

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.SC. BIOTECHNOLOGY

(Choice Based Credit System)

(with effect from the academic year 2020-21 onwards)

Se m	Pt. I/II/ III/I V/V	Sub no.	Subject status	Subject Title	Con tact Hrs/ week	L Hrs/ week	T Hrs/ week	P Hrs/ week	C credi ts
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
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	Basics of biodiversity and conservation	4	4	0	0	4
	III	4	Core-2	Cell biology and genetics	4	4	0	0	4
	III	5	Major practical -I	Lab in biodiversity conservation and cell biology	2	0	0	2	2
	III	6	Add-on Major (Mandatory)	Professional English for Life Sciences- I	4	4	0	0	4
	III	6	Allied I	Biochemistry - I	4	4	0	0	3
	III	7	Allied practical -I	Lab in Biochemistry - I	2	0	0	2	2
	IV	8	Common	Environmental studies	2	2	0	0	2
			Subtotal		34				29
II	I	9	Language	Tamil/ other languages	6	6	0	0	4
	II	10	Language	English	6	6	0	0	4
	III	11	Core-3	Instrumentation	4	4	0	0	4
	III	12	Core-4	Molecular biology	4	4	0	0	4
	III	13	Major practical II	Lab in Instrumentation and molecular biology	2	0	0	2	2
	III	15	Add-on Major (Mandatory)	Professional English for Life Sciences - II	4	4	0	0	4
	III	14	Allied - II	Biochemistry II	4	4	0	0	3
	III	15	Allied practical II	Lab in Biochemistry II	2	0	0	2	2
	IV	16	Common	Value Based Education / சமூகஒழுக்கங்களும் பண்பாட்டு விழுமியங்களும் / Social Harmony	2	2	0	0	2
			Subtotal		34				29

BASICS OF BIODIVERSITY AND CONSERVATION

L	T	P	C
4	0	0	4

Objective: To understand the basic principles and importance of biodiversity, need and means of conservation of biodiversity, and sustainable use of bio resources.

Unit I

Biodiversity - Principles, values and importance. Biodiversity acts relating to the protection of the environment. Ecosystem – Structure and function, ecosystem diversity, energy flow, food chain, food web and ecological succession. Types of ecosystem. (12L)

Unit II

Introduction to plants, animals and microorganism: Medicinal plants – Definition, scope, classification – Cryptogams and Phanerogams (*Andrographis*, *Ocimum*, *Aegle*, *Catharanthus*), Animals – Vertebrates and Invertebrates, Microorganism – Bacteria, Virus and Fungi. (11L)

Unit III

Conservation of biodiversity: *Ex situ* and *In situ* conservation – *In vitro* germplasm conservation – Cryopreservation techniques for short and long term conservation. Biogeographical zones of India – India as a megadiversity nation - Global biodiversity hot spots. Endangered and endemic species of India – Hot spots. (14L)

Unit IV

Exploitation of biodiversity – Threats to biodiversity – Conservation of biodiversity using biotechnological tools. Role of individuals in conservation of biodiversity. (11L)

Unit V

Environment practices – Climate change – global warming – ozone layer depletion – impacts on human communities. Bioresources – Biofertilizers, Biofuels and Biopesticides. Sustainable use of Bioresources. International agreement – Convention on Biological Diversity. (12L)

Total: 60L

References

1. www.gene.campaign.org/publications/free_releases.html
2. Free publications www.biodiversity.org
3. Ananthakrishnan, T.N. and K.G. Sivaramakrishnan 2006, Animal biodiversity patterns and processes. Scientific publishers, Jodhpur.
4. Biodiversity, E.O. Wilson, Editor, 12th edition, National academy press, USA

CELL BIOLOGY AND GENETICS

L	T	P	C
4	0	0	4

Objective: To understand the basic concept of cell structure, cell organelles, sub cellular organelles, and cytoplasmic matrix, Laws of Mendel, and population genetics.

Unit I

Cell as a living entity. Overview of Prokaryotic and eukaryotic cells – Variation in cell size and shapes, organization and function. Cell wall – Composition, organization. Plasma membrane – Properties and functions. **(11L)**

Unit II

Sub cellular organelles - Mitochondria – Chloroplast – Endoplasmic Reticulum – Lysosomes – Golgi complex. Cytosol – Properties of cytoplasmic matrix, Cytoskeleton, ergastic substances – cytoliths, raphides and inulin. **(12L)**

Unit III

Nucleus: Various forms - Structure of DNA – Function of DNA. Chromosomal types – giant chromosomes – Polytene and Lambrush chromosomes. Cell cycle – Molecular events – phases – Mitosis and Meiosis. **(12L)**

Unit IV

Mendel's experiment and laws – Allelic and Non Allelic – Multiple allelism. Principle of Bateson and Punnett's experiment. Sex linkage and sex linked genes. Cytoplasmic inheritance, crossing over linkage groups – Measurement of linkage and gene mapping. **(14L)**

Unit V

Population genetics – Hardy – Weinberg equilibrium – significance and factors affecting gene frequency. DNA as a genetic material – Griffith experiment. **(11L)**

Total: 60L

References

1. Cell and molecular biology 1998, Roberties and Roberties, K.M. Varghese publication.
2. Cell and molecular biology 1996, Gerald Karp, Blackwell pub, UK.
3. Introduction to cell biology, 1998, Sundarajan, Vikas Pub
4. Genes, 2002, Benjamine Levine- 8th edition OUP USA 1027p
5. Gardner/Simmons/Shustad. Principles of genetics, 8th EO-1999
6. Website- www.amazon.com

LAB IN BIODIVERSITY CONSERVATION AND CELL BIOLOGY

L	T	P	C
0	0	2	2

1. Identification and preservation of medicinal plants in the institution campus.
2. Calculation of species diversity index -Shannon wiener index and Simpson dominance index
3. Isolation and enumeration of microbes from soil sources.
4. Isolation and enumeration of microbes from water sources.
5. Isolation and enumeration of microbes from leaf litter.
6. Field visit to the nearest ecosystem (terrestrial/fresh water/marine)
7. Plant cell – Onion epidermal peel
8. Animal cell – Buccal cavity smear
9. Study of mitosis – Various stages – onion root tip
10. Study of meiosis – Rhoeo pollen squash
11. Giant chromosome - Chironomous larva

BIOCHEMISTRY - I

L T P C
4 0 0 3

Objective: To understand the classification, structure and properties of Carbohydrates, polysaccharides, proteins, lipids, and nucleic acids

Unit I

Carbohydrates: Definition and classification – configuration of monosaccharides – regular and ring structure. Mutarotation, Chemical properties of glucose and fructose. Structure and properties of disaccharides – Lactose, Maltose and Sucrose – occurrence and structure. **(10L)**

Unit II

Polysaccharides – Homo and Heteropolysaccharides – Starch, Glycogen, Cellulose, Hyaluronic acid and Chondroitin sulfate. Glycolysis and TCA cycle – energy yield. **(9L)**

Unit III

Protein and amino acids: Amino acids - Classifications – Structure - Properties. Proteins - Classification – Properties - Composition - and Structure – Biological functions. **(9L)**

Unit IV

Lipids - Definition – Composition. Fatty acids – classification – properties. Phospholipids – Structure, Properties, Significance (Lecithin, Cephalin and Sphingomyelin). **(8L)**

Unit V

Nucleic acid – Definition – Composition – Functions. Nitrogenous bases of purines and pyrimidines. Nucleosides and Nucleotides. DNA – Structure - Watson and Crick model. RNA – types – Structure of tRNA. **(9L)**

Total: 45L

References

1. Biochemistry, 1993, Lehinger J, CBS Publishers
2. Biochemistry, 1995, D.Voet and JG.Voet, John Wiley & sons. Inc. 2Ed.
3. Fundamentals of Biochemistry, 2000, Jain J.L. Chand & co, NewDelhi.
4. Biochemistry, 1999, Davidson, V.L. & Sitlmon, D.L., 4th ed, Lippincott William & Willeing.

LAB IN BIOCHEMISTRY - I

L T P C
0 0 2 2

1. Qualitative analysis of Carbohydrates
2. Qualitative analysis of Proteins.
3. Qualitative analysis of Lipids.
4. Qualitative analysis of Nucleic acids.
5. Quantitative analysis of Carbohydrates by Anthrone method.
6. Quantitative analysis of amino acids by ninhydrin method.
7. Quantitative analysis of proteins by Lowry's and Bradford's methods
8. Quantitative analysis of DNA by Diphenylamine method.

INSTRUMENTATION

L T P C
4 0 0 4

Objective: To understand the basic concepts of preparation of buffers and stock solutions, principle and operation of the common instruments used in bioscience laboratories.

Unit I

Preparation of buffers and stock solution of media/reagents. Preparation of molarity, molality, normality, formality, dilutions, percentage and ppm solutions. Brief introduction on Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP), International Organisation for Standards (ISO) and Annual Maintenance Contract (AMC). **(11L)**

Unit II

Principles and operation methods of weighing devices. Physical, Chemical and Electronic Balances. pH meter, Salinity and conductivity meter. Calibration of stage and ocular meter for micrometry. Haemocytometer, Laminar Air Flow chambers, Incubator, Shaker, Magnetic Stirrer, Distillation Units. **(11L)**

Unit III

Microscope: Physical properties of light – reflection, transmission, absorption, refraction, diffraction, concepts in microscopy- resolution, contrast, magnification, sensitivity. Light microscopes – compound microscope, dark field microscope, Phase contrast microscopy, Fluorescent microscope and Confocal microscope. Sample preparation for light microscope - fixation, staining, and histological techniques. Electron microscope - SEM, TEM – sample preparation for electron microscope. **(14L)**

Unit IV

Principle and application of Beer and Lambert's law – Instrumentation of colorimeter, spectrophotometer - Applications – Principle and instrumentation of IR and NMR, Atomic Absorption spectrophotometer (AAS) – Applications. Glasswares – Types – Uses. Sterilization – Principle – Methods of sterilization - Uses. **(13L)**

Unit V

Blotting techniques – Principle – Types – Southern Blot – Northern Blot – Western Blot. UV Transilluminators. Lyophilizers, deep freezers and Ultrafiltration techniques. **(11L)**

Total: 60L

References

1. A practical guide to clinical biochemistry- 1996, Keith Wilson, Cambridge University press.
2. Instrumental methods of analysis, 6th edition, Willard, Merrit, Dean, Settle.
3. Cell and molecular biology 1998, Roberties and Roberties, K M Varghese publications.
4. Cell and molecular biology 1996, Gerald Karp, Blackwell pub, UK.
5. Genes, 2002, Benjamine Levine- 8th edition OUP USA 1027p
6. Gardner/Simmons/Shustad. Principles of genetics, 8th EO-1999
7. Website- www.amazon.com

MOLECULAR BIOLOGY

L T P C
4 0 0 4

Objective: To understand the basic concepts of central dogma of molecular biology, regulation of gene expression, and regulation of protein synthesis.

Unit I

Molecular Biology – Introduction – Scope – Applications – Central dogma of Molecular Biology. DNA replication – Types – Experiments of Messelson and Stahl – Okazaki fragments – Rolling circle model. Prokaryotic and Eukaryotic replication. Enzymes of replication. **(13L)**

Unit II

Transcription and Translation in Prokaryotes and eukaryotes. Post transcriptional and Post translational mechanism. **(12L)**

Unit III

Regulation of gene expression – Positive and negative control – Operon concept – Trp operon – Lac operon – Ara operon - Control. Catabolic repression. **(12L)**

Unit IV

Regulation of protein synthesis. Introduction to Genomics and Proteomics - Gene pool and gene library. Antibiotics, Interferon, Antisense RNA. **(12L)**

Unit V

Genetic code – Characteristic features – Mutagens – Wobble hypothesis – Mutation in genetic code. DNA repair mechanism. **(11L)**

Total: 60L

References

1. Freidfelder. D and Malcinski. G.M., 1993, Essentials of molecular biology, II Ed, Jones Bartlett Publishers Inc, London.
2. Molecular biology of gene, 4th ed, 1987, J.D. Watson et al. The Benjamin/Cummings publ. California.
3. Gene VIII. 2002, Benjamin Lewis, OUP UK.
4. Maniatis et al, 2000, Molecular cloning: a laboratory manual, Cold Spring, Harlor laboratory press, NY.
5. R. A. Meyers, 1995, Molecular biology and biotechnology – A comprehensive desk reference. VCH publishers, NY
6. Cell and molecular biology 1996, Gerald Karp, John Wiley NY.

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc.Biotechnology) / Semester –II /
Major Practical - II**

LAB IN INSTRUMENTATION AND MOLECULAR BIOLOGY

L	T	P	C
0	0	2	2

1. Handling procedure of all lab instruments.
2. Sterilization techniques
3. Media preparation
4. Slide preparation for microscopic observation
5. Preparation of stock and working standard solutions: Molarity, Normality, Molality and Percentage solutions (w/w, w/v, v/v), PPM solution.
6. Determination of pH – using pH paper and pH electrode.
7. Preparation of buffers – acetate buffers, phosphate buffers
8. Determination of pKa value.
9. Separation of Chlorophyll pigments by Paper chromatography.
10. Isolation of DNA from any plant, animal or microbial sources.
11. Separation of DNA by Agarose gel electrophoresis.
12. Visit to Biotechnology lab and submission of report.

BIOCHEMISTRY - II

L T P C
4 0 0 3

Objective: To understand the basic concepts of acids and bases, principle and operation of common laboratory instruments and separation techniques.

Unit I

Theories of Acids and Bases – Lowry Bronsted theory – Arrhenius theory – Lewis theory. Derivation of Henderson Hasselbach equation – Applications. Buffer system of body fluids, pH maintenance. **(11L)**

Unit II

Centrifugation: Sedimentation, Principle of centrifugation – Types of rotor, Types of centrifuge- desktop, High- speed refrigerated, large capacity refrigerated, continuous flow centrifuge. Ultracentrifugation - Preparatory and analytical. Types of centrifugal separation- differential, density gradient centrifugation, rate zonal sedimentation, isopycnic sedimentation. **(14L)**

Unit III

Chromatography: Principles – types - Applications - Paper chromatography – Thin Layer Chromatography - Column Chromatography (ion exchange, affinity, gel filtration) HPLC. **(12L)**

Unit IV

Electrophoresis: Principle - Factors influence the electrophoresis - Types – Paper – PAGE – SDS PAGE , Isoelectro focusing, Two dimensional electrophoresis, Gel documentation system – Principle – Types – Applications. **(12L)**

Unit V

Electromagnetic radiation: Energy – Wavelength - Wave numbers – Frequency. Absorption and emission spectra – Applications. Principle, instrumentation and applications of UV-Visible Spectrophotometer. **(11L)**

Total: 60L

References

1. Biologists guide to principles and techniques of practical biochemistry-2000. Wilson K. Walker E. Arnold. Blackwell Pub. UK
2. Biophysical chemistry- Principles and techniques 2001. Upadhyay and Nath, Himalaya publications.
3. Spectroscopic methods in organic chemistry, 4th edition, Dudley H. Williams and Ian Fleming. W.H. Freeman & Co, Sanfransisco.
4. Biophysical chemistry 1980, Vol I, II, III C.R. Cantor & P.R. Schimmel. W.H. Freeman & Co, Sanfransisco.

**MSU/ 2020-21 / UG-Colleges /Part-III (B.Sc.Biotechnology) /
Semester –II / Allied Practical - II**

LAB IN BIOCHEMISTRY - II

L	T	P	C
0	0	2	2

1. Estimation of Acid value of fat.
2. Estimation of Iodine value of fat.
3. Estimation of Saponification value of fat.
4. Verification of Beer's law using colorimeter.
5. Finding observation maxima of solution using UV-Vis. Spectrophotometer.
6. Separation and identification of amino acids by paper chromatography.
7. Separation and identification of amino acids by Thin Layer Chromatography.
8. Separation and identification of fatty acids by Thin Layer Chromatography.