MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI
PG COURSES – AFFILIATED COLLEGES
Course Structure for M.Sc Biotechnology
(Choice Based Credit System)
(with effect from the academic year 2017- 2018 onwards)

Sem (1)	Sub no. (2)	Subject status (3)	Subject Title (4)	Contact Hrs/ week (5)	C credits (6)
	1	Core - 1	Cell biology	6	4
	2	Core - 2	Biomolecules and microbial physiology	6	4
	3	Core - 3	Molecular biology and genetics	5	4
	4	Core - 4	Principles of biotechnology	5	4
	5	Core - 5 Practical - 1	Lab in cell and molecular biology	4	2
	6	Core - 6 Practical – 2	Lab in Biomolecules and Microbial physiology	4	2
			Subtotal	**30**	**20**
II	7	Core - 7	Biochemistry and instrumentation	5	4
	8	Core - 8	Biology of immune system	5	4
	9	Core - 9	Bioprocess technology	4	4
	10	Core - 10	Nanobiotechnology	4	4
	11	Core - 11	Field Work	4	3
	12	Core - 12 Practical - 3	Lab in Biochemistry and instrumentation	4	2
	13	Core - 13 Practical - 4	Lab in Biology of immune system and bioprocess technology	4	2
			Subtotal	**30**	**23**

III	14	Core - 14	Plant biotechnology	6	4
	15	Core - 15	Animal biotechnology	6	4
	16	Core - 16	Stem cell biology	5	4
	17	Core - 17	Research methodology and biostatistics	5	4
	18	Core - 18 Practical - 5	Lab in Plant biotechnology and Animal biotechnology	4	2
	19	Core - 19 Practical - 6	Lab in Research methodology and biostatistics	4	2
			Subtotal	**30**	**20**
IV	20	Core - 20	Applied bioinformatics	4	4
	21	Core - 21	Proteomics and genomics	4	4
	22	Core - 22	Medical biotechnology	4	4
	23	Core - 23 Practical - 7	Lab in Applied bioinformatics	4	2
	24	Core - 24 Practical - 8	Lab in proteomics and genomics	4	2
	25	Elective - 1	Elective / Field Work / Study Tour Electives: Biomedical technology (or) Tissue engineering (or) Industrial biotechnology	3	3
	26	Core - 25	Project	7	8
			Subtotal	**30**	**27**
			Total	**120**	**90**

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –I / Ppr. No.1 / Core-1

CELL BIOLOGY

L	T	P	C
6	0	0	4

Objective: To understand the basic concept of cell structure, membrane, cellular functions of different types of cell, modes of transport across cellular membranes and cell cycle.

Unit I

Diversity of cell size and shape, Cell theory, Structure of prokaryotic and eukaryotic cells – Isolation and growth of cells. Microscopic techniques for the study of cells – Light, Phase contrast, Polarized, Fluorescent microscopes, cryo-microscopy, SEM, TEM, Scanning Tunneling microscope, photomicrography, confocal microscope. Sub cellular fractionation – centrifuge, ultracentrifuge.

(20L)

Unit II

Cellular organelles: Plasma membrane, Cell wall, Mitochondria, Chloroplsat, Nucleus, Endoplastic Reticulum, Ribosomes, Golgi complex, Lysosomes – Structural organization. Chromosomes and their organization. Transport of nutrients, ions, and macromolecules across membranes. Cellular transactions – role of mitochondria and chloroplast.

(20L)

Unit III

Cell cycle – role of cyclin in molecular event of cell cycle. Cellular responses to environmental signals in plants and animals – mechanisms of activation of cell cycle arrest. Cell motility.

(15L)

Unit IV

Cell cycle dependent diseases: Telomere, telomerase, telomere shortening, expression of telomerase in different tissues both somatic and germ cells; aging, uncontrolled cell cycle: cancer, hall mark of cancer, tumour suppressors, oncogenes, difference between normal cell and cancerous cells.

(20L)

Unit V

Cell cycle arrest, senescence, quiescence, immortalization of cells – T antigen, Fluorescent Activated Cell sorting (FACS).

(15L)

Total: 90L

Reference Books

1. Molecular biology of cell by Alberts et al.,
2. Molecular cell biology by Lodish et al,
3. Reproduction in eukaryotic cells by D M Prescott, academic press.
4. Developmental biology by S F Gilbert
5. Cell in development and inheritance by E B Wilson
6. The coiled spring by Ethan Bier
7. Fertilization by F T Longo
8. Molecular biology of steroid and nuclear hormone receptors by L P Freedman.

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –I / Ppr. No.2 / Core-2

BIOMOLECULES AND MICROBIAL PHYSIOLOGY

L	T	P	C
6	0	0	4

Objective: To understand the basic concept of chemical foundations of biology; classification, structure and functions of carbohydrates, proteins and nucleic acids; microbial architecture and metabolism.

UNIT I

Chemical foundations of biology - pH, pK, acids, bases, buffers, types of bonds in living systems – ionic bond, covalent bond, hydrogen bond, vanderwaal's forces.

(14L)

UNIT II

Carbohydrates (Monosacharides, disaccharides and polysaccharides) - Classification, structure and functions. Amino acids and proteins - Classification, structure and functions. Types , structure and functions of nucleic acids (DNA, RNA).

(17L)

UNIT III

Analytical techniques in biochemistry for the quantification and separation of different biomolecules: Chromatography – Paper, Thin layer, Ion-exchange, Affinity, Gel-filtration. Electrophoresis – agarose and poly acrylamide.

(15L)

UNIT IV

Microbial architecture: Prokaryotic cells – surface appendages, cilia and flagella, capsules, pili, fimbriae and slime layers, cell walls – algae, fungi, bacteria. Membranes of Gram positive and Gram negative bacteria, cytoplasm – constituents, Ribosomes and other inclusion bodies – endospores, gas vesicles and plasmids, Principles of microbial nutrition, , Mathematical expression of growth, Growth curve, microbial toxins. Principles of microbial nutrition, , Mathematical expresson of growth, Growth curve, microbial toxins.

(24L)

UNIT V

Microbial metabolism – Glycolysis, Pentose phosphate pathway, TCA cycle, Entner Doudoroff pathway, Electron Transport Chain, Aerobic and anerobic respiration, Fermentation, Anaplerotic reaction, Pepidoglycan synthesis, Bacterial photosynthesis.

(20L)

Total: 90L

Reference Books

1. Biochemistry by Leghinger
2. Biochemistry by Harper
3. Biochemical calculations by Irwin H Sege, John Wiley and sons.
4. General Chemistry by Linus Pauling, W H Freeman and company
5. Organic Chemistry by D J Cram and G S Hammond, McGraw Hill
6. Biochemistry by D Voet and J G Voet, John Wiliey and sons
7. Genes IX by B Lewin, Oxford university press
8. Chemical Microbiology, An Introduction to Microbial Physiology – A.H. Rose, Butterworth, London.
9. Microbiology. Bernard D.Davis et al., Harper International Edition
10. Microbiology concepts and applications. Pelczer Jr. Chan. Creig. Mc Graw Hill, Inc
11. Microbiology. Prescott, Harley and Klein wim C Brown publishers

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –I / Ppr. No.3 / Core-3

MOLECULAR BIOLOGY AND GENETICS

L	T	P	C
5	0	0	4

Objective: To understand the basic concept of genome organization, central dogma, regulation of gene expression, principles of genetic interactions and population genetics.

.Unit I

Organisation of genome: genes, split gene concept, exons, introns, transposons- types (IS elements, replicative transposons, retroposons). DNA Replication Models of DNA Replication, Conservative, Semiconservative and discontinuous, Messelson and Stahl experiment, Steps in initiation of replication, Enzymatic factors involved, Ori site , Okazaki fragments, Termination of replication, Types of DNA polymerases in eukaryotes and prokaryotes, modes of replication, theta, rolling circle, d-loop replication, Inhibition of replication.

(19L)

Unit II

Process of transcription - stages in initiation, elongation, termination, Types of RNA polymerases in prokaryotes and eukaryotes, Transcription factors in prokaryotes and eukaryotes, post transcriptional modifications, Polyadenylation, capping, r-RNA processing, Splicing-Spliceosome. Differences in transcription between prokaryotes and Eukaryotes, Process of translation - Stages in translation, genetic code, wobble hypothesis, eukaryotic and prokaryotic ribosomes, aminoacyl t-RNA synthatases, protein factors initiation complex, peptidyl transferase, releasing factors, differences between prokaryotic and eukaryotic systems, inhibition of translation. **(20L)**

Unit III

Regulation of gene expression – basic elements in the control of gene expression, structural and regulatory genes, mechanism of activation of gene expression, operon model, *viz*., lactose, arabinose and tryptophan,mechanism of attenuation. Transcriptional control in eukaryotes, zinc finger motifs, leucine zippers, steroid receptors, Cis-acting and trans-acting regulatory factors. Regulation of ribosomal proteins and antitermination.

(13L)

Unit IV

Genetic Foundations – Mendelian and non Mendelian inheritance, transformation, transduction, conjugation, recombination. Linkage and measurement of genetic linkage mapping. Mutational analysis. Chromosome structure and its abberrations – translocations, inversions, deletions, duplications, aneuploidy and polyploidy. Transposable elements. Transcription and Translation – prokaryotes and eukaryotes.

(12L)

Unit V

Behavioral genetics, population genetics, gene pool, Hardy Weinberg principle, gene interaction - allelic and non-allelic gene interaction, multiple alleles natural selection, genetic drift. **(11L)**

Total: 75L

Reference Books

1. REA's Problem Solvers in Genetics, Research Education Association,61, Ethel Roadwest, New Jersey
2. Modern Genetic Analysis, Griffiths, Lewontin, Gelbart, and Miller, Freeman's and Co, New York
3. Genes X: Benjamin Lewin
4. Cell and Molecular Biology by Gerald Karp, Academic Press
5. Genomes: T A Brown, John Wiley & Sons
6. Molecular Biology: David P Clark, Elsevier.
7. Principles of gene manipulation – Old, Twyman and Primrose
8. Gene cloning and DNA analysis – T. A. Brown

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –I / Ppr. No.4 / Core-4

PRINCIPLES OF BIOTECHNOLOGY

L	T	P	C
5	0	0	4

Objective: To familiarize students with the fundamental principles of biotechnology and its potential applications.

Unit I

Introduction to Biotechnology: Scope of Biotechnology. History of Biotechnology: Conventional and Modern Biotechnology, Biotech industries. Biotechnology Tree. Strategies of gene cloning. **(12 L)**

Unit II

Tools used in gene cloning: Restriction endonucleases, Types, Features. Ligases, Linkers, adaptors and homopolymer tails. Vectors – plasmid, bacteriophage, BAC and YAC. Molecular markers – introduction.

(17 L)

Unit III

Vectors: Properties of ideal Vector. Naming of Plasmids, Construction of plasmids- pBR322. Cosmid vectors, Animal vectors- SV40. Plant vectors- Ti derivatives.

(16 L)

Unit IV

Recombinant DNA technology: Introduction of genes – Vector mode – transformation and transfection. Vector less mode- Biolistics, Electroporation, Microinjection. Gene libraries – genomic DNA and cDNA. Nucleic acid hybridization.

(15 L)

Unit V

Techniques: Selection of recombinants. Marker techniques- PCR, RFLP, RAPD and blotting techniques, DNA sequencing – NGS -Gene cloning– introduction, Recent achievements and developments. Bioethics.

(15 L)

(Total: 75 L)

References Books:

1. Gene cloning and DNA analysis Brown, T.A (1996),. Blackwell science, Osney Mead, Oxford.
2. Biotechnology, Satyanarayana. U, (2008), Books and Allied (p) Ltd
3. A text book of Biotechnology, Dubey, R. C. (2007), S.Chand & Company Ltd. New Delhi.
4. Biotechnology and Genomics, Gupta P.K: (2004) Rastogi publication
5. Principles of Gene Manipulation Old & Primrose, (1989), 3rd edition

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –I / Ppr. No.5 / Core-5 – Practical - 1

L	T	P	C
0	0	4	2

LAB IN CELL BIOLOGY AND MOLECULAR BIOLOGY

CELL BIOLOGY

Isolation of mesophyll cells

Isolation of chloroplasts

Identification of cell division by mitosis (Onion root tip squash)

Identification of cell division by meiosis – plant sample (Rheo plant, Tradescantia, onion bud)

Identification of Giant chromosome from chironomous larvae

Bacterial Transformation

Transduction

Ligation

Phage isolation

Conjugation

MOLECULAR BIOLOGY

Isolation of chromosomal DNA from bacteria

Isolation of chromosomal DNA from Goat Liver

Isolation of chromosomal DNA from plants

Isolation of chromosomal plasmid DNA

Agarose gel electrophoresis

Elution of DNA

Restriction digestion of DNA

Polymerase chain reaction

Southern blotting technique

Bacterial Transformation

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –I / Ppr. No.6 / Core-6 - Practical - 2

L	T	P	C
0	0	4	2

LAB IN BIOMOLECULES AND MICROBIAL PHYSIOLOGY

1. Quantification of total carbohydrate by anthrone method
2. Quantification of aminoacids by ninhydrin method
3. Quantification of protein by Biuret method
4. Quantification of RNA by orcinol method
5. Quantification of DNA by diphenyl amine method
6. Enumeration of microorganisms from soil
7. Enumeration of microorganisms from water
8. Enumeration of microorganisms from spoiled food
9. Determination of growth curve of bacteria
10. Microscopic examination of bacteria and yeast (simple staining)
11. Gram staining
12. Acid-fast staining
13. Spore staining
14. Biochemical characteristics of selected organisms
    (a) IMViC Test
    (b) Hydrogen sulphide production test
    (c) Catalase test
    (d) Carbohydrate fermentation test
    (e) Starch hydrolysis test
15. Assay of antibiotics and demonstration of antibiotic resistance

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –II / Ppr. No.7 / Core-7

BIOCHEMISTRY AND INSTRUMENTATION

L	T	P	C
5	0	0	4

Objective: To understand the concepts of bioenergetics, structural and functional aspects of biomolecules, enzyme kinetics, applications and commercial production of enzymes.

Unit I

Bioenergetics – concept of free energy – Thermodynamic principles – coupled reactions. Carbohydrate metabolism: Glycolysis, TCA cycle, Gluconeogenesis, Glyconeogenesis, HMP shunt. **(10L)**

Unit II

Amino acid and protein metabolism: amino acid pool, general aspects of amino acid metabolism: deamination, transamination, decarboxylation and urea cycle, Metabolism of glycine, tryptophan, lysine, tyrosine and phenyalanine. Metabolism of lipids: Fatty acid oxidation: α-oxidation, β-oxidation, ω-oxidation, ketone bodies, biosynthesis of lipids, ketogenesis.
(15L)

Unit III

Metabolism of nucleotides, Electron Transport Chain (ETC) in chloroplast and mitochondria, Oxidative phosphorylation – chemiosmotic theory, uncouplers of oxidative phosphorylation, oxidative photophosphorylation. Integration and hormonal regulation of metabolism.
(15L)

Unit IV

Enzymes: Introduction, classification and nomenclature, factors affecting enzyme action – effect of pH, effect of temperature, effect of substrate concentration, effect of enzyme concentration. Kinetics of enzyme-catalyzed reaction involving single substrate – Michaelis-Menten derivation, significance of K_m and V_{max} values, Lineweaver-Burk plot, Edie-Hofste plot. Enzyme inhibition – reversible inhibition, irreversible inhibition, allosteric inhibition and feedback inhibition.
(19L)

Unit V

Enzyme immobilization techniques: Adsorption, covalent binding, entrapment, membrane confinement, Effect of immobilization on enzyme activity, Applications of immobilized enzyme technology, Scope of enzymes – medicine, detergents, food and beverage industries, leather industries, textile processing. Commercial production of enzymes – amylase, pectinase, cellulose and catalase. **(16L)**

(Total : 75L)

Reference Books

1. Biochemistry by Lehninger
2. Biochemistry, D Voet and JG Voet, John Wiley & Sons
3. Fundamentals of Biochemistry, J.L. Jain
4. Enzymes, Dixon and Web
5. Enzymes, Trevor Palmer

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –II / Ppr. No.8 / Core-8

BIOLOGY OF IMMUNE SYSTEM

L	T	P	C
5	0	0	4

Objective: To impart Knowledge on the science of immunology, immune mechanisms operating in the body for combating infections, and the classification structure and mechanism of immune activation.

Unit I

Immune system: Organization, structure and functions of lymphoid organs – Bone marrow, thymus, spleen and lymph nodes; Cells of the immune system – Haematopoeisis, B lymphocytes, T Lymphocytes, TCR, BCR,NK cells, Granulocytes, Types of immunity : Innate and acquired. humoral and cell mediated immune response. Antigen: definition, types, properties, T dependent and T independent antigens, super antigens – antigenicity and immunogenicity, epitopes, haptens and adjuvants. **(16L)**

Unit II

Immunoglobulins – structure and functions, Theories of antibody formation, Organization and expression of Immunoglobulin Light and Heavy chain genes. Generation of antibody diversity. Antigen-antibody interactions- precipitation and agglutination, Cytokines- Properties and functions, Interleukins and Interferons.

(15L)

Unit III

The complement systems: mode of activation, classical and alternate pathway, Membrane Attack Complex (MAC), Major histocompatibility complex (MHC): Structure, functions, general organization and inheritance of MHC, MHC molecules and genes, cellular distribution and regulation of MHC molecules. Mechanisms of antigen processing and presentation-cytosolic and endocytic pathways. Inflammation – mechanism and significance.

(14L)

Unit IV

Regulation of immune response**,** Immune response to infectious diseases – bacterial- TB, viral - HIV, protozoan- malaria. Autoimmune disorders, Hypersensitivity reactions – types and pathogenesis, Immuno deficiency diseases, Transplantation immunology, Immunosuppression, Tumour immunology, vaccination- new generation vaccines, Genetically engineered antibodies.

(14L)

Unit V

Immunological techniques – WIDAL,VDRL, pregnancy and Rheumatoid factor tests, Coomb's test, Well Felix test, Brucella agglutination test, Principle and applications of Radioimmuno assay (RIA), Enzyme Linked Immuno Sorbant Assay (ELISA), ELISPOT assay, chemiluminesence assay, Immunodiffusion, Immunoelectrophoresis, Immunofluorescence, Monoclonal antibody – production and applications. Immunohistochemical methods – Direct, indirect, Peroxidase-Antiper Oxidase (PAP) method, Avidin-Biotin Complex (ABC) method, Labelled Streptavidin Biotin (LSAB) method, Electron Microscopic (EC) method.

(16L)

(Total : 75L)

Reference Books

1. Kuby Immunology (2007) by Thomas J. Kindt, Richard A. Goldsby and Barbara A. Osborne. W.H.Freeman and Company
2. Immunology (2006) by David Male, Jonathan Brostoff, David B Roth and Ivan Roit. Elsevier Publishers.
3. Essentials of Clinical Immunology (2006) by Helen Chapel, Mansel Haeney, Siraj Misbah and Neil Snowden. Blackwell Publishing.
4. Immunology (2006) by C. Vaman Rao. Narosa Publishing House Pvt, Ltd
5. Immunobiology (The immune system in health and disease) (2005) by Charles A. Janeway, Paul Travers, Mark Walport and Mark Sholmchik. Garland Publishing.
6. Immunology of Infectious Diseases (2002) Edited by Kaufmann, Sher and Ahmed. ASM Press.
7. Understanding Immunology (2001) by Peter Wood. Pearson Education Limited
8. Roitt's Essential Immunology (2001) by Ivan M. Roit and Pete J. Delves. Blackwell Science Ltd.

Antibody Engineering (2006) by Ed Harlow and David Lane. Panima Publishing Corporation.

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –II / Ppr. No.9 / Core-9

BIOPROCESS TECHNOLOGY

L	T	P	C
4	0	0	4

Objective: To impart Knowledge on basic principles of bioprocess, design of fermenter, aseptic operations, separation techniques to recover value added products from living organisms and application of biotechnological process in industries.

Unit I

Introduction to Bioprocess Engineering, Bioreactors, Isolation, Screening Preservation and Maintenance of Industrial Microorganisms, Kinetics of microbial growth and death. primary and secondary metabolites. Media for Industrial Fermentation, Air and Media Sterilization.

(11L)

Unit II

Types of fermentation processes: Batch, Fed-batch and continuous bio reactions, stability of microbial reactors, analysis of mixed microbial populations, specialized bioreactors (pulsed, fluidized, photo bioreactors etc., Measurement and control of bioprocess parameters.

(12L)

Unit III:

Downstream Processing: Introduction, Removal of microbial cells and solid Matter, foam separation, precipitation, filtration, centrifugation, cell disruptions, liquid-liquid extraction, chromatography, Membrane process, Drying and Crystallization. Effluent treatment: B.O.D. and C.O.D. treatment and disposal of effluents

(13L)

Unit IV:

Whole cell Immobilization, protein immobilization and their Industrial Applications, Industrial Production of Chemicals: Alcohol (ethanol), Acids (citric, acetic and gluconic), solvents (glycerol, acetone, butanol), Antibiotics (penicillin, streptomycin, tetracycline), Amino acids (lysine, glutamic acid), Single cell Protein, Use of microbes in mineral beneficiation and oil recovery. **(14L)**

Unit V:

Introduction to Food Technology, Elementary idea of canning and packing, sterilization and Pasteurization of food Products, Technology of Typical Food/Food products (bread, cheese, idli) - Food Preservation. **(10L)**

(Total : 60L)

Reference Books

1. Biochemical Engineering, Aiba, S., Humphrey, A.E. and Millis, N.F. Univ. of Tokyo Press, Tokyo
2. Biochemical Reactors, Atkinson, B., Pion Ltd., London
3. Biochemical Engineering Fundamentals, Baily, J.E. and Ollis, D.F., McGraw- Hill Book Co. New York
4. Bioprocess Technology: Fundamentals and Applications, KTH, Stockholm.
5. Process Engineering in Biotechnology, Jackson, A. T., Prentice Iiall, Engelwood Cliffs

6. Bioprocess Engineering: Basic Concepts, Shuler, M.L. and Kargi, F., Prentice Hall, Engelwood Cliffs
7. Principles of Fermentation Technology, Stanbury, P.F and Whitaker, A., Pergamon Press, Oxford
8. Bio reaction Engineering Principles, Nielson,J. and Villadsen, J., Plenum Press
9. Chemical Engineering Problems in Biotechnology, Shuler, M.L. (Ed.), AICHE
10. Biochemical Engineering, Lee, J .M., Prentice Hall Inc.
11. Bioprocess Engineering - Kinetics, Mass Transport, Reactors and Gene Expression, Vieth, W.F., John Wiley & Sons, Inc.

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –II / Ppr. No.10 / Core-10

NANOBIOTECHNOLOGY

L	T	P	C
4	0	0	4

Objective: To understand the basic concepts of nanobiotechnology, principles of instrumentation, nanomaterials and their applications in the fields of medicine and scientific research.

Unit I

Nanobiotechnology – Introduction, Definition, History, Applications, Future, nanotechnology Hazards.

(7L)

Unit II

Tools and Techniques – Bottom-up, molecular self-assembly, Top down Fabrication technique – Electron Beam Lithography (EBL), Dip Pen Nanolithography (DPN), Soft Lithography – PDMS molding, Micro Electro Mechanical System (MEMS), Nano Electro Mechanical System (NEMS), Nanosensor, Transmission Electron Microscope (TEM), Scanning Transmission Electron Microscope (STEM), Scanning Electron Microscope (SEM), Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM).

(12L)

Unit III

Nanomaterials: Definition, Properties, methods to produce nanomaterials, nanocones, nanotubes, nanowires, nanocomposites, nanogears, Quantum Dots, nanoshells, Self –assembled Monolayers (SAMS). **(8L)**

Unit IV

Nanomedicine: Introduction, Biocompatibility of nanomedical materials, drug delivery, cancer therapy, nanorobotics, nanosurgery, nanosystems in drug targeting, nano-implantable devices, biomedical sensors, diagnostic imaging techniques, Ethical dimensions of nanomedicines.

(9L)

Unit V

Applications of Nanotechnology: Fuel cells, solar power, nanotechnology in space exploration, nanocomputers, LOC, Synthetic chips based on bacteriorhodopsins and G – protein coupled receptors, DNA microarray, Protein microarray, High throughput DNA sequencing with nanocarbon tubules. **(9L)**

(Total : 45L)

Reference Books

1. Nanobiotechnology-Concepts, Applications and Perspectives. Edited by Christof M. Niemeyer, Chad A. Mirkin Wiley - VCH, 2006.
2. Handbook of Nanostructural Biomaterials and their applications in Nanobiotechnology, Hari Singh Nalwa, American Scientific Publishers. 2005

3. Nanotechnology, Volume: 5-Nanomedicine and Nanotechnology. Edited by Viola Vogel. John Wiley & Sons Limited, 2008.
4. Nature Biotechnology, Volume 21, No. 10, 2003
5. Scientific American Volume 285 No.3, September 2001
6. Ratener D (2003) Nanotechnology – A Gentle Introduction to the Next Big Idea, Prentice Hall, ISBN: 031014005.
7. Nanoscale technology in Biological systems. Ralph S. Greco. CRC Press.2005.

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –II / Ppr. No.11 / Core-11-Field Work

FIELD WORK

L	T	P	C
0	0	4	3

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –II / Ppr. No.12 / Core-12 - Practical 3

L	T	P	C
0	0	4	2

LAB IN BIOCHEMISTRY AND INSTRUMENTATION

1. Preparation of solutions: Percentage solutions, Molar, Normal solutions ,Dilution of Stock solutions

2. Preparation of buffers using the Henderson Hasselbach equation.

Spectrophotometric experiments:

3. Verification of Beer Lambert's law.

4. Quantitative estimation of reducing sugars by Dinitrosalicylic acid method.

5. Quantitative estimation of Methionine by Nitroprusside method.

6. Estimation of protein- Biuret, Lowry, and Bradford Method.

7. Estimation of Cholesterol by Zak's method.

8. Estimation of DNA

9. Estimation of RNA.

Chromatographic techniques:

10. Separation of amino acids by Paper chromatography (Descending /Ascending)

11. Separation of Plant pigments by Thin layer chromatography

12. Purification of enzymes – precipitation and dialysis

13. Electrophoresis – SDS PAGE

14. Immobilization of enzymes

MSU / 2017-18 / PG –Colleges / M.Sc.(Biotechnology) / Semester –II / Ppr. No.13 / Core-13 - Practical 4

L	T	P	C
0	0	4	2

LAB IN BIOLOGY OF IMMUNE SYSTEM AND BIOPROCESS TECHNOLOGY

BIOLOGY OF IMMUNE SYSTEM

1. Blood film preparation and identification of cells
2. Preparation of serum
3. Purification of IgG from serum
4. Blood grouping
5. Total leucocyte count
6. Total RBC count
7. Single and double immune diffusion
8. Immuno-elctrophoresis
9. Rocket Immunoelectrophoresis
10. ELISA

BIOPROCESS TECHNOLOGY

1. Estimation of total solids in the effluent sample
2. Determination of total dissolved solids in polluted water
3. Determination of Dissolved Oxygen (DO) of polluted water
4. Determination of Biological Oxygen Demand (BOD) of polluted water
5. Determination of Chemical Oxygen Demand (COD) of polluted water
6. Estimation of nitrate in drinking water
7. Isolation of coliforms from sewage
8. Analysis of water for potability and determination of MPN