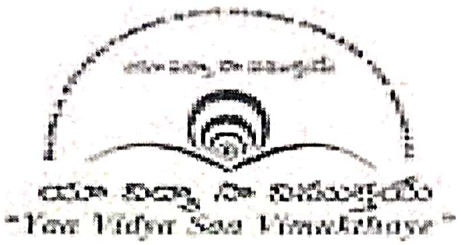
# D.K. GOVT.COLLEGE FOR WOMEN

# (AUTONOMOUS), NELLORE




# BOARD OF STUDIES

# 2018-2019

# MICROBIOLOGY

Verified by AC.

# D.K. Govt.College (Autonomous), Nellore

## B.Sc Microbiology (CBCS) Syllabus

## First Year- SEMESTER-I

### INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

**TOTAL HOURS: 48** **CREDITS:4**

**UNIT-I** **No.of hours :10**

History and mile stones in Microbiology

Contributions of Antony Von Leewenhock, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky, Beijerinck, Winogradsky

Importance and applications of microbiology

Classification of Microorganisms_ Haeckel's three ki9ngdom concept, Whittaker's five kingdom concept, three domain concept of Carl woese

Outline classification of bacteria as per the second edition fo Bergey's manual of systematic Bacteriology( up to classes only)

**UNIT-II** **No.of hours: 10**

General characteristics of Bacteria, Archea, mycoplasmas, Cyanobacteria, Algae, Fungi & Protozoa.

Ultra structure of Prokaryotic cell- Variant components and invariant components.

Composition and detailed structure of gram positive and gram negative cell wall, Endospore.

**UNIT-III** **No.of hours: 10**

Principles of microscopy – Bright field phase contrast and E lectron microscopy.

General Characteristics of viruses.

Morphology, Structure and replication of TMV and HIV.

Replications of Bacteriophage ( T4).

**UNIT-IV** **No.of hours: 8**

Isolation of Microorganisms from natural habitats

Pure culture techniques- dilution-plating, streak –plate, Spread-plate, Pour-plate and Enrichment culturing

Preservation of microbial cultures- subculturing, overlaying cultures with mineral oils, lyophilisation, sand cultures, storage at low temperature.

Cultivation of viruses- Tissue culture and embryonated egg.

**UNIT - V** **No.of hours: 10**

Staining Techniques-simple and differential (Gram staining and Spore staining) Hanging drop method

Sterilization and disinfection techniques- Physical methods- autoclave, hot-air oven, Radiation methods-UV rays, Gamma rays

Chemical methods- alcohols, phenols, Aldehydes, fumigants; Filtration methods HEPA Filters- Laminar Airflow Micropore filtration.

**Text books:**

1.**An introduction to microbiology** , A.P.Telugu Academy

2.**Introduction to Microbiology**- R.P. Singh

3. Pelczar, M.J., Chan, E.C.S, and Kreig, N.R. (1993). **Microbiology**. 5th Edition

**Reference books**

1.Atlas, R.A. and Bartha.R (2000). **Microbial Ecology. Fundamentals and Application,** Benjamin Cumings, New York.

2. Dube, R.C. and Maheswari, D.K. (2000) **General Microbiology**. S Chand, New Delhi.Himalaya Publishing House Mumbai.

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

**D.K. Govt.College (Autonomous), Nellore**

**B.Sc Microbiology (CBCS) Syllabus**

**First Year- SEMESTER-II**

## MICROB IAL BIOCHEMISTRY & METABOLISM

**TOTAL HOURS: 48** **CREDITS : 4**

**UNIT- I** **No.of.Hours: 10**

Out line classification and general characteristics of Carbohydrates (monosaccharides, disaccharides and polysaccharides).

General characteristic of amino acids and proteins

Structure of nitrogenous bases, nucleotides , nucleic acids

Fatty acids(saturated and unsaturated), Lipids(Spingo lipids, sterols and phospholipids)

**UNIT- IINo.of.Hours: 10**

Principle and applications of colorimetry , Spectrophoptometry (UV, Visible)

Chromatography(paper, thin-layer and Column)

Principle and applications of Centrifugation

Electrophoresis (Agarose , SDS, Native Gel).

**UNIT- III No.of Hours:10**

Properties of enzymes- Simple, Conjugated; Coenzymes, Cofactors,

IUB system of enzyme classification

Mechanism of enzyme action

Factors effecting catalytic activity

Inhibition of enzyme activity- Competetive, non competitive, incompetitive and allosteric

**UNIT- IV** **No.of.Hours: 8**

Microbial Nutrition-Nutritional requirements and uptake of nutrients by cells

Nutritional groups of microorganisms- autotrophs, heterotrophs, mixotrophs and methylotrophs

Growth media- synthetic, complex, 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 and biomass.

Anaplerotic reactions.

**UNIT- V** **No.of.Hours:10**

Aerobic respiration- Glycolysis, HMP pathway, ED pathway, TCA Cycle, Electron transport, oxidative and substrate level phosphorylation

Anaerobic respiration, Fermentation- Alcohol and lactic acid fermentations

Outlines of oxygenic and anoxygenic photosynthesis in bacteria (Light reaction, Cyclic & Noncyclic photophosphorylation) Calvin cycle.

**Text books:**

1.**Text book of Microbiology**(Microbiology Physiology and Genetics, Telugu Academy)

2. **Microbiology Physiology and Genetics**- R.P.Singh.

3. **General Microbiology**- pelczar

4. **Biochemistry** – U. Satyanarayana

# B.Sc MICROBIOLOGY (CBCS) SYLLABUS
## SECOND YEAR – SEMESTER- III
## MBT- 301 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

**TOTAL HOURS:48** **CREDITS: 4**

**UNIT-I** **No. of hours: 12**

Nucleic acids – DNA and structure, and types of RNA and organization of prokaryotic DNA.
Extrachromosomal genetic elements – Plasmids (sexplasmid, drug resistance plasmid,colicinogenic plasmid,Ti plasmid ) and transposons ( Insertion sequences, composite transposons, Tn3 transposons, retrosposons )
Replication of DNA – Semi conservative mechanism, Enzymes involved in replication.

**UNIT-II** **No.of hours: 10**

Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions.
Mutagens - Physical and Chemical mutagens.
Outlines of DNA damage and repair mechanisms (photoreactivation , Excision repair , Recombination repair , SOS repair )
Genetic recombination in bacteria – Conjugation, Transformation and Transduction.

**UNIT-III** **No. of hours: 8**

Concept of gene – Traditional and Modern - Muton, Recon and Cistron.
One gene one enzyme and one gene one polypeptide hypotheses.
Types of RNA and their functions.
Genetic code.

**UNIT-IV** **No. of hours: 8**

Structure of prokaryotic promoters, RNA polymerases, Transcription and translation.
Regulation of gene expression in bacteria – lac operon.

**UNIT-V** **No. of hours: 10**

Basic principles of genetic engineering.

Restriction endonucleases, DNA polymerases and ligases.
Vectors – $_{P}^{BR\ 322}$, $P^{UC\ 101}$ Polymerase chain reaction. Genomic and cDNA libraries.
Outlines of gene cloning methods.
General account on application of genetic engineering in industry, agriculture and medicine.

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 *bacteria(Demonstration)*
4. Estimation of DNA using UV spectrophotometer. (Demonstration)
5. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
6. Complement cell preparation, Transformation.
7. Problems related to Molecular biology.
8. Induction of mutations in bacteria by UV light.
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR (through Photographs), Gel electrophoresis apparatus, Microfuge, Gel doc.

**SUGGESTED READING**


Crueger, W. and Crueger, A. (2000). Biotechnology: A Text Book of Industrial Microbiology, PrenticeHall of India Pvt. Ltd., New Delhi.
Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
Glazer, A.N. and Nikaido, H. (1995). Microbial Biotechnology – Fundamentals of Applied Microbiology, W.H. Freeman and company, New York.
Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
Kannan, N. (2003). Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers. Panima Publishing Co., New Delhi.
Lewin, B. (2000). Genes VIII. Oxford University Press, England
Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers, London.
Nicholl, D.S.T. (2004). An Introduction to Genetic Engineering. 2 nd Edition. Cambridge University Press, London.
Old, R.W. and Primrose, S.B. (1994) Principles of Gene Manipulation, Blackwell Science Publication, New York.

# B.Sc MICROBIOLOGY (CBCS) SYLLABUS SECOND YEAR – SEMESTER- IV

## MBT- 401 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

**TOTAL HOURS: 48** **CREDITS: 4**

**UNIT-I** **No. of hours: 10**

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. - B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils.

**UNIT-II** **No. of hours: 10**

Antigens – types, chemical nature, antigenic determinants, haptens.
Factors affecting antigenicity.
immunoglobulin – basic structure, types, properties and functions of immunoglobulins.
Concept of hypersensitivity and Autoimmunity.
Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, complement fixation, blood groups.
Labeled antibody based techniques – ELISA, RIA and Immunofluoroscence.
Polyclonal and monoclonal antibodies production and applications

**UNIT-III** **No. of hours: 10**

Normal flora of human body.
Host pathogen interactions: infection, invasion, pathogen, pathogenicity, virulence and opportunistic infection.
General account on nosocomial infection.
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** **No. of hours: 8**

Antibacterial Agents- Penicillin, Streptomycin and Tetracycline.
Antifungal agents – Amphotericin B, Griseofulvin
Antiviral substances - Amantadine and Acyclovir

Tests for antimicrobial susceptibility.
Brief account on antibiotic resistance in bacteria - Methicillin-resistant Staphylococcus aureus (MRSA).
Vaccines – Natural and recombinant.

**UNIT-V** **No. of hours: 10**

General account of microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention and treatment
Bacterial diseases – Tuberculosis and Typhoid
Fungal diseases – Candidiasis.
Protozoal diseases – Malaria.
Viral Diseases - Hepatitis- B and AIDS

## MBP- 401 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

**TOTAL HOURS: 48** **CREDITS: 2**

1. Identification of human blood groups.

2. Separate serum from the blood sample (demonstration).

3. Estimation of blood haemoglobin.

4. Total RBC Count of the given blood sample

5. Differential Leukocyte Count of the given blood sample.

6. immunodiffusion by Ouchterlony double diffusion method.

7. Identify bacteria (E. coli, Pseudomonas, Staphylococcus, Bacillus) using laboratory techniques on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests.

8. Isolation of bacterial flora of skin by swab method.

9. Antibacterial sensitivity by Kirby-Bauer method. Identifiation of diseases based on the symptoms.

10. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)

11. Study of various stages of malarial parasite in RBCs using permanent mounts.

# D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE
# B.Sc MICROBIOLOGY (CBCS) SYLLABUS
## SEMESTER- V

### MBT- 501 ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

**TOTAL HOURS: 36** **CREDITS: 3**

**UNIT - I** **No. of hours: 8**

Terrestrial Environment: Soil profile and soil microflora
Aquatic Environment: Microflora of fresh water and marine habitats
Atmosphere: Aeromicroflora and dispersal of microbes
Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels.

**UNIT – II** **No. of hours: 8**

Role of microorganisms in nutrient cycling (Carbon, nitrogen, phosphorus).
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.Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation.

**UNIT – III** **No. of hours: 6**

Outlines of 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** **No. of hours: 7**

Plant Growth Promoting Microorganisms - Mycorrhizae, Rhizobia, *Azospirillum*, *Azotobacter*, *Frankia*, phosphate-solubilizers and Cyanobacteria.
Outlines of biological nitrogen fixation (symbiotic, non-symbiotic).
Biofertilizers - *Rhizobium*.

**UNIT – V** **No. of hours: 7**

Concept of disease in plants. Symptoms of plant diseases caused by fungi, bacteria, and viruses. Plant diseases - groundnut rust, Citrus canker and tomato leaf curl.
Principles of plant disease control.

D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
SEMESTER- VI
Paper- VIIA
MBT – 601A MICROBIAL BIOTECHNOLOGY

TOTAL HOURS: 36 CREDITS:3

UNIT- I No. of Hours: 8

Microbial Biotechnology: Scope and its applications in human therapeutics and environment (Bioremediation of Xenobiotics).
Genetically engineered microbes for industrial application: Bacteria and yeast

UNIT- II No. of Hours: 7

Recombinantmicrobialproductionprocessesin Pharmaceuticalindustries - Streptokinase
Recombinant vaccines (Hepatitis B vaccine).
Microbial polysaccharides, polyesters and Bioplastics.
Microbial biosensors.

UNIT-III No. of Hours: 10

Microbial based transformation of steroids.
Biocatalytic processes and their industrial applications: Production of high fructose corn syrup and Production of cocoa butter substitute.
Immobilization methods and their application.

UNIT- IV No. of Hours: 7

Bioethanol and Biodiesel production: commercial production from lignocellulosic waste and algal biomass.
Biogas production: Methane production using microbial culture.
Bio leaching.

UNIT- V No. of Hours: 4

Outlines of Intellectual Property Rights: Patents. Copyrights, Trademarks

## MBP- 601A MICROBIAL BIOTECHNOLOGY

**TOTAL HOURS: 36** **CREDITS: 2**

1. Yeast cell immobilization in calcium alginate gels
2. Pigment production from fungi / bacteria
3. Isolation of protease/ xylanase / lipase producing bacteria
4. Study of algal Single Cell Proteins.

### SUGGESTED READING


Crueger W, Crueger A (1990) Biotechnology: **A text Book of Industrial Microbiology** 2nd edition Sinauer associates, Inc.

Demain,A.L and Davies,J.E.(1999).**Manual of industrial Microbiology and Biotechnology,** 2nd Edition, ASM Press.

Glazer AN and Nikaido H (2007) **Microbial Biotechnology,** 2nd edition. Cambridge University Press

Glick BR, Pasternak JJ, and Patten CL (2010) **Molecular Biotechnology** 4th edition, ASM Press

Gupta PK (2009) **Elements of Biotechnology** 2nd edition, Rastogi Publications

Prescott, Harley and Klein's **Microbiology** by Willey JM. Sherwood LM, Woolverton CJ (2014),9th edition, Mc Graw Hill Publishers.

Ratledge, C and Kristiansen, B. (2001). **Basic Biotechnology**. 2nd Edition, Cambridge University Press.

Stanbury PF, Whitaker A, Hall SJ. (1995) **Principles of FermentationTechnology** 2nd edition., Elsevier Science

Swartz, J. R. (2001). **Advances in Escherichia coli production of therapeutic proteins. Current Opinion in Biotechnology**, 12, 195-201.

D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE
B.Sc MICROBIOLOGY (CBCS) SYLLABUS
SEMESTER- VI
Paper- VII B
MBT.601 B ADVANCES IN MICROBIOLOGY

**TOTAL HOURS: 36** **CREDITS:3**

**UNIT- I** **No. of Hours: 8**

Salient features of sequenced microbial genomes, core genome pool, flexible genome pool and concept of pangenome. Evolution of bacterial virulence - Genomic islands, Pathogenicity islands (PAI) and their characteristics.

**UNIT- II** **No. of Hours: 8**

Brief history and development of Metagenomics. Understanding bacterial diversity using metagenomics approach. Prospecting genes of biotechnological importance using metagenomics. Basic knowledge of viral metagenome, meta transcriptomics, metaproteomics and metabolomics

**UNIT- III** **No. of Hours: 8**

Epiphytic fitness and its mechanism in plant pathogens. Hypersensitive response (HR) to plant pathogens and its mechanism. Type three secretion systems (TTSS) of plant and animal pathogens.

**UNIT- IV** **No. of Hours: 5**

Biofilms: Types of microorganisms, molecular aspects and significance in environment, health care, virulence and antimicrobial resistance

**UNIT-V** **No. of Hours: 7**

Networking in biological systems, Quorum sensing in bacteria. Co-ordinated regulation of bacterial virulence factors. Basics of synthesis of poliovirus in laboratory. Future implications of synthetic biology with respect to bacteria and viruses.

MBP- 6018 ADVANCES IN MICROBIOLOGY

**TOTAL HOURS:36** **CREDITS:2**

1. Extraction of metagenomic DNA from soil
2. To understand the impediments in extracting metagenomic DNA from soil
3. PCR amplification of metagenomic DNA using universal 16s ribosomal gene primers
4. Case study to understand how the poliovirus genome was synthesized in the laboratory
5. Case study to understand how networking of metabolic pathways in bacteria takes Place

**SUGGESTED READING**


10. Fraser CM, Read TD and Nelson KE. Microbial Genomes, 2004. Humana Press
11. Miller RV and Day MJ. Microbial Evolution-Gene establishment, survival and exchange, 2004, ASM Press
12. Bull AT. Microbial Diversity and Bioprospecting, 2004, ASM Press.
13. Sangdun C. Introduction to Systems Biology, 2007. Humana Press
14. Klipp E, Liebermeister W. Systems Biology - A Textbook. 2009. Wiley -VCH Verlag
15. Caetano-Anolles G. Evolutionary Genomics and systems Biology, 2010, John WileY and Sons
16. Madigan MT, Martink JM, Dunlap PV and Clark DP (2014) Brook's Biology of Microorganisms, 14th edition. Pearson-Bejamin Cumming Wilson BA, Salyers AA Whitt DD and Winkler ME (2011) Bacterial Pathogenesis- A molecular Approach, 3rd edition. ASM Press.
17. Bouarab K, Brisson and Daayf F (2009) Molecular Plant-Microbe interaction CAB International.
18. Voit EO (2072) A First Course in Systems Biolory. Ist edition.Garland Science


## D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE
## B.Sc MICROBIOLOGY (CBCS) SYLLABUS
## SEMESTER- VI .
## Paper- VII C
## MBT.601 C INSTRUMENTATION AND BIOTECHNIQUES

**TOTAL HOURS: 36**
**CREDITS: 3**

**UNIT-I** **No. of Hours: 6**

Bright field and dark field microscopy. Fluorescence Microscopy, Phase contrastMicroscopy, Confocal Microscopy and Micrometry.

## UNIT-II

**No. of Hours:8**

Principles and applications of paper chromatography (including Descending and 2-D) Column packing and fraction collection. Gel filtration chromatography, ion-exchange chromatography. GLC and HPLC.

## UNIT-III

**No. of Hours: 8**

Principle and applications of native polyacrylamide gel electrophoresis,SDS- polyacrylamide gel electrophoresis, 2D gel electrophoresis and Isoelectric focusing.

## UNIT- IV

**No. of Hours: 6**

Principle and applications of study of absorption Spectra of bimolecular. Analysis of bimolecular using UV and visible range. Turbidometry

## UNIT- V

**No. of Hours: 8**

Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation.

## MBP-601C INSTRUMENTATION AND BIOTECHNIQUES (PRACTICAL)

**TOTAL HOURS: 36** **CREDITS: 2**

12. Study of fluorescent micrographs to visualize bacterial cells.
13. Ray diagrams of phase contrast microscopy and Electron microscopy.
14. Separation of mixtures by paper / thin layer chromatograph
15. Demonstration of column packing in any form of column chromatography
16. Separation protein mixtures by any form of chromatography.
17. Separation of protein mixtures by Polyacrylamide Gel Electrophoresis (PAGE).
18. Determination of $\lambda_{max}$ foran unknown sample and calculation of extinction coefficient.
19. Separation of components of a given mixture using a laboratory scale centrifuge.
20. Understanding density gradient centrifugation with the help of pictures
21. Estimation of DNA by diphenyl amine method.
22. Estimation of protein by Lowry method.

## SUGGESTED READING


7. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry,5th Ed., W.H. Freeman and Company.
8. Willey MJ, Sherwood LM & Woolverton C J. (2013). Prescott. Harley and Klein's Microbiology. 9th Ed., McGraw Hill.
9. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
10. De Robertis EDP and De Robertis EMF. (2006). cell and Molecular Biology.8th edition. Lipincott Williams and Wilkins, Philadelphia.
11. Cooper G.M. and Hausman R.E. (2009). The Cell: A Molecular Approach. 5th Edition. ASM Press& Sunderland, Washington D.C., Sinauer Associates, MA.
12. Nigam A and Ayyagari A. 2007. Lab Manual in Biochemistry. Immunolory and Biotechnology. Tata McGraw Hill.


## D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE
## B.Sc MICROBIOLOGY (CBCS) SYLLABUS
## SEMESTER-VI
## Cluster Elective I; Paper- VIII (I)A
## MBT- 602 A DIAGNOSTIC MICROBIOLOGY

**TOTAL HOURS: 36** **CREDITS: 3**

**UNIT-I** **No. of hours: 8**

Causative agent and symptoms of Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems: nervous (Meningitis, Encephalitis, Cryptococcosis, Trypanosomiasis) respiratory (Tuberculosis, Influenza, Histoplasmosis, toxoplasmosis), gastrointestinal (typhoid. Hepatitis, Candidiasis, amoebiasis), urogenital systems ( Nongonococcal urethritis, Genital herpes, candidiasis Trichomoniasis). Disease associated clinical samples for diagnosis.

**UNIT-II** **No. of hours: 8**

Collection of 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-III** **No. of hours: 8**

Examination of sample by staining-Gramstain.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, Mac Conkey agar. Distinct colony properties of various bacterial Pathogens.

**UNIT-IV** **No. of hours: 6**

Diagnosis of Typhoid, Dengue, HIV and Swine flu using Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods – PCR, Nucleic acid Probes.

**UNIT-V** **No. of hours: 6**

Importance and determination of sensitivity/resistance of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method

## MBT- 602A DIAGNOSTIC MICROBIOLOGY

**TOTAL HOURS: 36** **CREDITS: 2**

5. Collection, transport and processing of clinical specimens (Blood, Urine, Stool and Sputum). Receipts, Labeling, recording and dispatching clinical specimens.
6. Isolation of bacteria in pure culture. and Antibiotic sensitivity.
7. Identification of common bacteria (Staphylococcus, Streptococcus, E. coli) by studying their morpholory, cultural characters, Biochemical reactions, agglutination and other tests.
8. Maintenance and preservation of stock culture

**SUGGESTED READING**


6. Ananthanarayan R and Paniker CKJ (2009) **Textbook of Microbiology**, 8th edition, Universities Press Private Ltd.
7. 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
8. Collee JG, Fraser, AG, Marmion BP. Simmons A (2007) Mackie and Mccartney Practical **Medical Microbiology,** 14th edition, Elsevier.
9. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
10. Tille P (2013) Bailey's and Scott's Diagonistic Microbiology. 13th edition, Mosby

D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE
B.Sc MICROBIOLOGY (CBCS) SYLLABUS SEMESTER- VI

Cluster Elective I; Paper- VIII (I)b

## MBT- 602 B MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES

TOTAL HOURS: 36 CREDITS: 3

**UNIT - I** No. of Hours: 8

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- II** **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- III** **No. of Hours: 8**

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

**UNIT-IV** **No. of Hours: 8**

Enrichment culture techniques for detection of specific microorganisms - on XLD agar, Salmonella Shigella Agar, Manito! salt agar, EMB agar, Mcconkey Agar, Saboraud Agar. Ascertaining microbial quality of milk by MBRT. Rapid detection methods of microbiological quality of milk at milk collection centers (COB, 10 min Resazurin assay).

**UNIT-V** **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. QC&QA, warehousing, sample testing in pharma industry.

## MBP- 602B MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES

**TOTAL HOURS: 36** **CREDITS: 2**

1. Microbiological laboratory safety- General rules & Regulations.
2. Sterility tests for Instruments - Autoclave & Hot Air Oven
3. Disinfection of selected instruments & Equipments
4. Sterility of Air and its relationship to Laboratory & Hospital sepsis.
5. Sterility testing of Microbiological media

6. Sterility testing of Pharmaceutical products -Antibiotics, Vaccines & fluids

7. Standard qualitative analysis of water.

8. Quantitative analysis of water - Membrane filter method

9. Analysis of food samples for Mycotoxins.

**SUGGESTED READING**

1. Baird RM, Hodges NA and Denyer SP (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.

2. Garg N, Garg KL and Mukerji KG (2010) Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.

3. Harrigan WF (1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press.

4. Jay JM, Loessner MJ, Golden DA (2005) Modern Food Microbiology, 7th edition. Springer.

5. Laboratory Exercises in Microbiology, George.A.Wistreich & Max.D.Lechtman, 3 rd Ed, Glencoe press, London.

6. Manual of diagnostic microbiology, Dr.B.J.Wadher & Dr.G.L.Bhoosreddy, Firs.Ed. Himalaya publishing house, Nagpur.

7. Microbiology - A laboratory manual, Cappuccino & Sherman, 6th Ed, Pearson Education.

8. Pharmaceutical Microbiology - Purohit.

9. Pharmaceutical Microbiology- W.B. Hugo.

# D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE

## B.Sc MICROBIOLOGY (CBCS) SYLLABUS SEMESTER -VI

### Cluster Elective I; Paper- VIII (I)C

### MBT- 602C BIOINFORMATICS

TOTAL HOURS: 36
CREDITS: 3

**Unit I**

No. of Hours: 6

RDBMS - Definition of relational database
Mode of data transfer (FTP, SFTP, SCP), advantage of encrypted data transfer

Unit II

No. of Hours: 7

Bio-informatics- Its Definitions, Introduction, History. Bioinformatics - Objectives, Applications, Its need, Scope, Careers. Bioinformnatics scenario in India & the rest of the world. Sequences used in Bioinformnatics- DNA, Protein, RNA. Dawn of sequencing. Brief understanding of the DNA, Protein, RNA molecules.

Unit-III

No. of Hours: 7

Local and Global Sequence alignment, pair wise and multiple sequence alignment. Scoring an alignment, scoring matrice. Types of phylogenetic trees, Different approaches of phylogenetic tree construction - UPGMA, Neighbor joining, Maximum Parsimony, Maximum likelihood.

Unit-IV

No. of Hours: 7

Local and Global Sequence alignment, pair wise and multiple sequence alignment. Scoring an alignment, scoring matrices. Types of phylogenetic trees, Different approaches of phylogenetic tree construction - UPGMA, Neighbor joining, Maximum Parsomony, Maximum likelihood.

Unit-V

No. of Hours : 9

Diversity of Genomes: Viral, prokaryotic & eukaryotic genomes
Genome, transcriptome, proteome, 2-D gel electrophoresis, Maldi Toff spectroscopy
Major features of completed genomes: *E.coli, S.cerevisiae,* Human.
Hierarchy of protein structure -- primary, secondary and tertiary structures, modeling Structural Classes, Motifs, Folds and Domains.
Protein structure prediction in presence and absence of structure template.

## MBT- 602C BIOINFORMATICS

**TOTAL HOURS: 36** **CREDITS: 3**

1. Introduction to different operating systems - UNIX, LINUX and Windows

2. Introduction to bioinformatics databases (any three): NCBJ.

3. Sequence retrieval using BLAST

4. Sequence alignment & phylogenetic analysis using clustal W & Phylip.

5. Picking out a given gene from genomes using Genscan or other softwares (promoter region identification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, GENSCAN), Primer designing, Genscan/Genetool.

6. Protein structure prediction: primary structure analysis, secondary structure prediction using psi-pred, homology modeling usingSwissmodel.

7. Prediction of different features of a functional gene.

**SUGGESTED READING**


1. Andreas (2004) Bioinformatics- A practical guide to the analysis of genes & protein 2nd ED Baxevanis and Francis Ouellette.

2. Christian Crumlish The internet (1999). BPB publications.

3. K.Mani & N.vijayaraj Bioinformatics for the beginners

4. Lesk M.A.(2008) Introduction to Bioinformatics Oxford Publication, 3rd International Student Edition

5. Pennigton & Dunn (2002) Proteomics; Viva books publishers, New Delhi

6. Preeti (2007) Foundations of Computing, 4th ed., BPB Publications

7. Primrose and Twyman (2003) Principles of Genome Analysis & Genomics Blackwell

8. Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication

9. Saxena Sanjay (2003) A First Course in Computers, Vikas Publishing HousePradeep and Sinha

10. T.K.Altwood, D.J.Parry-smith (2004) Introduction to Bioinformatics Pears Education.

# D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE

## B.Sc MICROBIOLOGY (CBCS) SYLLABUS

## SEMISTER-VI

## Elective II: Paper- VIII (II)a

## MBT- 603 A MICROBES IN SUSTAINABLE AGRICULTURE

TOTAL HOURS: 36 CREDITS: 3

**Unit-I** **No.of Hours: 8**

Soil as Microbial Habitat, Soil properties. Diversity and distribution of microorganisms in soil. Mineralization of cellulose, hemicelluloses, lignin, phosphate, nitrate.

**Unit II** **No of Hours: 6**

Carbon dioxide, methane, nitrous oxide, nitric oxide - production and control

**Unit III** **No of hours: 6**

Agri-composting and vermi-composting

**UNIT IV** **No of Hours: 8**

Plant growth promoting bacteria, biofertilizers - symbiotic (*Bradyrhizobium, Rhizobium, Frankia),* Non Symbiotic (*Azospirillum, Azotobacter,* Mycorrhizae, MHBs, Phosphate solubilizers, algae). Novel combination of microbes as bio fertilizers, PGPRs

**UNIT V** **No of Hours: 6**

Biotech feed, Silage, Biomanure, biogas, biofuels - advantages and processing parameters. Advantages, social and environmental aspects of GM crops, Bt crops, golden rice.

## MBP- 603 A MICROBES IN SUSTAINABLE AGRICULTURE

TOTAL HOURS: 36 CREDITS: 2

1. Study of soil profile
2. Study of micro flora of different types of soils
3. *Rhizobium* as soil inoculants characteristics and field application
4. *Azotobacter* as soil inoculants characteristics and field application
5. Design and functioning of a biogas plant
6. Isolation of cellulose degrading organisms

**SUGGESTED READINGS**


1.Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego,

2.Singh RS. (1998). Plant Diseases Management. 7th edition. Oxford &**IBH,** New Delhi.

3.Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press.

4.Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA

5.Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press

6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA

7.Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.

8.Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.

9.Altman A (1998). Agriculture Biotechnology, !st edition, Marcel decker Inc.

10. Mahendra K. Rai (2005). Hand Book of Microbial Biofertilizers, The Haworth Press Inc. Ltd

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

# D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE

## B.Sc MICROBIOLOGY (CBCS) SYLLABUS SEMISTER-VI

**Cluster Elective II; Paper- VIII (II) b**

**MBT- 603 B BIOFERTILIZERS AND BIOPESTICIDES**

**TOTAL HOURS: 36** **CREDITS: 3**

**UNIT - I** **No. of Hours: 10**

Advantages of biofertlizers over chemical fertilizers. Symbiotic N2 fixers: Rhizobium - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants.
Frankia from non-legumes and characterization.
Cyanobacteria from Azolla, characterization, mass multiplication, Role in rice cultivation, Crop response, field application.

**UNIT - II** **No of Hours: 6 .**

Free living Azospirillum, Azotobacter - isolation, characteristics, mass inoculum production and field application.

**UNIT - III** **No of Hours: 6**

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

**UNIT-IV** **No of Hours: 7**

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

**UNIT-V** **No of Hours: 7**

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

TOTAL HOURS: 36 CREDITS: 2

5. Isolation of Rhizobium from root nodules.
6. Isolation of phosphate solubilizers from soil
7. Staining and observation of VAM
8. A visit to biofertilizer production unit.

## SUGGESTED READINGS


7. Agarwal SK (2005) **Advanced Environmental Biotechnology**, APH publication.
8. Kannaiyan, S. (2003). **Biotechnology of Biofertilizers,** CHIPS, Texas.
9. Mahindra K. Rai (2005). **Hand book of Microbial biofertilizers,** The Haworth Press, Inc. New York.
10. Reddy, S.M. et. al. (2002). **Bioinoculants for sustainable agriculture and forestry,** Scientific Publishers.
11. Salem F and Shakoori AR (2012) **Development of Bioinsecticide,** Lap Lambert Academic Publishing GmbH KG
12. Subba Rao N.S (1995) **Soil microorganisms and plant growth** Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.


## D.K.GOVT. COLLEGE (AUTONOMOUS) FOR WOMEN, NELLORE

### B.Sc MICROBIOLOGY (CBCS) SYLLABUS

### SEMISTER-VI

### Cluster Elective II; Paper- VIII (II)C

### MBT- 603 C MUSHROOM CULTIVATION

**TOTAL HOURS: 36** **CREDITS: 3**

**Unit I** **No of Hours: 8**

History and scope of mushroom cultivation. Types of edible mushrooms available in India. Mushroom morphology. Different parts of a typical mushroom & variations in mushroom morphology. Button, Paddy straw& Oyster- General Morphology, distinguishing characteristics.

**Unit II** **No of Hours: 6**

Classification Based on occurrence, natural habitats, color of spores, morphology of fruiting layers, Structure and texture of fruiting bodies. Key to differentiate edible from Poisonous mushrooms. Economic importance of edible mushrooms.

**Unit III** **No of Hours: 10**

Cultivation of Button, Oyster and Paddy straw Mushrooms: Collection of raw materials, compost & composting, spawn & spawning, casing & case run, cropping, picking & packing, marketing.

**Unit IV** **No of Hours: 6**

Nutritional profile of mushrooms, health benefits of mushrooms. Mushroom Toxins and illness, mushroom recipes.

**Unit V** **No of Hours: 6**

Effect of physical and chemical factors on the growth of mushrooms. Crop management during spawn running, casing to mushroom period, the cropping period. Post harvest management.

## MBT- 603 C MUSHROOM CULTIVATION PRACTICAL

**TOTAL HOURS: 36** **CREDITS: 2**

9. Microscopic and anatomical observations of different mushroom species ..
10. Preparation of spawn under controlled conditions(preparation of mother spawn in saline bottle and polypropylene bag and their multiplication
11. Types of Compost preparation and sterilization.
12. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves/waste.
13. Spawning, casing, Cropping and harvesting.
14. Substrate preparation, bed preparation, spawning and cropping.
15. Diseases of mushrooms (photographs).
16. Visit to relevant Labs/Field Visits

**SUGGESTED READINGS**


11. Mushroom Cultivation, Tripathi, D.P.(2005) Oxford &**IBH** Publishing Co. PVT.LTD, New Delhi.
12. Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).
13. A hand book of edible mushroom, S.Kannaiyan& K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi .