



SOLAPUR UNIVERSITY, SOLAPUR

M.Sc.Part- I Biotechnology

Revised Syllabus

w.e.f. June 2013 onwards

SOLAPUR UNIVERSITY, SOLAPUR
Syllabus for M.Sc. I Biotechnology

Syllabus to be implemented from June 2013 onwards

SEMESTER- I (THEORY)

Paper	Title of the paper	Marks
MBT 101	Microbiology	100
MBT 102	Biomolecules and Bioenergetics	100
MBT 103	Inheritance biology	100
MBT 104	Biostatistics and Bioinformatics	100

PRACTICALS

Practical	Title of the practical	Marks
MBT 105	Biomolecules and Bioenergetics and Microbiology	100
MBT 106	Inheritance biology and Biostatistics and Bioinformatics	100

SEMESTER- II (THEORY)

Paper	Title of the paper	Marks
MBT 201	Cell Biology	100
MBT 202	Enzyme Technology	100
MBT 203	Molecular Cell Processing	100
MBT 204	Immunology and Immuno techniques	100

Practical	Title of the practical	Marks
MBT 205	Cell biology and Enzyme Technology	100
MBT 206	Molecular Cell Processing and Immunology and Immune techniques	100

Solapur University, Solapur
M.Sc. I Biotechnology
(Revised semester pattern syllabus)
(w.e.f. June, 2013)

1) Title of the Course: M.Sc.-I Biotechnology (Revised Syllabus) -2013-14

2) Introduction: This course provides a broad overview of biotechnology and to produces expert hands that would have sufficient knowledge and expertise to solve the urgent problems of the region by using biotechnology. The course structure is technology-centric where students basically learn technology and are taught necessary basic subjects for that purpose.

3) Objectives of the course:

The objectives of M.Sc. Biotechnology course are

- To provide an intensive and in-depth learning to the students in field of biotechnology.
- Beyond simulating, learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today scientific and changing business world.
- To develop awareness & knowledge of different organization requirement and subject knowledge through varied subjects and training methodology in students.
- To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.

4) Advantages of the Course:

Biotechnology has tremendous job potential. The successful students will be able to establish trading, industrial and consultancy organizations in pharmaceuticals, paper, fermentation, food processing & preservation, agriculture, environment protection and also their own industry for micropropagation of commercially important plants *in vitro*, transgenic plants, vaccine production, clinical pathology, genetic counseling, human karyotyping etc.

- Multinational companies dealing with production of tissue cultured and genetically modified plants, food products, leather, dairy, beverages, pharmaceutical, chemical Industries, agribusiness, Environment protection.
- Medical & Scientific Research Organizations.
- Universities in India & abroad.

5) Eligibility of Course:

Eligibility: A Candidate possessing B.Sc. Degree with Biotechnology / Biochemistry/ Chemistry/ Microbiology/ Botany/ Zoology/ B.Pharm/ MBBS/ B.E./ B.Sc.Agri./ life sciences as a principal subject (Biotech), and who have passed the entrance examination conducted by the Solapur University shall be held eligible for admission to B.Sc. Course in Biotechnology. Students from other University with B.Sc. General Degree and who have passed the entrance examination conducted by the University are also eligible.

• **Admission:** Merit list based on average of B.Sc. aggregate and entrance exam conducted by University. For other university student merit list only on basis of entrance examination conducted by University.

6) Duration:

- The duration for this program is of 2 years with semester pattern(04 Semesters)

7) Medium of Instruction: English

8) Structure of the Course:

- Structure of M.Sc. course in faculty of Science has total of 04 semesters for 2 years.
- M. Sc. I comprises of total two semesters. In each semester (I & II) four theory papers (Paper I & Paper IV) having weightage of 100 marks each.
- For semester II comprises four theory papers (Paper V & Paper VIII) having weightage of 100 marks each. Each paper comprising of 4 to 5 units distributed in total 45 lecture hours.
- Semester wise the practical examination is conducted which is based on theory papers I, II, III and IV. Total weightage of practical is 100 marks.

Syllabus:
M. Sc. Biotechnology (Semester –I)

MBT 101 Microbiology (45
lectures)

Unit I: Microbial Taxonomy 9

History of Bergey's Manual, Prokaryotic Domains, Taxonomic ranks, Traditional and Modern methods of prokaryote Identification, General outline of Numerical and Polyphasic Taxonomy, Bacterial Nomenclature, Type Strain, Major Bacterial Culture collection units, Introduction to PHYLIP software.

Unit II Microbial Diversity 9

General characters of Oxygenic and Anoxygenic Photosynthetic microbes, Magnetogenic bacteria, Methanogenic archaeobacteria.

Unit III: Extremophiles 9

General characters and examples of Extremophiles- acidophilic, alkalophilic, thermophilic, barophilic, osmophilic and halophilic.

Unit IV: General Virology 9

Classification of viruses, Isolation and Cultivation of Bacteriophages, Cultivation of Animal viruses by using- Egg inoculation, Tissue culture and Live animals, Enumeration of viruses by- Electron microscopy, Plaque method and End point method, Inhibition and inactivation of viruses by- photodynamic inactivation by physical and chemical agents, antiviral chemotherapeutics and Interferons.

Unit V: Reproduction of Viruses 9

One step growth curve experiment, Single burst and premature lysis experiment, Reproduction of Bacteriophages- Lytic cycle (T phage, phage θ -X 174), Lysogenic cycle (λ , P2, and Mu 1 phages), Replication of Animal viruses- ssRNA + stranded (Polio), ssRNA - stranded (Influenza), dsRNA(HIV), ssDNA(Parvo), dsDNA(Hepatitis B), Plant viruses- Vector and Nonvector based transmission, reproduction of TMV.

References:

- 1) Bergy's Manual of Systemic Bacteriology.
- 2) Brock Biology of Microorganisms – MF Madigan
- 3) General Microbiology – Stanier *et al.*
- 4) Microbiology – Pelczar JR.
- 5) Microbial Genetics - Freifelder
- 6) General Virology - Luria
- 7) Introduction to Plant Virology – Bos I
- 8) Animal Virology – Fenner, F and White, D.O.

- 9) Virology – Dulbecco R. and Ginsberg H.S.
- 10) Extremophiles – B. N. Johri
- 11) Microbial Diversity – D. Colwd
- 12) Microbial life in Extreme Environment – D.S. Kushner
- 13) Microbial Ecology – J.M. Lynch and N.J. Poole

MBT 102: Biomolecules and Bioenergetics

(45

lectures)

UNIT II: MITOCHONDRIA

9

Architecture, chemical activity of mitochondria. Sequence of electron carriers and sites of oxidative phosphorylation, ATP generation, heme and non-heme iron proteins. Thermodynamic considerations, oxidation-reduction electrodes, standard electrode potentials, redox couples, phosphate group transfer potential. Respiratory controls. Theories of oxidative phosphorylation, uncouplers and inhibitors of energy transfer. ATP synthetase complex

UNIT III: CHLOROPLAST

9

Architecture, - light harvesting complexes, bacteriorhodopsin, plastocyanin, carotenoids and other pigments. Hill reaction, photosystem I and II - location and mechanism of energy transfer, photophosphorylation and reduction of carbon dioxide. Calvin cycle, quantitative efficiency, photorespiration, C₄ - metabolism. Chemiosmotic theory and evidence for its occurrence, ion transport through membranes, proton circuit and electro-chemical gradient ionophores, Q cycle and stoichiometry of Proton extrusion and uptake, P/O and H/P ratios, reverse electron transfer. Fractionation and reconstitution of respiratory chain complexes.

UNIT IV: HORMONES

General classification of hormones - synthesis, structure, secretion, transport, metabolism and mechanism of action of pancreatic, thyroid, parathyroid, hypothalamus, pituitary, adrenal and prostaglandins. Hormonal control of spermatogenesis, menstrual cycle,

Pregnancy and lactation. Cell membrane and intracellular receptors for hormones. Secondary messengers Plant growth hormones - auxins, gibberellins, abscisic acid, cytokinins. Phytohormones

UNIT V: NITROGEN FIXATION

9

Biological fixation of nitrogen- symbiotic and non-symbiotic. Nitrogenase enzyme complex azoferredoxin and Molybdoferredoxin. Physiological electron donors and mechanism of nitrogen reduction, assimilation of ammonia, nitrogen cycle. *nif* genes and its regulation (*Klebsiella* and *Rhizobium*).

References:-

1. Biochemistry by Lubert Stryer, 4th Edition
2. Biochemistry by Mathew VanHolde
3. Lehningers Principles of Biochemistry by Nelson and Cox
4. Hormones by Norman Litwack
5. Basic and Clinical Endocrinology- Greenspan and Baster
6. Biochemistry and Physiology of Plant Hormones- Thomas Moore
7. Annual Review of Biochemistry 1977
8. Thermodynamics for Biological Systems -Baine

**MBT 103: Inheritance biology
lectures)****(45****UNIT-I: Gene Concept, Mendelism and Extension of Mendelian Principles
10**

- A. Concept of Gene: Allele, Multiple Alleles, Pseudoallele, Complementation tests.
- B. Mendelian Principles: Dominance, Segregation, Independent Assortment, Deviation from Mendelian Inheritance.
- C. Extensions of Mendelian Principles: Codominance, Incomplete Dominance (Partial Dominance), Gene Interactions, Pleiotrophy, Genomic Imprinting, Penetrance and Expressivity, Phenocopy, Linkage and Crossing over, Sex determination, Sex Differentiation, Sex Linkage, Sex limited and Sex influenced characters.

UNIT- II: Mutation and Structural Alterations of Chromosome**10**

- A. Mutation: Types, Causes and detection, Mutant types –lethal, Conditional, Biochemical, Loss of Function, Gain of Function, Germinal versus Somatic mutants, Insertional Mutagenesis (Transposon based –biological mutagens).
- B. Structural and Numerical alterations of Chromosome: Deletion, Duplication, Inversion, Translocation, Ploidy and their genetic implications.

UNIT- III:Microbial Genetics

Methods of genetic transfers –Transformation, Conjugation, Transduction, sexduction, Mapping genes by interrupted mating, Fine structure analysis of genes –S Benzes work.

UNIT- IV: Gene Mapping Methods

Linkage maps, Tetrad analysis, Mapping with molecular markers, Mapping by using somatic cell hybrids, development of mapping population in plants.

UNIT- V: Extra Chromosomal Inheritance

Inheritance of mitochondrial and chloroplast genes, Maternal Inheritance, Plasmid inheritance.

References:

1. Principles of Genetics 8th edition, Eldon J. Gardner, Michael J. Simmons, and D. Peter Snustad, Wiley India Edition (Indian edition).
2. Molecular Genetics: An introductory Narrative (2nd Edition) Gunther S. Stent and Richard Calendar, CBS Publishers and Distributors (Indian Edition) –Reprint 2004.
3. Principles of Genetics, 7th Edition, Robert H Tamarin, Tata McGraw Hill Edition (Indian Edition) –Reprint 2004
4. Genetics 5th edition –Strickberger, Pearsons publisher –Low Price Edition (Indian Edition).
5. Modern Microbial Genetics –Editors Uldis N Streips and Ronald E. Yasbin Wiley –Liss publications, 1991.

MBT 104: Biostatistics and Bioinformatics

(45

Lectures)

UNIT I Basic terms, measures of central tendency and dispersion

13

Population, Sample, sampling method, variable, parameter, classification of data, Frequency distribution, tabulation, graphic and diagrammatic representation. Mean, median, mode, quartiles and percentiles, measures of dispersion: range, variance, standard deviation, coefficient of variation, symmetry: measures of skewness and kurtosis

Probability and distributions:

Definition of probability (frequency approach), independent events. conditional probability, Examples of Bernoulli, Binomial, Poisson and Normal distributions. Coefficient of distribution, Use of these distributions to describe in biological models.

UNIT II Bivariate data

10

Scatter plot, correlation coefficient (r), properties (without proof), Interpretation of r , linear regression. Fitting of lines of regression, regression coefficient, coefficient of determination.

HYPOTHESIS TESTING:

Hypothesis, critical region, and error probabilities. Z-test, 't'-test, Chi-square test for independence. P-value of the statistic. Confidence limits, Introduction to analysis of variance.

UNIT III Introduction to bioinformatics

8

Introduction to genomics and proteomics; NCBI; SRS.

BIOLOGICAL DATABASES [Introductory only]:

Nucleic acid sequence databases:- EMBL, DDBJ, GenBank; Primary Protein sequence databases:- PIR, MIPS, Swiss – PROT, TrEMBL, NRL–3D; Composite Protein sequence databases: - NRDB, OWL, MIPSx, SWISS-PROT + TrEMBL; Secondary Protein databases: - PROSITE, PRINTS, BLOCKS, PROFILES, Pfam, IDENTIFY; Structure classification databases: - SCOP, CATH, PDBsum.; Structural Databases: - PDB, NDB, MMDB.

UNIT IV Sequence analysis methods

6

Methods, Algorithms, tools and applications of Pairwise sequence analysis and multiple sequence analysis.

PHYLOGENETIC ANALYSIS:

Elements of phylogeny, methods of phylogenetic analysis, Phylogenetic tree of life, phylogenetic analysis tools- Phylip, ClustalW.

UNIT V Homology modeling

8

Homology modeling, prediction of protein structure from sequences, Secondary structure, three-dimensional structure prediction, Validation of 3-D structure (Ramchandran plot).

MOLECULAR MODELING:

Introduction, molecular mechanics, force field, potential energy functions, energy minimization, single point calculations, full-geometry optimization, conformational search, docking, molecular dynamics simulations, molecular modeling packages.

References:-

1. Biostatistics : A foundation for Analysis in the Health Sciences 7/E /Wayne W. Daniel, Wiley Series in Probability and Statistics.
2. Introductory Statistics. Fifth Edition. (2004) Prem S. Mann John Wiley and Sons (ASIA) Pte Ltd.
3. Basic Statistics-Aprimer for Biomedical Sciences-(Olive Jean Dunn).
4. Biostatistics-An introductory text – (Auram Gold Stein).
5. Statistics : An Introductory Analysis (Taro Yamane) Harper and Row Publisher 1964,67,73
6. Introduction to Bioinformatics, (Atwood, T. K. and Parry-Smith, D. J).
7. An introduction to Computational Biochemistry. (C. Stain Tsai, A JohnWiley and Sons, Inc., publications).
8. Developing Bioinformatics Computer Skills. (Cynthia Gibas and Per Jambeck).
9. Bioinformatics Methods and Applications Genomics, Proteomics and Drug Discovery. (Rastogi S. C. Mendiratta, and Rastogi P.)
10. NCBI Web site: <http://www.ncbi.nlm.nih.gov>

Practicals

MBT 105: Biomolecules and Bioenergetics and Microbiology

1. Isolation of chloroplast and evaluation of oxygen using Hill oxidant.
2. Study of methyl viologen as a terminal electron acceptor.
3. Study of respiration of mitochondria and oxidative phosphorylation.
4. Effect of inhibitors on respiratory chain.
5. Effect of uncouplers on oxidative phosphorylation.
6. Isolation and determination of activity of nitrate reductase.
7. Determination of relative strength of common redox reagents.
8. Study of *E. coli* as type strain with respect to its morphological and biochemical characters.
9. Study of Clustal W tool for phylogenetic relationship among related species.
10. Isolation of Acidophilic bacteria and study its morphological and biochemical characters.
11. Isolation of Alkalophilic bacteria and study its morphological and biochemical characters.
11. Isolation of Thermophilic bacteria and study its morphological and biochemical characters.
12. Isolation of Halophilic bacteria and study its morphological and biochemical characters.
13. Isolation and cultivation of Bacteriophages.
14. Embryonated Chick egg technique.

MBT 106: Inheritance Biology and Biostatistics and Bioinformatics

1. Demonstration of Mendelian principles using *Drosophila* / plant system.
2. Numerical exercises related to Mendelian principles, gene interactions, linkage and gene mapping.
3. Studies on induction and detection of sex linked recessive lethals (*Drosophila*).
4. Studies on mutagenic treatment to seeds, pollen grains and its mitotic and meiotic analysis.
5. Study of mutation analysis in bacteria (antibiotic resistance).
6. Study of transformation, conjugation and transduction.

7. Study of construction of restriction map of plasmid DNA.
8. Measures of Central Tendency and Dispersion on Excel
9. Statistical Analysis using EXCEL (Diagrammatic and graphical presentation)
10. Introduction to PubMed & PMC and retrieval of literature.
11. Retrieval of an amino acid sequence, nucleotide sequence and performing BLAST and FASTA.
12. Multiple sequence alignment by CLUSTALx/w (offline tool).
13. Homology modelling for prediction of 3D structure & its visualization.
14. Structure analysis: secondary, tertiary and Quaternary structure, bond angle, bond length, different interactions by RasMol.
15. Phylogenetic studies & construction of phylogenetic tree.
16. Introduction to chimera.

M. Sc. Biotechnology (Semester –II)

MBT 201: Cell Biology lectures)

(45

UNIT I: Cell organelles:

8

Cell Theory, Cell organization of prokaryotic and eukaryotic cells. Structural and functional capitalization of Cell organelles – mitochondria, chloroplast, Lysosomes, nucleus, Peroxisomes.

UNIT II: Intracellular Protein trafficking

9

Cytoplasmic Membrane: Chemical Composition of Membrane, Structure and function of Membrane proteins, Fluid Mosaic Model, Movement of substances across cell membrane – Diffusion, Active transport.

Membrane Trafficking: Vesicular transport from Endoplasmic reticulum to Golgi Apparatus, Endoplasmic reticulum and its function, Vesicular transport in Golgi apparatus. Golgi complex and its function.

UNIT III: Cytoskeleton

9

Structure and functions of microtubules, microfilaments and intermediary filaments. Working of Actin, Kinesin, Dynein and ATPase as motor protein. Actin and myosin in heart.

UNIT IV: Cell cycle and Cell adhesion

9

Cell Cycle: Cell Cycle Phases, mitosis and meiosis, Role of cyclins and Cdks, Cell cycle check points.

Cell Adhesion - Extracellular matrix. Cell-cell interactions and cell matrix interaction. Desmosomes, Hemidesmosomes, Integrins, Selectins, Cadherins, Tight Junction, Gap Junction.

UNIT V: Cell signalling

10

Extracellular Messengers & their receptors, G-protein- Coupled receptors their second messengers and signal transduction pathway- Regulation of Glucose levels, Protein Tyrosine Kinases-RTK- Dimerization, Protein Kinase activation, RTKs activates downstream signaling pathway, signaling by the insulin receptors (RTKs) , Calcium as an intracellular messenger: IP3 and Voltage-Gated Ca²⁺ Channels, Calcium binding Protein(calmodulin) & its role in signaling Intrinsic pathway of Apoptosis; Light induced signal transduction (Plant transduction). General Pathways of Ras- MAP Kinase pathway, Hedgehog pathway, WNT signalling pathway, Notch Pathway, Nf-κB Pathway.

REFERENCES:

1. Molecular Cell Biology, **Lodish et al.** Scientific American Books (1995)
2. The World of the Cell Becker, **W.M. et al.** Benjamin Cummings (2004)
3. Cell and Molecular Biology, **Karp G**, John Wiley and Sons. (1999).
4. Molecular Biology of Cell, **Alberts B et al.** Garland Publishers, (2001)
5. Lehninger Principle of Biochemistry, **Nelson DL and Cox MM**, Worth Publishers, (2000)
6. Principles of cell and Molecular Biology, **Kleinsmith LJ & Kish VM**, Harper Collins College Publishers (1995).

MBT 202: Enzyme Technology

(45 lectures)

UNIT I: ENZYMES

13

Classification - IUB system, rationale, overview and specific examples. Characteristics of enzymes, enzyme substrate complex. Concept of active centre, binding sites, stereospecificity and ES complex formation. Effect of temperature, pH and substrate concentration on reaction rate. Activation energy. Transition state theory.

ENZYME CATALYSIS: Factors affecting catalytic efficiency - proximity and orientation effects, distortion or strain, acid - base and nucleophilic catalysis. Methods for studying fast reactions. Chemical modification of enzymes. Isoenzymes, Ribozymes, Abzymes.

UNIT II: ENZYME KINETICS

07

Michaelis - Menten Equation - form and derivation, steady state enzyme kinetics. Significance of V_{max} and K_m . Bisubstrate reactions. Graphical procedures in enzymology - advantages and disadvantages of alternate plotting. Enzyme inhibition - types of inhibitors - competitive, non-competitive and uncompetitive, their mode of action and experimental determination. Enzyme activity, international units, specific activity, turnover number, end point kinetic assay

UNIT III: STRUCTURE FUNCTION RELATIONS

05

Lysozyme, ribonuclease, trypsin, carboxypeptidase, phosphorylase, aspartate transcarbamylase and Na - K ATPase.

UNIT IV: ALLOSTERIC INTERACTIONS

10

Allosteric sites, Modulators, Protein ligand binding including measurements, analysis of binding isotherms, cooperativity, Hill and Scatchard plots and kinetics of allosteric enzymes.

ENZYME REGULATION: Product inhibition, feedback control, enzyme induction and repression and covalent modification. Allosteric regulation.

UNIT V:ENGINEERING TECHNIQUES:

10

Metabolic engineering, enzyme engineering.

IMMOBILIZED ENZYMES: Relative practical and economic advantage for industrial use, effect of partition on kinetics and performance with particular emphasis on charge and hydrophobicity (pH, temperature and K_m). Various methods of immobilization - ionic bonding, adsorption, covalent bonding (based on R groups of amino acids), microencapsulation and gel entrapment. Immobilized multienzyme systems. Biosensors - glucose oxidase, cholesterol oxidase, urease and antibodies as biosensors

References: -

- 1) Fundamentals of Enzymology- Price and Stevens
- 2) Enzymes -Dixon and Webb
- 3) Isoenzymes By D. W. Moss
- 4) Immobilized Biocatalysts- W. Hartneir
- 5) Selected papers Allosteric Regulation -M. Tokushige
- 6) Enzymes: Biochemistry, Biotechnology and Clinical Chemistry, Trevor Palmer, (2004)
- 7) Principles and Applications in Engineering Series: Biotechnology for Biomedical Engineers - Martin L.Yarmush, CRC Press, Boca Raton London New York Washington,D.C.

MBT 203: Molecular Cell Processing

(45 lectures)

UNIT I : DNA Repair Mechanisms

05

Excision, Mismatch, SOS, Photoreactivation, Recombination repair, Eukaryotic repair Mechanisms

UNIT II : Recombination

05

Recombination between heteroduplex, Holiday intermediate, Proteins involved in Recombination, Role of *recA*, *recBCD* pathway in *E.coli*, single strand assimilation in Bacteria.

UNIT III : DNA Replication

10

Unit of Replication (Replicon : Bacterial, Eukaryotic and Extra chromosomal)

Bacterial Replication is connected to cell cycle, Enzymes involved in replication (DNA Polymerases of *E.coli* and Eukaryotes) Replication origin and Replication fork, Fidelity of Replication.

UNITIV : Transcription**15**

Prokaryotic transcription: RNA Polymerases, Sigma factor and specificity binding to DNA, Promoters and their consensus sequences , Initiation of transcription, Elongation of transcription, Termination of transcription (Rho dependent ,Rho independent termination, Antitermination) RNA Editing, Splicing

Eukaryotic transcription: RNA Polymerases, types & subunits, Promoter elements for three polymerases, Activators, Enhancers, Repressors. Elongation and Termination of transcription. RNA editing, splicing, polyadenylation.

UNITV: Translation**10**

Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA identity, aminoacyl tRNA synthetase, translational proof-reading, translational inhibitors, post translational modification of proteins.

References:

1. Benjamin Lewin -Gene VI, Gene VII, Gene IX, Gene X Oxford University press
- 2 David Friefieder -Essentials of Molecular Biology, Jones &Barlett publications
- 3 J. Kendrew Encyclopedia of Molecular Biology Blackwell Scientific publications.
- 4 Weaver Molecular Biology
- 5 J.D.Watson, N.H.Hopkins ,J.W Roberts,*et al* Molecular Biology of the Gene, Benjamin Cummings publ.co.inc.,California
- 6 J.Darnell. *et al* molecular biology of the cell(2nd edition) Garland Publishing Inc.
- 7 Meyers R.A (ed)., Molecular biology and biotechnology.VCH publishers NY Inc.
- 8 Alberts B et al Molecular biology of the cell. Garland Publishing Inc.
- 9 Watson J.D., Recombinant DNA.
- 10 Malacimski; Essentials of Molecular Biology.
- 11 Stansfield; Molecular and cell biology.
- 12 Walker Molecular biology and Biotechnology.
- 13 Brown T.A Essential of Molecular biology Vol 1 and 2 each.
- 14 Dale Molecular Genetics of Bacteria

MBT 204: Immunology and Immune techniques
lectures)

(45

Unit I: Immunity

09

Innate immunity- 1st and 2nd line of Defense, Humoral immunity- Clonal selection theory, Primary and Secondary immune response, Mechanism of antibody production against TI and TD antigens, Structures of Antibodies, Gene expression and Ig Diversity, Cell-Mediated immunity- lysis of Self-altered cells, Lytic pathways of CMI. Components of Humoral immunity and CMI.

Unit II: Antigen, MHC, Complement and Cytokines

09

Antigen- Types, Factors affecting antigenicity, Epitopes, Haptens, Adjuvants, Mitogens, MHC- Genetic organization and inheritance, Antigen processing and presentation (Cytosolic and Endocytic pathway), Presentation of non-peptide antigens, Complements- Complement activation pathways, Cytokines- Cytokines secreted by TH1 and TH2 cells and its regulation.

Unit III: Medical Microbiology

09

General information, structure/morphological and cultural characters, Life cycle, pathogenicity, and Laboratory Diagnosis of Bacterial Diseases (*C. diphtheria*, *Cl. tetani*, *M. tuberculosis*, *S. typhi*), Viral Diseases (Rabies, Influenza, HIV), Fungi (Candidiasis), Protozoan (*Plasmodium malaria*).

Unit IV: Clinical Immunology

09

Hypersensitivity: types and general mechanism of hypersensitivity) Autoimmunity: general mechanism, (organ specific, non-organ specific). Transplantation immunology- Immunologic Basics of Graft rejection, Immunosuppressive Therapy, Tumor immunology- Tumor antigens, Immune response to tumor antigens, Tumor evasion of the immune system, Cancer immunotherapy.

Unit V: Antigen-Antibody Interactions and Vaccines

09

Antigen-antibody interactions: Principles, applications, strength, cross-reactivity, features of interactions, precipitation, immunodiffusion, Immunoelectrophoresis, agglutination, complement fixation test, immunofluorescence test, Radioimmunoassay, ELISA, Flow cytometry with fluorescence. Genetically Engineered Vaccines- Subunit vaccines (Herpes simplex, SARS, *S. aureus*), Peptide vaccines (Foot and Mouth disease, Malaria), DNA vaccines (Dental caries), Attenuated vaccines (Cholera, Salmonella, Leishmania), Vector vaccines

References:

1. Immunology - Kuby
2. Essential Immunology- Roitt
3. Cellular and Molecular Immunology- Abbas
4. Immunology and Serology- Philip Carpenter
5. Textbook of Immunology- Barrette J.T.
6. Basic and Clinical Immunology- Fundenberg H.
7. Biology of Immune response- Abramoff and Lavice
8. Fundamental Immunology 5th edition (August 2003): by William E., Md. Paul
9. Immunology an Introduction- Tizard
10. Molecular Biotechnology-Principles and applicatons of rDNA- 4th Edition, Bernard R. Glich et al.
11. Textbook of Microbiology- Ananthanarayan and Paniker
12. Microbiology 5th Edition- Prescott
13. Microbiology – Pelczar JR.
14. Microbial Genetics - Freifelder
15. Brock Biology of Microorganisms – MF Madigan
16. General Microbiology – Stanier et al.
17. General Virology - Luria
18. Animal Virology – Fenner, F and White, D.O.
19. Virology – Dulbecco R. and Ginsberg H.S.
20. Medical Microbiology- Fritz H. Kayse

Practicals

MBT 205 :Cell Biology and Enzyme technology

1. To isolate and study Animal cell (human), Plant cell, Bacteria, and Fungi under a microscope and prepare a comparative table.
2. To study all the phases of Mitosis and Meiosis in a cell
3. To study Permeable and Semi-permeable membrane of cell using the concept of Osmosis
4. To investigate the effect of Heat/Enzymes/Chemicals on the permeability of plant cell membranes
5. Study of chloroplast
 - a. Observe chloroplast under microscope
 - b. Isolation of Chloroplast
6. Study of Mitochondria
 - a. To observe Mitochondria under microscope
 - b. Isolation of Mitochondria
7. To observe red blood cells and white blood cells.
8. To study the Cell proliferation/Cell viability using MTT.
9. Visit to nearest Hospital to study flow cytometer (FACS)
10. Isolation and quantification of activity of – amylase / invertase / alkaline phosphatase (salivary / plant source)
11. Determination of specific activity of enzyme.
12. Determination of activity of enzyme in presence of activator and inhibitor.
13. Determination of K_m and V_{max} of Invertase.
14. Determination of optimum parameter of enzyme – pH and temperature.
15. Induction and estimation of beta- galactosidase.
16. Immobilization of enzyme.

MBT 206: Molecular cell processing and Immunology and Immune techniques

1. Effect of protein synthesis inhibitors on the induction of beta galactosidase.
2. To study the phage activation in bacteria
3. Isolation of bacterial DNA.
4. Isolation plasmid DNA.
5. Isolation of DNA from yeast.
6. Isolation of RNA from Plant cell / yeast.
7. Silver nitrate staining of DNA.
8. Isolation of organelle DNA (Chloroplast / mitochondria)
9. Collection of blood separation of plasma and serum and its preservation.
10. Study of slide agglutination test by colony emulsion method for the diagnosis of *Salmonella typhi*.
11. Isolation of *Salmonella typhi* and study of its morphological and biochemical Characters.
12. Diagnosis of *Salmonella typhi* by Widal test (Qualitative and Quantitative test)
13. Isolation of *Candida* species and study its morphological characters (Budding, Mycelia, Spores).
14. To study the Dot-blot ELISA.
15. Demonstration of ELISA for HIV diagnosis.