

Structure of B.Sc Microbiology

<i>Year</i>	<i>Semester</i>	<i>Paper</i>	<i>Title</i>	<i>Hours</i>	<i>Marks</i>	<i>Credits</i>	
I	I	I	Introductory Microbiology	4	100	03	
			Practical –I	2	50	02	
	II	II	Microscopy and Microbial Biochemistry	4	100	03	
			Practical –II	2	50	02	
II	III	III	Microbial Genetics and Molecular Biology	4	100	03	
			Practical –III	2	50	02	
	IV	IV	Medical Microbiology & Immunology	4	100	03	
			Practical –IV	2	50	02	
	V	V	Environmental and Agricultural Microbiology	3	100	03	
			Practical –V	2	50	02	
		VI	VI	Food and Industrial Microbiology	3	100	03
				Practical –VI	2	50	02
	Any one paper from (A) and (B)	VII (A)	Microbial Biotechnology	3	100	03	
			Lab	2	50	02	
	VI	VII (B)*	Molecular Virology				
			Lab				
	**Any one cluster (Set of Three)	** Cluster VIII-A	Cluster Elective-A	3	100	03	
			1 Microbial Diagnosis in Health clinics	3	100	03	
			2 Microbial Quality control in Food and Pharmaceutical Industry	3	100	03	
			3 Biofertilizers and Biopesticides	2	50	02	
			Or	2	50	02	
			*	* Cluster Elective-B			
from VIII-A or VIII-B can be selected	VIII-B 1	rDNA Technology					
		2Haematology					
		3Bioinformatics					

B.Sc MICROBIOLOGY (CBCS) SYLLABUS
FIRST YEAR – Semester- I
MBT- 101 Introductory Microbiology, Microbial Techniques And
Biology Of Microorganisms

TOTAL HOURS: 48

CREDITS: 4

UNIT-I History (8h)

History and mile stones in Microbiology – Meaning, definition and history of Microbiology. Contributions of Antony von Leeuwenhoek, Edward Jenner, Louis Psteur, Robert Koch, Iwanowsky. Importance and applications of Microbiology.

UNIT – II Classification, general characters of eukaryotic Microorganisms, Isolation and Staining Techniques (10 h)

Classification of microorganisms – Heckel’s three Kingdom concept - Whittaker’s five kingdom concept and three domain concept of Carl Woese and phylogenetic tree. Isolation and identification of Microorganisms-Principles and types of stains (Simple, Differential and negative stains), structural stains – spore, capsule, flagella. Hanging-drop method.

UNIT –III Classification and general characters of prokaryotes and viruses (10 h)

Defferentiation of prokaryotes and eukaryotes. General characteristics of bacteria, archaea, mycoplasmas, cyanobacteria and actinomycetes. Ultra structure of a bacterial cell invariant components – cell wall, cell membranes, robosomes, nucleoid. Variant components – Capsule, flagella, fimbriae, endospore and storage granules, General characteristics and classification of viruses- animal, plant and microbial. General characteristics of eukaryotic microorganisms – microprotozoa, microalgae, molds and yeasts.

UNIT-IV Sterilization (8 h)

Sterilization and disinfection techniques - Principles and methods of sterilization, Physical methods – autoclave, hot- air oven, pressure cooker, laminar air flow, filter steilzation, Radiation methods – UV rays. Gamma rays. Ultrasonic methods. Chemical methods. Chemical methods – Use of alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites. Phenol coefficient.

UNIT-V Isolation & Preservation (8h)

Isolation of microorganisms from natural habitats(air, water, soil, rhizosphere and phyloplane). Pure culture techiques – enrichment culturing, dilution-plating, streak-plate, spread-plate and micromanipulator. Preservation of microbial cultures – subculturing, overlaying cultures with mineral oils, lyophilization sand cultures, storage at low temperature (ultra low temperature).

**MBP- 101 Introductory Microbiology, Microbial Techniques And
Biology Of Microorganisms**

TOTAL HOURS: 48

CREDITS: 2

1. Microbiology Good Laboratory Practices and Biosafety.
2. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, hot air oven, light microscope, pH meter) used in the microbiology laboratory.
3. Preparation of culture media for cultivation of bacteria, fungi
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Sterilization of heat sensitive material by membrane filtration and assessment for sterility
7. Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.
8. Isolation of single colonies on solid media.
9. Isolation of pure cultures of bacteria by streaking method.
10. Preservation of bacterial cultures by various techniques.
11. Diagrammatic or Electron photomicrographic observation of TMV, HIV, T4 phage and adenovirus

SUGGESTED READING

Ram Reddy, S. and Reddy, S.M. (2007). **Essentials of Virology**. Scientific Publishers India, Jodhpur.

Reddy, S.M. (2003). **University Microbiology .I** . Galgotia Publications New Delhi.

Dube, R.C. and Maheswari, D.K. (2000) **General Microbiology**. S Chand ,New Delhi.

Prescott, M.J., Harley, J.P. and Klein, D.A. (2010).

Microbiology. 5th Edition, WCB Mc GrawHill, New York.

Madigan, M.T., Martinkl, J.M. and Parker, J. (2010). **Brock Biology of Microorganisms**, 9th Edition, MacMillan Press, England.

B.Sc MICROBIOLOGY (CBCS) SYLLABUS

FIRST YEAR – Semester- II

MBT- 201 MICROSCOPY, MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 48

CREDITS: 4

UNIT-I Microscopy (6 h)

Principles of microscopy - bright field, dark field,- 3 h, phase-contrast, fluorescence and electron microscopy (SEM and TEM). Ocular and stage micrometers - Size determination of microorganisms.

UNIT-II

Biomolecules (10 h)

Biomolecules of microorganisms. Outline classification and general characteristics of carbohydrates (monosaccharides, disaccharides and polysaccharides). General characteristics of amino acids and proteins. Structure of nitrogenous bases, nucleotides, nucleic acids. Fatty acids (saturated and unsaturated) and lipids (spingolipds, sterols and phospholipids).

UNIT-III

Hydrogen ion concentration in biological fluids, pH measurement. Types of buffers and their use in biological reactions. Principle and applications of colorimerty and chromatography (paper, thin-layer and column).

Enzymes properties and classification. Enzyme unit and Biocatalysis induced fit, and lock and key model coenzymes. Cofactors. Factors affecting catalytic activity. Inhibition of enzyme activity competitive, noncompetitive, uncompetitive and allosteric.

UNIT-IV Microbial nutrition and Growth

No. of hours: 10

Microbial nutrition –nutritional requirements and uptake of nutrients by cells.Nutritional groups of microcroorganisms- autotrophs, heterotrophs, mixotrophs, methylotrophs.

Growth media synthetic, nonsynthetic, selective, enrichment and differential media. Microbial Growth- different phases of growth in batch cultures. Synchronous, continuous, biphasic growth. Factors influencing microbial growth. Methods for measuring microbial growth – Direct microscopy, viable count estimates, turbidometry, biomass.

UNIT-V Intermediary Metabolism

No. of hours: 10

Aerobic respiration -Glycolysis, Electron transport, oxidative and substrate level phosphorylation. Anaplerotic reactions. β -Oxidation of fatty acids. Anaerobic respiration (nitrate, sulphate respiration). Fermentation - Common microbial fermentations with special reference to alcohol and lactic acid fermentations.

MBP- 201 MICROSCOPY, MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 48

CREDITS: 2

1. Light compound microscope and its handling.
2. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram .ve bacilli), cyanobacteria (*Nostoc*, *Spirulina*), algae (*Scenedesmus* sp., diatoms), and fungi (*Saccharomyces*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*).
3. Calibrations of microscopic measurements (Ocular, stage micrometers).
4. Measuring dimensions of fungal spores
5. Simple staining
6. Negative staining
7. Gram's staining
8. Colorimetric estimation DNA by diphenylamine method
9. Colorimetric estimation of proteins by Biuret/Lowry method
10. Paper chromatographic separation of sugars and amino acids
11. Preparation of different media: synthetic media BG-11, Complex media-Nutrient agar, McConkey agar, EMB agar.
12. Enrichment culturing and isolation of phototrophs and chemoautotrophs.
13. Setting and observation of Winogradsky column.
14. Estimation of CFU count by spread plate method/pour plate method.
15. Bacterial growth curve.
16. Factors affecting bacterial growth – pH, temperature, salts

SUGGESTED READING

Prescott, M.J., Harley, J.P. and Klein, D.A. (2010). **Microbiology**. 5th Edition, WCB McGrawHill, New York.

Madigan, M.T., Martinkl, J.M. and Parker, J. (2010). **Brock Biology of Microorganisms**, 9th Edition, MacMillan Press, England.

Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). **General Microbiology**, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

Gottschalk, G. (1986). **Bacterial Metabolism**, SpringerVerlag, New York.

Caldwell, D.R. (1995). **Microbial Physiology and Metabolism**, W.C. Brown Publications, Iowa, USA.

Moat, A.G. and Foster, J.W. (1995). **Microbial Physiology**, John Wiley, New York.

B.Sc MICROBIOLOGY (CBCS) SYLLABUS
SECOND YEAR – Semester- III
MBT- 301 MICROBIAL GENETICS AND MOLECULARBIOLOGY

TOTAL HOURS:48

CREDITS: 4

Unit-I :

hours:10

Nucleic acids and DNA replication

DNA and RNA as genetic materials. Structure and organization of prokaryotic DNA
Extrachromosomal genetic elements – Plasmids and transposons. Replication of DNA -
Semiconservative mechanism, molecular details of DNA synthesis, enzymes involved in
replication. Differences between prokaryotic & eukaryotic DNA replication.

Unit-II:

Mutations And DNA Damage & Gene transfer mechanisms in bacteria

hours: 10

Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions,
tandem duplications, insertions. Various physical and chemical mutagens. Outlines of DNA
damage and repair mechanisms. Brief account on horizontal gene transfer among bacteria –
transformation, transduction and conjugation.

Unit-III:

GENE CONCEPT

hours: 8

Concept of gene – Muton, recon and cistron. One gene one enzyme, one gene one polypeptide, one
gene one product hypothesis. Types of RNA and their functions. Outlines of RNA biosynthesis in
prokaryotes. Genetic code. Structure of ribosomes.

Unit-IV:

Protein synthesis

hours: 12

Protein synthesis in prokaryotes and eukaryotes – Transcription, transcriptional processing and
translation and termination. Types of genes – structural, constitutive, regulator. Operon concept.
Regulation of gene expression in bacteria – *lac* operon.

Unit-V:

Genetic Engineering

hours: 8

Basic principles of genetic engineering. Restriction endonucleases, DNA polymerases and
ligases. Vectors. Outlines of gene cloning methods. Polymerase chain reaction. Genomic and
cDNA libraries. General account on application of genetic engineering in industry, agriculture and
medicine.

MBP- 301 MICROBIAL GENETICS AND MOLECULARBIOLOGY

TOTAL HOURS: 48

CREDITS: 2

1. Study of different types of DNA and RNA using micrographs and model / schematic representations
2. Study of semi-conservative replication of DNA through micrographs / schematic representations
3. Isolation of genomic DNA from *E. coli*
4. Estimation of DNA using UV spectrophotometer (A260 measurement)
5. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
6. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE).
7. Problems related to DNA and RNA characteristics, Transcription and Translation.

SUGGESTED READING

Verma, P.S. and Agarwal, V.K. (2004). **Cell Biology, Genetics, Molecular Biology, Evolution and Ecology**. S. Chand & Co. Ltd., New Delhi.

Freifelder, D. (1997). **Essentials of Molecular Biology**. Narosa Publishing House, New Delhi.

Crueger, W. and Crueger, A. (2000). **Biotechnology: A Text Book of Industrial Microbiology**, PrenticeHall of India Pvt. Ltd., New Delhi.

Glick, B.P. and Pasternack, J. (1998). **Molecular Biotechnology**, ASM Press, Washington D.C., USA.

Freifelder, D. (1990). **Microbial Genetics**. Narosa Publishing House, New Delhi.

Strickberger, M.W. (1967). **Genetics**. Oxford & IBH, New Delhi.

Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). **Principles of Genetics**. 5 th Edition. McGraw Hill, New York.

Glazer, A.N. and Nikaido, H. (1995). **Microbial Biotechnology – Fundamentals of Applied Microbiology**, W.H. Freeman and company, New York.

Old, R.W. and Primrose, S.B. (1994) **Principles of Gene Manipulation**, Blackwell

Science Publication, New York. Smith, J.E. (1996). **Biotechnology**, Cambridge University Press.

Snyder, L. and Champness, W. (1997). **Molecular Genetics of Bacteria**. ASM press, Washington, D.C., USA.

B.Sc MICROBIOLOGY (CBCS) SYLLABUS SECOND YEAR – Semester- IV MBT- 401
MEDICAL MICROBIOLOGY & IMMUNOLOGY

TOTAL HOURS: 48

CREDITS: 4

Unit-I History of Immunology Organs and cells of Immune System No. of hours: 10

Development of immunology. Types of immunity – innate and acquired; active and passive; humoral and cell-mediated immunity. Primary and secondary organs of immune system – thymus, bursa fabricus, bone marrow, spleen and lymph nodes. Cells of immune system. Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils.

Unit-II Antigens & Antibodies and hypersensitivity

No. of hours: 10

Antigens – types, chemical nature, antigenic determinants, haptens. Factors affecting antigenicity. Antibodies – basic structure, types, properties and functions of immunoglobulins. Components of complement and activation of complement. Types of antigen-antibody reactions-agglutinations,precipitation,neutralization,complexfixation, complement fixation, blood groups. Labeled antibody based techniques – ELISA, RIA and Immunofluorescence. Polyclonal and monoclonal antibodies – production and applications. Concept of hypersensitivity and Autoimmunity.

Unit-III Clinical Microbiology

No. of hours: 10

History of medical microbiology. Normal flora of human body, Definition of infection, non specific defense mechanisms, mechanical barriers, antagonism of indigenous flora. Antibacterial substances- lysozyme, complement, properdin, antiviral substances, phagocytosis, General principles of diagnostic microbiology- Collection, transport and processing of clinical samples. General methods of laboratory diagnosis-cultural, biochemical, serological, and molecular methods.

Unit-IV Chemotherapy and vaccines

No. of hours: 8

Antiviral agents-Interferon and base analogues. Host - pathogen interactions, Bacterial toxins, virulence and attenuation. Elements of chemotherapy – therapeutic drugs. Drug resistance. Mode of action of penicillin and sulpha drugs, and their clinical use. Tests for antimicrobial susceptibility. Preventive control of diseases – active and passive immunization. Vaccines – natural and recombinant.

UNIT V Microbial diseases

No. of hours: 10

General account of the following diseases – causal organisms, pathogenesis, epidemiology, diagnosis, prevention and control of: Air-borne diseases - Tuberculosis, Influenza Food and water-borne diseases - Typhoid, Hepatitis- A

General account of the following diseases – causal organisms, pathogenesis, epidemiology, diagnosis, prevention and control of: Insect-borne diseases – Malaria.

Contact diseases – Syphilis. Zoonotic diseases – Rabies. Blood-borne diseases –AIDS. General account of nosocomial infections.

MBP- 401 MEDICAL MICROBIOLOGY & IMMUNOLOGY

TOTAL HOURS: 48

CREDITS: 2

1. Identification of human blood groups.
2. Estimation of blood haemoglobin.
3. Perform Total Leukocyte Count of the given blood sample.
4. Perform Differential Leukocyte Count of the given blood sample.
5. Separate serum from the blood sample (demonstration).
6. Perform immunodiffusion by Ouchterlony method.
7. Identify bacteria (any three of *E. coli*, *Pseudomonas*, *Staphylococcus*, *Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests
8. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar)
9. Study of bacterial flora of skin by swab method
10. Perform antibacterial sensitivity by Kirby-Bauer method
11. Study symptoms of the diseases with the help of photographs: Polio, anthrax, herpes, chicken pox, HPV warts, AIDS (candidiasis), dermatomycoses (ring worms)
12. Study of various stages of malarial parasite in RBCs using permanent mounts.

SUGGESTED READING

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
5. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
6. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford.
7. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
8. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

B.Sc MICROBIOLOGY (CBCS) SYLLABUS

THIRD YEAR – Semester- V

MBT- 501 ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 3

UNIT-I :

Microorganisms and their habitats

HOURS: 10

Microorganisms of environment (soil, water and air). soil microflora, Aeromicroflora and dispersal of microbes. Microflora of fresh water and marine habitats. Extreme Habitats: Extremophiles- Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels. Role of microorganisms in nutrient cycling (nitrogen, sulphur). Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation.

UNIT-II:

Water Potability

Hours: 8

Microbiology of potable and polluted waters. Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests. Outlines of biodegradation of environmental pollutants – pesticides

UNIT – III:

Waste Management

Hours: 6

Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill).

Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment.

UNIT – IV:

Soil Microbiology and PGPR

Hours: 7

Biotic and abiotic components of soil, soil profile. Rhizosphere and phyllosphere

Plant Growth Promoting Microorganisms (PGPR) -mycorrhizae, rhizobia, *Azospirillum*, *Azotobacter*, cyanobacteria, *Frankia* and phosphate-solubilizing microorganisms. Outlines of biological nitrogen fixation (symbiotic, non-symbiotic). Biofertilizers - *Rhizobium*.

Unit – V:

Concept of Disease And Microbial pesticides

Hours: 7

Concept of disease in plants. Symptoms of plant diseases caused by fungi, bacteria, and viruses. Plant diseases caused by fungi (groundnut rust), bacteria (angular leaf spot of cotton) and viruses (tomato leaf curl)

Principles of plant disease control.

Biological control of plant diseases.

Biopesticides – *Bacillus thuringiensis*, Nuclear polyhedrosis virus (NPV), *Trichoderma* .

MBP- 501 ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 2

1. Study of soil flora isolation - qualitative & quantitative (bacteria, fungi and actinomycetes)
2. Enrichment/ isolation of – starch hydrolysers.
3. Study of air flora by petriplate exposure method.
4. Analysis of potable water: SPC, Presumptive, confirmed and completed test, determination of coliform count in water by MPN, Membrane filtration technique.
5. Waste water analysis: Biological Oxygen Demand(BOD).
6. Isolation and enumeration of major groups of microorganisms from rhizosphere and nonrhizosphere soil.
7. Study of root nodules and Isolation of *Rhizobium*
8. Isolation of *Azotobacter*
9. Staining and observation of Vesicular Arbuscular Mycorrhizal (VAM) fungi.
10. Isolation of plant diseases of local importance- Rusts, Smuts, Powdery mildews, Tikka disease of groundnut, Citrus canker, Bhendi yellow vein mosaic, Tomato leaf curl. Little leaf of Brinjal

SUGGESTED READINGS

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
2. Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition. Pearson/ Benjamin Cummings
3. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
4. Okafor, N (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York
5. Singh A, Kuhad, RC & Ward OP (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Heidelberg
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA
Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
7. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
8. Lynch JM & Hobbie JE. (1988). Microorganisms in Action: Concepts & Application in
9. Martin A. (1977). An Introduction to Soil Microbiology. 2nd edition. John Wiley & Sons Inc. New York & London.
10. Stolp H. (1988). Microbial Ecology: Organisms Habitats Activities. Cambridge University Press, Cambridge, England.

B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – Semester- V
MBT- 601 FOOD AND INDUSTRIAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 3

UNIT- I

Food Microbiology

No. of hours: 7

Intrinsic and extrinsic parameters that affect microbial growth in food. Microbial food Spoilage of different food materials - fruits, vegetables, meat, fish. Canned foods. Food intoxication (botulism and staph poisoning), food-borne diseases (salmonellosis and shigellosis) and their detection.

UNIT – II

Food Microbiology

No. of hours:7

General account of food preservation. Microbiological production of fermented foods – bread, cheese, yogurt.

Biochemical activities of microbes in milk.

Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw).

Concept of probiotics and nutraceuticals

UNIT – III

Industrial Microbiology

No. of hours: 7

Microorganisms of industrial importance – yeasts, moulds, bacteria, actinomycetes.

Screening and isolation of industrially-important microorganisms.

Outlines of strain improvement.

UNIT – IV

Industrial Microbiology

No. of hours: 6

Types of fermentation – aerobic, anaerobic, batch, continuous, submerged, surface, solid state.

Design of a stirred tank reactor fermentor.

Fermentation media.

UNIT – V

Industrial Microbiology

No. of hours: 9

Industrial production of alcohols (ethyl alcohol), beverages (beer), enzymes (amylases), antibiotics

(penicillin), amino acids (glutamic acid), organic acids (citric acid), vitamins (B12), biofuels (biogas - methane).

MBP- 601 FOOD AND INDUSTRIAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS:2

1. Observation of different spoiled food
2. Isolation of bacteria and fungi from spoilt bread/fruits/vegetables
3. Preparation of Yogurt/Dahi
4. Determination of the microbiological quality of milk sample by MBRT
5. Isolation of antagonistic microorganisms by crowded plate technique
6. Microbial fermentation for the production and estimation of ethanol
7. Microbial fermentation for the production and estimation of citric acid

SUGGESTED READING

1. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd Edition. Panima Publishing Company, New Delhi
2. Patel AH. (1996). Industrial Microbiology .1st Edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India
3. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An introduction.9th Edition. Pearson Education
4. Willey JM, Sherwood LM AND Woolverton CJ (2013), Prescott, Harley and Klein's Microbiology.9th Edition. McGraw Hill Higher education
5. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley
6. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
7. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
8. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
9. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
10. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, B.Sc MICROBIOLOGY (CBCS) SYLLABUS

THIRD YEAR – Semester- VI
Elective-A
MBT- 701 MICROBIAL BIOTECHNOLOGY

TOTAL HOURS:36

CREDITS: 3

Unit 1 Microbial Biotechnology and its Applications

No. of Hours: 8

Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology. Use of prokaryotic and eukaryotic microorganisms in biotechnological applications Genetically engineered microbes for industrial application: Bacteria and yeast

Unit 2 Therapeutic and Industrial Biotechnology

No. of Hours: 7

Recombinant microbial production processes in pharmaceutical industries - Streptokinase, recombinant vaccines (Hepatitis B vaccine) Microbial polysaccharides and polyesters, Microbial production of bio-pesticides, bioplastics Microbial biosensors

Unit 3 Applications of Microbes in Biotransformations Products and their Recovery

No. of Hours: 10

Microbial based transformation of steroids and sterols Bio-catalytic processes and their industrial applications: Production of high fructose syrup and production of cocoa butter substitute. Microbial product purification: filtration, ion exchange & affinity chromatography techniques Immobilization methods and their application: Whole cell immobilization

Unit 4

Microbes for Bio-energy and Environment

No. of Hours: 7

Bio-ethanol and bio-diesel production: commercial production from lignocellulosic waste and algal biomass, Biogas production: Methane and hydrogen production using microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics, mineral recovery, removal of heavy metals from aqueous effluents

Unit 5 RNAi and Intellectual Property Rights

No. of Hours: 4

RNAi and its applications in silencing genes, drug resistance, therapeutics and host pathogen Interactions Patents, Copyrights, Trademarks

MBP- 601 MICROBIAL BIOTECHNOLOGY

TOTAL HOURS: 36

CREDITS: 2

1. Study yeast cell immobilization in calcium alginate gels
2. Study enzyme immobilization by sodium alginate method

3. Pigment production from fungi (*Trichoderma* / *Aspergillus* / *Penicillium*)
4. Isolation of xylanase or lipase producing bacteria
5. Study of algal Single Cell Proteins

SUGGESTED READING

1. Ratledge, C and Kristiansen, B. (2001). Basic Biotechnology, 2nd Edition, Cambridge University Press.
2. Demain, A. L and Davies, J. E. (1999). Manual of Industrial Microbiology and Biotechnology, 2nd Edition, ASM Press.
3. Swartz, J. R. (2001). Advances in Escherichia coli production of therapeutic proteins.
4. Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM, Woolverton CJ (2014), 9th edition, Mc Graw Hill Publishers.
5. Gupta PK (2009) Elements of Biotechnology 2nd edition, Rastogi Publications,
6. Glazer AN and Nikaido H (2007) Microbial Biotechnology, 2nd edition, Cambridge University Press
7. Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM
8. Stanbury PF, Whitaker A, Hall SJ (1995) Principles of Fermentation Technology 2nd edition., Elsevier Science
9. Crueger W, Crueger A (1990) Biotechnology: A text Book of Industrial Microbiology 2nd edition Sinauer associates, Inc. Delhi, India

THIRD YEAR – Semester- VI
Elective-B
MBT- 702 Molecular Virology

UNIT – I

History of Virology and Biosafety: History and principles of virology. Structures of animal and plant viruses and their morphology. Principles of biosafety and requirements of virology laboratory.

UNIT – II

Virus Replication: Structure and replication strategies of bacteriophages – T7, λ , and plant viruses – ss RNA virus (TMV) and ds DNA virus (CaMV). Structure and replication strategies of animal viruses – Influenza virus, Adeno virus and Retro virus.

UNIT – III

Interferon and Antiviral Agents: Viral Interference and Interferons. Nature and source of interferons, Classification of interferons. Induction of interferon. Antiviral agents (chemical and biological) and their mode of actions.

UNIT – IV

Cultivation of Viruses and Viral Vaccines : Cultivation of viruses in embryonated egg. Conventional vaccines – Killed and attenuated. Modern vaccines – Recombinant proteins, subunits, DNA vaccines, peptides, immunomodulators (cytokines). Vaccine delivery and adjuvants, large-scale manufacturing.

UNIT – V

Virological Methods: Methods for purification of viruses with special emphasis on ultracentrifugation methods. Quantitative diagnostic methods – Haemagglutination, complement fixation, neutralization, Western blot. Nucleic acid based diagnosis – PCR, microarray and nucleotide sequencing.

Practicals:

1. Bacteriophage isolation, titration, plaque assay, single bust experiment.
2. Cultivation of viruses - Egg
3. Tissue culture techniques Animal inoculation techniques
4. Isolation and propagation of TMV Examination of blood smear by Leishman stain.
5. Rota viral RNA (ds RNA) analysis 6. Immunodiagnosis - ELISA tests

Reference Books :

General Virology - Luria and Darnel Virology and Immunology - Jokli Text book of Virology - Rhodes and Van Royen Plant Virology - Smith Genetics of bacteria and their viruses - W. Hayes Molecular Biology of the gene - Watson, Roberts, Staitz and Weiner A laboratory guide in virology - Charles H. Lunningham Basic lab procedures in diagnostic virology - Marty Cristensen Review of medical microbiology - Jawitz et al Medical laboratory Manual for tropical countries Vol I & II by Monica Cheesbrough Text Book of Microbiology - Ananthanarayanan and Jayaram Paniker Viral and Rickettsial infections of Man - Horsfall and Jam Text book of Virology - Rhodes and Van Royan Virological Procedures - Mitchal Hasking Virology - Wilson and Topley LLABUS

THIRD YEAR – Semester- VI

Cluster Elective VIII A-1

MICROBIAL DIAGNOSIS IN HEALTH CLINICS

TOTAL HOURS: 36

CREDITS: 3

Unit 1 Importance of Diagnosis of DiseasesNo. of hours: **8**

Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis.

Unit 2 Collection of Clinical SamplesNo. of hours: **8**

How to collect clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.

Unit 3 Direct Microscopic Examination and Culture.No. of hours: **8**

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa-stained thin blood film for malaria

Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

Unit 4: Serological and Molecular Methods No. of hours: 6

Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes.

Typhoid, Dengue and HIV, Swine flu

Unit 5: Testing for Antibiotic Sensitivity in Bacteria No. of hours: 6 Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method

MBP- 801 MICROBIAL DIAGNOSIS IN HEALTH CLINICS

TOTAL HOURS: 36

CREDITS: 2

1. Collection & transport of clinical specimens (Blood CSF Urine, Stool, Bone marrow, Sputum, Swabs, Aspiration fluid etc), Receipts, Labeling, recording and dispatching clinical specimens.,
2. Collection transport and processing of various clinical specimens , i.e. blood, CSF urine swabs faeces, etc. For microbiological diagnosis., Investigation of various common epidemics , Gastroenteritis, Cholera, Food poisoning, Meningitis , Encephalitis, P.U.O., Study of nosocomial infection.
3. Isolation of bacteria in pure culture and Antibiotic sensitivity.
4. Identification of common bacteria by studying their morphology, cultural character, Biochemical reactions, slide agglutination and other tests.
5. Maintenance and preservation of stock culture.

SUGGESTED READING

1. Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby

5. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier.

B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – Semester- VI Cluster Elective-A (VIII A-2)
MBT- 801 MICROBIAL QUALITY CONTROL IN FOOD AND
PHARMACEUTICAL INDUSTRIES

TOTAL HOURS: 36

CREDITS: 3

Unit 1 Microbiological Laboratory and Safe Practices

No. of

Hours: 10

Good laboratory practices - Good microbiological practices. Biosafety cabinets – Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3. Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration

Unit 2 Determining Microbes in Food / Pharmaceutical Samples No. of Hours: 8

Culture and microscopic methods - Standard plate count, Most probable numbers, Direct microscopic counts, Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products

Unit 3 Molecular methods of diagnosis Hours: No. of 4

Molecular methods - Nucleic acid probes, PCR based detection, biosensors.

Unit 4 Pathogenic Microorganisms of Importance in Food & Water No. of Hours: 10

Enrichment culture technique, Detection of specific microorganisms - on XLD agar, *Salmonella Shigella* Agar, Manitol salt agar, EMB agar, McConkey Agar, Sabouraud Agar

Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay)

Unit 5 HACCP for Food Safety and Microbial Standards

No. of Hours: 4

Hazard analysis of critical control point (HACCP - Principles, flow diagrams,)

limitations Microbial Standards for Different Foods and Water – BIS standards for common foods and drinking water

MBP- 802 A MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES

TOTAL HOURS: 36

CREDITS: 2

1. Microbiological laboratory safety- General rules & Regulations.
2. Staining Techniques (Grams and LPCB)–Food samples- vegetables and packed foods.
3. Sterility tests for Instruments – Autoclave & Hot Air Oven
4. Disinfection of selected instruments & Equipments
5. Sterility of Air and its relationship to Laboratory & Hospital sepsis.
6. Sterility testing of Microbiological media
7. Sterility testing of Pharmaceutical products –Antibiotics, Vaccines & fluids
8. Standard qualitative analysis of water.
9. Quantitative analysis of water – Membrane filter method
10. Analysis of food samples for Mycotoxins

SUGGESTED READING

1. Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press
2. Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
3. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer
4. Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.

5. Microbiology - A laboratory manual, Cappuccino & Sherman , 6 th Ed, Pearson Education
6. Manual of diagnostic microbiology, Dr.B.J.Wadher & Dr.G.L.Bhoosreddy, First .Ed ., Himalaya publishing house, Nagpur.
7. Pharmaceutical Microbiology – W.B. Hugo
8. Pharmaceutical Microbiology – Purohit
9. Laboratory Exercises in Microbiology, George.A.Wistreich & Max.D.Lechtman, 3 rd Ed, Glencoe press, London.

B.Sc MICROBIOLOGY (CBCS) SYLLABUS THIRD YEAR – Semester-VI –Cluster
Elective A (VIII A-3)
MBT- 803 BIOFERTILIZERS AND BIOPESTICIDES

TOTAL HOURS: 36

CREDITS:3

Unit 1 Biofertilizers

No of Hours: 10

General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers. Symbiotic N₂ fixers: *Rhizobium* - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants

Frankia - Isolation, characteristics, Alder, Casurina plants, non-leguminous crop symbiosis.

Cyanobacteria, *Azolla* - Isolation, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.

Unit 2 Non - Symbiotic Nitrogen Fixers 6**No of Hours:**

Free living *Azospirillum*, *Azotobacter* - free isolation, characteristics, mass inoculums, production and field application.

Unit 3 Phosphate Solubilizers**No Of****Hours: 6**

Phosphate solubilizing microbes - Isolation, characterization, mass inoculum production, field application

Unit 4 Mycorrhizal Biofertilizers**No of Hours:****7**

Importance of mycorrhizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.

Unit 5 Bioinsecticides**No Of****Hours: 7**

General account of microbes used as bioinsecticides and their advantages over synthetic pesticides, *Bacillus thuringiensis*, production, Field applications, Viruses – cultivation and field applications.

MBP- 803A BIOFERTILIZERS AND BIOPESTICIDES**TOTAL HOURS: 36CREDITS: 2**

1. Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action.
2. Isolation of microbes (bacteria & fungi) from soil (28°C & 45°C).
3. Isolation of phosphate solubilizers from soil
3. A visit to biofertilizers production unit to see Inoculum production and field application of Rhizobium, *Azospirillum*/*Azotobacter*

Suggested Readings

1. Kannaiyan, S. (2003). Bioethnology of Biofertilizers, CHIPS, Texas.
2. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
3. Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
4. Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.

5. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG

Aggarwal SK (2005) Advanced Environmental Biotechnology, APH puCluster
Elective-A B. Sc. III – Semester VI
BTT- rDNA TECHNOLOGY (VIII A-2)

Unit I **10hrs**

Restriction and Modification: Enzymes used in molecular cloning; Polymerases, ligases, phosphatases, kinases and nucleases. Classification of restriction endonucleases.

Unit II **14hrs**

Cutting and joining DNA (cohesive end ligation, methods of blunt end ligation). Screening methods (Genetic marker and blue white screening) Cloning vehicles - Plasmid, Bacteriophage, Construction of genomic and cDNA libraries. Advantages of cDNA libraries.

Unit III **12hrs**

Methods of gene sequencing – Maxam - Gilberts and Sanger's dideoxy chain termination methods; Polymerase chain reaction technique (Components in PCR and PCR conditions), Blotting techniques.

Unit IV **12hrs**

Methods of gene transfer in fungi, yeast and higher plants using microinjection, microprojectile bombardment (gene gun method, Electroporation, transformation and Selection of transformed cells.

Unit V **12hrs**

Applications of recombinant DNA technology in Agriculture (Transgenic Plants) Medicine (production of Insulin, Growth hormone, Tissue plasmogen activator and HBsAg vaccine)

Suggested Books:

1. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.

B. Sc. III – Semester VI
Cluster Elective-B (VIII B-1)
rDNA TECHNOLOGY

Unit I **10hrs**

Restriction and Modification: Enzymes used in molecular cloning; Polymerases, ligases, phosphatases, kinases and nucleases. Classification of restriction endonucleases.

Unit II **14hrs**

Cutting and joining DNA (cohesive end ligation, methods of blunt end ligation). Screening methods (Genetic marker and blue white screening)
Cloning vehicles - Plasmid, Bacteriophage, Construction of genomic and cDNA libraries.
Advantages of cDNA libraries.

Unit III **12hrs**

Methods of gene sequencing – Maxam - Gilberts and Sanger's dideoxy chain termination methods; Polymerase chain reaction technique (Components in PCR and PCR conditions), Blotting techniques.

Unit IV **12hrs**

Methods of gene transfer in fungi, yeast and higher plants using microinjection, microprojectile bombardment (gene gun method, Electroporation, transformation and Selection of transformed cells.

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2. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.

PRACTICALS BTP - rDNA TECHNOLOGY

1. Problem in Genetic engineering.
2. Transformation in Bacteria using plasmid.

3. Restriction digestion of DNA and its electrophoretic separation.
4. Ligation of DNA molecules and their testing using electrophoresis.
5. Activity of DNAase and RNAse on DNA and RNA.
6. Isolation of Plasmid DNA.
7. Demonstration of PCR

B.Sc MICROBIOLOGY (CBCS) SYLLABUS

THIRD YEAR – Semester-VI

Cluster Elective B (VIII B-2)

HAEMATOLOGY

Hours 60

Marks 100

UNIT – I: Laboratory Preparation in Haematology:

10 Hours

Introduction to practical. Basic requirements. Collection of blood. Anticoagulants and effects of anticoagulants on blood cell morphology. Effects of storage of blood.

UNIT – II: Routine Haematology:

15 Hours

Composition of blood. Haemoglobin synthesis. Various haemoglobins. Haemopoietic system of the body. Blood cell counts. Erythropoiesis, Leucopoiesis and development of blood corpuscles. Thrombopoiesis. Laboratory technique of haemocytometry. Clinical significance of Total erythrocyte count, total leucocyte count, differential count, erythrocyte sedimentation rate and platelet count.

UNIT – III: Haemostasis and Haematological Diseases:

15 Hours

General consideration of blood coagulation. Mechanism of coagulation. The fibrinolytic mechanism. Clinical significance of routine coagulation tests. Anaemia. Various types of anaemias – Iron deficiency anaemia, Aplastic anaemia, Perinicious anaemia, Sideroblastic anaemia and Sickle cell anaemia. Other haematological diseases – HDNB, Thalassaemia, Leukaemia. Parasitic infections of blood – structure and life cycle of Plasmodium vivax, types of malaria, Structure and life cycle of Wuchereria bancrofti.

UNIT- IV: Automation in Haematology:

10 Hours

General considerations. Blood cell counters. Flow through cytochemical differential counter. Automated coagulated systems.

UNIT - V: Immunohaematology and Blood banking:

10 Hours

Human Blood Group Systems. Inheritance of blood group systems. Blood transfusion.

SUGGESTED READINGS

Park, K. (2007), Preventive and Social Medicine, B.B. Publishers

Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition,
Bhalani Publishing House

Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training
Courses

Guyton A.C. and Hall J.E. Textbook of Medical Physiology.

Robbins and Cortan, Pathologic Basis of Disease, VIIIEdition.

Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand
and Co. Ltd.

PRACTICAL s-HAEMATOLOGY

Routine haematological tests – Blood smear preparation, TC, DC, ESR, Platelet count.

Determination of Haemoglobin.

Determination of PCV.

Determination of bleeding time.

Determination of blood clotting time.

Blood Grouping.

SYLLABUS THIRD YEAR – Semester-VI –Cluster Elective B (VIII B-3)

B.Sc MICROBIOLOGY (CBCS) SYLLABUS

THIRD YEAR – Semester-VI

Cluster Elective B (VIII B-3)

BIOINFORMATICS

Periods: 60

Max. Marks: 100

UNIT I - HISTORY, SCOPE AND IMPORTANCE (10 hours)

Important contributions - aims and tasks of Bioinformatics - applications of Bioinformatics - challenges and opportunities - internet basics- HTML introduction to NCBI data model- Various file formats for biological sequences

UNIT II - DATABASES - TOOLS AND THEIR USES (15 hours)

Importance of databases - Biological databases-primary sequence databases; Composite sequence databases- Secondary databases- nucleic acid sequence databases - Protein sequence data bases - structure databases - bibliographic databases - specialized genomic resources- analysis packages

UNIT III - SEQUENCE ALIGNMENT METHODS (15 hours)

Sequence analysis of biological data-Significance of sequence alignment pair wise sequence alignment methods- Use of scoring matrices and gap penalties in sequence alignments- multiple sequence alignment methods - Tools and application of multiple sequence alignment.

UNIT IV - PREDICTIVE METHODS USING DNA AND PROTEIN SEQUENCES (10 hours)

Gene predictions strategies - protein prediction strategies - molecular visualization tools- phylogenetic analysis: Concept of trees- phylogenetic trees and multiple alignments. **UNIT V - DRUG DISCOVERY PROCESS** (10 hours) Discovering a drug - target identification and validation - identifying the lead compound - optimization of lead compound - chemical libraries.

Periods: 24

Max. Marks: 50

1. Introduction to Computers.
2. Hands on experience on NCBI databases

3. Sequence alignment with BLASTA and FASTA
4. Construction of Phylogenetic tree.
5. Demonstration of Protein visualization (if software available)