MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.Sc. Biochemistry

(Choice Based Credit System)

(with effect from the academic year 2020-2021 onwards)

Eligibility for admission to B.Sc., Biochemistry

Candidates shall be admitted to the course provided he/she has passed plus two examinations of the State or Central Board with Biology/Biochemistry as one of the subjects.

Part I/II/III/ IV/V	Sub. No	Subject Status	Subject Title	Contact hrs/ week	L hrs/ week	T hrs/ week	P hrs / week	C Credits
Semester – I								
I	1	Language	Tamil/Other Languages	6	6	0	0	4
II	2	Language	Communicative English	6	6	0	0	4
III	3	Core-1	Biomolecules	4	4	0	0	4
III	4	Major Practical – 1	Analysis of Biomolecules	2	0	0	2	2
III	5	Add on Major (Mandatory)	Professional English for Life Sciences – I	4	4	0	0	4
III	6	Allied - 1	Principles of Nutrition	4	4	0	0	3
III	7	Allied Practical -1	Analysis of Nutrients	2	0	0	2	2
IV	8	Common	Environmental Studies	2	2	0	0	2
			Subtotal	**30**	**26**	**0**	**4**	**25**
Semester – II								
I	9	Language	Tamil/Other Languages	6	6	0	0	4
II	10	Language	English	6	6	0	0	4
III	11	Core-2	Analytical Biochemistry	4	4	0	0	4
III	12	Major Practical – 2	Analytical Biochemistry techniques	2	0	0	2	2

III	13	Add on Major (Mandatory)	Professional English for Life Sciences – II	4	4	0	0	4
III	14	Allied - 2	Food Biochemistry and Preservation	4	4	0	0	3
III	15	Allied Practical - 2	Food analysis	2	0	0	2	2
IV	16	Common	Value Based Education / Social Harmony Value Based Education / சமூகஒழுக்கங்களும் பண்பாட்டு விழுமியங்களும் / Social Harmony	2	2	0	0	2
			Subtotal	**30**	**26**	**0**	**4**	**25**

MSU/2020-21/UG - Colleges/Part - III (B.Sc. Biochemistry)/Semester-I/Core - 1

BIOMOLECULES

L	T	P	C
4	0	0	4

Objective

To know the various micro and macro molecules in living systems and to acquire understanding on their biological importance.

Total Hours: 64

UNIT I 12 Hours

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

UNIT II 14 Hours

Carbohydrates - Classification, structure, occurance, reaction & biological importance. Stereo isomerism - Epimers D & L form - Optical activity, Ring form of sugars - Mutarotation - α & ß configuration. Reducing & Non reducing sugars - Monosaccharides - Glucose, Fructose, Galactose, Ribose - Structure & chemical reactions (identification tests). Disaccharides - Sucrose, Maltose, Lactose - structure, function & properties. Polysaccharides - Homo & Hetero polysaccharides - Reactions of starch & dextrin.

UNIT III 12 Hours

Lipids- definition, classification & physical properties. Types of fatty acids - Saturated & unsaturated fatty acids, MUFA, PUFA (ω-3 & ω-6 fatty acids) - Structure & biological importance. Eicosanoids - prostaglandins. Triacyl glycerol - chemistry & characterization, Saponification Number, Iodine Number, Acid Number, RM Number. Phospholipids chemistry - Lecithin, Cephalin, sphingolipids - (Sphingomyelin, cerebroside, gangliosides - structure & function only). Steroids- Cholesterol - structure & function.

UNIT IV 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, ß conformation. Monomeric and Oligomeric proteins (Myoglobin and Hemoglobin). Conjugated proteins - glycoproteins and lipoproteins

UNIT V 12 Hours

Nucleic acids: Purines, Pyrimidines - Structure & function, Nucleosides, Nucleotides. Nucleic acids - DNA - Double helical structure and Biological importance, RNA - Structure, Types & Biological Importance.

References

1. Robert-K-Murray-et-al- Harpers-illustrated-biochemistry-28th-ed-Mcgraw-Hill-2009
2. Devlin, T.M., John Wiley & Sons, Inc. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., (New York).
3. Tymoczko, John L., Jeremy M. Berg, and Lubert Stryer. Biochemistry: a short course.
4. Macmillan, 2011.
5. Cox, Michael M. Lehninger principles of biochemistry. Freeman, 2013.
6. Garrett, Reginald, and Charles Grisham. Biochemistry. Nelson Education, 2012.
7. Voet, Donald, Judith G. Voet, and Charlotte W. Pratt. "Fundamentals of biochemistry." NewYork: John Wiley & Sons 2008.

MSU/2020-21/UG-Colleges/Part-III (B.Sc. Biochemistry)/Semester-I/Major Practical-1

ANALYSIS OF BIOMOLECULES

1. Qualitative analysis of carbohydrates
    a. Analysis of monosaccharides - pentose, glucose, fructose, galactose and mannose.
    b. Analysis of disaccharides - sucrose, maltose and lactose.
    c. Analysis of polysaccharides - starch, dextrin.
2. Qualitative analysis of lipids - saturated & unsaturated fatty acids, cholesterol.
3. Qualitative analysis of amino acids - Analysis of tyrosine, tryptophan, arginine, histidine, methionine, cysteine, cystine and proline.
4. Reactions of proteins - Biuret test, Saturation tests, Precipitation by acids, alkalis, salts and heavy metals.
5. Determination of Iodine number of an edible oil.
6. Determination of Acid number of an edible oil.
7. Determination of Saponification number of an edible oil.

References

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

PRINCIPLES OF NUTRITION

L	T	P	C
4	0	0	4

Objective

To acquire insight on the role of nutrients and their relationship in maintaining health of the individual.

Total Hours: 64

UNIT I 12 Hours

Basic concepts in Nutrition

Introduction to Nutrition – Food as source of nutrients, Definition of Nutrition, Nutrients, Energy, Adequate, Optimum and Good nutrition. Relationship between food, nutrition and health; Malnutrition. Basis of healthy diet and basic nutrients.

UNIT II

Carbohydrates, Proteins and Dietary fibres 14 Hours

Carbohydrates – Definition, Composition, Nutritional classification, Functions, RDA and sources – Effects of too high and too low carbohydrates on health. Proteins – Definition, Composition and Functions, RDA and sources of Proteins and Aminoacids – Nutritional classification – Deficiency. Dietary fibre – Classification, sources and its role in Human nutrition.

UNIT III

Lipids and Water 12 Hours

Lipids – Definition, Nutritional classification, Functions, RDA, Sources and effects of deficiency. Role and nutritional significances of PUFA, MUFA, SFA and ω3 fattyacids. Water as a nutrient, Function, Sources, Requirement, Water balance and effects of deficiency.

UNIT IV

Minerals 14 Hours

Minerals- Definition, Nutritional classification and Functions – Macrominerals – Calcium, Phosphorus, Magnesium, Sodium and Potassium – RDA, sources, Functions and effects of deficiency. Microminerals – Iron, Iodine, Copper, Flourine and Zinc – Requirements, Sources, Functions and effects of deficiency.

UNIT V

Vitamins 12 Hours

Vitamins – Definition, Nutritional classification, Functions and Deficiency – Fat soluble vitamins – Vitamin A, D, E and K – RDA, sources and effects of deficiency. Water soluble vitamins – Thiamine, Riboflavin, Niacin, Ascorbic acid, Folic acid, Vitamin B6 and Vitamin B12 – RDA, sources and effects of deficiency.

References

1. Swaminathan, M., Essentials of Food and Nutrition, Vol I & II, Bappco Publishers, Madras 2000.
2. Srilakshmi, B., Nutrition Science, New Age International (p) Ltd, Publishers, 2012.
3. 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, 2015.

MSU/2020-21/UG-Colleges/Part-III (B.Sc. Biochemistry)/Semester-I/Allied Practical- 1

ANALYSIS OF NUTRIENTS

1. Quantitative estimation of Sugar in fruits
2. Quantitative estimation of total free aminoacids in vegetables
3. Quantitative estimation of calcium in milk
4. Quantitative estimation of Phosphorus in malted food
5. Quantitative estimation of Iron in malted food
6. Quantitative estimation of Ascorbic acid in fruit juice
7. Determination of Gluten content of Wheat.
8. Determination of β- Carotene in Carrot by Column chromatography

References

1. Varley, H., Gowenlak, A.H. and Hill, M. Practical Clinical Biochemistry, William Itinmaon Medical Books, London, 2010.
2. Sadasivam, S. and Manickam, A. Biochemical Methods, Second Edition, New age International P. Ltd., Publishers, New Delhi, 2013.
3. Raghuramulu, N., Madhavannair, K. and Kalyana Sundaram, National Institute of Nutrition, 2013. A Manual of Laboratory Techniques, Hyderabad.
4. Swaminathan, M. Food Science, Chemistry and Experimental Foods, Bappco Publishers, 2013.

MSU/2020-21/UG-Colleges/Part-III (B.Sc. Biochemistry)/Semester-II/Core-2

ANALYTICAL BIOCHEMISTRY

L	T	P	C
4	0	0	4

Objective

To gain knowledge and understanding of the basic principles and applications of various techniques in the identification, separation and purification of biomolecules and to develop skill-based interest in the analytical field.

Total Hours: 64

UNIT I 12 Hours

Water, Acid, Bases and Buffers. Water - structure, hydrogen bonding, ionic product of water - concept of pH, pOH and its calculation. Measurement of pH using pH meter. Concepts of acids, bases and buffers, Henderson - Hasselbach equation, pKa and calculation of pKa.

UNIT II 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. Centrifugation techniques - principles and applications.

UNIT III 14 Hours

Chromatography techniques - Principles and applications of Paper chromatography, Thin layer chromatography, Gel filtration chromatography, Affinity chromatography, GLC and HPLC.

UNIT IV 12 Hours

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

UNIT V 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 and NMR spectroscopy.

Radioactivity - alpha, beta and gamma radiation. Measurement of radioactivity using Liquid Scintillation Counter, Autoradiography, Radioisotopes commonly used in metabolic studies.

References

1. Wilson, Keith, and John Walker, eds. Principles and techniques of biochemistry and molecular biology - Cambridge university press, 2010.
2. Bisen, Prakash Singh, and Anjana Sharma, Introduction to instrumentation in life sciences. Crc Press, 2012.
3. Boyer R, Modern Experimental Biochemistry 3d edition (Addison Weslery Longman 2000).
4. Upadhyay, Upadhay and Nath, Biophysical Chemistry Principles and Techniques – (Himalaya Publications, 1997).
5. Simpson CFA and Whittacker. M, Electophoretic techniques.
6. S.M. Brown, An introduction to spectroscopy for Biochemistry.

MSU/2020-21/UG-Colleges/Part-III (B.Sc. Biochemistry)/Semester-II/Major Practical-2

ANALYTICAL BIOCHEMISTRY TECHNIQUES

1. Preparation of Molar, Normal and Percentage solutions
2. Extraction of casein from milk.
3. Preparation of starch from potato.
4. Estimation of lactose in milk.
5. Estimation of aminoacids by Sorenson's Formal titration.
6. Separation of aminoacids by Paper chromatography
7. Estimation of RNA by colorimetry
8. Separation of DNA by Agarose gel electrophoresis

References

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

FOOD BIOCHEMISTRY AND PRESERVATION

L	T	P	C
4	0	0	4

Objective

To understand the importance of food quality, quality assessment, food safety and standard food preservation methods.

Total Hours: 64

UNIT I 12 Hours

Concepts of Food and Nutrition.

Functions of food; Basic food groups; nutrients supplied by food; Food Composition, Food analysis. Basal metabolism, Balanced diet and Recommended dietary allowance (RDA).

UNIT II 12 Hours

Food Additives and Adulterants

Food additives – definition; Common food additives, function and usage; Permissible limits of additives in foods; Implications of additives on consumers health; Food adulteration – meaning and definition; Types of food adulterants; Methods used for detection of food adulterants.

UNIT III 14 Hours

Testing of Food Quality

Food quality – meaning and need of food quality testing; Types of evaluation – subjective and objective; Subjective evaluation methods based on difference, rate, sensitivity etc.; Objective evaluation methods – tools and instruments used. Food Laws and Standards – Need and importance.

UNIT IV 14 Hours

Introduction to Food Preservation, Preservation using low and high temperature.

Importance of food preservation, Basic principles of food preservation. Preservation by the use of low and high temperature – refrigeration, freezing- advantages, factors to be considered;

Preservation by the use of high temperature – drying and dehydration – methods of drying, mechanical dehydration, merits and demerits, factors affecting drying. Pasteurization

UNIT V 12 Hours

Preservation using sugar, chemicals, salts and fermentation.

Sugar concentrates – principles of gel formation, preparation of jam, jelly, sauce and squash preserves, candied, crystallized fruits; Preservation of fruit juices. Salt preservation – pickling- principle involved. Chemical preservatives – definition, permitted preservatives, FPO specification. Preservation by fermentation – common fermented foods.

References

1. Sivasankar, B. (2013) Food Processing and preservation 2 nd edition, prentice Hall, Pvt, Ltd.
2. Srilakshmi, N., (2016) 6th Edition, Food Science, New Age International Private Ltd., New Delhi, 2002.
3. Swaminathan, M., Food Science, Chemistry and Experimental Foods, Bappco Publishers, Bangalore, 2014.
4. Early, R. (1995). Guide to Quality Management Systems for the Food Industry, Blackie, Academic and Professional, London.
5. Gould, W.A. and Gould, R.W. 1988. Total Quality Assurance for the Food Industries, CTI Publications Inc, Baltimore.
6. Pomeranz, Y. and Meloan, C.E. 1996. Food Analysis : Theory and Practice, CBS Publishers and Distributor, New Delhi.
7. Askar, A. and Treptow, H. 1993. Quality Assurance in Tropical Fruit Processing, Springer – Verlag, Berlin

MSU/2020-21/UG-Colleges/Part-III (B.Sc. Biochemistry)/Semester-II/Allied Practical- 2

FOOD ANALYSIS

1. Estimation of moisture content in food sample.
2. Estimation of ash content in food sample.
3. Determination of pH of food products using pH meter.
4. Determination of alcoholic acidity in food sample.
5. Qualitative analysis of Food adulterants in Milk, Ghee, Oils, Honey, Turmeric powder, Chilly powder, Tea powder and Sugar.

References

1. Srivastava R.P. Fruit and vegetable preservation – Principles and Practices, International Book Distributing Co., (IBDC), New Delhi, 2013.
2. Sadasivam, S. and Manickam, A. Biochemical Methods, Second Edition, New age International P. Ltd., Publishers, New Delhi, 2013.
3. Raghuramulu, N., Madhavannair, K. and Kalyana Sundaram, National Institute of Nutrition, 2013. A Manual of Laboratory Techniques, Hyderabad.
4. Swaminathan,M. Food Science, Chemistry and Experimental Foods, Bappco Publishers2013,