical	Lab in Biochemical techniques	24UBC3C6P	4	3		40	60	100
	III	Allied Course -III	Microbiology - I	24UBC3A3	4	4	3	25	75	100
	III	Allied-III & IVPractical	Lab in Microbiology	24UBC3A2P	3	-	-	-	-	-

	IV	Non Major Elective-I	Health and Nutrition	24UBC3N1A	2	2	3	25	75	100
			Nutrition for Women	24UBC3N1B						
			Nanomedicine	24UBC3N1C						
	Total				**30**	**20**		**-**	**-**	**600**
IV	I	Language Course - IV	Cheyyul (Sanga ilakkiyam, Needhi ilakkiyam)nadagam, ilakkiya varalaru, pothukkatturai	24U4LT4	6	3	3	25	75	100
			Hindi	24U4LH4						
			French	24U4LF4						
	II	English Course-IV	English for Competitive Examination	24U4EL4	6	3	3	25	75	100
	III	Core Course-VII	Enzyme	24UBC4C7	5	5	3	25	75	100
	III	Core Course-VIII Practical	Lab in Enzyme Analysis	24UBC4C8P	4	3	3	40	60	100
	III	Allied Course -IV	Microbiology-II	24UBC4A4	4	4	3	25	75	100
	III	Allied-III & IV Practical	Lab in Microbiology	24UBC3A2P	3	3	3	40	60	100
	IV	Non Major Elective-II	Medicinal Diet	24UBC4N2A	2	2	3	25	75	100
			Biochemistry in Nutrition	24UBC4N2B						
			Health and Disease	24UBC4N2C						
	Total				**30**	**23**		**-**	**-**	**700**
V	III	Core course-IX	Bioenergetics and Metabolism	24UBC5C9	5	5	3	25	75	100
	III	Core course-X	Genetics & Computational Biology	24UBC5C10	5	5	3	25	75	100
	III	Core course-XI	Cell & Molecular Biology	24UBC5C11	5	5	3	25	75	100
	III	Core course-XII Practical	Lab in Cell & Molecular Biology	24UBC5C12P	6	3	3	40	60	100
	III	Major Based Elective-I	Plant Biochemistry	24UBC5MBE1A	4	4	3	25	75	100
			Neurobiology	24UBC5MBE1B						
			Drug biology	24UBC5MBE1C						
	III	Internship /Field Study / Industrial Visit		24UBC5IS1	-	1				100*
	IV	Skill Based Elective-I	Hospital Management	24UBC5SBE1A	3	2	3	25	75	100
			Herbs and Drug action	24UBC5SBE1B						
			Ethnomedicine	24UBC5SBE1C						
	IV	Soft Skills		24U5SS	2	2	3	25	75	100
		Self Paced Learning - I (Online course)			-	2*				
	Total				**30**	**27**		**-**	**-**	**700**
VI	III	Core course-XIII	Clinical Biochemistry	24UBC6C13	6	6	3	25	75	100
	III	Core course-XIV	Immunology	24UBC6C14	5	5	3	25	75	100
	III	Core Course-XV Practical	Lab in Clinical Biochemistry and Immunology	24UBC6C15P	6	3	3	40	60	100
	III	Major Based Elective-II	Pharmaceutical Biochemistry	24UBC6MBE2A	4	4	3	25	75	100
			Advanced Endocrinology	24UBC6MBE2B						
			Nutritional Biochemistry	24UBC6MBE2C						
	III	Project work		24UMB6PW	5	5		40	60	100
	IV	Skill Based Elective-II	Nanotechnology	24UBC6SBE2A	3	2	3	25	75	100

			Pharmacognosy	24UBC6SBE2B						
			Cardiovascular biology	24UBC6SBE2C						
	IV	Gender studies		24U6GS	1	1	3	25	75	100
		Self Paced Learning - II (Online course)			-	2*				
	Total				**30**	**26**		**-**	**-**	**700**
I-VI	V	Extension Activities			-	1		-	-	-
Total (Three years)						**140 (4*)**				**4000**

Semester	Course code	Title of the course	Hours	Credits
I	24UBC1C1	CC- I: Biomolecules	5	5

Objectives: To understand the basis of chemical structure and function of various biomolecules found in living systems

Unit- I **(20 Periods)**

Carbohydrates: Introduction and general classification of carbohydrates. Monosaccharides: Structures, properties and biological functions of monosaccharides. Oligosaccharides: Dissaccharides - structures, properties and biological functions of maltose, Lactose and Sucrose. Polysaccharides: Classifications of polysaccharides, Structures, properties and biological functions of Homo-polysaccharides - starch, cellulose, glycogen, pectin and Hetero-polysaccharides - Hyaluronic acid, Chondroitin sulphate, chitin and Heparin.

Unit -II **(20 Periods)**

Amino acids: Structure, classification, physical, and chemical properties. Peptides: Features of peptide bond, naturally occurring peptides – Glutathione, enkaphalins and endorphins. Proteins: Classification, physical and chemical properties of proteins, structural organization of proteins - Primary, secondary, tertiary and quaternary structures.

Unit-III **(20 Periods)**

Fatty acids: Definition, nomenclature, classification of fatty acids-saturated and unsaturated fatty acids. Essential fatty acids. Lipids: Classification of lipids- simple, conjugated and derived lipids, occurrence, structure and physical and chemical properties of phospholipids, glycolipids, sphingolipids and cholesterol. Lipoproteins: Types and functions of lipoproteins – Chylomicrons, VLDL, LDL and HDL.

Unit-IV **(20 Periods)**

Nitrogenous bases: - purines and pyrimidines, nucleosides, nucleotides, formation of phosphodiester bonds. DNA: - Types of DNA, Structure of DNA – Watson and Crick double helix model, physic-chemical properties and functions of DNA. Special base sequences of DNA – palindromic sequence, cruciforms. RNA:- Types and basic structural features of RNA – mRNA, tRNA and rRNA, properties and functions of RNA.

Unit -V **(10 Periods)**

Vitamins: Introduction to vitamins, classification of vitamins - structures, sources, RDA, functions,deficiency diseases of fat soluble and water-soluble vitamins.

Minerals Source and deficiency disorders of Macro-minerals; Sodium, Potassium, Calcium, Magnesium,Micro-minerals: Copper, phosphorus, Iron, Iodine, Zinc and Selenium.

TEXT BOOK(S)

1. Nelson, D.L., Cox, M.M. and Lehninger, A.L. (2008) Lehninger principles of biochemistry. 5th ed.
2. Murray. R.K, Granner.D.K, Mayes. P. A, Rodwell. V.W. Harper 's Biochemistry. 27th ed.McGraw Hill, 2006.
3. Essentials of Biochemistry – A.I. Jain. Fundamentals of Biochemistry – O.P. Agarwal.
4. Berg, J.M., Stryer, L., Gatto, G.J., Tymoczko, J.L. and Gatto, G.J. (2015) Biochemistry. 8th ed. New York: W.H. Freeman.
5. Voet, D. and Voet, J.G. (2011) Biochemistry. 4th ed. Hoboken, N.J.: John Wiley.

REFERENCE BOOK(S)

1. Devasena, T. (2019). *Biomolecules*. MJP Publisher.
2. Mishra, S.R. (2003). *Biomolecules*. Discovery Publishing House.
3. Berg, J.M., Tymoczko, J.L., & Stryer, L. (2006). *Biochemistry* (International edition). New York: W.H. Freeman & Co Ltd.
4. Papachristodoulou, D.K., Snape, A., Elliott, W.H., & Elliott, D.C. (2014). *Biochemistry and Molecular Biology* (5th ed.). Oxford: Oxford University Press.
5. Ridgway, N.D., & McLeod, R.S. (Eds.). (2015). *Biochemistry of Lipids, Lipoproteins and Membranes* (6th ed.). Amsterdam: Elsevier Science**.**

Course Outcomes:

CO No	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Understanding the general classification and biological significance of carbohydrates, monosaccharides, oligosaccharides, and polysaccharides.	Kl
CO2	Realizing the structure, classification, and properties of amino acids, peptides, and proteins.	Kl, K2 &K3
CO3	Learning about the structure, classification, and biological significance of fatty acids, lipids, and lipoproteins.	K2, K3 &K4
CO4	Applying knowledge of nucleic acid structure, function, and types of RNA and DNA in biological systems.	K2& K3
CO5	Understanding the role of vitamins and minerals in human health, their sources, functions, and deficiency disorders.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course								Hours	Credits
I	24UBC1C1	Biomolecules								5	5
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	3	2	2	3	1	2	2.5
CO-2	3	3	3	2	3	2	3	2	1	3	2.7
CO-3	3	2	3	2	3	3	3	2	2	2	2.6
CO-4	3	3	3	3	2	2	3	3	2	2	2.8
CO-5	2	2	2	2	3	2	3	2	1	3	2.3
Mean overall score											2.78 (High)

Semester	Course code	Title of the course	Hours	Credits
I	24UBC1C2P	CCP – II: Lab in Biomolecules	4	3

Objectives: To understand principles, theory and calculations of each experiment and gain hands onpreparation of all the solutions and to standardize solutions individually.

Qualitative analysis **(22 Periods)**

1. Laboratory safety – Do ‘s and do not.
2. Determination of Absorption Maximum
3. Weighing of reagents, Preparations of Normality and Molarity solutions. Handling of Microscope.
4. Qualitative analysis of carbohydrates (glucose, fructose, maltose, galactose, sucrose, lactose,Starch).
5. Qualitative analysis of amino acids (Tryptophan, Tyrosine, Arginine, Proline and Histidine).
6. Qualitative analysis of Lipid.

Quantitative analysis **(23 Periods)**

1. Determination of reducing sugar- Benedict's method – Titrimetric Analysis.
2. Estimation of amino acid by Ninhydrin method.
3. Estimation of acid number of Edible oils.
4. Determination of saponification number of edible oils.
5. Estimation of Iodine value of oil.

TEXT BOOK(S)

1. Manuals in Biochemistry – Dr. J. Jayaraman, New Age International Pub, Bangalore2011.
2. Practical Biochemistry – Plummer, New Delhi: Tata McGraw Hill Publishing Company, 2000.
3. David T. Plummer (1990) An Introduction to Practical Biochemistry,179 Third Edition

REFERENCE BOOK(S)

1. Biochemical methods -S. Sadasivam, V.A Manickam 2ed New Age International Publishers, 2006.
2. Biochemical Tests - Principles and Protocols. nil Kumar, Sarika Garg and Neha Garg. Vinod Vasishtha Viva Books Pvt Ltd, 2012.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Understand the structure, properties, and types of carbohydrates.	Kl & K2
CO2	Gain proficiency in the qualitative analysis of carbohydrates.	Kl, K2 &K3
CO3	Acquire knowledge regarding the qualitative analysis of amino acids.	K2, K3 &K4
CO4	Develop an understanding of reducing sugars and their determination.	K2& K3
CO5	Understand the significance of the iodine value in oils and its estimation.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course					Hours	Credits			
I	24UBC1C2P	Lab in Biomolecules					4	3			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	2	2	3	3	2	3	2	2.6
CO-2	3	3	3	2	2	3	3	3	3	2	2.9
CO-3	3	3	2	3	3	3	3	3	3	2	2.9
CO-4	3	2	3	3	2	3	3	3	3	3	2.9
CO-5	3	3	3	2	3	3	3	3	3	3	3.0
Mean overall score											2.9 (High)

ALLIED COURSE-I
ALLIED CHEMISTRY-I

(For Biochemistry students admitted from 2024-2025 onwards)

Semester :I	**Marks : 75**
Course Code : 24UBC1A1	**Credits : 4**
Total periods : 60	**Exam Hours : 3**

OBJECTIVES

- To know about types of bonding
- To learnt about carbohydrates, aminoacids and proteins
- To know about basic concepts of acids, bases and catalysis
- To know about coordination chemistry
- To learn about aromatic compounds and organic reactions

UNIT- I : CHEMICAL AND METALLIC BONDING (12 Periods)

Types of bonding: Ionic bond, covalent bond and coordinate bond. MO theory- bonding, Anti bonding, non-bonding orbitals. Bond order. Applications of MO theory to H_2, He_2, O_2 and molecules.

Metallic bond: Electron gas, Pauling and band theories, semiconductors – intrinsic, extrinsic (N-type and P-type semiconductors).

UNIT- II: CARBOHYDRATES, AMINOACIDS AND PROTEINS (12 Periods)

Carbohydrates: classification – glucose and fructose – preparation and properties. Structure of glucose and Fructose -Fischer and Haworth Cyclic Structure.

Amino acids and proteins: Amino acids – Classification based on structure Essential and non-essentials amino acids – preparation, properties and uses – peptides (elementary treatment only)

Proteins – Classification based on physical properties and biological functions. Structure of proteins – primary and secondary (elementary treatment).

UNIT- III: ACIDS, BASES AND CATALYSIS (12 Periods)

Acids-Bases: Arrhenius, Lowry-Bronsted and Lewis concepts of acids and bases-pH, buffer solution, Henderson-Hasselbalch equation and its importance (no derivation) -Biological importance of pH and buffer solutions in living system- Determination of pH by colorimetric method.

Catalysis: Catalysis -Types of catalysis - Homogeneous and heterogeneous catalysis, factors affecting catalysis.

UNIT- IV: AROMATIC COMPOUNDS AND ORGANIC REACTIONS (12Periods)

Aromatic compounds: Structure and Conditions for Aromacity and Aromaticity of benzeneHuckels rule. Substitution reaction: Nitration, Halogenations, Alkylation. Naphthalene – Isolation, Structure, properties and uses.

Organic reaction: Biuret, Decarboxylation, Benzoin, Perkin, Cannizaro, Claisen and Haloforms reactions

UNIT-V: COORDINATION CHEMISTRY (12 Periods)

Coordination Chemistry: Simple salts- Double salts- Coordination compound types of ligands-Chelation-Nomenclature – isomerism- Werner's theory -Pauling's and Sedgwick theory -VBT. Industrial importance of EDTA.

Biologically important co-ordination compounds: Hemoglobin and Chlorophyll- structure and biological role.

UNIT-VI: PHASE RULE

Phase rule: Phase, component, degree of Freedom, and phase rule definitions - one component system– water system.

TEXT BOOKS AND REFERENCES BOOKS

1..R.D. Madan, "Modern Inorganic Chemistry", 2nd edition, S. Chand & Company Ltd., 2000.

2.P.L. Soni – "Text book of Inorganic Chemistry. S. Chand & Co., New Delhi (1999)

3. B.S. Bahl and Amn Bahl, Advanced Organic Chemistry, S. Chand & Co. Ltd, New Delhi (1996).

4.Glasstone S. and Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co Ltd.

5.Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin Chand and Co.

6.A .K. Srivastava – "Organic Chemistry" – 1st Ed.,(2002) – New Age International Publishers,New Delhi.

7.Gopalan R, Subramanian PS and Rengarajan K (1993) ``Elements of analytical chemistry" second revised edition, Sultan Chand.

8 J.D. Lee, Concise Inorganic Chemistry, Blackwell Science Ltd., London (2006).

9.Gopalan R, Text Book of Inorganic Chemistry, 2nd Edition, Hyderabad, Universities Press, (India), 2012.

10 . Morrison R.T. and Boyd R.N., Bhattacharjee S. K. Organic Chemistry (7th edition), Pearson India, (2011)

11 .M.K. Jain – "Organic Chemistry" – 12th Ed., (2003) Sulthan and Chand Company, New Delhi.

12. R.D. Madan, J.S. Tiwari and G.L. Mudhara – A Textbook of First Year B.Sc. Chemistry: S.Chand and Co, 2002

13.Gurdeep R Chatwal, Sham K. Anand (2005) ``Instrumental methods of chemical analysis", Himalaya publishing house.

14. Sharma, B. K., Instrumental methods of chemical analysis, Goel Publishing House, Merrut (1997).

COURSE OUT COMES

CO number	CO Statement On the Successful completion of the course the student would be able	Knowledge level
CO1	To know about types of bonding	K1
CO2	To learnt about carbohydrates, aminoacids and proteins	K2
CO3	To analyse basic concepts of acids, bases and catalysis	K2
CO4	To apply coordination chemistry in biological system	K3
CO5	To explain about aromatic compounds and to write organic reactions	K3

Mapping with Programme Outcomes and Programme Specific outcomes

Semester	Course code	Title of the Course					Hours	Credits			
I	24UBC1A1	ALLIED CHEMISTRY-I					4	4			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	1	3	3	2	1	3	3	2	1	2	2.1
CO2	2	2	2	3	2	3	2	3	2	3	2.4
CO3	3	2	3	2	1	2	3	3	3	2	2.4
CO4	2	2	3	3	2	3	3	2	2	1	2.3
CO5	1	3	2	2	3	2	3	1	2	3	2.2
Mean overall score											2.3(High)

ALLIED I & II PRACTICAL

LAB IN VOLUMETRIC AND ORGANIC QUALITATIVE ANALYSIS

(For Biochemistry students admitted from 2024-2025 onwards)

Semester :I	**Marks : 60**
Course code : 24 UBC1A2P	**Credits : 3**
Total periods : 45 +45 (90)	**Exam Hours: 3**

OBJECTIVES

- To enable the students to understand the concepts of volumetric analysis
- To learn the Organic qualitative analysis

I. VOLUMETRIC ANALYSIS 1. Acidimetric and Alkalimeter

(a) Strong acid VS strong base

(b) Weak acid VS strong base

2. Permanganometry

(a) Estimation of ferrous sulphate

(b) Estimation of oxalic acid

3. Iodometry

(a) Estimation of potassium dichromate

(b) Estimation of potassium permanganate

4. Complexometry

(a) Determination of Hardness of water

II. ORGANIC ANALYSIS

Analyze the following organic Compounds.

1. Carbohydrate, 2. Amide, 3. Aldehydes, 4. Ketone, 5. Acid & 6. Amine

The students may be trained to perform the specific reactions like tests for Element (nitrogen only), Aliphatic/ Aromatic, Saturated /Unsaturated and Functional group present and record their observations.

REFERENCES

1. R. Gopalan, Elements of analytical chemistry, S. Chand, New Delhi, 2000.
2. N. S. Gnanapragasam and G. Ramamurthy, Organic Chemistry lab manual,S.Viswanathan and

Co. Pvt. Ltd. Chennai-1998

Note:Scheme for Practical Evaluation.

Organic Qualitative Analysis - 20

Volumetric Estimation -35

Record - 5

Internal Assessment - 40

Total: 100 Mark

Organic Qualitative Analysis: 20

Identification of Nitrogen - 4 marks

Saturated and unsaturated - 3 marks

Aliphatic or Aromatic - 3 marks

Preliminary reactions with

Procedure - 5 marks

Functional group identified

Correctly - 5 marks

Volumetric Analysis: 35

Procedure 5 marks

Results

< 2 % - 30 marks

2-3 % -20 marks

3-4 % - 10 marks

> 4 % - 5 marks

COURSE OUT COMES

CO Number	CO Statement	Knowledge level
	On the Successful completion of the course the student would be able	
CO1	To carry out volumetric analysis	K1
CO2	To identify organic compounds	K2
CO3	To estimate hardness of water	K3

Mapping with Programme Outcomes and Programme Specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
I&II	24 UBC1A2P		LAB IN VOLUMETRIC AND ORGANIC QUALITATIVE ANALYSIS							3	3
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	2	3	3	2	3	2	2.5
CO2	2	2	3	3	2	3	2	3	2	3	2.5
CO3	3	2	3	2	2	2	3	3	3	3	2.6
Mean overall score											2.5(High)

Semester	Course code	Title of the course	Hours	Credits
I	24U1VED	Value Education	2	2

UNIT I: PHILOSOPHY OF LIFE AND SOCIAL VALUES: (6 Periods)

Human Life on Earth (Kural 629) - Purpose of Life (Kural 46) - Meaning and Philosophy of Life(Kural 131, 226) - Family (Kural 45), Peace in Family (Kural 1025) Society (Kural 446), The Lawof Life (Kural 952), Brotherhood (Kural 807) Five responsibilities / duties of Man (a) to himself (b) to his family (c) to his environment (d) to his society, (e) to the Universe in his lives (Kural 43,981).

UNIT II: HUMAN VALUES AND CITIZENSHIP: (6 Periods)

Aim of education and value education: Evolution of value oriented education, Concept of Humanvalues : types of Values - Character Formation - Components of Value education - A P J Kalam'sten points for enlightened citizenship - The role of media in value building.

UNIT-III VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT (6 Periods)

Constitutional or national values: Democracy, socialism, secularism, equality, Justice, liberty freedom and fraternity - Social Values: Pity and probity, self-control, universal brotherhood - Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith - Religious Values: Tolerance, wisdom, character - Aesthetic Values - Love and appreciation of literature and fine arts and respect for the same - National Integration and International Understanding.

UNIT-IV: YOGA AND HEALTH: (6 Periods)

Definition, Meaning, Scope of Yoga - Aims and objectives of Yoga – Yoga Education with modern context - Different traditions and schools of Yoga - Yoga practices: Asanas, Pranayama and Meditation.

UNIT V : HUMAN RIGHTS : (6 Periods)

Concept of Human Rights: Indian and international perspectives - Evolution of Human Rights - definitions under Indian and International documents - Broad classification of Human Rights and Relevant Constitutional Provisions: Right to Life, liberty and Dignity - Right to equality - Right against exploitation - Cultural and Educational Right - Economic Rights - Political Rights - SocialRights - Human Rights of Women and Children - Peace and harmony.

REFERENCES:

1. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road, Thanjavur 613 004, Leah Levin, Human Rights, NBT, 1998
2. V.R. Krishna Iyer, Dialetics and Dynamics of Human Rights in India, Tagore Law Lectures.4.Yogic Thearpy - Swami Kuvalayananda and Dr.S.L.Vinekar, Government of India, Ministry of Health, New Delhi.
3. SOUND HEALTH THROUGH YOGA - Dr.K.Chandrasekaran, Prem Publications, Sedaptti, 1999.
4. Grose. D. N – "A text book of Value Education' New Delhi (2005)
5. Gawande . EN – "Value Oriented Education" – Vision for better living. New Delhi (2002)Saruptsons
6. Brain Trust Aliyar- "Value Education for Health, Happiness and Harmony" Erode (2004)Vethathiri publications

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Understand the purpose of life, human responsibilities, and the values of family, society, and the universe, based on the teachings of Kural.	K1, K2
CO2	Explore the role of value-oriented education in character formation and responsible citizenship, with reference to A.P.J. Kalam's principles.	K1, K2
CO3	Analyze the importance of national and global values, including democracy, justice, equality, and international understanding for societal development.	K2, K3
CO4	Understand the principles and practices of Yoga, including Asanas, Pranayama, and Meditation, for physical and mental well-being.	K1, K2
CO5	Comprehend the concept of Human Rights, including their classifications and constitutional provisions, with a focus on rights for women and children.	K2, K3

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course							Hours	Credits
I	24U1VED	Value Education							2	2
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	3	3	2	2	3	2	2	2.5
CO-2	3	3	3	2	3	3	3	3	3	3	2.9
CO-3	3	2	3	3	3	2	3	3	3	2	2.8
CO-4	2	2	3	3	2	3	3	3	3	3	2.7
CO-5	3	3	3	2	3	3	2	3	2	3	2.7
Mean overall score											2.72 (High)

Semester	Course code	Title of the course	Hours	Credits
II	24UBC2C3	CC-III: Human Physiology	5	5

Objectives: To understand fundamental mechanisms underlying normal function of cells, Tissues,organs, and organ systems of the human body

Unit- I **(18 Periods)**

Body fluids: Extracellular fluid-plasma, interstitial fluid and transcellular fluid. Intracellular fluid: Lymph & Blood-composition, functions, osmolarity of the body fluids, ionic composition, electrolytes, body buffers. Blood cells, hemoglobin, hemopoiesis, blood coagulation and blood groups.

Unit- II **(22 Periods)**

Circulation: Structure and function of Heart, blood vessels and its types, cardiac cycles, cardiac factors controlling blood pressure, electrocardiogram. Functions of heart. Respiration: Anatomy, and physiology of respiration, pulmonary surfactant, exchange of gases between lung and blood and between blood and tissues. Role of lung in acid-base balance.

Unit-III **(20 Periods)**

Digestive System: Overview of the digestive system, secretions of digestive tract, digestive hormones, process of digestion, absorption, assimilation of carbohydrates, proteins, fats, nucleic acids. Absorption of vitamins, minerals and water.

Unit- IV **(20 Periods)**

Excretory system: Structure and functions of kidney. Urine- composition and formation. Renal regulation of acid-base balance. Common disorder related to excretory system. Muscle: Kinds of muscle, structure. Mechanism and theories of muscle contraction.

Unit-V **(10 Periods)**

Nervous System: Overview of nervous system, classification of nervous system, signal transmission at synapse and its types, neurotransmitters and cAMP Neuromuscular Junction. Brain chemical, metabolism, CSF and its function. Special Senses: Physiology of Olfaction, Gustation, Vision, Hearing and equilibrium. Biochemical aspects of learning and memory. Enkephalins and endorphins.

TEXT BOOK(S)

1. Human Physiology: Vol I & II C.C. Chatterjee, 2016.
2. Martini, F.H. and Nath, J. L. 2009. Fundamentals of Anatomy & Physiology.
3. K. Sembulingam and Prema Sembulingam (2012) Essentials of medical physiology Jaypee brothers Medical publishers (P) Ltd;6th Edition

REFERENCE BOOK(S)

1. A.C. Guyton (2010) Text Book of Medical physiology, Saunders; 12th edition.
2. Human Physiology-Systemic & applied-Sahalya, 2009.
3. Bipin Kumar. 2001. Human Physiology.
4. Gerard J. Tortora, Bryan H. Derrickson (2014) Principles of anatomy and physiology, John wileyand sons Inc;10th Edition.
5. D U Silverthorn (2015) Human physiology - An integrated approach, Pearson; 7th edition.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Understand the composition, functions, and osmolarity of body fluids, including blood and lymph.	Kl & K2
CO2	Explain the process of circulation, structure and function of the heart, and the physiology of respiration, including gas exchange and acid-base balance.	Kl, K2 & K3
CO3	Describe the structure and functions of the digestive system, including the processes of digestion, absorption, and assimilation of nutrients.	K2, K3 &K4
CO4	Understand the excretory system and muscle structure, focusing on the formation and regulation of urine and mechanisms of muscle contraction.	K2& K3
CO5	Analyze the nervous system, special senses, and the biochemical aspects of learning, memory, and neurotransmission.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course								Hours	Credits
II	24UBC2C3	CC-III: Human Physiology								5	5
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	3	2	3	2	3	2	3	2.7
CO-2	3	3	3	2	3	3	3	3	3	3	2.9
CO-3	3	2	3	3	3	3	3	3	3	2	2.8
CO-4	3	2	3	3	2	3	3	3	3	3	2.8
CO-5	3	3	3	2	3	3	3	3	2	3	2.8
Mean overall score											2.8 (High)

Semester	Course code	Title of the course	Hours	Credits
II	24UBC2C4P	CP-IV: Lab in Human Physiology	4	3

Objectives: To Understand the Physiological concepts of homeostasis and control mechanismsand to study the functions of body systems- with emphasis on clinical relevance.

Human physiology: **(45 Periods)**

1. To Study the different parts of Microscope.
2. To Study the Differential count of RBC & WBC by Hemocytometer (Neubauer Chamber).
3. Differential leucocyte count by Leishman ‘s staining method.
4. Estimation of Hemoglobin by Sahli ‘s acid hematin method
5. Determination of Packed cell volume (PCV) by Microhematocrit method.
6. Determination of Erythrocyte sedimentation rate (ESR).
7. a. Determination of Clotting time by Capillary Tube method.

   b. Determination of bleeding time by Standard filter Paper method.
8. Identification of Blood Grouping and Rh typing.
9. Determination of Blood Pressure by Sphygmomanometer

Demonstration

10. Histology of Tissues – Columnar, cubical, ciliated, squamous, stratified squamous- Demonstration
11. Macroscopic structure of organs – lungs, artery, vein, stomach, ovary, testis, Uterus.
12. Determination of Respiratory rate and Pulse rate – before and after exercise

TEXT BOOK(S)

1. G.K.Pal& P. Pal. 2006. Textbook of Practical Physiology. 2nd Edn. Orient Blackswan.
2. Stuart Fox. A Laboratory Guide to Human Physiology: Concepts and Clinical Applications.

REFERENCE BOOK(S)

1. Laboratory Manual in Biochemistry, 1981. J.Jayaraman, New Age International publishers, NewDelhi

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	To Understand the Physiological concepts of homeostasis and control mechanisms and to study the functions of body systems-with emphasis on clinical relevance.	Kl & K2
CO2	Learn about the blood group	Kl, K2 & K3
CO3	Understand the RBC and WBC	K2, K3 &K4
CO4	A Clear Knowledge about the PCR and ESR	K2& K3
CO5	Provide the knowledge about the sphygmomanometer	K1, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code		Title of the Course							Hours	Credits
II	24UBC2C4P		CP-IV: Lab in Human Physiology							4	3
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	3	3	3	3	2	3	2	2.7
CO-2	3	3	3	3	3	3	3	3	3	3	3.0
CO-3	3	2	3	3	2	3	2	3	3	2	2.6
CO-4	3	3	3	2	3	2	3	2	3	3	2.7
CO-5	3	3	2	3	3	3	3	3	2	3	2.8
Mean overall score											2.76 (High)

ALLIED COURSE-II

ALLIED CHEMISTRY-II

(For Bio-Chemistry students admitted from 2024-2025 onwards)

Semester :II	**Marks : 75**
Course code :24UBC2A2	**Credits : 4**
Total periods : 60	**Exam Hours : 3**

OBJECTIVES

- To understand electron displacement effects and halogen compounds
- To study isomerism in organic molecules
- To understand chemistry of colloids, emulsion and gels
- To learn about Chemical Kinetics and Chemical equilibrium
- To acquire knowledge about Separation and purification techniques

UNIT-I: ELECTRON DISPLACEMENT **(12 Periods)**

Inductive effect, Mesomeric, Resonance, Hyper Conjugations and Steric Effect. Polar effects. Inductive effect – Relative Strength of Aliphatic monocarbocylic acid and aliphatic amines.

Resonance – Condition for resonance - Consequences of resonance – resonance of energy. Basic Property of aniline and acidic property of phenol.

UNIT - II: ISOMERISM AND HETEROCYCLIC COMPOUNDS **(12 Periods)**

Structural isomerism - Optical isomerism – Lactic and Tartaric acid -condition for optical isomerism- enantiomers- diastereomers-– racemic mixture and resolution.

Geometrical Isomerism – maleic and fumaric acids.

Heterocyclic compounds: Furan, Pyrrole and Pyridine – preparation, properties and uses – basic properties of Pyridine and Pyrrole.

UNIT- III: COLLOIDS, EMULSION AND GELS (12 Periods)

Colloids: Definition, differences between true solution, colloidal solution and suspension, phases of colloidal solution-Electrical properties – Electrophoresis and Electro osmosis (definition and uses only) - protection of colloids – Gold number- medicinal applications of colloids.

Emulsion: definition, types, preparation, and applications-Emulsifying agents and Their importance. Gels: definition, types, preparation, properties and applications.

UNIT -IV: CHEMICAL KINETICS AND CHEMICAL EQUILIBRIUM (12 Periods)

Chemical kinetics: rate of reaction, order, molecularity, first order rate law, half-life period and derivation of the first order equation.

Chemical equilibrium: Criteria of homogeneous and heterogeneous equilibrium, Decomposition of HI, N_2O_4, $CaCO_3$ and PCl_5.

UNIT -V: SEPARATION AND PURIFICATION TECHNIQUES (12 Periods)

Separation Techniques: Distillation -Steam, Fractional and azeotropic distillation, crystallization-Principles, Working techniques and applications.

Chromatography-Principles, Experimental techniques and applications of Paper, thin layer and column Chromatography

UNIT- VI: ENERGETICS

Energetic: First law of thermodynamics – state and path function – need for the second law – carnots cycle and thermo- dynamic scale of temperature, spontaneous and Non – spontaneous processes – entropy – Gibbs free energy

TEXT BOOKS AND REFERENCES BOOKS

1. R.D Madan – “Modern Inorganic Chemistry” (1987), S. Chand & Co Pvt Ltd.
2. P.L. Soni – “Text book of Inorganic Chemistry. S. Chand & Co., New Delhi (1999).
3. P.L. Soni and H.M. Chawla - “Text Book of Organic Chemistry” - 28th Edition. (1999) - Sulthan and Chand company, New Delhi.
4. . Bahl, B.S. and Bahl, A., Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010)

5. B.R. Puri, L.R. Sharma, K.C. Kalia, 'Principles of Physical Chemistry', 21st edition, Vallabh Publications, 2004-2005.
6. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin Chand and Co. **:**
7. J. D. Lee, Concise Inorganic Chemistry, Blackwell Science Ltd., London (2006).
8. Sathya prakash., G.D.Tuli., S.K.Basu and R.D.Madan "Advanced Inorganic chemistry' Volume 1s.chand &company .
9. A.K. Srivastava – "Organic Chemistry" – 1st Edition.,(2002) – New Age International Publishers, New Delhi.
10 O.P.Agarwal Advanced orgcanic chemistry Sultan Chand & Co.,
11. Glasstone S. and Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co Ltd.

COURSE OUT COMES

CCO number	CO Statement	Knowledge level
	On the Successful completion of the course the student would be able	
CO1	To understand electron displacement effects and halogen compounds	K1
CO2	To know isomerism in organic molecules	K2
CO3	To learnchemistry of colloids, emulsion and gels	K2
CO4	To analyse Kinetics of reaction and Chemical equilibrium	K3
CO5	To aquire knowledge about Separation and purification techniques	K3

Mapping with Programme Outcomes and Programme Specific outcomes

Semester	Course code	Title of the Course					Hours	Credits			
II	24UBC2A2	ALLIED CHEMISTRY-II					4	4			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	3	1	3	2	1	2	2.2
CO2	2	2	3	3	2	3	2	1	2	2	2.2
CO3	3	2	3	2	3	2	3	3	3	2	2.6
CO4	2	2	3	3	2	3	3	2	2	1	2.3
CO5	1	3	2	1	3	2	3	3	3	3	2.4
Mean overall score											2.3(High)

ALLIED I & II PRACTICAL

LAB IN VOLUMETRIC AND ORGANIC QUALITATIVE ANALYSIS

(For Biochemistry students admitted from 2024-2025 onwards)

Semester :I	**Marks : 60**
Course code : 24 UBC1A2P	**Credits : 3**
Total periods : 45 +45 (90)	**Exam Hours: 3**

OBJECTIVES

- To enable the students to understand the concepts of volumetric analysis
- To learn the Organic qualitative analysis

I. VOLUMETRIC ANALYSIS 1. Acidimetric and Alkalimeter

(a) Strong acid VS strong base

(b) Weak acid VS strong base

2. Permanganometry

(a) Estimation of ferrous sulphate

(b) Estimation of oxalic acid

3. Iodometry

(a) Estimation of potassium dichromate

(b) Estimation of potassium permanganate

4. Complexometry

(a) Determination of Hardness of water

II. ORGANIC ANALYSIS

Analyze the following organic Compounds.

1. Carbohydrate, 2. Amide, 3. Aldehydes, 4. Ketone, 5. Acid & 6. Amine

The students may be trained to perform the specific reactions like tests for Element (nitrogen only), Aliphatic/ Aromatic, Saturated /Unsaturated and Functional group present and record their observations.

REFERENCES

1. R. Gopalan, Elements of analytical chemistry, S. Chand, New Delhi, 2000.
2. N. S. Gnanapragasam and G. Ramamurthy, Organic Chemistry lab manual,S.Viswanathan and Co. Pvt. Ltd. Chennai-1998

Note:Scheme for Practical Evaluation.

Organic Qualitative Analysis - 20

Volumetric Estimation -35

Record - 5

Internal Assessment - 40

Total: 100 Mark

Organic Qualitative Analysis: 20

Identification of Nitrogen - 4 marks

Saturated and unsaturated - 3 marks

Aliphatic or Aromatic - 3 marks

Preliminary reactions with

Procedure - 5 marks

Functional group identified

Correctly - 5 marks

Volumetric Analysis: 35

Procedure 5 marks

Results

< 2 % - 30 marks

2-3 % -20 marks

3-4 % - 10 marks

> 4 % - 5 marks

COURSE OUT COMES

CO Number	**CO Statement**	**Knowledge level**
	On the Successful completion of the course the student would be able	
CO1	To carry out volumetric analysis	K1
CO2	To identify organic compounds	K2
CO3	To estimate hardness of water	K3

Mapping with Programme Outcomes and Programme Specific outcomes

Semester	Course code		Title of the Course							Hours	Credits
I&II	24 UBC1A2P		LAB IN VOLUMETRIC AND ORGANIC QUALITATIVE ANALYSIS							3	3
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	2	3	3	2	3	2	2.5
CO2	2	2	3	3	2	3	2	3	2	3	2.5
CO3	3	2	3	2	2	2	3	3	3	3	2.6
Mean overall score											2.5(High)

Semester	Course code	Title of the course	Hours	Credits
II	24U2EVS	Environmental Studies	2	2

Objectives

To understand the natural resources and conservation, public health, environmental monitoring and remediation, industrial environmental management, or research or education of environmental science.

Unit 1: **(5** Periods**)**

Multidisciplinary nature of environmental studies. Definition, scope and importance need for publicawareness.

Unit 2: Natural Resources: **(6** Periods**)**

Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber Extraction,mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, Floods, drought, conflictsover water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineralresources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water Logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use ofalternate energy sources. Case studies.

f) Land resources: Land as a resource, land degradation, man induced Landslides, soil erosion anddesertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems **(6** Periods**)**

Concept of an ecosystem. : Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem :-

A. Forest ecosystem. B. Grassland ecosystem. C. Desert ecosystem

D. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit 4: Biodiversity and its conservation **(6** Periods**)**

- Introduction – Definition: genetic, species and ecosystem diversity.
- Bio geographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aestheticand option values
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit 5: Environmental Pollution and Social Issues and the Environment (7 Periods)

Definition, Cause, effects and control measures of:-

a. Air pollution. Water pollution c. Soil pollution. Marine pollution. Noise pollution Thermal pollution. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and Industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies.

Diaster management: floods, earthquake, cyclone and landslides.

From Unsustainable to Sustainable development

Urban problems related to energy

Water conservation, rain water harvesting, watershed management

Resettlement and rahabilitation of people; its problems and concerns. Case Studies

Environmental ethics: Issues and possible solutions.

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.Case Studies.

Wasteland reclamation.

- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act

- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

References

1. Agarwal KC, 2001. Environmental Biology, Nidi Publishers Ltd. Bikaner.
2. Bharucha Erach, 2003. The Biodiversity of India, Mapin Publishing Pvt. Ltd Ahmedabad -380013, India.
3. Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
4. Clark RS, Marine Pollution, Clanderson Press, Oxofrd (TB).
5. Cunningham WP, Cooper TH, Gorhani E & Hepworth MT, 2001. Environmental Encyclopaedia,Jaico Publishing House, Mumbai, 1196pgs.
6. Gleick HP, 1993. Water in Crisis, Pacific Institute for Studies in Development, Environment and Security. Stockholm Environmental Institute, Oxford University Press, 473pgs.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Define and explain the scope and importance of environmental studies, including the multidisciplinary nature and public awareness needs.	K1, K2
CO2	Discuss the types and issues of natural resources, including renewable and non-renewable resources, and assess the role of individuals in conservation.	K2, K3
CO3	Describe ecosystem concepts, structure, function, and types, analyzing ecological roles of producers, consumers, and decomposers in various ecosystems.	K2, K4
CO4	Explain biodiversity and conservation methods, identify threats, and evaluate conservation strategies at global, national, and local levels.	K2, K5
CO5	Identify and examine major environmental issues like pollution and social challenges, discussing laws and individual actions for sustainability.	K1, K3, K4, K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course					Hours	Credits			
II	24U2EVS	Environmental Studies					2	2			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.3
CO-2	2	1	2	2	2	2	3	2	3	2	2.1
CO-3	2	2	1	2	3	2	3	2	3	2	2.2
CO-4	2	1	3	3	2	3	2	2	3	2	2.3
CO-5	3	2	2	2	1	3	2	2	3	2	2.2
Mean overall score											2.2 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24UBC3C5	CC-V: BIOCHEMICAL TECHNIQUES	5	5

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.

Unit I **(18 Periods)**

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

Unit II **(18 Periods)**

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

Unit III **(18 Periods)**

Chromatography Techniques: Principles of chromatography, size exclusion, Ion-exchange and affinity chromatography's. High performance liquid chromatography (HPLC), Gas liquid chromatography (GLC), Thin layer chromatography (TLC), Paper chromatography, GC-MS, LC- MS, Maldi Tof, ICPMS and Surface Plasma Resonance methods.

Unit IV **(18 Periods)**

Electrophoresis: General principles, Electrophoresis of proteins: SDS-PAGE, Native gels, Gradient gel, Isoelectric focusing, 2-D gel electrophoresis (2-D PAGE), cellulose acetate electrophoresis, continuous flow electrophoresis; Detection, estimation and recovery of proteins. Electrophoresis of nucleic acids: agarose gel electrophoresis of DNA, Pulse field gel electrophoresis, electrophoresis ofRNA, Capillary electrophoresis.

Unit V **(18 Periods)**

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 radioisotopes in biology.

TEXT BOOK(S)

1. Biophysical Chemistry -Principle and Techniques-Upadhyay- Upadhyay Nath.2009.
2. Frei Felder D. M. Physical Biochemistry- Application to Biochemistry and Molecular Biology, 2nd ed., W.H. Freeman, 1982.
3. Techniques in Biochemistry – Punit Puri (2021).
4. "Centrifugation: Principles and Applications" by T. S. L. S. K. I. A. T. N. N. C. F. H. Van der Voet
5. "Biological Separation Processes" by R. G. W. C. W. L. M. H. D. F. Van der Meer

REFERENCE BOOK(S)

1. Frei Felder D. M. Physical Biochemistry- Application to Biochemistry and Molecular Biology,2nd ed., W.H. Freeman, 1982.
2. "Principles and Practice of Centrifugation" by J. C. N. K. Horne
3. Wilson & Walker. Principles and Techniques in Practical Biochemistry. 5th ed.
4. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st ed. Wiley-Liss,2001.
5. Analytical Techniques in Biochemistry (Mahin Basha -2020)

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Develop competence in handing various chromatographic techniques and apply them in isolating and characterizing different biological molecules.	Kl & K2
CO2	Understanding the applications of centrifugation and chromatography in biological investigations	Kl, K2 & K3
CO3	Purify proteins by affinity chromatography using epitope tags such as histidine tag, GST tag, Flag tag etc.	K2, K3 &K4
CO4	Learn about the various instruments handling	K2& K3
CO5	Characterizing different biological molecules.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course					Hours	Credits			
III	24UBC3C5	CC-V: BIOCHEMICAL TECHNIQUES					5	5			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	3	2	2	2	2	3	2	3	2	2.4
CO-2	2	2	2	2	2	2	3	2	3	2	2.3
CO-3	2	2	1	2	3	2	3	2	3	2	2.3
CO-4	2	2	2	2	2	3	2	2	3	2	2.4
CO-5	2	2	2	1	3	3	2	2	3	2	2.4
Mean overall score											2.4 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24UBC3C6P	CP-VI: LAB IN BIOCHEMICAL TECHNIQUES	04	03

Objectives:

1. To study the techniques used in understanding the biological process
2. To understand the principle and application of Bioinstrumentation.

Practical **(45 Periods)**

1. Preparation of buffers and measurement of pH.
2. Estimation of Glycine- Formal Titration.
3. Measurement of Blood Pressure.
4. Calculate Body Mass Index.
5. Handling of Colorimeter
6. Handling of Spectrophotometer
7. Handling of laboratory centrifuge

ANALYTICALTECHNIQUES

8. Separation of sugar & amino acid by paper chromatography
9. Separation of lipid by thin layer chromatography
10. Separation of plant pigments by column chromatography

TEXT BOOK(S)

1. Methods in Enzymology Vol. I and II by S.P. Colowick and N.O. Kaplan eds. New York:Academia Press 1955.
2. A Textbook of Practical Biochemistry by David Plummer. Tata Mc Graw Hill Education,1988.
3. Varley's Practical Clinical Biochemistry by Alan H Gowenlock, published by CBS Publishersand distributors, India Sixth Edition,

REFERENCE BOOK(S)

1. A Textbook of Practical Biochemistry by David Plummer. Tata Mc Graw Hill Education,1988.
2. Laboratory Mannual in Biochemistry by J. Jayaraman. New Age International Publishers. 2ndEdn. 1981.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Understand about the principle of techniques.	Kl & K2
CO2	Understanding the applications of centrifugation	Kl, K2 & K3
CO3	Learn about the chromatography techniques	K2, K3 & K4
CO4	properties of Nucleic acids and Vitamins	K2 & K3

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course					Hours	Credits			
III	24UBC3C6P	CP-VI: LAB IN BIOCHEMICAL TECHNIQUES					4	3			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	3	3	3	3	3	3	3	3.0
CO-2	3	3	2	2	3	3	3	3	3	3	2.8
CO-3	3	3	2	3	3	3	3	3	3	3	2.8
CO-4	3	3	3	3	3	3	3	3	3	3	3.0
CO-5	3	3	3	2	3	3	3	3	3	3	2.8
Mean overall score											2.8 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24UBC3A3	AC-III: MICROBIOLOGY-I	4	4

Objectives: The aim of Microbiology is to introduce basic principles and application relevance of clinical disease.

Unit -I **(12 Periods)**

Introduction and history of Microbiology-contribution of Louis Pasteur, Robert Koch, Alexander Fleming, Anton Van Leeuwenhoek, Joseph Lister, & Needham. Concepts of origin of life- abiogenesis and biogenesis, Spontaneous generation theory. Scope of Microbiology.

General structure of Fungi, Algae and Protozoa, General characters of viruses, structure, classification, multiplication and cultivation. Structure and replication of bacteriophages.

Unit-II **(12 Periods)**

Microscopy- Principles & uses of bright field, dark field, phase contrast, fluorescent, electron microscopy (TEM&SEM). Principles of staining of bacteria- simple staining, Negative staining, Gram's staining, Acid fast staining (Ziehl Neelsen staining), spore staining & staining of metachromatic granule

Unit-III **(12 Periods)**

Morphology and anatomy of bacterial cell- Cell size, shape, arrangement. Structure of Prokaryotic plasma membrane, cell wall, capsule, slime layer, S-layer, flagella, pili, nucleoid, inclusion bodies, endospore.

Unit-IV **(12 Periods)**

Culture media- Nutritional requirements of bacteria, classification of media. Methods of isolation of pure cultures - Serial dilution technique, streak plate method, pour plate method, spread plate method. Anaerobic culture methods. Preservation of cultures- refrigeration, deep-freezing, freeze drying (lyophilization).

Unit- V **(12 Periods)**

Sterilization (physical and chemical methods)-Sterilization by heat (Moist heat, dry heat and incineration), radiation (ionizing radiations and Ultraviolet rays), aldehydes and disinfectants. Factors influencing sterilization.

TEXT BOOK(S)

1. Prescott LM, Harley JP and Klein DA (2003) Microbiology (10th edition) McGraw Hill, New York.

2. Pelczar Jr, M.J. Chan, E.C.S and Krei N.R (1993) Microbiology McGraw Hill, New York.
3. Michael Madigan, John Martinko, David Stahl and David Clark (1997) Brock Biology ofMicroorganisms (Thirteenth Edition) Pearson International edition.

REFERENCE BOOK(S)

1. "Microbiology: A Systems Approach" by Marjorie Kelly Cowan.
2. "Microbiology: An Introduction" by Gerard J. Tortora, Berdell R. Funke, and Christine L. Case
3. "Brock Biology of Microorganisms" by Michael T. Madigan, John M. Martinko, David A. Stahl, and David P. Clark
4. "Bergey's Manual of Systematic Bacteriology" by David R. Boone and Richard W. Castenholz
5. "Microbial Control and Sterilization" by William A. Rutala

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels(K-Levels)
CO1	To become aware with the contributions of Louis Pasteur, Edward Jenner and Robert Koch in microbiology and immunology.	Kl & K2
CO2	To get acquainted with the discovery of antibiotics and their targets, drug/antibiotic resistance,	Kl, K2 & K3
CO3	Understanding the importance of microorganisms as model systems in genetics and biochemistry.	K2, K3 & K4
CO4	Provides the preventive and therapeutic approaches of infectious diseases, hospital acquired infections	K2& K3
CO5	Gives an idea about techniques	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcome

Mapping with Programme Outcomes

Semester	Course code	Title of the Course					Hours	Credits			
III	24UBC3A3	AC-III: MICROBIOLOGY-I					4	4			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	3	3	3	3	3	3	3	3.0
CO-2	3	3	2	2	3	3	3	2	3	3	2.7
CO-3	3	3	2	3	3	3	3	3	2	3	2.7
CO-4	3	3	3	3	3	3	3	3	3	3	3.0
CO-5	3	3	3	2	3	3	3	3	2	3	2.7
Mean overall score	**2.6 (High)**										Mean overall score

Semester	Course code	Title of the course	Hours	Credits
III	24UBC3A2P	AP-III & IV: LAB IN MICROBIOLOGY	3	-

Objectives: The objectives of the Microbiology are to introduce basic principles and application relevance of clinical disease for students. It covers all biology of bacteria, viruses and other pathogensrelated with infectious diseases in humans.

Part I **(22 Periods)**

1. Laboratory precautions- General rules and regulations.
2. Common instruments in Microbiology laboratory.
3. Cleaning and sterilization of glass wares.
4. Preparation of media.
5. Isolation of pure culture - Isolation of bacteria by pours plate, streak plate and spread plate methods.
6. Cultural characteristics of Microorganisms - Colony morphology on culture plate.

Part II **(23 Periods)**

7. Study of the various components of the microscope, its handling and maintenance.
8. Preparation of bacterial smear
9. Staining of bacteria:
    - Simple staining of bacteria,
    - Gram staining,
    - Negative staining,
    - Spore staining,
    - Volutin granule staining
10. Motility of bacteria by hanging drop method.

TEXT BOOK(S)

1. Aneja, K.R (2003) Experiments in Microbiology, Plant Pathology and Biotechnology (4th edition),New age international, New Delhi.
2. James G. Cappuccino and Natalie Sherman (2014) Microbiology: A Laboratory Manual (10thEdition), Pearson

REFERENCE BOOK(S)

1. Sundaraj T, Aswathy Sundarraj (2002), Microbiology Laboratory Manual (First edition),

Chennai.

Dubey, R.C and Maheshwari, O.K (2005) Practical Microbiology, S Chand and Co.
2. Ltd., (Firstedition), New Delhi.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Students gain knowledge about the different cell organelles of microorganisms	Kl & K2
CO2	Students learn about their detailed functions.	Kl, K2 & K3
CO3	Students will also study the growth and control of microbes	K2, K3 &K4
CO4	Learn about bacteriological techniques involved in microbiology.	K2 & K3
CO5	Students will learn about the biomolecules by studying their structures and types.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code		Title of the Course							Hours	Credits
III	24UBC3A2P		AP-III&IV: LAB IN MICROBIOLOGY							3	3
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	3	3	3	3	3	3	3	3.0
CO-2	2	2	2	2	3	2	2	2	2	2	2.2
CO-3	2	2	2	3	3	2	2	2	2	2	2.2
CO-4	3	3	3	3	3	3	3	3	3	3	3.0
CO-5	2	2	2	2	3	2	2	2	2	2	2.2
Mean overall score											2.34 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24UBC3N1A	NME: HEALTH AND NUTRITION	02	02

Objectives: The objectives of the Health and Nutrition are to introduce Body development andmaintenance, Energy provision.

Unit – I **(6 Periods)**

Health - definition, Factors affecting human health. Importance of health care of children, adults andelderly people. Balanced diet and calorific value.

Unit -II **(6 Periods)**

Vitamins-definition, classification, sources, properties, functions and deficiency symptoms.Recommended daily allowances.

Unit -III **(6 Periods)**

Sources and functions of dietary fats, role of fats and lipids in health. Calorific value.

Unit – IV **(6 Periods)**

Minerals- Role of minerals on human health, sources, biological functions, deficiency disorders withspecial reference to Calcium, Phosphorus, Potassium, Copper, Iron, Zinc and Selenium. Minerals inbiological systems and their importance –Iron, Calcium, Phosphorus, Iodine, Copper, Zinc.

Unit – V **(6 Periods)**

Role of proteins and carbohydrates in health. Functions of protein and carbohydrate and their calorific value. Dietary sources and deficiency disorders – Kwashiorkor and Marasmus supplementation programmes in India and their implications.

TEXT BOOK(S)

1. S.Davidson and J.R.Passmore (1986) Human Nutrition and Dietetics, (8th ed),ChurchillLivingstone
2. J. S. Garrow, W. Philip T. James, A. Ralph (2000), Human Nutrition and Dietetics(10thed Churchill Livingstone)
3. M.Swaminathan (1995) Principles of Nutrition and Dietetics, Bappco
4. Margaret Mc Williams (2012) . Food Fundamentals (10th ed) ,Prentice Hall.
5. Textbook of Nutrition and Dietetics" by S. Swaminathan

REFERENCE BOOK(S)

1. Food, Nutrition, and Health -Dr.Shashi Goyal and Pooja Gupta (2012).
2. Food Nutrition and Health-Beena Mathur.2019.
3. Human Health and Nutrition: New Research-2015 Sergej M. Ostojic
4. "Human Nutrition: Science for Healthy Living" by K. S. Joshi.
5. "Advanced Nutrition and Human Metabolism" by Sareen S. Gropper, Jack L. Smith

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Students gain knowledge about the Health and calorific value.	Kl & K2
CO2	Students learn about their detailed functions of sources of dietary fat	Kl, K2 & K3
CO3	Students will also study the Vitamins and Minerals	K2, K3 &K4
CO4	Learn about dietary sources and Deficiency disorder.	K2 & K3
CO5	Students will learn about the diseases condition.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific Outcomes

Mapping with Programme Outcomes:

Semester	Course code		Title of the Course							Hours	Credits
III	24UBC3N1A		HEALTH AND NUTRITION							02	02
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	2	3	2	2	3	1	2	2.5
CO-2	3	3	3	2	3	2	3	2	1	3	2.7
CO-3	3	2	3	2	3	3	3	2	2	2	2.6
CO-4	3	3	3	3	2	2	3	3	2	2	2.8
CO-5	2	2	2	2	3	2	3	2	1	3	2.3
Mean overall score											2.78 (High)

Semester	Course code	Title of the course	Hours	Credits
III	24UBC3N1B	NME: NUTRITION FOR WOMEN	02	02

Objectives: Understand the role of nutrition in different stages of life cycle. Gain experience in Planning menu for different stages. Develop skills in organizing and evaluating nutrition projects in the community.

Unit -I **(6 Periods)**

Principles of Nutrition - Nutrients and their functions. Food groups, meal planning, Balanced diet,RDA, over nutrition, under nutrition, malnutrition.

Unit -II **(6 Periods)**

Nutrition during Pregnancy- Physiological changes during pregnancy. Importance of Nutritionduring pregnancy. Complications in pregnancy, food and nutritional requirements.

Unit -III **(6 Periods)**

Nutrition during Lactation- Physiology and psychology of lactation, hormonal control, compositionof colostrum's and breast milk, nutritional requirements of a nursing mother.

Unit- IV **(6 Periods)**

Nutritional care of Infants- Birth weight, growth and development, advantages of breast feeding, food and nutritional requirements for infants, weaning and supplementary foods for infants and immunization**.**

Unit- V **(6 Periods)**

Nutrition for Adolescents- Growth and development, nutritional requirements, nutritional problems,food habits and factors influencing food intake.

TEXT BOOK(S)

1. Mahtab, S, Bamji, Kamala Krishnasamy, G.N.V. Brahmam, Text Book of Human Nutrition, Third Edition, Oxford and IBH Publishing Co. P. Ltd., New Delhi, 2012.
2. Srilakshmi, B., Dietetics, New Age International (P) Ltd., New Delhi, 2013.
3. Swaminathan, M., Advanced Textbook on Food and Nutrition, Vol. 1, Second Edition,Bangalore Printing and Publishing Co. Ltd., Bangalore, 2012.
4. "Textbook of Pediatric Nutrition" by Victor R. Preedy
5. "Textbook of Adolescent Nutrition" by Louise S. Upton and Jennifer S. Fanning

REFERENCE BOOK(S)

1. Dietary Guidelines for Indians, ICMR, National Institute of Nutrition, Hyderabad, 2013.
2. Gopalan, C. Rama Sastri B.V. and Balasubramanian, Nutritive Value of Indian Foods, NIN,ICMR, Hyderabad, 2014.
3. Krause, M.V. and Hunscher, M.A., Food, Nutrition and Diet Therapy, 14th Edition, W.B.Saunders
4. "Infant and Child Nutrition" by David B. M. H. Allen and Elaine W. F. Smith
5. "Adolescent Nutrition: A Guide to Healthy Eating" by Carolyn L. Iddins and Judith R. Morrow

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Understand the basic concepts of principle of nutrition	Kl & K2
CO2	Gain knowledge on Nutrition during pregnancy	Kl, K2 & K3
CO3	Acquire knowledge on functions and Nutritional care of Infants	K2, K3 &K4
CO4	Relate metabolism of different nutrients with dietary intake.	K2 & K3
CO5	Suggest preventive measures to overcome metabolic abnormalities.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course								Hours	Credits
III	24UBC3N1B	NME-P-1: NUTRITION FOR WOMEN								02	02
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	2	3	2	3	2	2	3	1	2	2.5
CO-2	3	3	3	2	3	2	3	2	1	3	2.7
CO-3	3	2	3	2	3	3	3	2	2	2	2.6
CO-4	3	3	3	3	2	2	3	3	2	2	2.8
CO-5	2	2	2	2	3	2	3	2	1	3	2.3
Mean overall score											**2.58 (High)**

Semester	Course code	Title of the course	Hours	Credits
III	24UBC3N1C	NME: NANOMEDICINE	02	02

Objectives: Nanotechnology, along with related concepts such as nanomaterials, nanostructures and nanoparticles, has become a priority area for scientific research and technological development.

Unit-I **(6 Periods)**

Introduction to nanomedicine; class overview, Types of nanomaterials, Tools and methodology I. Surface and size characterization (AFM, EM, Electrophoresis, BET, TGA)

Unit-II **(6 Periods)**

Tools and methodology II. Chemical property characterization (FTIR, electrochem, NMR, MS, LC), Cellular processes at nanoscale, Nano nephrology

Unit-III **(6 Periods)**

Nano neurology and molecular imaging, Drug delivery (modes and example applications), Nanomedicine and cancer (diagnostic and imaging)

Unit- IV **(6 Periods)**

Toxicity of nanomaterials in medicine, Application of Nano system in Medicine, Nanomedicine in drug delivery and detoxification, Nanomedicine in immunotherapy

Unit-V **(6 Periods)**

Nanomedicine in diagnostics and bioimaging, Drug administration and transport by fluid motion Drug dispersion and diffusion in biological systems, Drug permeation through biological barriers Pharmacokinetics and biodistribution, Ligand-receptor engineering and targeted delivery, Case studies in nanomedicine

REFERENCE

1. Nanomedicine-Huw summers – 5th edition -2013
2. Nanomedicine in treatment of diseases-2023 Bushra Akhtar, Faqir Muhammad, Ali Sharif .
3. Principles of Nanotechnology-Phani Kumar 2nd edition
4. "Nanotechnology in Medicine: Perspectives and Prospects" by Rainer G. R. Böhm, Susanne Schmidt, and Dietmar W. Hutmacher.
5. "Nanobiotechnology: Concepts, Applications and Perspectives" edited by Christoph Borner, Daniel M. K. M. Matthias, and Heribert Inspek

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Understand the basic concepts of Nanomedicine	Kl & K2
CO2	Gain knowledge on nanomaterials and its uses	Kl, K2 & K3
CO3	Acquire knowledge on nanomaterials uses in medicine fields	K2, K3 &K4
CO4	Gain the knowledge about nanomedicine uses in nano therapy	K2 & K3
CO5	Understand the basic concepts of bioimaging	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course					Hours	Credits			
III	24UBC3N1C	NME: NANOMEDICINE					02	02			
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	2	3	2	3	3	1	2	2.7
CO-2	3	3	3	3	3	2	3	3	1	3	2.9
CO-3	3	3	3	3	3	3	3	3	2	2	3.0
CO-4	3	3	3	3	3	3	3	3	2	2	3.0
CO-5	2	3	2	3	3	2	3	3	2	3	2.7
Mean overall score											2.86 (High)

Semester	Course code	Title of the course	Hours	Credits
IV	24UBC4C7	CC-VII: ENZYMES	05	05

Objectives: By the end of the course, the students should be able to demonstrate advanced knowledge and understanding in the Enzymes and Enzyme Kinetics.

UNIT- I **(20 Periods)**

History and terminology, nomenclature and classification of enzymes. Holoenzymes, metalloenzymes, metal activated enzymes, monomeric enzymes, oligomeric enzymes, ribozymes. Enzyme specificity, units of enzyme activity. Non protein enzymes - ribozymes and Abzymes.

UNIT- II **(16 Periods)**

Enzyme kinetics- Factors affecting enzyme activity- Michaelis-Menten equation analyses of kinetic data- Lineweaver-burk plot- catalytic efficiency- Haldane relationship- Hill‘s plot- Bisubstrate reactions- sequential - ping-pong reactions rate equations and examples. Enzyme inhibition- Irreversible- reversible- competitive- non-competitive - uncompetitive inhibition- Graphical analysis.

UNIT- III **(18 Periods)**

Enzymatic catalysis- acid-base catalysis- covalent catalysis- metal ion catalysis electrostatic catalysis- catalysis through proximity and orientation effects catalysis by transition state binding. Coenzymes: Structure and function of coenzymes– Thiamine pyrophosphate, nicotinamide nucleotides, Flavin nucleotides, Coenzyme A, Lipoate, Folate and biotin. Isoenzymes: Definition, features and clinical significance with examples – Lactate dehydrogenase (LDH) and creatine kinase(CK).

UNIT- IV **(18 Periods)**

Mechanism of enzyme action- active site Characteristics, Lock and Key model, induced fit hypothesis. Mechanism of enzyme catalysis, enzyme-substrate complex formation, mechanism of substrate reactions. Mechanism of action of chymotrypsin, lysozyme and carboxypeptidase.

UNIT- V **(18 Periods)**

Immobilized Enzymes: Principles, methods and applications of immobilized enzymes. Regulation of enzyme activity- allosteric control- reversible covalent modification- proteolytic activation- sequential- concerted and cumulative feedback control- importance of compartmentation- Allosteric enzymes- Jacob and Monod model of allosteric enzymes-

Koshland model- subunit interaction and regulation of enzyme activity – ATCase. Applications of enzymes- in food, textile and leather industries and role of enzymes in medicine

TEXT BOOK(S)

1. Enzymes - Dixon, E.C Webb, CJR Thorne and K.F. Tipton, Longmans, London.
2. Fundamentals of Enzymology 2 ed., (1998) - Nicholas C.Price, Lewis Stevans, OxfordUniversity Press, First Edition (1990).
3. Understanding Enzymes, Trevor Palmer, Ellis Horwood Limited, Third Edition (1991).
4. Protein Biotechnology, Gary Walsh and Denis Headon, John Wiley and Sons, 1994.
5. Protein Biochemistry and Biotechnology, Gary Walsh and John Wiley and Sons Ltd. 2002.

REFERENCE BOOK(S)

1. Nelson.D.L, Cox. M. M. Lehninger_s Principle of Biochemistry. 4th ed. Freeman, 2004
2. Berg.J.M, Tymoczko.J.L, Stryer, L. Biochemistry. 6th ed. Freeman, 2006.
3. Dixon & Webb. Enzymes. 3rd ed. Longmans, 1979.
4. Murray. R.K, Granner.D.K, Mayes. P. A, Rodwell. V. W. Harper's Biochemistry. 27th ed.McGraw Hill, 2006
5. "Industrial Enzymes: Structure, Function and Applications" by Christoph P. L.

COURSE OUTCOME MAPPING WITH KNOWLEDGE LEVEL

CO No.	CO-STATEMENTS	Cognitive Levels (K-Levels)
	On the Successful completion of the course the student would be able to	
CO1	To acquire fundamental knowledge on enzymes and their importance in biological reactions.	Kl & K2
CO2	To understand ability to difference between a chemical catalyst and biocatalyst.	Kl, K2 & K3
CO3	Exposure to the concept of activation energy and its importance in biological reactions.	K2, K3 &K4

CO4	Exposure to the nature of non-protein enzymes such as ribozymes.	K2 & K3
CO5	Understanding the role of enzymes in clinical diagnosis and industries.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific Outcomes

Mapping with Programme Outcomes:

Semester	**Course code**		**Title of the Course**							**Hours**	**Credits**
IV	**24UBC4C7**		**CC-VII: ENZYMES**							**05**	**05**
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	3	3	3	3	3	3	3	1	2	2.9
CO-2	3	3	3	3	3	2	3	3	1	3	2.9
CO-3	3	3	3	3	3	3	3	3	2	2	3.0
CO-4	3	3	3	3	3	3	3	3	2	2	3.0
CO-5	3	3	3	3	3	3	3	3	2	3	3.0
Mean overall score											**3.0 (High)**

Semester	Course code	Title of the course	Hours	Credits
IV	24UBC4C8P	CP-VIII: LAB IN ENZYMES ANALYSIS	04	03

Objectives: To assay the activity of enzymes from different sources.

Practical **(45 Periods)**

1. Estimation of protein by Biuret's method.
2. Estimation of Phosphorus – Fiske Subbarow method.
3. Estimation of Iron – Wong's method
4. Estimation of sodium and potassium by Flame photometry
5. Determination of specific activity, effect of pH, temperature and substrate concentration of a. Salivary Amylase b. Urease
6. Estimation of AST/ (SGOT)-Serum Glutamate Oxaloacetic transaminase.
7. Estimation of ALT/ (SGPT)- Serum Glutamate Pyruvate transaminase.
8. Determination of activity Acid Phosphatase.
9. Determination of activity Alkaline Phosphates.
10. Measurement of Superoxide dismutase in Plant extract.

TEXT BOOK(S)

1. Varley_s Practical Clinical Biochemistry by Alan H Gowenlock, Published by CBSPublishers and distributors, India Sixth Edition (1998).
2. Analytical Biochemistry & separation Techniques- Palanivelu Third edition (2004)
3. Biochemical calculations- Irwin H Segel, second edition, John Wiley & sons,USA (1976).

REFERENCE BOOK(S)

1. Tietz Fundamentals of Clinical chemistry- Burtis and Ashwood, Fifth Edition, WBSaunders Company. Oxford Science Publications USA, (2001).
2. Practical Biochemistry – Keith Wilson & John Walker, fifth Edition,Cambridge UniversityPress, UK (2000).

COURSE OUTCOME MAPPING WITH KNOWLEDGE LEVEL

CO No.	CO-STATEMENTS	Cognitive Levels (K-Levels)
	On the Successful completion of the course the student would be able to	
CO1	Understand and explain various biochemical methods for estimating proteins, phosphorus, and iron.	K2
CO2	Apply flame photometry to estimate sodium and potassium in biological samples.	K3
CO3	Analyze and determine the enzyme activity of salivary amylase and urease under varying conditions (pH, temperature, substrate concentration).	K4
CO4	Analyze and interpret the enzyme activities of AST (SGOT) and ALT (SGPT) in serum	K4
CO5	Understand and measure the activity of different phosphatases and superoxide dismutase in plant extracts	K2

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course					Hours	Credits		
IV	24UBC4C8P	CP-VIII: LAB IN ENZYMES ANALYSIS					04	03		
Couse outcomes	Programme outcomes(POs)					Programme Specific Outcomes(PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	3	2	3	3	3	1	2	2.7
CO-2	3	3	3	3	2	2	3	3	1	3	2.7
CO-3	3	3	3	3	3	3	3	3	2	2	2.8
CO-4	3	3	3	3	2	3	3	3	2	2	2.8
CO-5	3	3	3	3	3	3	3	3	2	3	2.8
Mean overall score											2.7 (High)

Semester	Course code	Title of the course	Hours	Credits
IV	24UBC4A4	AC-IV: MICROBIOLOGY -II	04	04

Objectives: In this course the meaning of food microbiology and interaction between microorganismand foods and how food spoilage will be study.

Unit-I **(9 Periods)**

Food as a substrate for microbes – Microbes involved in food microbiology – Mould, Yeast, Bacteria-Factors affecting the growth of Microorganisms in food. Principles of food preservation – Asepsis-Removal of microorganisms, anaerobic conditions – high and low temperatures – drying – radiation – chemical preservatives – food additives.

Unit- II **(9 Periods)**

Collection and transport of clinical specimens for microbiological examination – Virulence factorsof bacteria causing human infections – Normal flora of human body. Staphylococcus aureus, Streptococcus pyogenes, *S.pneumoniae*, Neisseria gonorrhoeae, *N.meningitidis*.

Unit -III **(9 Periods)**

Food-borne diseases – Food poisoning – infective and toxic bacterial food borne diseases and their diagnosis – Food sanitation and its control measures.

Unit -IV **(9 Periods)**

Food spoilage – General principles – underlying food spoilage and contamination – Cereals, vegetables, fruits, and poultry products, meat, fish, sea foods. Microorganisms in milk and milk products – Yoghurt, butter milk, butter and cheese – Quality control of Milk – MBRT, SPC, Phosphatase tests.

Unit -V **(9 Periods)**

Basic concepts of Virology - General characteristics of viruses, differences between bacteria and viruses. Classification of viruses Physical and chemical Structures of different Viruses on the basis of capsid symmetry - enveloped (Herpes virus), helical (TMV) and icosahedral (Polyoma viruses), Capsids, complex (Bacteriophage, and Virion size, enveloped (Herpes), helical (TMV) and icosahedral (Polyoma), Capsids.

REFERENCE BOOK(S)

1. Adams MR Moss MO (2004). Food Microbiology, 2nd Edition, Panima Publishing House,New Delhi.
2. James M Jay (2003). Modern Food Microbiology. 4th Edition, CBS Publishers & Distributors, New Delhi. Bioinformatics basic skills and applications –Rastogi.
3. Frazier WC and Westhoff DC (1988). Food Microbiology, 4th Edition, Mc Graw Hill, NewYork.

4. "Food Microbiology" by Frazier, W.C. & Westhoff, D.C.
5. "Fields Virology" **by** David M. Knipe & Peter M. Howley

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	To know the contribution of gut microbiome in human health	Kl & K2
CO2	Exposure to the basic concepts of metabolic engineering and synthetic biology	Kl, K2 & K3
CO3	To understand the concepts of fight against major killer diseases – Tuberculosis and HIV.	K2, K3 & K4
CO4	Provides the preventive and therapeutic approaches of infectious diseases, hospital acquired infections	K2& K3
CO5	Gives an idea about techniques	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course					Hours	Credits			
IV	24UBC4A4	AC-IV: MICROBIOLOGY -II					04	04			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	1	2	3	2	2	1	3	2.3
CO-2	2	3	3	2	3	3	3	2	3	3	2.7
CO-3	3	3	2	2	2	2	3	3	3	2	2.5
CO-4	2	2	3	3	2	3	2	3	2	3	2.5
CO-5	1	3	2	3	3	2	2	2	3	2	2.4
Mean overall score											2.56 (High)

Semester	Course code	Title of the course	Hours	Credits
III & IV	24UBC3A2P	AP-III &IV: LAB IN MICROBIOLOGY	03	03

Objectives: The objectives of the Microbiology are to introduce basic principles and application relevance of clinical disease for students. It covers all biology of bacteria, viruses and other pathogensrelated with infectious diseases in humans.

Part I **(22 Periods)**

Laboratory precautions- General rules and regulations.

1. Common instruments in Microbiology laboratory.
2. Cleaning and sterilization of glass wares.
3. Preparation of media.
4. Isolation of pure culture - Isolation of bacteria by pours plate, streak plate and spread platemethods.
5. Cultural characteristics of Microorganisms - Colony morphology on culture plate.

Part II **(23 Periods)**

6. Study of the various components of the microscope, its handling and maintenance.
7. Preparation of bacterial smear
8. Staining of bacteria:
    - Simple staining of bacteria,
    - Gram staining,
    - Negative staining,
    - Spore staining,
    - Volutin granule staining
9. Motility of bacteria by hanging drop method.

TEXT BOOK(S)

1. Aneja, K.R (2003) Experiments in Microbiology, Plant Pathology and Biotechnology (4thedition), New age international, New Delhi.
2. James G. Cappuccino and Natalie Sherman (2014) Microbiology: A Laboratory Manual (10thEdition), Pearson

REFERENCE BOOK(S)

1. Sundaraj T, Aswathy Sundarraj (2002), Microbiology Laboratory Manual (First

edition),Chennai.

2. Dubey, R.C and Maheshwari, O.K (2005) Practical Microbiology, S Chand and Co. Ltd., (Firstedition), New Delhi.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Students gain knowledge about the different cell organelles of microorganisms	Kl & K2
CO2	Students learn about their detailed functions.	Kl, K2 & K3
CO3	Students will also study the growth and control of microbes	K2, K3 &K4
CO4	Learn about bacteriological techniques involved in microbiology.	K2 & K3
CO5	Students will learn about the biomolecules by studying their structures and types.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course					Hours	Credits			
III & IV	24UBC3A2P	AP-III &IV: LAB IN MICROBIOLOGY					03	03			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	3	1	2	3	2	2	1	3	2.3
CO-2	2	3	3	2	3	3	3	2	3	3	2.7
CO-3	3	3	2	2	2	2	3	3	3	2	2.5
CO-4	2	2	3	3	2	3	2	3	2	3	2.5
CO-5	1	3	2	3	3	2	2	2	3	2	2.4
Mean overall score											2.48 (High)

Semester	Course code	Title of the course	Hours	Credits
IV	24UBC4N2A	NME-II: MEDICINAL DIET	02	02

OBJECTIVES

- Provide basic knowledge about diet
- Understand of diet modification for GI diseases
- Plan a diet for liver diseases
- Prepare diet chart for Infectious diseases
- Plan a diet for Diabetes, Renal and Cardio-vascular diseases

UNIT I **(6 Periods)**

Principles of Therapeutic Diet: Definitions of Normal diet, Therapeutic diet, soft Diet and Liquid diet. Objectives of Diet Therapy. Advantages of using normal diet as the basis for Therapeutic diet.Normal Diet-therapeutic modification of normal diet

UNIT II **(6 Periods)**

Diet modification in Gastrointestinal diseases: Peptic ulcer, Diarrhea, Lactose intolerance, Constipation and Malabsorption syndrome.

UNIT III **(6 Periods)**

Diet Modification in liver and gall bladder in diseases: Etiology, symptoms and dietary treatment injaundice, hepatitis, cirrhosis of liver and hepatic coma.

UNIT IV **(6 Periods)**

Diet Modification in Infectious Diseases: Fevers, Typhoid, Tuberculosis and Viral Hepatitis. Dietary modifications in Tuberculosis.

UNIT V **(6 Periods)**

Diet Modification in Diabetes, Renal and Cardio-vascular diseases-Diabetes, acute & chronic glomerulonephritis, nephrosis, renal failure, kidney stone and Hypertension.

TEXTBOOK:

1. M.Raheena Begum, AText Book of Foods, Nutrition and Dietetics, Sterling Publishers Pvt. Ltd.
2. M.V.Raja Gopal, Sumati.R.,Mudambi, Fundamentals of foods and Nutrition, Wiley EasternLimited, Year1990.
3. William S.R Nutrition and Diet Therapy, 1985, 5thedition, Mosly Co. St. Louis.

REFERENCE BOOKS

1. Rodwell Williams Nutrition and Diet Therapy, 1985, the C.V Mosly St. Louis.
2. M.V.Krause & M.A.Mohan, Food Nutrition and Diet Therapy, 1992 by W.B Saunders Company,Philadelphia, London.
3. Davidson and Passmore, Human Methods and Diabetics, 1976 the English Language BookSociety and Churchill.
4. "Clinical Nutrition in Practice" by Sally Robinson
5. "Nutrition in the Prevention and Treatment of Disease" by Ann M. Coulston, Carol Boushey, and Melvin H. Williams

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Possess basic knowledge about diet	Kl & K2
CO2	Sketch diet plan for GI disease	Kl, K2 & K3
CO3	Sketch diet plan for liver disease	K2, K3 &K4
CO4	Sketch diet plan for infectious disease	K2 & K3
CO5	Prepare diet chart for diabetes and CVD	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course					Hours	Credits			
IV	24UBC4N2A	NME-II: MEDICINAL DIET					02	02			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	2	2	1	3	2	3	2	1	3	3	2.33
CO-2	3	3	2	3	2	3	3	2	3	3	2.83
CO-3	3	2	3	3	3	3	3	3	3	2	2.83
CO-4	2	2	3	3	3	2	3	2	3	3	2.67
CO-5	3	3	3	3	3	3	3	3	3	3	3.00
Mean overall score											3.00

Semester	Course code	Title of the course	Hours	Credits
IV	24UBC4N2B	NME-II: BIOCHEMISTRY IN NUTRITION	02	02

	(high)

Objectives: This course will provide students with an understanding of Principles of nutrition. - Human nutrient requirements involved in Biochemical reaction.

Unit – I **(6 Periods)**

Nutritional profile of foods: - Cereals, pulses, vegetables, fruits, nuts, oil seeds, animal foods, milk and milk products, egg, fish, meat, drinks and spices. Role of dietary carbohydrates, proteins, fats, fiber and antioxidants.

Unit -II **(6 Periods)**

Determination of calorific value of foods by Bomb calorimeter. Measurement of energy expenditure, respiratory quotients of food stuffs, specific dynamic action. BMR:- measurement of BMR and factors influencing BMR. RDA for patients: - Anemic, Diabetic, Blood pressure and obese.

Unit – III **(6 Periods)**

Recommended dietary allowances for infants, children, adolescent, pregnant, lactating women, athletes and geriatrics.

Unit- IV **(6 Periods)**

Drug - nutrient Interactions, food toxins, food allergy, adverse effects of alcohol, tobacco, tea, Acidic and alkaline foods. Nutraceuticals: - Introduction and classification of nutraceuticals.

Unit- V **(6 Periods)**

Nutritional therapy for inborn errors of metabolism, role of diet and nutrition in the prevention andtreatment of diseases: - Diabetes mellitus, peptic ulcer, jaundice, hypertension and cardiovascular diseases.

TEXT BOOK(S)

1. Human nutrition by B. Srilakshmi, New age International Pvt Ltd, 2009
2. Human nutrition and dietetics, S. Davidson and J.R. Passmore.
3. Human nutrition and dietetics, IS Garraw, WPT James, 10th edition.
4. Mechanism and theory in food chemistry, DWS Wong, CBS New Delhi, 1996.
5. Modern nutrition in health and diseases, Whol and Good hart.

REFERENCE BOOK(S)

1. Textbook of Applied Biochemistry and Nutrition and Dietetics-Lalh, 2023.
2. Textbook of Nutritional Biochemistry, Darshan Malik , Nandita Narayanasamy , V APratyusha , Jayita Thakur , Nimisha Sinha-2023
3. Textbook of Applied Biochemistry and Nutrition and Dietetics-Lalh, 2023.
4. Textbook of Nutritional Biochemistry, Darshan Malik , Nandita Narayanasamy , V APratyusha , Jayita Thakur , Nimisha Sinha-2023
5. "Nutrition Therapy and Pathophysiology" by Marcia Nahikian-Nelms and Kathryn P. Sucher

TEXT BOOK(S)

1. Aneja, K.R (2003) Experiments in Microbiology, Plant Pathology and Biotechnology (4thedition), New age international, New Delhi.
2. James G. Cappuccino and Natalie Sherman (2014) Microbiology: A Laboratory Manual (10thEdition), Pearson

REFERENCE BOOK(S)

1. Sundaraj T, Aswathy Sundarraj (2002), Microbiology Laboratory Manual (First edition),Chennai.
2. Dubey, R.C and Maheshwari, O.K (2005) Practical Microbiology, S Chand and Co. Ltd., (Firstedition), New Delhi.

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Understand the basic concepts of biochemistry in nutrition.	Kl & K2
CO2	Gain knowledge on metabolism of Nutritional profile of food.	Kl, K2 & K3
CO3	Acquire knowledge on functions and mode of action of different hormones and drugs.	K2, K3 &K4

CO4	Understand Knowledge about the Nutritional therapy for inborn error of metabolism	K2 & K3
CO5	Suggest preventive measures to overcome metabolic abnormalities.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	**Course code**		**Title of the Course**							**Hours**	**Credits**
IV	**24UBC4N2B**		**NME-II: BIOCHEMISTRY IN NUTRITION**							**02**	**02**
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**	
CO-1	2	2	1	3	2	3	2	1	3	3	2.33
CO-2	3	3	2	3	2	3	3	2	3	3	2.83
CO-3	3	2	3	3	3	3	3	3	3	2	2.83
CO-4	2	2	3	3	3	2	3	2	3	3	2.67
CO-5	3	3	3	3	3	3	3	3	3	3	3.00
Mean overall score											**2.73 (high)**

Semester	Course code	Title of the course	Hours	Credits
IV	24UBC4N2C	NME-II: HEALTH AND DISEASE	02	02

Objective: To understand the biochemistry and disorders of various diseases commonly affecting human beings.

Unit -I **(6 Periods)**

Specimen collection and processing (blood, urine and faeces). Anti-coagulants and preservatives for blood and urine. A brief review of units and abbreviations used in expressing concentrations, standard solutions and clinical values. Electrolytes and acid base balance. Maintenance of acid basebalance by respiratory and renal mechanism. Acidosis and alkalosis.

Unit- II **(6 Periods)**

Disorders of Carbohydrate metabolism: Diabetes mellitus, glucose tolerance test, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level.

Unit- III **(6 Periods)**

Disorders of Lipids and Proteins: Plasma lipoproteins, cholesterol, triglycerides and phospholipids in health and diseases. Hyperlipidemia, hyperlipoproteinemia, beta lipoproteinemia. Abnormalitiesin nitrogen metabolism uremia, hyperuricemia, coma.

Unit -IV **(6 Periods)**

Disorders of liver, kidney and heart: Jaundice, fatty liver, functions of liver and kidney. Diagnostic enzymes – enzymes in health and diseases. Renal calculi, Cardiac arrest and management, atherosclerosis.

Unit -V **(6 Periods)**

Cancer – properties of cancer cells, etiology of cancer, carcinogenic agents, biochemistry of metastasis, tumor markers. Gall stones, Prenatal diagnosis and postnatal diagnosis, duodenal ulcer,diseases of hyper and hypothyroidism.

TEXT BOOK(S)

1. Textbook of Medical Biochemistry, Chatterjea, MN and Rana Shinde. Jaypee Brothers, NewDelhi, 7th edition, 2007.
2. The Biochemistry of Clinical Medicine, William S. Hoffman, Year Book Medical publishers, 1964.
3. Clinical Medicine (A Textbook of Clinical Methods and Laboratory Investigations), Krishna Das (Editor in Chief), 2013, Jaypee Brothers Meical publishers, New Delhi.

4. Clinical Biochemistry: Metabolic and Clinical Aspects by William J. Marshall, Stephen K. Bangert
5. Textbook of Endocrine Diseases by David G. Gardner and Dolores Shoback

REFERENCE BOOK(S)

1. Clinical Chemistry Interpretation and techniques, 4th edition, A.Kaplan, R. Jack, K.E.Opheim, B. Toivola, A.W. Lyon, Williams and Wilkins, USA, 1995.
2. Clinical Chemistry in Diagnosis and treatment, J.F. Zilva and P.R. Pannall the 7th ed., GPublishing pvt limited, 1984.
3. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, Carl A. Burtis ,Edward.Ashwood and David E. Bruns, Elsevier2012.
4. Biochemistry with clinical Correlation, T.M. Devlin, 7th edition, Wiley Publications2010.
5. Cancer: Principles & Practice of Oncology by Vincent T. DeVita Jr., Theodore S. Lawrence, and Steven A. Rosenberg

Course Outcomes:

CO No.	CO-STATEMENTS On the Successful completion of the course the student would be able to	Cognitive Levels (K-Levels)
CO1	Health outcomes are an interrelated set of attributes that describe the consequences of disease for an individual.	Kl & K2
CO2	Understand about the impairments, symptoms, functioning, participation of health diseases.	Kl, K2 & K3
CO3	Learn about the different activities and social roles, and health-related quality of life	K2, K3 &K4
CO4	Provides the structure and properties of different diseases	K2 & K3
CO5	Gives an idea about health and diseases.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes:

Semester	Course code	Title of the Course								Hours	Credits
IV	24UBC4N2C	NME-II: HEALTH AND DISEASE								02	02
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	1	2	2	3	2	1	2	2	2.0
CO-2	3	3	2	3	3	3	3	2	3	3	2.83
CO-3	2	2	3	3	2	3	2	3	3	2	2.5
CO-4	3	2	3	3	3	2	3	2	3	3	2.67
CO-5	3	3	3	3	3	3	3	3	3	3	3.0
Mean overall score											**2.60 (high)**

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5C9	BIOENERGETICS AND METABOLISM	5	5

Objectives: To understand the energy transformation and metabolic pathways in living organism.

Unit -I **(20 Periods)**

Metabolism of Carbohydrates-Intermediary metabolism of carbohydrates - Reactions, energetics and regulation of glycolysis; Feeder pathways for glycolysis; Fate of pyruvate under aerobic and anaerobic conditions; Pyruvate dehydrogenase complex and its regulation; Reactions, regulation and amphibolic nature of TCA cycle; Anaplerotic reactions; Pentose phosphate pathway; Gluconeogenesis; Cori cycle; Glycogen metabolism;

Unit-II **(16 Periods)**

Metabolism of Lipids-Fatty acid oxidation - Franz Knoop ‘s experiment; βoxidation of saturated, unsaturated and odd carbon fatty acids; Peroxisomal βoxidation; α- and ω-oxidations of fatty acids; Ketone bodies – Formation and utilization; Biosynthesis of saturated fatty acids; Elongation and desaturation of fatty acids; Triacylglycerols – Biosynthesis, Regulation of fatty acid metabolism; Cholesterol biosynthesis and its regulation;Biosynthesis of phosphoglycerates and sphingolipids.

Unit- III **(18 Periods)**

Protein and nucleotides metabolism: Protein, amino acid and nucleotides metabolism - Degradation of amino acids oxidative and nonoxidative deamination, transamination, decarboxylation, detoxication of ammonia. Biosynthesis of purines and pyrimidines- De novo and salvage pathways and their regulation. Catabolism of purines and pyrimidines. Biosynthesis of ribonucleotides and deoxyribonucleotides.

Unit- IV **(18 Periods)**

Bioenergetics: Free energy and entropy changes in biological system, coupling of endergonic and exergonic processes. High energy phosphates and their role in redox reaction. Biological oxidation. Enzymes involved in oxidation and reduction- oxidases, dehydrogenases, hydro peroxidase and oxygenase. Cytochrome P-450 monooxygenases system.

Unit -V **(18 Periods)**

Metabolic Disorders: Molecular genetics of metabolic disorders; Inborn errors of

metabolism; Glycogen storage diseases; Principles and methods of gene therapy in Thalassemia, Cystic fibrosis, Adenosine deaminase deficiency, Gaucher's disease. Free radicals in biological system: Antioxidants; Enzymic and non-enzymic components of antioxidative defense mechanism

TEXT BOOK(S)

1. Principles of Biochemistry – 7th edition, Lehninger, Nelson & Cox, Macmillan worth Publishers, 2013.
2. Harper's Biochemistry Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 24th edition, Prentice Hall International. Inc.
3. Biochemistry, 5th edition, Stryer W.H Freeman. Donald Voet, J.G. Voet, John Wiley, 2005.
4. Principles of Biochemistry, Geoffrey L. Zubay, 3rd edition William W. Parson, Dennis E. Vance, W.C.Brown Publishers,1995.

REFERENCE BOOK(S)

1. General Biochemistry – Weil (Wiley Eastern, India). 5. Essentials of Biochemistry – A.I. Jain.2nd edition. S.Chand publications, 2004.
2. Primer for the Exercise and Nutrition Sciences: Thermodynamics, Bioenergetics, Metabolism, Christopher B. Scott. 2010.
3. Fundamentals of Biochemistry (1999) - Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley&Sons, NY
4. Biochemistry, Lubert Stryer, 4th edition,W.H.Freeman&Co, 1995

Course Outcomes:

Course Outcome	CO Statement	Knowledge level
CO1	To learn basic concepts of Bioenergetics, mechanisms of oxidative phosphorylation and photophosphorylation.	Kl & K2
CO2	To understand composition and structure of bio membranes, transport mechanisms across biological membranes.	Kl, K2 & K3
CO3	To learn the concept and mechanism of ATP synthesis.	K2, K3 &K4
CO4	Provides the structure and properties of Nucleic acids	K2 & K3
CO5	Provide knowledge about the metabolism	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course							Hours	Credits
v	24UBC5C9	BIOENERGETICS AND METABOLISM							5	5
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)				Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	2	3	2	3	2	3	2	2.5
CO-2	2	2	2	1	3	3	2	2	3	3	2.4
CO-3	2	2	2	2	2	3	3	2	3	2	2.5
CO-4	1	2	3	2	3	2	2	3	3	3	2.4
CO-5	2	2	1	2	2	3	3	2	3	2	2.2
Mean overall score											2.4(High)

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5C10	GENETICS AND COMPUTATIONAL BIOLOGY	5	5

Objectives: To identify and describe the process and purposes of the cell cycle, meiosis, and mitosis, as well as predict the outcomes of these processes. Computational Biology publishes works describing new methods or applications of analytical platforms for complex biological data**.**

Unit- I **(10 Periods)**

Gene: gene concept, unit of function, replication, recombination and mutation. Gene function: onegene/one enzyme hypothesis, pathways of gene action. Genome organization: Genome organization in prokaryotes and eukaryotes. special features of eukaryotic gene structure andorganization, genome organization in mitochondria and chloroplast.

Unit -II **(18 Periods)**

DNA content and C-value paradox. Various types of DNA sequences (simple sequences, repetitive sequences, nonsense sequences, tandem gene clusters, satellites). DNA Damage and repair: Spontaneous and Induced mutations – Physical and Chemical mutagenesis, Molecular mechanisms of mutagenesis – Transition, Transversion, Frame Shift, mis-sense and non-sense mutations, Photo-reactivation, Excision Repair, Mismatch Repair, Post-replication Repair, SOS Repair

Unit-III **(11 Periods)**

Recombination in bacteria and viruses: Transformation: Competence factors, mechanism of transformation, mapping genes by transformation, Conjugation: Structure and mechanism of F plasmid, Mechanism of transfer of F plasmid, Hfr, mechanism of integration of F plasmid into bacterial chromosome, circularization of chromosome, Conjugation mapping – different methods**.**

Unit -IV **(18 Periods)**

Bioinformatics: History and definition of Bioinformatics, Bioinformatics technical tool box, biological data, File format, conversion of file format, Data retrieval system, Genome browsers.

Databases: Bioinformatics databases, Types of databases, Nucleotide sequence databases, Primary nucleotide sequence databases-EMBL, Gene Bank, DDBJ; Secondary nucleotide databases, Protein sequence databases-SwissProt/ TrEMBL, Protein structure databases- Protein Data Bank, SCOP and CATH.

Unit -v **(18 Periods)**

Definitions of some common terms in genetics- phenotype, genotype, heterozygous, homozygous, allele (dominant, recessive, wild-type, mutant), character, gene, gene locus, pure line, hybrid. Mendel ‘s laws. Monohybrid cross, multiple alleles, dihybrid cross, test cross, backcross, epistasis. Chromosome structure. Polytene and lamp brush chromosomes. Types of chromosomes on the basis of centromere position. Karyotyping.

TEXT BOOK(S)

1. Fundamentals of Genetics and Molecular Biology-Dr.Vishnu Shankar SinhaS
2. Watson. J. D, Baker. T. A, Bell. S. P, Gann. A, Levine. M, Losick.
3. Molecular Biology of Gene. The Benjamin / Cummings Pub. Co. Inc, 2008.
4. Lehninger_s Principles of Biochemistry, sixth Edition, 2009 Publisher: W. H. Freeman; 6th edition | ISBN: 071677108X
5. Darnell, Lodish and Baltimore. Molecular Cell Biology, Scientific American Publishing Inc, 2000
6. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter.
7. Molecular biology of the Cell. 4th ed. Garland publishing Inc, 2002

REFERENCE BOOK(S)

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Molecular biology of the Cell. 4th ed. Garland publishing Inc, 2002
2. Benjamin Lewin. Gene VII. Oxford University Press, Nelson C
3. Emery’s Elements of Medical Genetics and Genomics. Peter D Turnpenny.
4. Genetics A Molecular Approach. Peter J Russell.3rd edition.

COURSE OUTCOME MAPPING WITH KNOWLEDGE LEVEL

Course Outcome	CO Statement	Knowledge level
CO1	Study the discovery of DNA as genetic material, DNA replication, transcription, DNArepair and translation.	Kl & K2
CO2	Analyze coding and non-coding regions of eukaryotic genome and their importance.	Kl, K2 & K3
CO3	Exposure with the importance of E. coli lac operon, PCR, expression vectors andtheir importance in Biotechnology.	K2, K3 &K4
CO4	To produce insulin using recombinant DNA technology.	K2 & K3
CO5	Acquaintance with the merits and demerits of transgenic crops.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course							Hours	Credits
V	24UBC5C10	GENETICS AND COMPUTATIONAL BIOLOGY							5	5
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)				Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	4	3	2	4	3	3	2	4	3	2.9
CO-2	3	3	2	3	4	3	3	4	3	2	3.0
CO-3	2	2	3	2	3	3	3	2	4	2	2.6
CO-4	2	3	2	3	3	3	2	4	3	3	2.8
CO-5	3	3	2	2	3	3	3	3	4	3	2.9
Mean overall score											**2.84**(High)

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5C11	CELL AND MOLECULAR BIOLOGY	5	5

Objectives: To study the structural and functional organization of cells. To acquire basic fundamental knowledge and explore skills in molecular biology and become aware of the complexity and harmony of the cells.

Unit -I **(18 Periods)**

An Overview of cells: Origin and evolution of cells. Classification of cells. Ultra- structure of prokaryotic and eukaryotic (plant & animal) cells. Plasma membrane, cell wall their structural organization. Cellular organelles – Mitochondria, chloroplast; Nucleus, Golgi apparatus. Other organelles and their organization, Transport of nutrients, ions and macromolecules across membranes.

Unit -II **(18 Periods)**

Cell cycle- Different phases of cell cycle, Controls and Check points, cyclins and cdks – types and their role. Apoptosis, Cytoskeleton and Cell motility Cell communication: General principles of signaling – endocrine, exocrine& synaptic signaling, surface and intracellular receptors, G proteins and generation of secondary messenger, mode of action of cAMP and ca++ calmodulin.

Unit -III **(18 Periods)**

Structure and functions of DNA, Types of RNA and its function. Enzymes involved in Molecular Biology-DNA polymerases, RNA polymerase, Helicase, Primase, Ligase, Exonuclease and endonuclease. Mechanism of prokaryotic and eukaryotic replication; machinery for replication; Synthesis of leading and lagging strands, Okazaki fragments,

Unit -IV **(18 Periods)**

Transcription: prokaryotic and eukaryotic transcription, RNA polymerase, general and specific transcription factors, regulatory elements and mechanisms of transcription and regulations -Post transcriptional modification-Capping, polyadenylation, splicing, RNA editing.

Unit -V **(18 Periods)**

Translation: Protein synthesis in prokaryotic and eukaryotes- activation, initiation, elongation and termination of protein synthesis. Inhibitors of protein synthesis, Post translational modification, Gene regulation- Operon model – lac and trp operons, transposans and their functions.

TEXT BOOK(S)

1. Cell & Molecular Biology. E.D.D De Robertis & E.M.F De Robertis, Waverly publication.
2. Molecular Biology of the cell. Alberts, B; Bray, D, Lews, J., Raff, M., Roberts, Kand Watson, J.D. 1991 3rd edn. Garland publishers, Oxford
3. Microbiology - M. J. Pelzar, E. S. N. Cfan and N.R. Kreig, McGraw Hill Publ.
4. Introductory Microbiology - J. Heritage, E.G.V. Erans, R.A. Killington, Cambridge Univ. Press.

REFERENCE BOOK(S)

1. General Microbiology - H.G. Schlegel Cambridge University Press.
2. Microbiology – concepts and Application. John Wiley and Sons, New York, 1988.
3. General Microbiology – R. Y. Stanier, J. L. Ingraham, M. L. Wheelis, Page th
4. R Painter; MacMillan Press ltd; 5edn (1986) Microbiology, Tortora, Funke and Chase, Benzamin & Cummings

Course Outcomes:

Course Outcome	CO Statement	Knowledge level
CO1	Study the discovery of DNA as genetic material, DNA replication, transcription,DNA repair and translation.	Kl & K2
CO2	Analyze coding and non-coding regions of eukaryotic genome and theirimportance.	Kl, K2 & K3
CO3	Exposure with the importance of E. coli lac operon, PCR, expression vectors and their importance in Biotechnology.	K2, K3 &K4
CO4	To produce insulin using recombinant DNA technology	K2 & K3
CO5	Gives an idea about energy level and its synthesis.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course					Hours	Credits			
V	24UBC5C11	CELL AND MOLECULAR BIOLOGY					5	5			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	2	3	2	3	2	4	2	2.6
CO-2	2	2	2	3	3	3	3	3	3	2	2.7
CO-3	2	2	2	2	2	2	3	2	4	2	2.4
CO-4	2	3	2	2	2	3	2	3	3	3	2.5
CO-5	3	2	2	2	3	3	2	3	4	2	2.6
Mean overall score											2.56(High)

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5C12P	LAB IN CELL AND MOLECULAR BIOLOGY	5	5

Objective: To introduce students to various practical aspects of Molecular biology Practical

Practical: **(45 Periods)**

1. Isolation of plasmid & Genomic DNA
2. Estimation of DNA by diphenylamine method
3. Estimation of RNA by orcinol method
4. Separation of DNA by Agarose Gel Electrophoresis
5. Separation of protein by SDS-PAGE
6. Purification of enzyme by ammonium sulphate precipitation Microbial Techniques
7. Staining technique - Gram's staining
8. Estimation of nitrogen, iron, phosphorus, and calcium.

TEXT BOOK(S)

1. Manuals in Biochemistry – Dr. J. Jayaraman, New Age International Pub, 2000.
2. Instrumental Methods of Chemical Analysis Bk.Sharma, Goel publications Meerut, 2000
3. Laboratory Manual in Bio Chemistry, Jayaraman, New Age International Pub,2000.
4. Laboratory manual in Biochemistry T.N.Pattabiraman. All India publishers,1998.
5. Lab Manual in General Microbiology - N Kannan, Palaniappa Brothers, 2000.

REFERENCE BOOK(S)

1. Manuals in Biochemistry – Dr. J. Jayaraman, New Age International Pub, 2000.
2. Instrumental Methods of Chemical Analysis Bk.Sharma, Goel publications Meerut, 2000
3. Laboratory Manual in Bio Chemistry, Jayaraman, New Age InternationalPub,2000.
4. Laboratory manual in Biochemistry T.N.Pattabiraman. All India publishers,1998.
5. Lab Manual in General Microbiology - N Kannan, Palaniappa Brothers, 2000.

Course Outcomes:

Course Outcome	CO Statement	Knowledge level
CO1	Understand about the cell structure	Kl & K2
CO2	Learn about the techniques used in molecular analysis	Kl, K2 & K3
CO3	Identify the cell structure and principle	K2, K3 &K4

CO4	Learn about the practical analysis in cell separation technique	K2 & K3
CO5	Describe the cell and study the cell structure and function	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	**Course code**		**Title of the Course**							**Hours**	**Credits**
V	24UBC5C12P		LAB IN CELL AND MOLECULAR BIOLOGY							**5**	**5**
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	3	2	2	3	2	3	3	4	3	2.8
CO-2	2	2	2	3	4	3	3	3	3	2	2.7
CO-3	2	2	2	2	3	2	3	3	4	2	2.5
CO-4	2	3	2	3	2	3	2	3	3	3	2.6
CO-5	3	2	2	2	3	3	2	3	4	2	2.6
Mean overall score											**2.64**(High)

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5MBE1A	PLANT BIOCHEMISTRY	4	4

Objectives: To know the Introduction to Plant cells and metabolic process.

UNIT- I **(18 periods)**

Physiology of Plants: Diffusion and Osmosis in plants and their significance, relationship among turgor pressure, wall pressure and osmotic pressure, water potential concept. Mechanism of water absorption, Ascent of sap, Transpiration: - types, mechanism of transpiration and factors affecting transpiration.

UNIT- II **(18 periods)**

Photosynthesis: Photosynthetic apparatus, Photosynthetic pigments, Light reactions- cyclic and non-cyclic phosphorylation, Calvin cycle, Photorespiration, C4 plants, CAM plants. Glyoxylate cycle.

Nitrogen Metabolism and Nitrogen Cycle: Nitrogen in soil, nitrate reduction in plants, Nitrogen fixation: - Nonbiological and biological nitrogen fixation, biochemistry of symbiotic and nonsymbiotic nitrogen fixation, nitrogen cycle, Sulphur cycle, phosphorus cycle

UNIT- III **(18 periods)**

Plant Stress physiology: Plant stress, Plant responses to abiotic and biotic stresses, Water deficit and drought resistance, Flooding, Temperature stress, Salt stress, Ion toxicity, Pollution stress and potential biotic stress (insects and diseases).

UNIT- IV **(18 periods)**

Biochemistry of Plant Growth: Biochemistry of seed development: - dormancy and germination. Phytochrome, photoperiodism and vernilization.

Plant Growth Regulators: Physiological effects of Auxins, Gibberllins, Cytokinins, ABA and Ethylene. Secondary metabolites: Terpenes, Phenols, flavonoids and nitrogenous compounds and their roles in alternative medicine.

UNIT- V **(18 periods)**

Introduction to tissue culture-Media composition and preparation. Culture types callus culture cell suspension culture, protoplast culture and etc., Somatic embryogenesis, organogenesis, Embryo culture and embryo rescue. Micropropagation. Protoplast isolation, Protoplast culture and fusion, selection of hybrid cells, cybrids, soma clonal variation. Germplasm storage and cryo- preservation.

Application of transgenesis in crop improvement – Insect resistance, disease resistance, virus resistance herbicide resistance, and resistance to abiotic stress.

TEXT BOOK(S)

1. Mukherji, S and Gosh A. K. Plant Physiology. 2nd ed. New Central Book Agency,
2. Slater A, NW Scott, MR Fowler. Plant bio technology, 2nd ed. Oxford University Press, 2008.
3. Hopkins, W. G and Huner, N. P. A. Introduction to Plant Physiology. 3rd ed. John Wiley & Sons Inc. New York, 2004.
4. Molecular Biotechnology: Principles and Applications of Recombinant DNA- B.R. Glick & J.J. Pasterak, ASM Press, Washington, D.C., 2010
5. Gene cloning and DNA analysis: an introduction / T.A. Brown.—6th ed. Brown, T.A.(Terence A.) Wiley-Blackwell. 2010.
6. Elements of Biotechnology- P.K.Gupta, Rastogi Publications, 2nd editionrd3 2015-2016.
7. A text book of Biotechnology- R.C.Dubey, S.Chand Publications, 2014
8. Industrial Microbology- A.H.Patel,Macmillan , India Ltd, 2012
9. Animal Cell Culture and Technology, Michael Butler Garland Science/BIOS Scientific Publishers, Second Edition, London and New York. 2004

Course Outcomes:

Course Outcomes:

Course Outcome	CO Statement	Knowledge level
CO1	Understand plant cell structure, organization, and apply specific biochemical functions to all compartments of the plant cell.	Kl & K2
CO2	Learn the structure, function and biosynthetic pathways of essential biochemical molecules including their key chemical and physical properties.	Kl, K2 & K3
CO3	Understand the physical properties of plant cell	K2, K3 &K4
CO4	Understand protein structural hierarchy and relate structure to function	K2 & K3
CO5	Learn the structure, function and biosynthetic pathways of essential biochemical molecules including their key chemical and physical properties.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	**Course code**		**Title of the Course**							**Hours**	**Credits**
V	24UBC5MBE1A		PLANT BIOCHEMISTRY							4	4
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	3	2	2	3	2	4	2	3	2	2.6
CO-2	2	2	3	3	3	3	3	2	3	2	2.6
CO-3	2	2	2	2	4	2	3	3	3	2	2.5
CO-4	2	3	2	3	2	3	3	2	3	3	2.6
CO-5	3	2	2	1	3	3	2	2	4	2	2.4
Mean overall score											**2.54**(High)

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5MBE1B	NEUROBIOLOGY	4	4

Objectives: The objectives of the students who wish to focus on or emphasize neuroscience in their course of study at CNS.

Unit – I **(12Periods)**

Neuromorphology and Neurocellular Anatomy: Central Nervous system – General features of Neurons, Cellular organization of neurons Dendrites and Axons, neurotubules, neurofilaments, synapse neuralgia, astrocytes, oligodendrocyte, ependymal cells, Schwan cells. Spinal Cord: Topographical anatomy, spinal nerves, spinal meninges, joint reflexes, gray and white matter of spinal cord.

Unit-II **(12Periods)**

Neurophysiology: Neuronal membrane, excitability, ion channels and transport of ions. Nerve And Synapse Structures: Structure function correlation at the synapse. Transmission across the synapse: membrane potential in the steady state action potential generation and propagation.

Unit -III **(12Periods)**

Chemical Composition of Brain: Formation, structure and biochemistry of myelin, chemistry of major brain lipids, developmental changes, lipid composition, biosynthesis and catabolism of major lipids, characteristics of brain lipids, regional variations. Neurotransmitter: Chemistry, synthesis, storage and release of nervous neurotransmitters, transmitter action, synaptic modulation and mechanism of neuronal integration.

Unit -IV **(12Periods)**

Synaptic Transmission: Structure of the synapse, correlation of structure and function at the synapse, transmission across the synapse, pre and post synaptic events, membrane potential in the steady state action, action potential and propagation of nerve impulse. cAMP in hormone action. Blood Brain Csf Barriers: Characteristics of blood CSF barrier, composition of CSF, formation of CSF, active transport from CSF to brain CSF brain interface.

Unit -V **(12Periods)**

Neuropeptides – Classes of neuropeptides, mode of action, role of neuropeptides in obesity and pain neuropeptide receptors, coexistence of neuropeptides with other neurotransmitters in ―Dorsomedial Hypothalamic Nucleus‖. Developmental Neurobiology: Organogenesis and neuronal multiplication, axonal and dendritic growth, glial multiplication and myelination, growth in size, regeneration and repair mechanisms, plasticity.

TEXT BOOK(S)

1. Neuroscience: Exploring the Brain Fourth, North Americ Edition by Bear PhD, Mark F., Connors PhD, Barry W., Paradiso PhD, Mich (2015) Hardcover4th Edition.

2. Principles of Neural Science, Fifth Edition (Principles of Neural Science (Kandel)) 5th Edition. Eric R. Kandel (Editor), James H. Schwartz (Editor), Thomas M. Jessell (Editor), Steven
3. A. Siegelbaum (Editor), A. J. Hudspeth (Editor)

REFERENCE BOOK(S)

1. Neuroscience: Exploring the Brain Fourth, North Americ Edition by Bear PhD, Mark F., Connors PhD, Barry W., Paradiso PhD, Mich (2015) Hardcover 4th Edition.
2. Principles of Neural Science, Fifth Edition (Principles of Neural Science (Kandel)) 5th Edition. Eric R. Kandel (Editor), James H. Schwartz (Editor), Thomas M. Jessell (Editor), Steven A. Siegel Baum (Editor), A. J. Hudspeth (Editor)
3. Neuroscience 5th Edition Dale Purves (Author), George J. Augustine (Author), David Fitzpatrick (Author), William C. Hall (Author), Anthony-Samuel LaMantia (Author), Leonard E.White (Author

OUTCOME

1. Course provides numerous resources to students for learning including an extensive website and a collection of practice questions
2. In the last few years, the course director has introduced some novel sessions using TBL and Jigsaw pedagogy (students rated these very favorably)
3. Course director has recognized that students need time to prepare for small group sessions and has allotted some class time for this purpose

COURSE OUTCOME MAPPING WITH KNOWLEDGE LEVEL

Course Outcome	CO Statement	Knowledge level
CO1	Students learn about neuroscience major will be able to describe the structure and function of the brain at the sub-cellular and systems level of analysis.	Kl & K2
CO2	Learn about the neuroscience major will be able to conduct, interpret, and report the results of a research project using up-to-date sub-cellular and systems neuroscience techniques	Kl, K2 & K3
CO3	Learn the nervous system functions to produce animal and human behavior.	K2, K3 &K4

CO4	Learn about the neuroscience major will be able to describe the structure and function of the brain at the behavioral level of analysis.	K2 & K3
CO5	Learn about the synaptic and systems-level events contribute to our understanding of attention, learning, memory, drugs, drug abuse, and some behavioral/neurobiological disorders	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	**Course code**		**Title of the Course**							**Hours**	**Credits**
V	24UBC5MBE1B		NEUROBIOLOGY							4	4
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	4	2	2	3	2	4	2	4	3	2.8
CO-2	2	2	2	3	3	3	3	3	4	2	2.7
CO-3	2	3	2	2	4	2	3	2	3	2	2.5
CO-4	2	3	3	2	3	3	2	3	4	3	2.7
CO-5	3	2	2	1	4	3	2	2	4	2	2.5
Mean overall score											**2.64**(High)

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5MBE1C	DRUG BIOLOGY	4	4

Objective: To learn about various drugs. To identify risk factors and protective factors associated with substance abuse (drugs and alcohol).

Unit I **(12Periods)**

Introduction: Definitions, ADME, concentration time profile, plotting the data, different fluid compartments and blood flow rate compartment models, biological half-life, elimination rate constant. Biopharmaceutics and pharmacokinetics in drug research.

Unit- II **(12Periods)**

Drug disposition: Total body clearance, renal clearance, mechanism of clearance, clearance ratio, factors affecting renal clearance, hepatic clearance, volume of distribution and its significance.

Unit -III **(12Periods)**

Bioavailability and bioequivalence: Definitions, federal requirements, methods of determination of bioavailability using blood and urinary excretion data. Protocol design for bioavailability assessment. Methods for bioequivalence determination.

Unit -IV **(12Periods)**

Pharmacokinetic characterization of drugs: Pharmacokinetics of drugs following one/ two compartment open models with first order elimination kinetics as applied to rapid intravenous injection, Intravenous transfusion and oral administration. Determination of absorption rate constant using Wagner-Nelson, Loo Riegelman methods. Flip-flop models, method of residual. Urinary excretion data and its application in pharmacokinetic characterization of drugs.

Unit -V **(12Periods)**

Dosage regimen: Dosage regimen adjustment in patients with renal and hepatic Diseases. Drugdosage in elderly, children and obese patients. Non-Linear Pharmacokinetics: Various causes of non-linearity, Application and limitations of physiologic pharmacokinetic models.

TEXT BOOK(S)

1. Applied Biopharmaceutics & Pharmacokinetics, by Shargel, L., S. Wu-Pong
2. Biopharmaceutics and Pharmacokinetics: An Introduction by Notari, R. E.
3. Introduction to Biopharmaceutics, by Gibaldi, M.
4. Biopharmaceutics and Relevant Pharmacokinetics, by Wagner, J. G.
5. Textbook of Biopharmaceutics and Clinical Pharmacokinetics by Niazi, S.K.
6. Handbook of Bioequivalence Testing, by Niazi, S. K.

REFERENCES BOOK(S)

1. Modeling in Biopharmaceutics, Pharmacokinetics, and Pharmacodynamics: Homogeneous and Heterogeneous Approaches, by Macheras, P. and A. Iliadis
2. Comparative Pharmacokinetics: Principles, Techniques and Applications, by Riviere,
3. J. E Foundations of Pharmacokinetics, by Rescigno, A. Clinical Pharmacokinetics and Pharmacodynamics: Concepts and Applications, by Rowland, M. and

COURSE OUTCOME MAPPING WITH KNOWLEDGE LEVEL

Course Outcome	CO Statement	Knowledge level
CO1	Identification of different anions, cations and different inorganic pharmaceuticals	Kl & K2
CO2	Knowledge about the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals	Kl, K2 & K3
CO3	understand the medicinal and pharmaceutical importance of inorganic compounds	K2, K3 &K4
CO4	Learning this subject content will develop the ideas with the fundamental of drug chemistry among the pupil	K2 & K3
CO5	To have been introduced to a variety of inorganic drug classes	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course							Hours	Credits
V	24UBC5MBE1C	DRUG BIOLOGY							4	4
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)				Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	3	3	2	4	3	4	2	2.8
CO-2	2	2	2	3	3	3	3	3	4	2	2.7
CO-3	3	3	2	2	4	2	3	2	3	2	2.6
CO-4	2	3	2	2	3	3	2	3	4	3	2.6
CO-5	3	2	2	1	4	3	2	2	3	2	2.5
Mean overall score											**2.64**(High)

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5SBE1A	HOSPITAL MANAGEMENT	3	2

Objective:

1. To understand the role of administration in patient care, planning and management
2. To understand the importance of information system in hospitals
3. To understand the policy and procedures in clinical services
4. To understand the legal and safety aspects in health care services
5. To understand the aspects of counselling and its importance in hospital management

Unit – I **(6 Periods)**

General features of a hospital, various departments –Outpatient department, Casualty and Emergency services, General surgery department, ICU, Obstetrics department, Clinical laboratory. Supportive services- Admission department, medical records department, Pharmacy, Food services Housekeeping department, Volunteer department.

Unit – II **(6 Periods)**

Information system in hospital: Communication, Delegation, Decision making, Monitoring, Evaluation, Meetings and Negotiations; Quality assurance.

Unit – III **(6 Periods)**

Biomedical research: Ethics; consent, nature of consent. Ethics pertaining to blood transfusion, transplantation-Donor categories, confirmation of brain death, live donation, bio medical waste management.

Unit – IV **(6 Periods)**

Hospital Administration, Hospital ethics, Challenges in hospital administration, Legal aspects, Working conditions, Environmental Safety, Health services, National Health Policy

Unit -V **(6 Periods)**

Counselling- Types, Techniques, Function, Development of counselling services, Duties of a counsellor.

TEXT BOOK(S)

1. Hospitals-Facilities Planning and Management, K.J.Kunders, Tata Mc Graw Hill, New Delhi,2008
2. Hospital Administration and Human Resource Management, R.C. Goyal,4th Edition, Prentice Hallof India Pvt Ltd., 2005

REFERENCE BOOK(S)

1. Hospital Administration and Management: Theory and Practice: R. Kumar S.L. Goel,
2. Hospital Administration and Management: A Comprehensive Guide,Joydeep Das Gupta, JaypeeBrothers,Medical Publishers Pvt. Limited, 2009
3. Principles of Hospital Administration and Planning,BM Sakharkar,Jaypee brothers,Medical Publishers Pvt. Limited,2008 4. Hospital Management,K. V. Ramani , 2011,Pearson Education India
4. Hospital Administration And Human Resource Management, D. K. Sharma, R. C. Goyal,6thedition,PHI learning Pvt., Ltd.2013
5. Cell biology, T. Devasena, 2012, Oxford University press.
6. Principles and techniques of practical Biochemistry, Keith Wilson and John Walker,1995.Cambridge University Press

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Analyze the importance and role of various departments, support services in hospitals	Kl & K2
CO2	Discuss about information system in hospitals and Quality assurance.	Kl, K2 & K3
CO3	Communicate about Ethics governing various clinical aspects like blood transfusion, transplantation	K2, K3 &K4
CO4	Aware of various legal and safety aspects in hospital administration	K2 & K3
CO5	Discuss about counselling and analyze the role of counsellors in Hospital management	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course					Hours	Credits		
V	24UBC5SBE1A	HOSPITAL MANAGEMENT					3	2		
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	4	2	3	3	3	4	3	4	3	2.8
CO-2	2	2	3	3	4	3	3	3	4	3	2.8
CO-3	2	3	2	2	3	2	3	2	3	2	2.5
CO-4	2	3	2	3	3	3	3	3	4	3	2.8
CO-5	3	2	2	1	4	3	2	2	4	2	2.5
Mean overall score											**2.72**(High)

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5SBE1B	HERBS AND DRUG ACTION	3	2

Objective: To raise awareness of issues in herbal and traditional medicine safety and pharmacovigilance among relevant organizations, including those representing patient groups, healthcare providers, medicines information providers, media and others.

Unit - I **(6 Periods)**

Terminologies – Definitions – Classification of medicinal plants based on their effects with special reference to India.

Unit - II **(6 Periods)**

Allergens – types – sources – active principles – Chemical nature – Cell modifiers – Lectins – mutagens, teratogens – Allergic reactions with known examples.

Unit - III **(6 Periods)**

Drugs acting on brain and nervous system – Rheumatic arthritis – Psychoactive drugs – Depressants, Stimulants, hallucinogens – sources, effects, basic mechanism of action.

Unit -IV **(6 Periods)**

Cardiovascular diseases – blood pressure – cardiac drugs of plant origins – alkaloids, anticoagulants – basic mechanism of action. Pulmonary / respiratory disorders – asthma – bronchitis – common cold – allergy – Remedy from plants.

Unit -V **(6 Periods)**

Drugs for urinogenital disorders – roots of Withania somniferous – Memory stimulants – Centella asiatica – Drugs for dissolving kidney stones – Musa paradisica (pseudo stem) – Anti-inflammatory drugs – Cardiospermum – Anticancer drugs – Catharanthus roseus.

REFERENCE BOOK(S)

1. Kumar, N.C., An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi. 1993
2. Rao, A.P. Herbs that heal. Diamond Pocket Books (P) Ltd., New Delhi, 1999.

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Describe the flow behavior of fluids and concept of complexation	Kl & K2

CO2	Learn about the basic knowledge of pharmaceutical suspensions and colloids	Kl, K2 & K3
CO3	To understand the material handling techniques.	K2, K3 &K4
CO4	Knowledge about the mechanism pathways of different class of medicinal compounds	K2 & K3
CO5	Knowledge about the mechanism pathways of different class of medicinal compounds.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	**Course code**		**Title of the Course**							**Hours**	**Credits**
V	**24UBC5SBE1B**		**HERBS AND DRUG ACTION**							**3**	**2**
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	4	2	2	3	2	3	2	4	3	2.7
CO-2	2	2	2	3	4	3	3	3	4	3	2.8
CO-3	2	2	2	2	3	2	3	3	4	2	2.5
CO-4	2	3	2	3	3	3	3	2	4	3	2.7
CO-5	3	2	2	1	4	3	2	3	4	2	2.5
Mean overall score											**2.64 (High)**

Semester	Course code	Title of the course	Hours	Credits
V	24UBC5SBE1C	ETHANOMEDICINE	3	2

Objectives: To document traditional medicinal plants knowledge used in treating skin diseases.

Unit- I **(6 Periods)**

Definition, history and its scope – Inter disciplinary approaches in ethnobotany - Collectionof ethnic information.

Unit- II **(6 Periods)**

Medicinal plants in phytomedicine Importance of medicinal plants - role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins). Emblica officinalis, Saraca Asoca, Withania Somnifera, Aegle marmelousm, Phyllanthous amarus, , Bacopa,Monnieri, Swertia Chiraita, Gymnema Sylvestre, Commiphora Wightii, Peeper longum, Cinnamomum Zeylanicum.

Unit -III **(6 Periods)**

Tribal medicine – methods of disease diagnosis and treatment – Plants in folk religion – Aegle marmelos, Ficus benghalensis, Curcuma domestica, Cyanodon dactylon and *Sesamum indicum. Allium sativum L. Mangifera indica L., Coriandrum sativum L, Asparagus racemosus Willd. Aloe barbadensis* Mill, *Tagetes arecta L. Coriandrum sativum L. Psidium guajava L. Punica granatum, Curcumadomestica* Val.

Unit -IV **(6 Periods)**

Traditional knowledge and utility of some medicinal plants in Tamilnadu – Solanum trilobatum, Cardiospermum halicacabum, Vitex negundo, Adathoda vasica, Azadirachta indica, Gloriosa,superba, Eclipta alba, Aristolochia indica, Phyllanthus fraternus and Boerhaavia diffusa.

Unit -V **(6 Periods)**

Plants in day today life – Ocimum sanctum, Centella asiatica, Solanum trilobatum, Cassiaauriculata, Aloe vera. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and vegetables - Greens (Moringa, Solanum nigrum) Cabbage. Drugs for urinogenital disorders – roots of Withania somnifera – Memory stimulants – Centella asiatica – Drugs for dissolving kidney stones – Musa paradisica (pseudostem) – Antiinflammatory drugs – Cardiospermum – Anticancer drugs – Catharanthus roseus.

TEXT BOOK(S)

1. Ethnobiology – R.K.Sinha & Shweta Sinha – 2001. Surabhe Publications – Jaipur.
2. Tribal medicine – D.C. Pal & S.K. Jain 1998, Naya Prakash, 206, Bidhan Sarani, Calcutta –700 006.
3. Contribution to Indian ethnobotany – S.K. Jain 1995, 3rd edition, Scientific publishers,P.B.No. 91, Jodhpur, India.
4. A Manual of Ethnobotany – S.K.Jain, 1995, 2nd edition.
5. Kumar, N.C. (1993). An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi. 2. Rao, A.P. (1999). Herbs that heal. Diamond Pocket Books (P) Ltd., New Delhi.

REFERENCE BOOK(S)

1. Ethnobiology – R.K.Sinha & Shweta Sinha – 2001. Surabhe Publications – Jaipur.
2. Tribal medicine – D.C. Pal & S.K. Jain 1998, Naya Prakash, 206, Bidhan Sarani, Calcutta –700 006.
3. Contribution to Indian ethnobotany – S.K. Jain 1995, 3rd edition, Scientific publishers,P.B.No. 91, Jodhpur, India.
4. A Manual of Ethnobotany – S.K.Jain, 1995, 2nd edition.

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Understand about the uses of plants –will know one plant-one employment	Kl & K2
CO2	Understand phytochemical analysis related to medicinally important plants and economic products produced by the plants	Kl, K2 & K3
CO3	know about the importance of Medicinal plants and its useful parts.	K2, K3 &K4
CO4	Learn about the important plants in our daily life and also about the traditional medicines and herbs, and its relevance in modern times	K2 & K3
CO5	Learn about the chemistry of plants &herbal preparations	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code		Title of the Course							Hours	Credits
V	24UBC5SBE1C		ETHANOMEDICINE							3	2
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	4	2	3	4	3	4	3	4	3	2.9
CO-2	2	3	3	4	4	3	3	4	4	3	3.0
CO-3	3	3	2	2	3	2	3	2	3	2	2.5
CO-4	2	3	2	3	3	3	3	3	4	3	2.8
CO-5	3	2	2	2	4	3	2	2	4	2	2.6
Mean overall score											**2.76**(High)

Semester	Course code	Title of the course	Hours	Credits
VI	24UBC6C13	CC-XIII: CLINICAL BIOCHEMISTRY	06	06

Objectives

1. To know the clinical aspects of various metabolic disorder
2. To understand the significance of diagnostic biochemistry

Unit I **(20 periods)**

Approaches to Clinical Biochemistry: Collection, processing, preservation and transport of clinical specimens. Automation and quality control. Normal, abnormal constituents and clinical significance of urine.

Hematology: Blood: - composition and their functions, Anemia: - classifications, erythrocyte indices. Blood coagulation system, Clotting time, Bleeding time, Prothrombin time, RBC count, WBC count, Platelet count, Differential count, determination of Hemoglobin, PCV and ESR. Hemoglobinopathies, Thalassemias. Blood banking. Cross matching

Unit II **(16 periods)**

Homeostasis, Disorders of fluids, electrolyte balance and gastrointestinal system, disorder involving change in hydrogen ion concentration. Liver function tests, jaundice, haemolytic, hepatic and obstructive jaundice. Renal function tests, normal and abnormal constituents of urine. Gastric function test, thyroid function test.

Unit III **(19 periods)**

Disorders of carbohydrate metabolism: Sugar level in normal blood, maintenance of blood sugar concentration – endocrine influence on carbohydrate metabolism, hypoglycemia, glycosuria, renal threshold value, diabetes mellitus – classification, complications, glucose tolerance test (GTT), diabetic coma, diabetic ketoacidosis, glycogen storage diseases, fructosuria, galactosemia, and hypoglycemic agents.

Unit IV **(18 periods)**

Disorders of Amino Acid and Protein Metabolism: Inborn errors of amino acid metabolism: - Phenylketonuria, alkaptonuria, cystinuria, albinism and tyrosinemia. Disorders of Purine and Pyrimidine Metabolism: Gout, Lesh-Nyhan syndrome, xanthinuria, Orotic aciduria. Disorders of Bilirubin Metabolism: Jaundice: - classification, clinical features.

Unit V **(17 periods)**

Disorders of lipid metabolism: lipid metabolism in liver and adipose tissue, plasma lipoproteins, cholesterol triglycerides and phospholipids in health and diseases, fatty liver, atherosclerosis, lipid storage diseases, hypolipoproteinemia and hyperlipoproteinemia.

TEXT BOOK(S)

1. Clinical Chemistry in diagnosis and treatment, Philip, 6th ed ELBS. D. Mayne & Edward Arnold, 1994.
2. Textbook of Clinical Chemistry, 3rd ed, Burtis & Ashwood, TietZ WB Saunders, 1999.
3. Text book of Medical Biochemistry 2nd Edition, M.N. Chatterjee and Rana Shinde, Jaypee Brothers Medical Publishers Private limited, New Delhi 1995.
4. Clinical Biochemistry – Metabolic & Clinical Aspects, William J.Marshall, Stephen K. Bansert, Churchill Livingstone, 1995.
5. Clinical Chemistry – Principles, procedures, correlations – Bishop, Lippincott.2000.

REFERENCE BOOK(S)

1. Clinical Chemistry in diagnosis and treatment, Philip, 6th ed ELBS. D. Mayne & Edward Arnold, 1994.
2. Textbook of Clinical Chemistry, 3rd ed, Burtis & Ashwood, TietZ WB Saunders, 1999.
3. Text book of Medical Biochemistry 2nd Edition, M.N. Chatterjee and Rana Shinde, Jaypee Brothers Medical Publishers Private limited, New Delhi 1995.
4. Clinical Biochemistry – Metabolic & Clinical Aspects, William J.Marshall, Stephen K. Bansert, Churchill Livingstone, 1995.
5. Fundamentals of Biochemistry - Ambika shanmugam, S.Chand, by Publishers 1988

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Students learn about the biochemistry at the atomic level, draw molecules and reaction mechanisms perfectly.	Kl & K2
CO2	Students learn about the in detail about amino acid structures, types of amino acids, classifications, structure of proteins and types of proteins.	Kl, K2 & K3
CO3	Students learn about the molecular structures of 20 amino acids, differentiating essential and non-essential amino acids, biologically important modified amino acids and their functions.	K2, K3 &K4
CO4	Learn how amino acids and proteins are metabolized, emphasizing the role of few intermediates of their metabolism,	K2 & K3

	monitoring the deficiency and abundance disorders of amino acid metabolisms and the role of enzymes in the regulation of the pathways	
CO5	To learn about the normal constituents of urine, blood and their significance in maintaining good health.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	**Course code**		**Title of the Course**							**Hours**	**Credits**
V	**24UBC5SBE1C**		**ETHANOMEDICINE**							**6**	**6**
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	2	2	3	1	2	3	1	2	3	2.5
CO-2	2	3	2	3	2	3	2	3	2	3	2.6
CO-3	2	2	1	2	3	2	1	2	1	3	2.2
CO-4	1	3	3	2	2	3	3	2	2	1	2.4
CO-5	3	1	2	1	3	3	1	3	1	2	2.4
Mean Overall Score											**2.42(high)**

Semester	Course code	Title of the course	Hours	Credits
VI	24UBC6C14	CC-XIV: IMMUNOLOGY	05	05

Objectives: To study about immune response and immunological techniques

Unit I **(12 Periods)**

The Immune system- Primary and Secondary Lymphoid organ, Lymphocytes- their origin and differentiation, NK cells. Antigen presenting cells-macrophages, dendritic cells, Langerhans cell- their origin and function. Mechanism of phagocytosis. Complement - characteristic features- biological function-activation, types of immune responses, immune tolerance.

Unit II **(12 Periods)**

Immunity: Types of immunity- Innate immunity- classification- mechanism of nonspecific immunity. Acquired immunity- active and passive, vaccine-active immunization, passive immunization. Immune response. Humoral and cell mediated immunity –induction mechanism-cytokines -interleukins- Interferon-their role in immune response.

Unit III **(12 Periods)**

Immunoglobulins- Structure, types, biological functions - generation of diversity. Antigen- Types –factors determining antigenicity. Antigen- antibody interactions agglutination, complement fixation - opsonization, bacteriolysis and precipitation Antitoxins

Unit IV **(12 Periods)**

Immunity to infection: Hypersensitivity reactions- types and mechanism Transplantation- types-allograft rejection mechanism and prevention of graft rejection- immune-suppressive drugs. HLA-immune response genes- HLA molecules, auto immune diseases- pathogenesis– treatment.

Unit V **(12 Periods)**

Immunochemical techniques. Production of antisera- the precipitation reaction, immunodiffusion, Immunoelectrophoresis, immunofluorescence, complement fixation test. Principle, technique and applications of RIA and ELISA. Hybridomas –monoclonal antibody production-uses.

TEXT BOOK(S)

1. Immunology -8th edition, Ivan Roitt, - Publisher Wiley-Blackwell: 2012
2. Immunology -Weir, Churchill Livingstone, Publisher: 8 edition (June 1997);
3. Donald M. Weir, Immunology, John Steward. Publ. by Harcourt Publishers Ltd; (1997).

4. Immunology -3rd ed Kuby,Freeman, 1997.
5. "Techniques in Immunology" by William E. Paul (4th Edition, 2020)

REFERENCE BOOK(S)

1. Immunology - Tizerd, Saunders College Publishing, 9th edition 2004.
2. Immunology- Dulsy Fatima and N. Arumugam, 2014.
3. Immunology- Male, with student Consult Online Access, 2012.
4. Immunology- C. Vaman Rao, 2007.
5. "Basic Immunology: Functions and Disorders of the Immune System" by Abul K. Abbas, Andrew H. Lichtman, and Shiv Pillai (5th Edition, 2018)

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Understanding of the overview of immune system including cells, organs and receptors.	Kl & K2
CO2	To learn structure and functions of different classes of immunoglobulins, the genetic basis of antibody diversity and the importance of humoral, cell-mediated and innate immune responses in combating pathogens.	Kl, K2 & K3
CO3	To understand mechanisms involved in different types of hypersensitivity, and the importance of conventional vs. recombinant vaccines.	K2, K3 &K4
CO4	To get acquainted with the importance of antigen-antibody interaction in disease diagnosis.	K2 & K3
CO5	To understand the principles of tolerance, autoimmunity and the role of immunity in protection against pathogens	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course							Hours	Credits
VI	**24UBC6C14**	**CC-XIV: IMMUNOLOGY**							**05**	**05**
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**				**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	2	2	1	2	3	2	1	2	2	2.3
CO-2	2	3	2	3	2	3	2	3	2	3	2.7
CO-3	2	3	3	2	3	2	3	2	3	2	2.6
CO-4	2	2	3	3	2	3	3	3	3	2	2.7
CO-5	3	2	3	2	3	3	2	3	3	2	2.7
Mean Overall Score											**2.64** (**high**)

Semester	Course code	Title of the course	Hours	Credits
VI	24UBC6C15P	CP-XV: LAB IN CLINICAL BIOCHEMISTRY	06	03

Objective: To impart thorough knowledge about the biochemical basis of various Diseases and disorders.

Practical: **(45 Periods)**

1. Collection of blood and urine, Types of preservative and anticoagulants
2. Qualitative tests of urine. Abnormal constituents- sugar, protein (albumin), ketone bodies, bile pigments and bile salts.
3. Quantitative estimation in blood
    a. Glucose
    b. Cholesterol
    c. Calcium
    d. Urea.
    e. Iron
    f. Bilirubin
    g. Uric acid
    h. Creatinine
4. Quantitative estimations in urine
    a. Glucose
    b. Urea
    c. Uric acid
    d. Creatinine
    e. Albumin
    f. Globulin
    g. A/G ratio

TEXT BOOK(S)

1. A Textbook of Practical Biochemistry- David Plummer, Tata McGraw-Hill Education, 1988.
2. Laboratory Manual in Biochemistry. J.Jayaraman, New Age International Publishers. 2nd Edn. 1981.
3. Introductory Practical Biochemistry - S.K.Sawhney, Randhir Singh, Narosa publishing house, 2000.

4. Textbook of Clinical Chemistry, 3rd ed- TietZ , WB Saunders, Burtis & Ashwood, 1999.
5. Practical Clinical Biochemistry- Alan H Gowenlock, Varley‘s published by CBS Publishers and distributors, India Sixth Edition, 1988.
6. Practical clinical Biochemistry- Harold Varley, CBS Publishers & Distributors, 2006.

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Students learn about the problem-solving techniques to identify and correct procedural errors, identify instrument malfunctions and seek proper supervisory assistance, and verify the accuracy of laboratory results obtained	Kl & K2
CO2	Students learn about the investigations and perform analyses that provide information about biochemical questions and help to solve biochemical problems.	Kl, K2 & K3
CO3	students are also given basic training in safety measures quality control and automation	K2, K3 &K4
CO4	Students learn about the scientific ethics and problem solving	K2 & K3
CO5	Students learn about the technical skills, social behavior, and professional awareness incumbent upon a laboratory technician	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course								Hours	Credits
VI	**24UBC6C15P**	**CP-XV: LAB IN CLINICAL BIOCHEMISTRY**								**06**	**03**
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	2	2	1	3	3	2	2	3	2	2.3
CO-2	3	3	3	2	3	3	3	3	2	2	2.8
CO-3	2	2	2	3	2	3	2	2	3	2	2.3
CO-4	3	3	3	3	3	3	3	2	3	3	2.9
CO-5	3	3	2	3	3	3	3	3	3	3	3.0
Mean Overall Score											2.66 (**high**)

Semester	Course code	Title of the course	Hours	Credits
VI	24UBC6BCE2A	MBE-II : PHARMACEUTICAL BIOCHEMISTRY	04	04

Objectives: To make a detailed study about action of drugs on living system

Unit -I **(18 Periods)**

Introduction: Sources of drugs, routes of drug administration, dosage forms, drug dosage. Bioavailability: - Bioavailability of drugs, determination and its importance, Bioequivalence. Combined effect of drugs: - Synergism, antagonism.

Unit -II **(18 Periods)**

Pharmacokinetics: Absorption, distribution of drugs, factors influencing drug absorption and distribution. Drug elimination: - Renal excretion, feacal excretion, biliary excretion, pulmonary excretion and other routes of excretion.

Unit -III **(18 Periods)**

Pharmacodynamics: Mechanism of phase I and Phase II metabolic reactions, factors affecting drug metabolism, significance of drug metabolism. Mechanism of drug action: Basis of drug action, drug - receptor interactions, Receptor mediated and non-receptor mediated drug action, Placebo effects, Factors modifying drug action.

Unit -IV **(18 Periods)**

Adverse drug reactions: Classification: - Pharmacologic ADRs, Non-pharmacological ADRs, disease related ADRs, multiple drug reactions, miscellaneous ADRs, Acute poisoning: - General principles and management. Drug dependence, drug tolerance and intolerance.

Unit -V **(18 Periods)**

Drug discovery: Random screening, serendipity, molecular modification of a known drug, rational approaches in drug designing Drug development: Preclinical research, clinical research, FDA review and FDA post- market safety monitoring.

TEXT BOOK(S)

1. Pharmaceutical Pharmacology by S C Metha and Ashutosh Kar, 2011, New age International Publishers.
2. Text book of Medical Pharmacology by Padmaja Udayakumar, 2nd Edition, CBS Publishers & Distributors, New Delhi, Bangalore.
3. Oxford Text book of Clinical Pharmacology and Drug Therapy, D.G Grahme Smith and K.Aronson.
4. Pharmacology and Pharmatherapeutics – R.S.Satoskar, S.D.Bhandhakarand.
5. Lippincotts Illustrated review Pharmacology, Mary.J.Mycek, Richards.

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Describe the history of pharmacy, development of pharmacy profession and industry in India.	Kl & K2
CO2	Describe various routes of drug administration, concept of dosage forms, unit operations involved in preparation of these dosage forms	Kl, K2 & K3
CO3	Describes alternative system of medicines.	K2, K3 &K4
CO4	Explain the factors which influence the design of pharmaceutical dosage forms.	K2 & K3
CO5	Summarize the factors influencing formulation of various dosage form like solution.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course					Hours	Credits			
VI	24UBC6BCE2A	MBE-II: PHARMACEUTICAL BIOCHEMISTRY					04	04			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	2	2	3	3	2	3	2	3	2.6
CO-2	2	3	2	3	3	3	3	2	2	2	2.5
CO-3	3	3	3	2	2	3	3	3	2	2	2.7
CO-4	3	3	3	3	3	3	3	3	3	2	3.0
CO-5	3	3	2	2	3	3	3	3	2	3	2.7
Mean Overall Score											2.7 (**high**)

Semester	Course code	Title of the course	Hours	Credits
VI	24UBC6MBE2B	MBE-II: ADVANCED ENDOCRINOLOGY	04	04

Objectives: Clinical endocrinology plays a vital role in clinical Biochemistry and Metabolism

Unit I **(15 Periods)**

Hypothalamus and pituitary hormones: Vasopressin and oxytocin- synthesis and biological effects. Hypothalamic releasing factors. Anterior pituitary hormones actions. Growth promoting and lactogenic hormones. Glycoprotein hormones the POMC family. Endorphins, MSH. Gigantism, Acromegaly, Dwarfism and Diabetes insipidus.

Unit II **(15 Periods)**

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

Unit III **(15 Periods)**

Hormones of the thyroid Biosynthesis and biological actions of thyroid hormones. Antithyroid agents. Thyroid disease- thyrotoxicosis, Goiter, Grave‘s disease, Hashimoto‘s thyroiditis. Parathyroid hormone- Biological actions regulation of calcium and phosphorous metabolism. Calcitonin. Calcitriol- Biosynthesis and functions. Hyper and hypocalcemia. Hyperparathyroidism, hypo parathyroidism, Paget‘s disease. Ricket ‘s and osteomalacia.

Unit IV **(15 Periods)**

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

Unit V **(15 Periods)**

Adrenal hormones - Glucocorticoids, Mineralocorticoids- synthesis and biological effects. Catecholamines: biosynthesis and biological effects. Gonadal hormones Androgens and estrogens. Ovarian cycle. Abnormal secretion of adrenal hormones Addison‘s disease. Cushing‘s syndrome, congenital adrenal hyperplasia, phaeochromocytoma

TEXT BOOKS

1. Textbook of Endocrinology –8th edn. Wilson and Foster, 1998.
2. Principles of Biochemistry – Mammalian Biochemistry – Smith et al, Mc Graw Hill, 1982.

3. Mechanisms of Hormone Action, Estelle Jones, Hardcover - 2015
4. Harper ‘s Biochemistry – Murray et al. 26th ed. McGraw Hill, 2003.
5. Principles of Biochemistry – Mammalian Biochemistry – Smith et al. McGraw Hill 7th ed.
6. Textbook of Endocrinology- Williams et al, 2015.

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	The student will demonstrate an understanding of the anatomy of the endocrine system.	Kl & K2
CO2	The student will demonstrate an understanding of the basic properties of hormones.	Kl, K2 & K3
CO3	The student will demonstrate the role of hormones in maintaining body function.	K2, K3 &K4
CO4	The students will demonstrate those endocrine details helpful in the clinical realm	K2 & K3
CO5	The student will demonstrate knowledge of the major endocrine disorders	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code		Title of the Course							Hours	Credits
VI	**24UBC6MBE2B**		**MBE-II: ADVANCED ENDOCRINOLOGY**							**04**	**04**
Couse outcomes	**Programme outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean scores of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO-1	3	2	1	2	2	3	1	2	1	1	2.0
CO-2	3	3	2	2	3	3	3	2	2	2	2.6
CO-3	2	3	3	2	3	3	3	3	2	3	2.8
CO-4	3	3	3	3	3	3	3	3	3	2	3.0
CO-5	3	2	3	2	3	3	3	2	3	3	2.7
Mean Overall Score											**2.7 (high)**

Semester	Course code	Title of the course	Hours	Credits
VI	24UBC6MBE2C	MBE-II: NUTRITIONAL BIOCHEMISTRY	04	04

Objectives: The course is an introduction to nutritional biochemistry. The students will learn how nutrients effect biochemical processes and signal transduction pathways, and how this can lead to development on nutritionally related diseases.

Unit – I **(15 Periods)**

Nutritional profile of principal foods: Cereals, pulses, vegetables, fruits, nuts, oil seeds, animal foods, milk and milk products, egg, fish, meat, drinks and spices. Role of dietary carbohydrates, proteins, fats, fiber and antioxidants. Energy content of foods: Determination of calorific value by Bomb calorimeter.

Unit – II **(15 Periods)**

Dietary requirements: Balanced diet, Recommended dietary allowances for infants, children, adolescent, pregnant, lactating women, athletes and geriatrics. Measurement of energy expenditure, respiratory quotients of food stuffs, specific dynamic action.

BMR: - Measurement of BMR and factors influencing BMR.

Unit-III **(15 Periods)**

Dietary protein: Biological value of proteins and nitrogen balance. Essential and non-essentials amino acids. Protein energy malnutrition – etiology, management of kwashiorkor and marasmus.

Unit – IV **(15 Periods)**

Minerals: Nutritional significance of dietary macro minerals (Ca, P, Mg, S, K, Na, Cl) and trace minerals (Iron, Iodine, Zinc and copper). Disorders related to the deficiency of minerals. Nutraceuticals: Introduction and classification of nutraceuticals.

Unit- V **(15 Periods)**

Nutrition and body defenses: Drug - nutrient interaction, nutritional therapy for inborn errors of metabolism, role of diet and nutrition in the prevention and treatment of diseases:- Diabetes mellitus, Jaundice, Peptic ulcer, Gout, blood pressure, cardiovascular diseases, nephritis.

TEXT BOOK(S)

1. Human nutrition by B. Srilakshmi, New age International Pvt Ltd, 2009
2. Human nutrition and dietetics, S. Davidson and J.R. Passmore.
3. Human nutrition and dietetics, IS Garraw, WPT James, 10th edition

4. Modern nutrition in health and diseases, Whol and Good hart.
5. Mechanism and theory in food chemistry, DWS Wong, CBS New Delhi, 1996.

REFERENCE BOOK(S)

1. Human nutrition by B. Srilakshmi, New age International Pvt Ltd, 2009
2. Human nutrition and dietetics, S. Davidson and J.R. Passmore.
3. Human nutrition and dietetics, IS Garraw, WPT James, 10th edition
4. Modern nutrition in health and diseases, Whol and Good hart.
5. "Nutrition in the Prevention and Treatment of Disease" by Ann M. Coulston, Carol Boushey, and Mario Ferruzzi 2017 (3rd Edition)

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Understand the basic concepts of biochemistry	Kl & K2
CO2	Gain knowledge on metabolism of carbohydrate protein and lipids	Kl, K2 & K3
CO3	Acquire knowledge on functions and mode of action of different hormones.	K2, K3 &K4
CO4	Relate metabolism of different nutrients with dietary intake.	K2 & K3
CO5	Suggest preventive measures to overcome metabolic abnormalities.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code		Title of the Course							Hours	Credits
VI	24UBC6MBE2C		MBE-II: NUTRITIONAL BIOCHEMISTRY							04	04
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	1	2	2	3	2	2	1	2	2.1
CO-2	3	3	2	2	3	3	3	3	2	3	2.7
CO-3	2	3	3	2	3	3	3	3	2	3	2.7
CO-4	3	3	3	2	3	3	3	3	3	3	3.0
CO-5	3	3	3	3	3	3	3	3	3	3	3.0
Mean Overall Score											**2.7 (high)**

Semester	Course code	Title of the course	Hours	Credits
VI	24UBC6SBE2A	SBE-II: Nanotechnology	03	02

Objectives: Nanotechnology, along with related concepts such as nanomaterials, nanostructures and nanoparticles, has become a priority area for scientific research and technological development.

Unit-I **(6 Periods)**

Introduction to nanomedicine; class overview, Types of nanomaterials, Tools and methodology I. Surface and size characterization (AFM, EM, Electrophoresis, BET, TGA)

Unit-II **(6 Periods)**

Tools and methodology II. Chemical property characterization (FTIR, electrochem, NMR, MS, LC), Cellular processes at nanoscale, Nano nephrology

Unit-III **(6 Periods)**

Nano neurology and molecular imaging, Drug delivery (modes and example applications), Nanomedicine and cancer (diagnostic and imaging)

Unit- IV **(6 Periods)**

Toxicity of nanomaterials in medicine, Application of Nano system in Medicine, Nanomedicine in drug delivery and detoxification, Nanomedicine in immunotherapy

Unit-V **(6 Periods)**

Nanomedicine in diagnostics and bioimaging, Drug administration and transport by fluid motion Drug dispersion and diffusion in biological systems, Drug permeation through biological barriers Pharmacokinetics and biodistribution, Ligand-receptor engineering and targeted delivery, Case studies in nanomedicine

REFERENCE

1. Thomas Webster. Technologies and application.
2. Introduction to Nanomedicine and Nanotechnology" M. S. P. S. S. M. D. E. P. V. P. Y. S. S. S. 2017
3. "Nanotechnology for Health and Medicine" P. G. S. R. and B. R. 2016
4. "Nanotoxicology: Toxicity Evaluation of Nanomaterials" V. A. R. B. A. 2015.
5. "Nanotechnology in Medicine and Healthcare" S. A. L. M. P. D. 2018.

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Understand the basic concepts of Nanomedicine	Kl & K2
CO2	Gain knowledge on nanomaterials and its uses	Kl, K2 & K3
CO3	Acquire knowledge on nanomaterials uses in medicine fields	K2, K3 &K4
CO4	Gain the knowledge about nanomedicine uses in nano therapy	K2 & K3
CO5	Understand the basic concepts of bioimaging	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course					Hours	Credits			
VI	24UBC6SBE2A	SBE-II: Nanotechnology					03	02			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	2	1	2	2	3	2	2	1	2	2.1
CO-2	3	3	2	2	3	3	3	3	2	3	2.7
CO-3	3	3	2	2	3	3	3	3	2	3	2.7
CO-4	3	3	3	2	3	3	3	3	3	3	3.0
CO-5	3	3	3	2	3	3	3	3	3	3	3.0
Mean Overall Score											**2.7 (high)**

Semester	Course code	Title of the course	Hours	Credits
VI	24UBC6SBE2B	SBE-II: PHARMACOGNOSY	03	02

Objectives: To describe the development of a pharmacognosy course that uses a combination ofdidactic teaching, team-based projects, and practicum laboratory practice.

Unit – I **(6 Periods)**

History, Definition and scope of pharmacognosy; Systems of Indian Medicines -Siddha, Unani, Ayurveda, Homeopathy; Terminologies.

Unit – II **(6 Periods)**

Classification of Crude drugs – Taxonomical, Morphological, Pharmacological andchemical classifications; Chemistry of drugs and its evaluation.

Unit – III **(6 Periods)**

Preparation of crude and commercial drugs. Making infusion, decoction, lotion, washers, insect repellents, suppositories, tincture, making herbal syrups,

compresses, poultice, plasters, ointments, herbal oils and herbal salves. Surgical fibers,sutures and dressing.

Unit – IV **(6 Periods)**

Organoleptic study of the following medicinal plants: Fruit – Amla, Bulb –Garlic, Rhizome – Ginger, seed – castor, Bark – Cinchona, Leaves – Neem, Flower – Clove.

Unit – V **(6 Periods)**

Analytical Pharmacognosy – drug adulteration and detection. Biological testing of herbal drug. Phytochemical investigations with reference to secondary metabolites of locally available medicinal plants.

REFERENCE BOOK(S)

1. Pharmacognosy, S.B.Gokhale, Dr.C.K. Kokate, A.P. Purohit, Publisher: Nirali Prakasham, Pune, 2002.
2. Herbs that Heal, Acharya Vipul Rao – Diamond Pocket Books, New Delhi, 2005 Practical Pharmacognosy. Dr.C.K. Kokate et al. 2003
3. An Introduction to Medicinal Botany and Pharmacognosy – N.C. Kumar, Emkay Publications, New Delhi, 2004.
4. "Pharmacognosy and Pharmacobiotechnology" -V. K. Ahluwalia, A. K. Dhiman 2013.
5. "Pharmacognosy and Phytochemistry"-: J. B. Harborne , 2019

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Learn about the analytical methods and quality assurance in drug manufacturing.	Kl & K2
CO2	Students learn the observational, analytical and critical thinking skills to develop, implement and evaluate solutions that solve drug control and drug manufacturing problems.	Kl, K2 & K3
CO3	Learn about the definition, history, scope and development of pharmacognosy.	K2, K3 &K4
CO4	Learn about the techniques in the cultivation, processing, storage and production of crude drugs of natural origin.	K2 & K3
CO5	Students learn about the role of Pharmacognosy in allopathy and traditional system of medicine	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course					Hours	Credits			
VI	24UBC6SBE2B	SBE-II: PHARMACOGNOSY					03	02			
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	3	2	2	3	2	3	2	2	2.7
CO-2	3	3	3	2	3	3	3	3	2	3	3.0
CO-3	2	3	2	2	2	3	2	3	3	2	2.5
CO-4	3	2	3	2	2	3	2	3	3	2	2.6
CO-5	3	3	2	2	3	3	3	3	3	3	3.0
Mean Overall Score											2.76 (**high**)

Semester	Course code	Title of the course	Hours	Credits
VI	24UBC6SBE2C	SBE-II: CARDIOVASCULAR BIOLOGY	03	02

Objectives: To recognize the key importance of medical problems in the context in the health priority of the country; Practice the specialty of cardiology in keeping with the principles ofprofessional ethics.

Unit- I **(18 Periods)**

Fundamentals of Cardiovascular Disease Global Burden of Cardiovascular Disease, Heart Disease in Varied Populations, Economics and Cardiovascular Disease, Clinical Decision-Making in Cardiology, Measurement and Improvement of Quality of Cardiovascular Care.

Unit- II **(18 Periods)**

Evaluation of the Patient The History and Physical Examination: An Evidence-Based Approach, Electrocardiography, Exercise Stress Testing, Echocardiography, Genetics of Myocardial Disease, Genetics of Myocardial Disease, The Chest Radiograph in Cardiovascular Disease, Nuclear Cardiology, Cardiovascular Magnetic Resonance, 4 Curriculum DM (Cardiology) Computed Tomography of the Heart, Cardiac Catheterization, Coronary Angiography and Intravascular Ultrasound Imaging.

Unit -III **(18 Periods)**

Heart Failure Mechanisms of Cardiac Contraction and Relaxation, Pathophysiology of Heart Failure, Clinical assessment, Acute Heart Failure, Systolic Heart Failure, Heart Failure w/Preserved Systolic Fx, Surgical management of Heart Failure, Assisted Circulation in the treatment of Heart Failure, Emerging therapies for Heart Failure, Care of Patients with End-Stage Heart Disease.

Unit -IV **(18 Periods)**

Arrhythmias, Sudden Death, and Syncope Genesis of Cardiac Arrhythmias: Electrophysiological Considerations, Diagnosis of Cardiac Arrhythmias, Therapy for Cardiac Arrhythmias, Cardiac Pacemakers and Cardioverter-Defibrillators, Specific Arrhythmias: Diagnosis and Treatment, Cardiac Arrest and Sudden Cardiac Death, Hypotension and Syncope.

Unit-V **(18 Periods)**

Preventive Cardiology The Vascular Biology of Atherosclerosis, Risk Factors for Atherothrombotic Disease, Systemic Hypertension: Mechanisms and Diagnosis, Systemic

Hypertension: Therapy, Lipoprotein Disorders and Cardiovascular Disease, The Metabolic Syndrome, Diabetes Mellitus, and Atherosclerotic Vascular Disease, Nutrition and Cardiovascular Disease, Primary and Secondary Prevention of Coronary Heart Disease, Comprehensive Rehabilitation of Patients with Cardiovascular Disease, Complementary and Alternative Approaches to Management.

REFERENCE BOOK(S)

1. Braunwald_s Heart Disease Hurst_s The Heart Grossman's Cardiac Catheterization, Angiography, and Intervention
2. Stress Testing: Principles and Practice by Myrvin H. Ellestad Drugs for the Heart by Lionel H. Opie
3. The Cardiac Catheterization Handbook by Morton L. Kern Hemodynamic Roundsby Morton J. Ker Moss and Adams' Heart Disease in Infants, Children, and Adolescents
4. Pediatric Cardiology for Practitioners (4th Edition) by Myung K. Park Feigenbaum's Echocardiography
5. Shamroth.s An Introduction to Electrocardiography Valvular Heart Disease by Alpert & Dalen

Course Outcome:

Course Outcome	CO Statement	Knowledge level
CO1	Learn about the Identify priorities and barriers to important cardiovascular outcomes research	Kl & K2
CO2	Students learn about the trace the flow of blood throughout the body.	Kl, K2 & K3
CO3	Learn about the advance collaborative high-yield, high-impact outcomes research.	K2, K3 &K4
CO4	Students learn about the blood enters and leaves the heart and where it becomes oxygenated.	K2 & K3
CO5	Students will also be able to label the chambers of the heart and trace the flow of blood through it.	KI, K2 & K5

Relationship matrix for Course outcomes, Programme outcomes/ Programme specific outcomes

Mapping with Programme Outcomes

Semester	Course code	Title of the Course					Hours	Credits		
VI	24UBC6SBE2C	SBE-II: CARDIOVASCULAR BIOLOGY					03	02		
Couse outcomes	Programme outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean scores of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO-1	3	3	2	2	2	3	3	3	2	2	2.7
CO-2	3	3	3	2	2	3	3	3	3	2	2.9
CO-3	3	3	3	3	2	3	3	3	3	3	3.0
CO-4	3	3	3	2	2	3	3	3	3	2	2.8
CO-5	3	3	3	3	2	3	3	3	3	3	3.0
Mean Overall Score											**2.88 (high)**