

MANONMANIAM SUNDARANAR UNIVERSITY

TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.Sc. Biochemistry

(Choice Based Credit System)

(with effect from the academic year 2017-2018 onwards)

Sem (1)	Pt I/II/ III/I V/V (2)	Sub No (3)	Subject Status (4)	Subject Title (5)	Contact Hrs./ Week (6)	L Hrs./ Week (7)	T Hrs./ Week (8)	P Hrs./ Week (9)	C Cre- dits (10)
1	I	1	Language	Tamil / Other Language	6	6	0	0	4
	II	2	Language	English	6	6	0	0	4
	III	3	Core – 1	Biomolecules	4	4	0	0	4
	III	4	Core – 2	Cell Biology	4	4	0	0	4
	III	5	Major Practical – I	Biophysical & Biochemical Analysis – I	2	0	0	2	2
	III	6	Allied – I	Microbiology / Biotechnology	4	4	0	0	3
			For other Major Students	Chemical Biology and Biophysical Chemistry					
	III	7	Allied Practical – I	Allied Microbiology or Biotechnology Practicals	2	0	0	2	2
For other Major Students			ANALYSIS OF BIOMOLECULES - I						
IV	8	Common	Environmental Studies	2	2	0	0	2	

II	I	9	Language	Tamil / Other Language	6	6	0	0	4
	II	10	Language	English	6	6	0	0	4
	III	11	Core – 3	Physiology	4	4	0	0	4
	III	12	Core – 4	Analytical Biochemistry	4	4	0	0	4
	III	13	Major Practical – II	Biophysical & Biochemical Analysis- II	2	0	0	2	2
	III	14	Allied – II	Microbiology / Biotechnology	4	3	0	0	3
			For other Major Students	Biochemistry					
	III	15	Allied Practical – II	Microbiology / Biotechnology Practicals	2	0	0	2	2
			For other Major Students	ANALYSIS OF BIOMOLECULES –II					
	IV	16	Common	Value Based Education /சமூக ஒழுக்கங்களும் பண்பாட்டு விழுமியங்களும் / Social Harmony	2	2	0	0	2
				Subtotal	30				25

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc.Biochemistry) / Semester – I / Core – I

BIMOLECULES

Total hours : 64

Unit -1

12 Hours

Introduction to Biomolecules – Hierarchy of Biomolecules, Macromolecules and their building blocks in Biological system. Common functional group in organic molecules (-OH, -SH,-CHO,-COOH, -NH₂, -NH etc). Isomerism & Isomeric compounds with examples.

Unit-2

Carbohydrates- Classification, structure, occurrence, reaction & biological importance. Stereo isomerism-Epipimers form –Optical activity- Ring form of sugar- Mutarotation- α & β configuration – Reducing & Non reducing sugar – Monosaccharides – glucose, fructose, galactose, ribose –structure & Chemical reaction (identification tests). Disaccharides – sucrose, Maltose, Lactose- structure, function & properties. Polysaccharides- Homo & Hetero polysaccharides – Reactions of Starch & Dextrin.

Unit – 3

12 Hours

Lipids – definition, classification & physical properties. Types of fatty acids- saturated & unsaturated Fatty acids, PUFA ω -3 & ω -6 fatty acids – structure, function & biological importance. Triacyl glycerols – chemistry & characterization, Saponification Number, Iodine Number, Acid Number, RM Number. Phospholipids chemistry – Lecithin, Cephalin, Spingolipids -(sphingomyelin, cerebroside, gangliosides – structure & function only) Steroids – Cholesterol – structure & function.

Unit -4

14 Hours

Aminoacids & Proteins :Aminoacids – classification, Essential & Non-essential aminoacids – sources, structure, chemical reactions & properties (physical-pH, pI, solubility, Melting point, Rf value).

Proteins – Classification of proteins, Properties- solubility, Denaturation, renaturation, Structural organization of proteins – Primary, secondary, tertiary & quaternary structure. Secondary structure – α helix, β conformation. monomeric and Oligomeric proteins (Myoglobin and Hemoglobin), Conjugated proteins – glycoproteins and lipoproteins.

Unit-5 Nucleic acids

12 Hours

Purines, Pyrimidines – Structure & functions, Nucleosides & Nucleotides.

Nucleic acids – DNA – Double helical structure and Biological importance. RNA structure, types and biological importance.

References

1. Outlines of Biochemistry – Conn & Stumph
2. Agarwal's text book of Biochemistry – Goel Publishing House
3. General Biochemistry – J.H.Weil (6th edition)
4. Principles of Biochemistry – Lehninger, Nelson Cox – Macmillan Worth Publishers – 2008
5. Harper's Biochemistry (25th edition)
6. Principles of Biochemistry – Emil.L.Smith, Philip handler.

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc.Biochemistry) / Semester – I / Core – 2

CELL BIOLOGY

Total Hours : 64

Unit – 1

13 Hours

Structural organization of prokaryotic and eukaryotic cells. Ultra structure of nucleus, mitochondria, endoplasmic reticulum, Golgi apparatus, Lysosome and peroxysomes. Membrane – fluid mosaic model. **Unit – 2**

13 Hours

Membrane transport – Simple diffusion – diffusion of charged and uncharged molecules. Active transport – symport, antiport, Na⁺ K⁺ ATPase, Ca⁺ ATPase carriers, Ionophores. Endocytosis and exocytosis.

Cell junction; desmosome, tight junction and gap junction – Organization and role in cell adhesion.

Unit – 3

14 Hours

Chemical signaling between cells- second messengers and signaling molecules. The cell cycle – Interphase, G1, S and G2 phases. Regulation of cell cycle, cell death- necrosis and apoptosis, cell fusion.

Unit – 4

12 Hours

Cell division – mitosis – various stages of mitosis- prophase, metaphase, anaphase and telophase. Meiosis – various stages of meiosis.

Unit – 5

12 Hours

Chromosome structure, structure of gene. Mutation- point mutation, frame shift, back mutation and suppression.

Reference

1. Cell Biology and Histology – Gartner et al
2. Cell and Molecular Biology - De. Robertis and De Robertis
3. Cell Biology and Molecular Biology – Karp [wiley] 1999
4. Principles of genetics – Tamrine
5. Principles of Genetics – Gardner
6. Molecular Biology of the gene – Watson
7. Molecular and Cell Biology – Lodish, Baltimore.

BIOPHYSICAL AND BIOCHEMICAL ANALYSIS – I

1. Estimation of lactose in milk
2. Preparation of starch from potato
3. Estimation of aminoacids by Sorensens formal titration
4. Determination of iodine number of edible oil.
5. Determination of Acid number of edible oil.
6. Determination of Saponification number of edible oil.
7. Preparation of total solids from milk.
8. Extraction of casein from milk.

References

1. Laboratory Manual in Biochemistry – T.N Pattambiraman – 3rd edition
2. Laboratory Manual in Biochemistry – J. Jayaraman, New Age International Publishers
3. Biochemical Methds- S. Sathasivam, A. Manicham, New Age International Publishers
4. An Introduction to Practical Biochemistry – David . T Plummer – 3rd edition

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc.Biochemistry / Semester – I / Allied – I

Chemical Biology and Biophysical Chemistry

Total Hours: 64

Unit-1

13 Hours

Carbohydrates – classification, structure, occurrence & reaction & biological importance. – Reducing and non reducing sugar- Monosaccharides – glucose, fructose- structure & chemical reactions (Identification test). Disaccharides – sucrose, maltose, lactose – structure, function & properties. Polysaccharides –Homo & Hetero polysaccharides- reactions of starch and dextrin.

Unit-2

13 Hours

Lipids- definition, classification & physical properties. Types of fatty acids- saturated & unsaturated fattyacids, PUFA (ω -3 & ω -6 fattyacids). Triacyl glycerols- chemistry and characterisation, Saponification number, iodine number, acid number, RM number. Steroids- Cholesterol – structure & function.

Unit-3

13 Hours

Aminoacids, proteins and nucleic acids

Aminoacids- classification, essential & non-essential aminoacids. Prteins- classification of proteins, properties – solubility, denaturation, renaturation and biological importance

Pirines, pyrimidines- structure & function, nucleotides, nucleosides.

Nucleic acids –DNA –Double helical structure and biological importance. RNA –structure, types, function & biological importance.

Unit-4

13 Hours

Water, acid bases and buffers. Concept of pH. Measurement of pH using pH meter. Concepts of acids, bases and buffers, Henderson - Hasselbach equation. Centrifugation techniques- principles and applications

Chromatography techniques- principle and application of paper chromatography, thin layer chromatography and gel filtration chromatography.

Unit-5

14 Hours

Spectroscopy techniques – basic principles of light absorption and its transmittance – Beer-Lambert's law.

Principles and applications of UV and Visible spectroscopy.

Electrophoresis techniques - Principles, factors affecting migration rate, Techniques and applications of Agarose gel electrophoresis, PAGE and SDS-PAGE.

Reference Books

Chemical Biology

1. Outlines of Biochemistry – Conn & Stumph
2. Agarwal's textbook of Biochemistry – Goel Publishing House
3. General Biochemistry – J.H. Weil (6th edition)
4. Principles of Biochemistry – Lehninger, Nelson Cox - Macmillan Worth Publ-2000
5. Harper's Biochemistry (25th edition)

Biophysical chemistry

1. A biologist guide to principles and techniques of Practical Biochemistry – Wilson and Walker - 5th edition (Cambridge university press, 2000)
2. Modern Experimental Biochemistry – Boyer R, 3rd edition (Addison Wesley Longman, 2000)
3. Biophysical chemistry principles and techniques- Upadhyay and Nath (Himalaya publications 1997)
4. Electrophoretic techniques – Simpson CFA and Whittacker.M
5. An introduction to spectroscopy for Biochemistry – S.M. Brown.

ANALYSIS OF BIOMOLECULES-I

1. Qualitative analysis of carbohydrates
 Analysis of monosaccharides – pentose, glucose, fructose
 Analysis of disaccharides – sucrose, maltose and lactose
 Analysis of polysaccharides – starch
2. Qualitative analysis of amino acids
 Analysis of tyrosine, tryptophan, arginine, histidine, methionine, cysteine
3. Reactions of proteins – biuret, saturatin test, precipitation by acids, alkalis, salts and heavy metals
4. Estimation of iodine number of oil
5. Determination of saponification number of oil
6. Determination of acid number of oil
7. Estimation of protein from Soya bean

References

1. Laboratory manual in Biochemistrty - T. N. Pattambiraman – 3rd edition
2. Laboratory manual in Biochemistrty - J. Jayaraman, New Age International Publishers
3. Biochemical methods - S. Sathasivam, A. Manickam, New Age International Publishers
4. An Inroductin to practical Biochemistry - David . T. Plummer-3rd edition.

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc.Biochemistry)/Semester – II / Core - 3

Physiology

Total Hours: 64 Hours

Unit-1

13 Hours

Blood and circulatory system: Composition of blood, function, types of blood cells and their function. Blood groups – ABO and Rhesus systems. Blood clotting; clotting factors- intrinsic and extrinsic factors, Mechanism of blood clotting. Structure of Heart.

Unit-2

13 Hours

Respiratory system: Structure of Lungs. Diffusion of O₂ and CO₂ in blood, lungs and tissues. Oxygen dissociation curve – Hill plot. Role of lungs in acid-base balance.

Unit-3

12 Hours

Excretory system: structure of kidneys, structure of Nephrons- Composition and formation of urine, Renal regulation of acid-base balance, Renal threshold, Glomerular filtration rate.

Unit-4

13 Hours

Digestive system: structure of GI tract. Composition of salivary, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids and proteins.

Unit-5

13 Hours

Sensory organs: Neurons- structure, Nerve impulse and Neurotransmitters. Structure of eye and ear. Muscle types- Muscular contraction and relaxation. Role of Vitamin A in Vision.

References

1. Human physiology- C.C. Chatterjee, 11th edition
2. Text book of Physiology- Saratha Subramaniam
3. Text book of Medical Physiology- A.G.Guyton
4. Human physiology- Vander et al 4th edition
5. Harper's Biochemistry- Murray et al 25th edition 2000
6. Principles of Biochemistry- Mammalian Biochemistry- Smith et al., McGraw Hill 7th edition.

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc.Biochemistry)/Semester – II / Core - 4

ANALYTICAL BIOCHEMISTRY

Total Hours : 64

Unit-1

12 Hours

Water, Acid, Bases and buffers - Water - structure, hydrogen bonding, ionic product of water- concept of pH, p^{OH} and its calculation. measurement of pH using pH meter. Concepts of acids, bases and buffers, Henderson - Hasselbach equation, pKa and calculation of pKa.

Unit-2

12 Hours

Solutions- components of solutions, methods of expressing concentration - mole fraction, molality, molarity, parts per million, mass percent. Isotonic, hypertonic and hypotonic solutions. Donnan membrane equilibrium-applications. Separation by centrifugation techniques – principles and applications.

Unit-3

14 Hours

Chromatography techniques – principles and application of paper chromatography, Thin layer chromatography, Gel filtration chromatography, Ion exchange chromatography, GLC and HPLC.

Unit-4

12 Hours

Electrophoresis techniques – principles, factor affecting migration rate, Techniques and applications of Agarose gel electrophoresis, PAGE and SDS-PAGE.

Unit-5

14 hours

Spectroscopy and Radioisotopes

Spectroscopy techniques – basic principles of light absorption and its transmittance – Beer- Lambert's law.

Principles and applications of colorimeter, spectrophotometer, Atomic absorption spectrophotometer. Principles of IR and NMR spectroscopy.

Radio activity- alpha, beta and gamma radiation. Measurement of radioactivity using Liquid Scintillation Counter, Radio isotopes commonly used in metabolic studies.

References

1. A biologist guide to principles and techniques of Practical Biochemistry – Wilson and Walkar -5th edition (Cambridge University press 2000)
2. Modern Experimental Biochemistry - Boyer R 3rd edition (Addison Wesley and Longman, 2000)
3. Biophysical chemistry principles and techniques – Upadhay and Nath. (Himalaya publications, 1997)
4. Electrophoretic techniques – Simpson, CFA and Whittacker,M
5. An introduction to spectroscopy for Biochemistry – S.M.Brown.

BIOPHYSICAL AND BIOCHEMICAL ANALYSIS –II

1. Qualitative analysis of carbohydrates
Analysis of monosaccharides – pentose, glucose, fructose, galactose and mannose.
Analysis of disaccharides – sucrose, maltose and lactose.
Analysis of polysaccharides – starch, dextrin
2. Qualitative analysis of lipids – saturated, unsaturated fatty acids and cholesterol.
3. Qualitative analysis of amino acids;
Analysis of tyrosine, tryptophan, arginine, histidine, methionine, cysteine, cystine and proline.
4. Reactions of proteins- Biuret, Saturation tests, Precipitation by acids, alkalis, salts and heavy metals.

References

1. Laboratory Manual in Biochemistry – T.N Pattambiraman – 3rd edition
2. Laboratory Manual in Biochemistry – J. Jayaraman, New Age International Publishers
3. Biochemical Methods- S. Sathasivam, A. Manicham, New Age International Publishers
4. An Introduction to Practical Biochemistry – David . T Plummer – 3rd edition

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc.Biochemistry)/Semester – II / Allied - II

BIOCHEMISTRY

Total hours : 64

Unit-1

12Hours

Enzymes- general characteristics, classification, definition with examples. Holoenzyme, apoenzyme, coenzyme, unit of enzymes. Definition of IU, katal, Enzyme turn over number and specific enzyme activity. Multienzyme complexes- Fattyacid synthase complex. Mechanism of enzyme action: Active site, Role of cofactors in enzyme catalysis NAD/NADP, FMN/FAD, coenzyme A, pyridoxal phosphate.

Unit-2

12 Hours

Enzyme kinetics: Factors affecting enzyme activity- enzyme concentration, substrate concentration, pH and Temperature. Deviation of Michaelis Menton equation for unisubstrate reactions. Km and its significance. Lineweaver-Burk plot.

Enzyme inhibition; reversible and irreversible inhibition, competitive inhibition, non-competitive and un competitive inhibition (deviation not required). Isoenzymes and their medical application.

Unit-3

16 Hours

General introduction to metabolism: carbohydrate metabolism – glycolysis, oxidation of pyruvate to acetyl co A. TCA cycle, pentose phosphate pathway, glycogen metabolism (Structure not required)

Lipid metabolism; sources of lipids, oxidation of fatty acid, β -xidation role f carnitine in β -oxidation. Biosynthesis of saturated fatty acid- synthesis of palmitic acid.

Unit-4

10 Hours

Electron transport chain and its significance, inhibitors of ETC, oxidative phosphorylation- chemiosmotic theory, site of oxidative phosphorylation. P/O ratio, inhibitors and uncouplers foxidative phosphorylation.

Purine and Pyrimidine biosynthesis and degradation.

Unit-5

14 Hours

Amino acid metabolism Transamination, deamination and decarboxylation of aminoacids. Metabolism of glycine, tryptophan, lysine. Urea cycle, ketogenesis.

References

1. Principles of Biochemistry- Lehninger 3rd edition
2. Enzymes – Trevor Palmer
3. Principles of Biochemistry- B.L. Smith
4. Agarwal's textbook of Biochemistry- Geol publishing House
5. Harper's review of Biochemistry, 24th edition
6. Text book of Biochemistry – Lubert Stryer, 4th edition
7. Principles of Biochemistry – Emil L. Smith, Abraham White, Philip Handler-7th edition

Analysis of Biomolecules - II

Isolation and Estimation of DNA (Animal tissue, Plant tissue sources)

1. Isolation and estimation of RNA from yeast
2. Estimation of iron from Plant sources
3. Estimation of Protein from Soya bean
4. Estimation of Carbohydrates from Wheat
5. Determination of Saponification value of oil.
6. Estimation of calcium from milk
7. Estimation of Vitamin C from Citrus Fruits
8. Estimation of chlorophyll
9. Estimation of carotenoids

References

1. Laboratory Manual in Biochemistry- T.N. Pattambiraman -3rd edition
2. Laboratory Manual in Biochemistry – J. Jayaraman, New Age International Publishers
3. Biochemical methods – S. Sathasivam and , A. Manicham, New Age International Publishers
4. An Introduction to Practical Biochemistry – David . T Plummer – 3rd edition