MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

UG COURSES – AFFILIATED COLLEGES

B.SC. BIOTECHNOLOGY

(Choice Based Credit System)

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

Sem **(1)**	**Pt. I/II/ III/IV/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 credits** **(10)**
I	I	1	Language	Tamil/ other languages	6	6	0	0	4
	II	2	Language	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	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	**30**				**25**
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	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	Social Value Education	2	2	0	0	2
				Subtotal	**30**				**25**
III	I	17	Language	Tamil/ other languages	6	6	0	0	4
	II	18	Language	English	6	6	0	0	4
	III	19	Core-5	Microbiology	4	4	0	0	4
	III	20	Major practical-III	Lab in Microbiology	2	0	0	2	2
	III	21	Allied III	Biophysics	4	4	0	0	3
	III	22	Allied practical III	Lab in Biophysics	2	0	0	2	2
	IV	23	Skill based core-I	Floriculture (or) Vermi and mushroom culture	4	4	0	0	4
	IV	24	Non major elective	Nutritional biotechnology (or) Vector borne diseases	2	2	0	0	2
				Subtotal	**30**				**25**

IV	I	25	Language	Tamil/ other languages	6	6	0	0	4
	II	26	Language	English	6	6	0	0	4
	III	27	Core-6	Immunology	4	4	0	0	4
	III	28	Major practical IV	Lab in Immunology	2	0	0	2	2
	III	29	Allied IV	Biostatistics	4	4	0	0	3
	III	30	Allied practical IV	Lab in Biostatistics	2	0	0	2	2
	IV	31	Skill based core-II	Personality Development/Yoga	4	4	0	0	4
	IV	32	Non major elective	Genetic diseases (or) Cancer biology	2	2	0	0	2
	V	33	Extension activity	NCC, NSS, YRC, YWF	0	0	0	0	1
				Subtotal	**30**				**26**
V	I	34	Core-7	Genetic engineering	5	5	0	0	4
	II	35	Core-8	Plant biotechnology	5	5	0	0	4
	III	36	Elective	Basic bioinformatics (or) Nanobiotechnology (or) Genomics	5	5	0	0	4
	III	37	Elective	Clinical Research (or) Biosafety & Bioethics (or) Developmental Biology	5	5	0	0	4
	III	38	Major practical V	Lab in Genetic engineering	4	0	0	4	2
	III	39	Major practical VI	Lab in Plant biotechnology	4	0	0	4	2
	IV	40	Skill Based-III	Computer era	2	0	0	0	2
				Subtotal	**30**				**22**
VI	III	41	Core-9	Animal biotechnology	5	4	0	0	4
	III	42	Core-10	Stem cell technology	5	4	0	0	4
	III	43	Core-11	Bioprocess technology	5	4	0	0	4
	III	44	Major practical VII	Lab in Animal biotechnology	3	0	0	3	2
	III	45	Major practical VIII	Lab in Stem cell technology	2	0	0	3	2
	III	46	Major practical IX	Lab in Bioprocess technology	3	0	0	3	2
	III	47		Project - Group	7				6
				Subtotal	**30**				**24**
				Total	**180**				**147**

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

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. Fee 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

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

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

MSU/ 2017-18 / UG-Colleges /Part-III (B.Sc.Biotechnology) / Semester – I / Major Practical –I

BASICS OF BIODIVERSITY AND 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 - Chiranomous larva

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

BIOCHEMISTRY - I

L	T	P	C
4	0	0	3

Objective: To understand the classification, structure and properties of Carboydrates, 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 Heteropolysaccharies – 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. Nitrogeneous 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, Lippincoth William & Willeing.

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

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.

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

INSTRUMENTATION

L	T	P	C
4	0	0	4

Objective: To understand the basic concepts of preparation of buffers and stock slolutions, 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, spectophotometer - 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

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

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 – Appliations – 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/ 2017-18 / UG-Colleges /Part-III (B.Sc.Biotechnology) / Semester –II / Major Practical - II

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.

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

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

Electrophorosis: 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 – Wavelenth - 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/ 2017-18 / UG-Colleges /Part-III (B.Sc.Biotechnology) / Semester –II / Allied Practical - II

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.