

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI
UG COURSES – AFFILIATED COLLEGES
B.SC. MICROBIOLOGY
 (Choice Based Credit System)
 (with effect from the academic year 2017-2018 onwards)

| | | | |
|----------|-----|----------------------|--|
| V | III | Core-VII | Environmental and Agricultural Microbiology |
| | III | Core-VIII | Industrial Microbiology |
| | III | Elective | Bioinformatics |
| | III | Elective | Dairy Microbiology |
| | III | Major Practical– V | Environmental and Agricultural Microbiology |
| | III | Major practical-VI | Industrial Microbiology |
| | III | Major Practical– VII | Dairy Microbiology |
| | IV | Skill Based, Common | Personality Development/ Effective Communication/ Youth Leadership |

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|-----------|-----|----------------------|-------------------------|
| VI | III | Core-IX | Food Microbiology |
| | III | Core-X | Clinical Microbiology |
| | III | Core –XI | Microbial Biotechnology |
| | III | Major practical-VIII | Food Microbiology |
| | III | Major Practical – IX | Clinical Microbiology |
| | III | Major practical-X | Microbial Biotechnology |
| | III | Project | Project |

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ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

Preamble: Transforming student society caring nature as an eco-friendly one by introducing the relationship between microbes and nature, its roles and its utilization for the creation sustainable environment

Unit –I : Aero Microbiology

Aero Microbiology - Aerosol - droplet nuclei - air pollution - sources (Microbiological) - Air quality analysis, air sampling devices - air borne pathogens.

[10 L]

Unit –II : Solid waste management

Solid waste management - sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill) - Liquid waste management, composition (BOD and COD) Primary, secondary (oxidation pond, trickling filter, activated sludge process and septic tank) and tertiary treatment.[15L]

Unit –III : Environmental Microbiology

Distribution of microorganisms in nature - Microbial communities in soil - physical and chemical characteristics of soil - Factors influencing the microbial density in soil – Bioleaching [10 L]

Unit –IV : Symbiosis

Microbial associations - Symbiosis – commensalism- competition - amensalism - synergism - parasitism and predation - Rumen microbiology [10 L]

Unit –V :Xenobiotics

Microorganisms in the decomposition of organic matter - Nitrogen cycle - carbon cycle - phosphorous and sulphur cycle, degradation - Xenobiotic degradation (Haloalkyl Propellants, Alkyl Benzyl Sulfonates)[15 L] [Total: 60 L]

Text book Recommended

- Rangasamy G and Bagyaraj. D.J. (1996) - Agricultural Microbiology - Prentice - Hall of India pvt Ltd, New delhi
- Atlas R.M and Bartha M (2003) Microbial ecology - Fundamentals and applications.

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L T P C

INDUSTRIAL MICROBIOLOGY

4 0 0 4

Preamble: Displaying concepts, regular affairs, techniques involved in the production of microbial based industrial products among the interested students and to make them employable in industries or to convert them as an entrepreneur.

Unit –I : Development of industrial microbiology

Brief history and developments in Industrial Microbiology - Types of fermentation process - solid state and liquid state (Stationary and submerged) fermentations - batch, fed batch and continuous fermentations [12 L]

Unit – II: Fermentor

Components of a typical bioreactor, Types of bioreactors - Laboratory, Pilot - scale and production fermenters, constantly stirred tank and air lift fermenter - Measurement and control of fermentation parameters - P^H, temperature, dissolved oxygen, foaming and aeration. [15 L]

Unit –III : Industrial Microbes

Sources of industrially important microbes and methods for their isolation, Preservation and maintenance of industrial strains - Strain improvement medium formulation [13 L]

Unit - IV :Down stream processing

Down stream processing - cell disruption - filtration centrifugation - solvent extraction-precipitation, lyophilization, spray drying [10 L]

Unit –V : Commercial Production

Production of Citric acid and Vinegar - Ethanol - Glutamic acid Vitamin B₁₂ - Antibiotics (Penicillin - Streptomycin), Dextran and Xanthan.[10 L] [Total: 60 L]

Text book recommended

- Stanbury P.F.A. Whitakar and Hal S.J (1995) Principles of fermentation technology (2nd Edition)
- Casida, L.E.1989 - industrial Microbiology willey Eastern Limited New delhi

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MAJOR - ELECTIVE

**L T P C
4 0 0 4**

Preamble: Introducing the basics of bioinformatics among motivated students to carryout effective research using bioinformatics tools in the future.

PAPER I : BIOINFORMATICS

Unit –I : Data Analysis

RDBMS - Definition of relational database - Mode of data transfer (FTP, TCP), advantage of encrypted data transfer (10 L)

Unit –II : Biological database

Biological database - nucleic acid, genome, protein sequence and structure, gene expression databases, database of metabolic pathway, Mode of data storage - File - formats - FASTA, Gene bank and Uniprot, Data submission and retrieval form NCBI, DDBJ, Uniprot, PDB (15 L)

Unit –III : Sequence alignment

Local and Global sequence alignment, pairwise and multiple sequence alignment, scoring an alignment, scoring matrices, PAM and BLOSUM Series of matrices - Types of Phylogenic trees - Different approaches of phylogenetic tree construction – UPGMA.(10 L)

Unit –IV : Diversity of Genomes

Diversity of Genomes : Viral, prokaryotic and eukaryotic genomes - transcriptome - proteome, 2-D gel electrophoresis, MALDI - TOF Spectrometry, Major features of completed genomes : *E.Coli*, *S. cerevisiae*, Arabidopsis, Human. .(10 L)

Unit –V : Protein structure

Hierarchy of protein structure - primary, secondary and tertiary structures, modeling, structural classes, Motifs, Folds and Domains, Protein structure prediction -Research in bioinformatics:- Comparative analysis, Homology Modeling and Drug discovery and design insilico method (15 L)
[Total: 60 L]

Text book recommended

- Saxena Sanjay (2003) A first course in computers, Vikas Publishing house
- Pradeep and SinhaPreeti (2007) Foundations of computing 4th edition BPB Publication
- LeskM.A(2008) introduction to Bioinformatics oxford Publication, 3rd International student edition.
- Dr.A.John De Britto (2011) Bioinformatics .

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MAJOR - ELECTIVE

L T P C 4 0 0 4

Preamble: To make the students aware of the types, relationship between microbes and dairy, factors affecting, quality improvement of dairy products to strengthen the dairy sector.

PAPER II : DAIRY MICROBIOLOGY

Unit –I : Milk Protein

Milk - Composition of milk, Protein - casein, whey proteins - Fat - Milk enzymes - Lactose (carbohydrate), milk colour, viscosity, flavor and Acidity - Nutritive value of milk - Antimicrobial systems in Raw milk (Lysozyme, Lactoferrin, Lactoferoxidase). (10 L)

Unit –II : Sources of microorganisms

Sources of microorganisms in milk (The cow's udder, the skin of the cow, Milking utensils, Feeds, Air of the stable, Hands of milk persons, Receiving of milk)- Classification of microbes (Biochemical types, temperature characteristics and pathogenicity) (15 L)

Unit –III : Dairy products

Dairy products - Curd - Butter milk - cheese - Yogurt - Acidophilus milk - Kefir - Koumiss - sour cream, Viili (10 L)

Unit - IV :Milk borne bacterial disease

Milk borne bacterial disease (Diphtheria, Pasteurellosis, Q fever, Tuberculosis, Mastitis) viral - Foot and mouth disease Fungal - Microsporam, Aspergillosis (10 L)

Unit - V Bacteriological tests for milk

Bacteriological tests for milk - Phosphatase milk - standard plate count - Direct microscopic count (DMC) - Burri smear - (clot - on - boiling) - Alizarin alcohol test - shake culture method - Rejection or platform testing - Detection of *Staphylococcus aureus* in milk (15 L)
[Total: 60 L]

Text book recommended

- Parihar and parihar - Dairy Microbiology (2011 Agrobios (india)
- Adams M.R and Moss M.O (1995) Food Microbiology
- Frazier W.C and westhoff D.C (2014) Food microbiology Tata MC Craw Hill Publishing co Ltd New delhi
- Jay J.M (1987) Modern food Microbiology

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MAJOR PRACTICAL – V

ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

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- Determination of BOD
- Determination of COD
- Microbial degradation of cellulose
- Most probable number test (MPN)
- Membrane filter technique for the quality analysis of water
- Estimation of total suspended solids of effluent
- Isolation of bacteria from soil
- Isolation of fungi from soil
- Isolation of actinomycetes from soil
- Testing antagonistic activity of soil microbes
- Isolation of microbes from rhizosphere.
- Estimation of soil pH
- Estimation of soil Nitrate
- Estimation of soil Sulphate
- Estimation of soil Phosphorus

References:

- J.G. Cappuccino and N.Sherman 1996 Microbiology - A laboratory manual - Benjamin Cummins, New York.
- M. Kannan 1996, Laboratory Manual in General Microbiology
- P. Gunasekaran - Laboratory Manual in Microbiology
- Dr.S.Rajan and Mrs.R.Selvi Christy - Experimental procedures in Life Sciences - Ajantha book house, chennai

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MAJOR PRACTICAL – VI

INDUSTRIAL MICROBIOLOGY

L T P C 0 0 4 2

Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

1. Demonstration of fermentation from yeast
2. Protoplast Fusion – Somatic hybridization (demonstration)
3. Sterility testing of injectables (demonstration)
4. Isolation of industrially important microbes
5. Preservation of industrially important microbes (Demonstration)
6. Purification of protein by ammonium sulphate precipitation
7. Production of antibiotic from Microorganisms
8. Production of Vitamins using Microorganisms (demonstration)
9. Production of Glutamic acid using microorganisms (demonstration)
10. Lyophilization (demonstration)

References:

- J.G. Cappuccino and N.Sherman 1996 Microbiology - A laboratory manual - Benjamin Cummins, New York
- M. Kannan 1996, Laboratory Manual in General Microbiology
- P. Gunasekaran - Laboratory Manual in Microbiology.
- Dr.S.Rajan and Mrs.R.Selvi Christy - Experimental procedures in Life Sciences – Ajantha book house, chennai

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MAJOR PRACTICAL – VII
DAIRY MICROBIOLOGY

LTPC 0042

Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

1. Methylene Blue reduction test
2. Resazurin test
3. Milk Phosphatase test (Demonstration)
4. Standard Plate Count of Milk
5. Microbial examination of Curd
6. Direct Microscopic Count of Milk (DMC)
7. Clot on boiling test (COB test)
8. Yoghurt preparation
9. Alcohol test (for milk)
10. Isolation of Lactobacilli from milk

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L T P C 4 0 0 4

FOOD MICROBIOLOGY

Preamble; To make the students to understand the positive and negative impact of microbes and its role in food spoilage and production to favor food security.

Unit –I : Food as a substrate for micro organisms

Food as a substrate for micro organisms (pH, a^w value, Oxidation reduction potential, Nutrient content) - Microorganisms important in food microbiology - Mold, Bacteria and Yeast - General principles of food preservation : Asepsis, Removal, Anaerobic conditions. [15 L]

Unit – II: Contamination of food

Contamination of food (From green plant and fruits - animals - sewage - soil - water - air - during handling and processing) - Classification of foods by Ease of spoilage - Chemical changes caused by Micro organisms [10 L]

Unit –III : Preservation of food

Preservation - High temperature, Low temperature - Drying - Food additives - Sanitation - Hazard analysis, Critical control point - personal hygiene - oriental fermented food (Piden, Minchin, Fermented coffe, Soy sauce) [15 L]

Unit –IV : Contamination, spoilage of foods

Contamination, spoilage of foods - cereals and cereal products - vegetable and fruit - meat and meat product - milk and milk product - poultry - egg and egg products[10 L]

Unit –V : Food poisoning

Food poisoning - Food borne infections - Bacterial (Staphylococcus, Clostridium, Salmonella) - Fungal (Mycotoxins - Aflatoxin, Patulin, ochratoxin) - Viral (Hepatitis) - Rickettsia – Trichinosis [10 L]

[Total: 60 L]

Text book recommended

- Parihar and parihar - Dairy Microbiology (2011 Agrobios (india)
- Adams M.R and Moss M.O (1995) Food Microbiology
- Frazier W.C and westhoff D.C (2014) Food microbiology Tata MC Craw Hill Publishing co Ltd
- Jay J.M (1987) Modern food Microbiology

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MAJOR PRACTICAL – VIII
FOOD MICROBIOLOGY

L T P C 0 0 4 2

Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

- Enumeration of microorganism from bread
- Isolation and identification of microbes from fruits
- Isolation and identification of microbes from vegetable
- Isolation of microorganisms from grains
- Determination of thermal death time
- Determination of thermal death Point
- Isolation of yeast from grapes
- Wine production using yeast (Demonstration)
- Isolation of *Salmonella* from poultry products
- Bread preparation (Demonstration)

References:

1. J.G. Cappuccino and N.Sherman 1996 Microbiology - A laboratory manual - Benjamin Cummins, New York
2. M. Kannan 1996, Laboratory Manual in General Microbiology
3. P. Gunasekaran - Laboratory Manual in Microbiology
4. Dr.S.Rajan and Mrs.R.Selvi Christy - Experimental procedures in Life Sciences - Ajantha book house, chennai
5. Dr.S.M.Reddy and Dr.S.Ram Reddy - Microbiology A laboratory manual - BSC Publishers and Distributors – Hyderabad

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CLINICAL MICROBIOLOGY

Preamble: To educate the students about the relationship between microbes and man, its effect and control measures of diseases.

Unit - I sources of infection

Normal microbial flora of the human body - sources of infection : Food, water, vector and air - mode of transmission : Direct - person to person and animal to person - In direct : Air and other modes (Food, water and insects) - Koch's postulates - control measures - Virulence factors of microbes - invasiveness and pathogenicity - Non specific resistant factors.[13 L]

Unit - II Diagnostic Microbiology

Diagnostic Microbiology - collection and transport of specimen for microbiological examination - General methods for isolation and identification of bacteria. Typing of bacterial isolates – Serodiagnosis [10 L]

Unit - III Clinical Symptoms Bacterial infections

Clinical Symptoms - Epidemiology, Pathogenesis, Laboratory diagnosis, Prevention and treatment of the following bacterial infections - Streptococcal infections - Meningitis - Tuberculosis - Leprosy : Gastrointestinal disorders - Typhoid, Cholera, Bacillary dysentery : Sexually transmitted disease - Syphilis and Gonorrhoea : Anaerobic wound infection (Tetanus and gas gangrene) [13 L]

Unit - IV Clinical Symptoms of Viral infections

Clinical Symptoms - Epidemiology, Pathogenesis, laboratory diagnosis, Prevention and treatment of the following viral infections - Respiratory infections (Common cold, influenza, Measles, Mumps and Rubella) - Immunodeficiency disease (AIDS, Cytomegalovirus) and Herpes simplex virus.[12 L]

Unit - V : Clinical Symptoms of Protozoan infections

Clinical Symptoms - Epidemiology, pathogenesis, laboratory, prevention and treatment of the following fungal and protozoan infections - systemic mycoses – subcutaneous mycoses, protozoan: Amoebiasis, Malaria, Leishmaniasis - Nosocomial infections.

[12 L]

[Total: 60 L]

Text book Recommended

- Ananthanaryanan R and Panikar J (200) Text book of Microbiology, Orient Longmans
- Rajan (2007) Medical Microbiology MJP Publisher, Chennai
- Kani L Mukherjee, Medical Lab technology Hill Publishing Co., Ltd., New Delhi Vol I-III

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L T P C 4 0 0 4

MICROBIAL BIOTECHNOLOGY

Preamble: Portraying history, tools, techniques and applications of biotechnology among interested students to understand their importance and its scope in research and generation of employment.

Unit –I : History of biotechnology

Milestone in biotechnology - Definition - concepts - History and achievements Principle and Application of rDNA technology [12 L]

Unit –II:Physical methods for gene transfer

Transformation of DNA - Chemical method, Electroporation, Gene delivery - microinjection - biolistic method (gene gun), liposome and viral mediated delivery, agro Enzyme production technology through microbes Protein engineering and site directed mutagenesis - Enzyme immobilization and application [13 L]

Unit – III: DNA Sequencing

Introduction to genomics Sanger's methods of DNA Sequencing : traditional introduction to new generation sequencing - primar walking and shotgun sequencing [10 L]

Unit - IV :Transgenic plants

Transgenic plants - Ti plasmid - virus, herbicide resistant plants: Trangenic animals - mice - retroviral method - embryonic stem cell method - Application - Trangenic sheep - transgenic fish - Hybridoma and monoclonal antibodies.[12 L]

Unit –V : Products of microbial biotechnology

Products of microbial biotechnology - products of human therapeutic interest - insulin - hGH, antisense molecules, Bt transgenic - cotton, brinjal, Gene Therapy, recombinant vaccine.[13L]
[Total: 60 L]

Text book recommended

- Stanbury P.F.A. Whitakar and Hal S.J Principles of fermentation technology (2nd Edition)
- Casida, L.E.1989 - industrial Microbiology willey Eastern Limited New delhi

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**MAJOR PRACTICAL – IX
CLINICAL MICROBIOLOGY**

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Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

- Isolation of normal flora from mouth
- Isolation of bacteria from pus
- Isolation of bacteria from urine
- Isolation of normal bacteria from blood
- Antibiotic susceptibility testing by Disc diffusion method
- Fungi - slide culture techniques
- Parasite - iodine wet mount
- Giemsa staining
- Leishman staining
- Widal test - Slide and tube test
- ELISA technique - Demonstration

References:

- J.G. Cappuccino and N.Sherman 1996 Microbiology - A laboratory manual - Benjamin Cummins, New York
- M. Kannan 1996, Laboratory Manual in General Microbiology
- P. Gunasekaran - Laboratory Manual in Microbiology
- Dr.S.Rajan and Mrs.R.Selvi Christy - Experimental procedures in Life Sciences - Ajantha book house, chennai
- Dr.S.M.Reddy and Dr.S.Ram Reddy - Microbiology A laboratory manual - BSC Publishers and Distributors – Hyderabad

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**MAJOR PRACTICAL – X
MICROBIAL BIOTECHNOLOGY**

**L T P C
0 0 4 2**

Preamble: Exposing students exhibiting passion over teaching, research and jobs in industries to basics and routine experiments carried out in diverse areas pertaining to their theory background so as to improve their experimental skills, reliability and effectiveness needed for effective research and employment.

- Restriction Digestion of DNA (Demonstration)
- Ligation of insert DNA to vector DNA (Demonstration)
- Immobilization of bacterial cells and enzymes
- Production of Amylase enzyme from bacteria
- Production of Protease from bacteria
- Preparation of single cell protein from *Spirulina*
- Production of ethanol from cane sugar using Yeast.
- Production of Monoclonal antibodies (Demonstration)
- Vermi -composting - Demonstration
- Mushroom cultivation - Demonstration

References:

- J.G. Cappuccino and N.Sherman 1996 Microbiology - A laboratory manual - Benjamin Cummins, New York
- M. Kannan 1996, Laboratory Manual in General Microbiology
- P. Gunasekaran - Laboratory Manual in Microbiology
- Dr.S.Rajan and Mrs.R.Selvi Christy - Experimental procedures in Life Sciences - Ajantha book house, chennai
- Dr.S.M.Reddy and Dr.S.Ram Reddy - Microbiology A laboratory manual - BSC Publishers and Distributors – Hyderabad

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PROJECT (Compulsory)

MICROBIOLOGY

L T P C

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Preamble: To address and assess the diverse problems associated with various fields relevant to microbes through the techniques learnt to design managerial measures for a healthy environment

