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# SYLLABUS
# for
# M. Sc. Biotechnology
## Structure of M. Sc. Biotechnology under CBCS Scheme

**Core Course**
**Semester I**

CC1(M1BT01CT01): Instrumentation and Analytical Techniques
CC2(M1BT02CT02): Cell Biology and Molecular Genetics
CC3(M1BT03CT03): Fundamentals of Microbiology
CC4(M1BT04CT04): Biomolecules and Metabolism
(Practical) CC1,2 (M1BT05CP01): Instrumentation and Analytical Techniques + Cell Biology and Molecular Genetics
(Practical) CC3,4 (M1BT06CT02): Fundamentals of Microbiology + Biomolecules and Metabolism
SEC1(M2BT07SEC01): Techniques of Molecular Biology

**Semester II**

CC5 (M2BT01CT05): Molecular Biology
CC6 (M2BT02CT06): Immunology and Enzymology
CC7 (M2BT03CT07): Bioinformatics and Biostatistics
CC8(M2BT04CT08): Genetic Engineering
(Practical) CC5, 6 (M2BT05CP03): Molecular Biology + Immunology and Enzymology
(Practical) CC7, 8 (M2BT06CP04): Bioinformatics and Biostatistics + Genetic Engineering

**Semester III**

CC9 (M3BT01CT09): Environmental Biotechnology
CC10 (M3BT02CT10): Animal Biotechnology
CC11(M3BT03CT11): Plant Biotechnology
CC12 (M3BT04CT12): Fermentation Technology
(Practical) CC9,10 (M3BT05CP05): Environmental Biotechnology + Animal Biotechnology
(Practical) CC11, 12 (M3BT06CP06): Plant Biotechnology + Fermentation Technology
SEC2 (M3BT07SEC02): Techniques of Plant Biotechnology

**Semester IV : Choice of A or B**

**A : Industrial Training :** Major Research Based Project including Practical work at research laboratory or institute of repute other than parent university (5 Months)

**B : Discipline Specific Electives**
DSE1(M4BT01ET01): Minor Research Project (Compulsory for all students)

**(Any 3 out of the given list)**

DSE 2 (M4BT02ET02) (a/b): a. Agriculture Biotechnology
b. Biosafety, Bioethics and IPR
DSE3(M4BT03ET03)(a/b): a. Food and Dairy Biotechnology
b. Advanced Biotechnology
DSE4(M4BT04ET04)(a/b): a. Medical and Pharmaceutical Biotechnology
b. Host- Parasite Interactions

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(Practical) DSE1
(Practical) DSE 2

## MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

### M. Sc. BIOTECHNOLOGY SEMESTER –I (2016-17)

**Paper I: *CC1 (M1BT01CT01)*: *INSTRUMENTATION AND ANALYTICAL TECHNIQUES (THEORY)***

**TOTAL HOURS: 60** **CREDITS: 4**

**Unit I:** **Credit hours: 10**

Laboratory instrumentation: principle, components, assembly, working and applications of: Laminar clean air flow bench, autoclave, incubators, weighing balances, pH meter, water bath, hot air oven, colony counter and microtome. Laboratory safety measures.

**Unit II:** **Credit hours: 10**

Aseptic techniques: Principles of sterilization, Brief idea of various methods of sterilization, Physical, chemical, disinfectants, membrane filtration, pasteurization, tyndallization. Definition and classification of compounds used for sterilization, antibiotics and antimicrobials. Evaluation of effectiveness of antimicrobial/antiseptic compounds.

**Unit III:** **Credit hours: 15**

Microscopy: Types, principle, components, working, specimen, preparation and applications of Light, Bright field, Dark field, Phase contrast, Electron (SEM, TEM). Scanning tunneling. Fluorescence, Nomarsky differential interference contrast, Confocal, Atomic force microscopes.

**Unit IV:** **Credit hours: 15**

Chromatography: General Principles, process and applications of Paper and Thin Layer Chromatography. GLC, HPLC, Absorption, Ion Exchange, Gel filtration, Affinity chromatography, Radioactive tracer technique, autoradiography, Gamma and Scintillation counters, Brief idea of NMR, IR, GC-MS.

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**UNIT V:** **Credit hours: 10**

Centrifugation and spectrophotometry: Types of centrifuges. Principles, working and applications of preparative, Analytical, Microcentrifuge. Refrigerated ultracentrifuge. Colorimeter and types of spectrophotometer: principle, working and application.

**Suggested Readings**


1. Pattabhai, V. and Gautham (2002), N. Biophysics. 2nd edition Narosa pub.
2. Narayan, P. Essentials of Biophysics. New Age International.
3. Roy, R.N. A Text Book of Biophysics. New Central Book Agency.
4. Daniel, M. Basic Biophysics. Agrobios.
5. Rodney Cottegril (2003), Biophysics: an introduction 2nd edition, John wiley & sons publication.


## MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

### M. Sc. BIOTECHNOLOGY SEMESTER –I (2016-17)

**Paper II: *CC2 (M1BT02CT02)*: *CELL BIOLOGY AND MOLECULAR GENETICS (THEORY)***

**TOTAL HOURS: 60** **CREDITS: 4**

**Unit I** **Credit hours: 10**

Structure and organization of cell. Intra-cellular compartmentalization. Structure, function and significance of cell wall, plasma membrane, Membrane proteins and transport across biomembrane. Structure, function and significance of Cell organelles, flagella, cilia, cytoskeleton. Genetic organization of Mitochondria and chloroplast.

**Unit II** **Credit hours: 15**

Nucleus: nuclear membrane, nucleolous and nuclear pore complex. Chromatin; structure, types organization and chemistry of the chromosome. C-value paradox, Nuclear dyes and their application in staining of chromosomes. Karyotyping, Polytene, lambrush and B-chromosomes. Chromosome banding and its staining.

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Cell cycle events, regulation of cell division: cyclins, cyclin-dependent kinases, inhibitors, control of cell division in multicellular organisms

**Unit III** **Credit hours: 15**

Brief idea of model organisms of genetic studies: *Drosophila*, *Neurospora*, *C. elegans*, *Acetabularia*. Gene interaction: modification of mendalian ratios. Linkage and crossing over, linkage map, linked gene inheritances. Genetic recombination at molecular level (Holliday model). Role of RecA protein in recombination. Numerical and structural changes in chromosomes.

**Unit IV** **Credit hours: 10**

Mutation – molecular basis of spontaneous and induced mutations. Adaptive mutations in bacteria. Detection of mutations: Ames test, Luria-delbruck fluctuation test. Molecular mechanism of radiation and chemical mutagenesis: use of base analogs, ionizing radiations and alkylating agents for mutagenesis.

**Unit V** **Credit hours: 10**

Transposons: Types, structure, properties and their significance. Mechanism of transposition, transposon mutagenesis. Integrons, Insertion sequences (IS), Composite transposons. Replicative and non replicative transpositions. Role of transposase and resolvase. Examples of Transposable elements, Retrotransposon.

**Suggested Readings**


1. Alberts, B., Bray, D. Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999. Molecular Biology of Cell. Garland Publishing Co. New York, USA.
2. Snustad, D.P. and Simmons, M.J. 2000. Principles of genetics. John Wiley and Sons.
3. Russel, P.J. 1998. Genetics. The Benjamin/Cumming Publishing Co.
4. Gasque, E. Manual of Laboratory experiments in cell Biology. W.C. Wilson Public.
5. Robertis, E.D.P., Robertis, E.M.F. Cell and Molelcular Biology. Sauder College Publication.
6. Beeker, W.M. The world of the cell. Pearson Education.
7. Karp, G. Cell and Molecular Biology. John Willey and sons.
8. Lodish and Baltimore. Molecular Cell Biology. W.H. Freeman and Co.

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# MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

## M. Sc. BIOTECHNOLOGY SEMESTER –I (2016-17)

### Paper III: *CC3 (M1BT03CT03)*: *FUNDAMENTALS OF MICROBIOLOGY (THEORY)*

**TOTAL HOURS: 60** **CREDITS: 4**

**Unit-I** **Credit hours: 10**

Historical events and contributions of important microbiologists. Kingdom and domain system of classification. Bacterial nomenclature and taxonomy. Numerical taxonomy, Chemotaxonomy, Bergey's manual of systematic bacteriology. Problems and paradoxes associated with bacterial taxonomy. Evolutionary relationships and phylogeny. Analysis of dendrograms and cladograms.

**Unit-II** **Credit hours: 15**

Archaea, Cyanobacteria, Actinobacteria: Discovery, General characters, classification, morphology, structural organization, reproduction, economic and ecological significance: differences and similarities with bacteria. L forms, Rickettsia, Chlamydia, Spirochaetes, viroids, prions, virusoids: Brief idea of general characteristics, structural organization and significance.

**Unit-III** **Credit hours: 10**

Bacteria: Morphological types. Structure, arrangement and function of flagella and pili. Cell membrane, Cell wall: types, structural organization, significance, Gram staining, Significance of LPS and role in pathogenicity. Nucleoid: organization and significance. Plasmids: properties and types. Important diseases caused by bacteria.

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**Unit-IV** **Credit hours: 10**

Virus: Structural organization, classification, multiplication, transmission and significance. Mycoplasma, Spiroplasma and Phytoplasma: General characters, reproduction, transmission and significance. Important diseases caused by viruses, mycoplasma, spiroplasma and phytoplasma.

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**Unit V** **Credit hours: 15**

Techniques of microbial culture, Anaerobic culture. Culture media; types, composition, preparation. Selective culture methods, Enrichment culture. Isolation and development of pure culture. Maintaining and preservation of cultures, Enumeration of microbes. Principles of Staining, Nature of dyes and types of staining; Characterization and identification of microbes based on morphology, cultural physiological and biochemical characteristics, serology and molecular methods of identification.

**Suggested Readings**


1. Tortora GJ, Funke BR, and Case C.L. (2004). *Microbiology*: *An Introduction.* 4th edition. Pearson Education.
2. Atlas RM. (1997). *Principles of Microbiology*. 2nd edition. WM.T.Brown Publishers.
3. Cappucino J and Sherman N. (2010). *Microbiology: A Laboratory Manual*. 9th edition. Pearson Education limited.
4. Madigan MT, Martinko JM and Parker J. (2009). *Brock Biology of Microorganisms*. 12th edition. Pearson/Benjamin Cummings.
5. Pelczar MJ, Chan ECS and Krieg NR. (1993). *Microbiology*. 5th edition. McGraw Hill Book Company.
6. Dubey, R.C. and Maheshwari, D.K. A Text Book of Microbiology. S. Chand and Company.
7. Prescott, H. and Klein. 2000. Microbiology. McGraw Hill.

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# MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

## M. Sc. BIOTECHNOLOGY SEMESTER –I (2016-17)

**Paper IV: *CC4 (M1BT04CT04)*: *BIOMOLECULES AND METABOLISM (THEORY)***

**TOTAL HOURS: 60** **CREDITS: 4**

**Unit I** **Credit hours: 10**

Bioenergetics: entropy, enthalpy, Gibbs free energy concept, Laws of thermodynamics. Acids and Bases, redox potential, pH and Buffers, Henderson and Hasselbach equation, pKa, pKb. Preparation of buffers. Electron transport mechanism (chemi-osmotic theroy), Energy rich molecules. Mechanism of ATP synthesis.

**Unit II** **Credit hours: 10**

Carbohydrates: classification, structure, properties and functions. Role of carbohydrates in signaling,glycosylation of other biomolecules. Carbohydrate derivatives: muriens, glycoproteins, glycolipids, peptidoglycan. Carbon fixation, Glycolysis (aerobic and anaerobic), TCA, HMP, PPP and other pathways, Gluconeogenesis, Glycogenesis, Glycogenolysis.

**Unit III** **Credit hours: 10**

Lipids: classification, structure, properties and functions of fatty acids, triacylglycerols, phospholipids, sterols and terpenes, Conjugated lipids - lipoproteins. ketone bodies, Lipids with specific biological functions, micelles and liposomes. Biosynthesis of saturated and unsaturated fatty acids, β-oxidation.

**Unit IV** **Credit hours: 15**

Amino acids: general properties and biosynthesis, Transamination, Deamination, Decarboxylation; glutamine and glutamic acid pathway, urea cycle, uric acid biosynthesis. Protein structure (primary, secondary, tertiary and quaternary). Ramachandran plot. Protein sequencing, Vitamins and Co-enzyme (biological and biochemical functions).

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**Unit V** **Credit hours: 15**

Electrophoresis: Types, Principles and applications: Gel electrophoresis, SDS PAGE, Affinity electrophoresis, Capillary electrophoresis, Dielectrophoresis, DNA electrophoresis, Electroblotting, Electrofocusing, Immunoelectrophoresis, Isotachophoresis, Pulsed field gel electrophoresis. Methods of studying metabolism: Use of biochemical mutants, Isotopic labeling, Metabolome and its applications.

**Suggested Readings**


1. Voet and Voet. 2000. Biochemistry. John Wiley.
2. Lehninger. 2000. Principles of Biochemistry. CBS Publishers.
3. Stryer, L. 2002. Biochemistry. W.H. Freeman.
4. Harper. 2003. Biochemistry. McGraw-Hill.
5. Zubay. 1995. Biochemistry. Brown Publishers.
6. Trehan, K. Biochemistry. Wiley Eastern Publications.
7. Jain, J.L. Fundamentals of Biochemistry. S. Chand and Company.
8. Deb, A.C. Fundamental of Biochemistry.
9. Methew, C.K. Biochemistry. Pearson Education.
10. Horton and Moran. Principles & Biochemistry. Prentice Hall.