

AP STATE COUNCIL OF HIGHER EDUCATION

CBCS PATTERN FOR MICROBIOLOGY

B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS - 2020



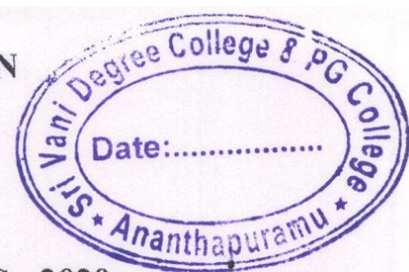
YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS
I	I	MBT - I	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY	100	4
		MBP I	INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY	50	1
	II	MBT II	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	100	4
		MBP II	MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY	50	1
II	III	MBT III	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	100	4
		MBP III	MOLECULAR BIOLOGY AND MICROBIAL GENETICS	50	1
	IV	MBT - IV	IMMUNOLOGY AND MEDICAL MICROBIOLOGY	100	4
		MBP IV	IMMUNOLOGY AND MEDICAL MICROBIOLOGY	50	1
		MBT - V	MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY	100	4
		MBP - V	MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY	50	1

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Y. V. V. V.
PRINCIPAL
Sri Vani Degree & PG College,
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CBCS PATTERN FOR MICROBIOLOGY



B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS - 2020

MBT- I: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 60

CREDITS: 4

UNIT-I: History of Microbiology & Place of Microorganisms in the living world

No. of hours: 12

History of Microbiology- Theory of spontaneous generation-Biogenesis and abiogenesis; in the context of contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky, Martinus Beijerinck and Sergei Winogradsky

Importance and applications of microbiology

Place of Microorganisms in the Living World Haeckel s three Kingdom concept, Whittaker s five kingdom concept, three domain concept of Carl Woese

UNIT-II: Prokaryotic microorganisms and Viruses

No. of hours: 12

Ultra structure of Prokaryotic cell- cell wall (in detail); Structure and/Functions (in brief) of cell membrane, cytoplasm, nucleoid, plasmid, inclusion bodies, flagella (brief structure and arrangement), pili, capsule, endospore

General characteristics of Bacteria (Size, shape, arrangement, reproduction); few examples of heterotrophic, autotrophic, parasitic, obligate intracellular parasitic bacteria.

General characteristics of Archaea

General characteristics of viruses, Cultivation of Viruses (in brief)

Morphology, Structure and replication of TMV and Lambda

UNIT-III: Eukaryotic microorganisms

No. of hours: 12

Fungi - Habitat, nutrition, vegetative structure and modes of reproduction; outline classification

Algae Habitat, thallus organization, photosynthetic pigments, storage forms of food, reproduction.

Protozoa – Habitat, cell structure, nutrition, locomotion, excretion, reproduction, encystment, outline classification

Y. Ushal
PRINCIPAL
Sri Vani Degree & PG College
ANANTAPURAMU.

P. Ramesh
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UNIT-IV: Principles of Microscopy, Sterilization and Disinfection

No. of hours: 12

Principles of microscopy - Bright field and Electron microscopy (SEM and TEM).

Staining Techniques - Simple and Differential staining techniques (Gram staining, spore staining, Acid fast staining).

Sterilization and disinfection techniques –

Physical methods autoclave, hot- air oven, pressure cooker, laminar air flow, filter sterilization, Radiation methods UV rays, Gamma rays.

Chemical methods alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites.

UNIT-V: Isolation and Culture of Bacteria and Fungi

No. of hours: 12

Isolation of Microorganisms from natural habitats.

Growth media- Natural, synthetic and semi synthetic media, Basal and complex media, selective, enrichment, enriched and differential media

Pure culture techniques dilution-plating, Streak-plate, Spread-plate, Pour-Plate and micromanipulator. Preservation of microbial cultures sub culturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

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Sri Vani Degree & PG College,
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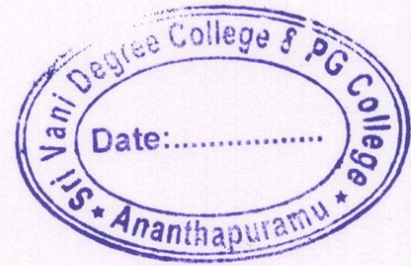
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MBP- I: INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 30

CREDITS: 1

1. Microbiology Good Laboratory Practices and Biosafety.
2. Preparation of culture media for cultivation of bacteria
3. Preparation of culture media for cultivation of fungi
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Light compound microscope and its handling
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram -ve bacilli), Algae and Fungi.
8. Simple staining
9. Gram s staining
10. Hanging-drop method.
11. Isolation of pure cultures of bacteria by serial dilution and streak/spread/pour plate method.
12. Preservation of bacterial cultures by various techniques.
13. Observation of electron micrographs of bacterial cells



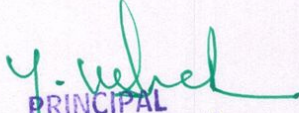
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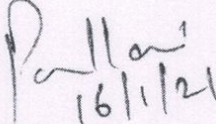
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PRINCIPAL
Sri Vani Degree & PG College,
ANANTAPURAMU.

Pallavi
16/1/21

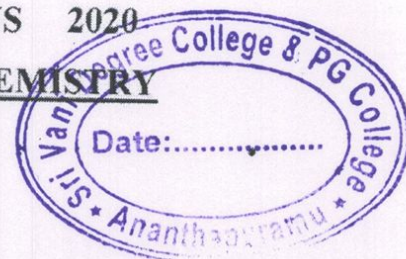
SUGGESTED READING:

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- Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.
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- Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
- Stanier, R. Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
- Microbiology Edited by Prescott
- Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
- Gopal Reddy *et al.*, Laboratory Experiments in Microbiology


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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS 2020
MBT II: MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY



TOTAL HOURS: 60

CREDITS: 4

UNIT-I: Biomolecules

No. of hours: 12

General characters and outline classification of Carbohydrates (Monosaccharides-Glucose, fructose, ribose, Disaccharides- Sucrose, Lactose, Polysaccharides- Starch, glycogen, Cellulose)
General characters and outline classification of Lipids and fatty acids (phospholipids, polybeta hydroxy alkanes)
General characteristics of amino acids and proteins. Amino acids in peptidoglycan
Structure of Nucleic acid

UNIT-II: Enzymes

No. of hours: 12

Properties and classification of Enzymes.
Biocatalysis - induced fit and lock and key models.
Coenzymes and Cofactors.
Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.
Factors effecting enzyme activity

UNIT III: Analytical Techniques

No. of hours: 12

Principle and applications of -
Colorimetry
Chromatography (paper, thin-layer and column),
Spectrophotometry (UV & visible),
Centrifugation and
Gel Electrophoresis (Agarose and SDS).

P. Harini
16/1/21

C. Madhu

Y. Ushal

P. S. S. S.

UNIT IV: Microbial Nutrition and growth

No. of hours: 12

Nutritional requirements of Microorganisms
Methods of uptake of nutrients by cells
Nutritional groups of microorganisms- autotrophs, heterotrophs, lithotrophs, organotrophs, phototrophs, chemotrophs
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.

UNIT- V : Microbial metabolism

No. of hours: 12

Aerobic respiration - Glycolysis, TCA cycle, ED Pathway, Electron transport
Oxidative and substrate level phosphorylations.
Anaerobic respiration (Nitrate and sulphate respiration)
Fermentation- lactic acid and ethanol fermentations
Outlines of oxygenic and anoxygenic photosynthesis in bacteria

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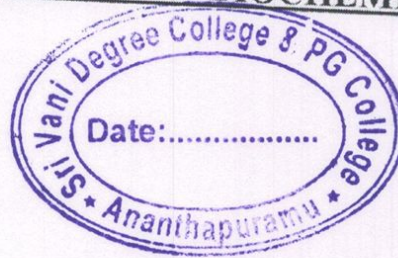
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PRINCIPAL
Sri Vani Degree & PG College,
ANANTAPURAMU.

Pallan
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MBP II: MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY

TOTAL HOURS: 30



CREDITS: 1

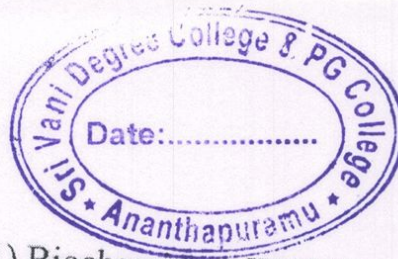
1. Qualitative Analysis of Carbohydrates.
2. Qualitative Analysis of Aminoacids.
3. Colorimetric estimation of proteins by Biuret / Lowry method.
4. Separation of components of a given mixture using a laboratory scale centrifuge.
5. Separation of mixtures by paper / thin layer chromatography.
6. Demonstration of column packing in any form of column chromatography.
7. Effect of temperature / pH on bacterial growth
8. Demonstration of electrophoretic technique
9. Study and plot the growth curve of E. coli by turbidometric and standard plate count methods

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y. whel
PRINCIPAL
Sri Vani Degree & PG College,
ANANTAPURAMU.

Rallan
16/1/21

SUGGESTED READING:



- Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications,
Iowa, USA.
- Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2 nd
Edition, CBS Publishers and Distributors, New Delhi.
- Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student
Companion. I.K. International Pvt. Ltd.
- Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed.,
W.H.Freeman
- Voet,D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons
White, D. (1995). The Physiology and Biochemistry of Prokaryotes, Oxford University
Press, New York.

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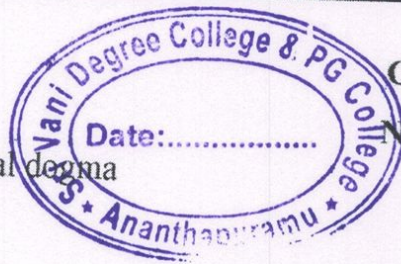
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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS - 2020
MBT III: MOLECULAR BIOLOGY AND MICROBIAL GENETICS

TOTAL HOURS: 60

UNIT- I: Nucleic acids

DNA and RNA Role in heredity-The central dogma
Watson and Crick model of DNA
Types of RNA, structure and functions
Organization of DNA in prokaryotes



CREDITS: 4

No. of hours: 12

UNIT- II : Genetic material and replication

Experiments which established DNA as genetic material
RNA as genetic material
Mechanism of DNA Replication in Prokaryotes
Proof of semi conservative mechanism of replication (Messelson - Stahl Experiment)
Extra chromosomal genetic elements - Plasmids and transposons

No. of hours: 12

UNIT- III: Gene expression and regulation

Concept of gene - Mutton, recon and cistron; One gene- one polypeptide, one gene- one enzyme and one gene-one product hypothesis.
Genetic code
Structure of ribosomes
Protein synthesis Transcription and translation in Prokaryotes
Regulation of gene expression in bacteria *lac* operon

No. of hours: 12

UNIT- IV: Mutations, damage and repair

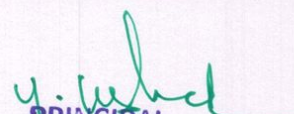
Outlines of DNA damage and repair mechanisms
Mutations - spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions
Mutagens - Physical and Chemical mutagens
Bacterial recombination Transformation, Conjugation, Transduction (Generalized and specialized transductions)

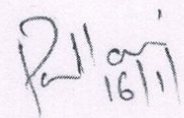
No. of hours: 12

UNIT- V: Genetic engineering

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.

No. of hours: 12


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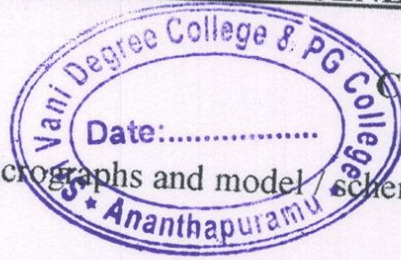

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MBP III: MOLECULAR BIOLOGY AND MICROBIAL GENETICS

TOTAL HOURS: 30

CREDITS: 1



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.
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.
8. Induction of mutations in bacteria by UV light.
9. Instrumentation in molecular biology - Ultra centrifuge, Transilluminator, PCR

C. Mohi
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PRINCIPAL
Sri Vani Degree & PG College,
ANANTAPURAMU.

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SUGGESTED READING:

- Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
- Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
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- Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi.

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PRINCIPAL
Sri Vani Degree & PG College,
ANANTAPURAMU.

Pallavi
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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS 2020
MBT IV: MEDICAL MICROBIOLOGY AND IMMUNOLOGY

TOTAL HOURS: 60



CREDITS: 4

UNIT-I: Immune System

No. of hours: 12

Concept of Innate and Adaptive immunity
Primary and secondary organs of immune system thymus, bursa fabricus, bone marrow, spleen, lymph nodes and lymphoid tissues
Cells of immune system- Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils
Complement system (in brief)

UNIT-II : Immune response

No. of hours: 12

Characteristics of antigen (Foreignness, Molecular size, Heterogeneity and solubility) haptens.
Antibodies basic structure and types.
Generation of Immune Response - Primary and Secondary Immune Response
MHC- Functions of MHC I & II molecules
Generation of Humoral Immune Response (Plasma and Memory cells), Immune complex formation and elimination - Agglutination, Precipitation, Neutralisation, Complement fixation, Phagocytosis
Generation of Cell Mediated Immune Response
Hypersensitivity- definition and types (in brief)

UNIT- III: Microbes in Health and Disease

No. of hours: 12

Normal flora of human body.
Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Opportunistic infections, Nosocomial infections.
General account on microbial diseases causal organism, pathogenesis, epidemiology, diagnosis, prevention and control of the following
Bacterial diseases Tuberculosis, Typhoid, Botulism
Fungal diseases Candidiasis.
Protozoal diseases Malaria.
Viral Diseases - Hepatitis- A and AIDS

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Sri Vani Degree & PG College,
ANANTAPURAMU.

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UNIT- IV: Principles of Diagnosis

No. of hours: 12

General principles of diagnostic microbiology- Collection, transport of clinical samples
Identification by culturing
Identification by biochemical/physiological properties
Identification by molecular assays (PCR, DNA probes)
Identification by serological tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation)

UNIT- V: Prevention and Treatment

No. of hours: 12

Vaccines Active (Natural and recombinant) and passive
Monoclonal antibodies- Production and application
Antimicrobial agents- General modes of action of antibacterial (Penicillin, Streptomycin), antifungal (Amphotericin and Griseofulvin), antiviral (Amantadine, Acyclovir) agents
Interferons
Tests for antimicrobial susceptibility (Disc diffusion)
Antibiotic resistance in bacteria

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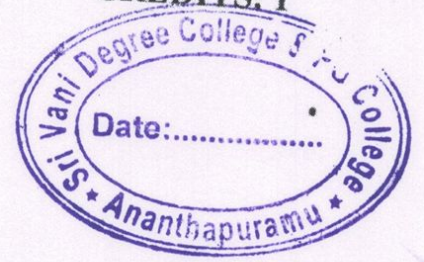
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MBP IV: MEDICAL MICROBIOLOGY AND IMMUNOLOGY

TOTAL HOURS: 30

CREDITS: 1



1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Immunodiffusion by Ouchterlony method.
4. Identification of any of the bacteria (*E. coli*, *Pseudomonas*, *Staphylococcus*, *Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
5. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS Isolation of bacterial flora of skin by swab method.
6. Antibacterial sensitivity by Kirby-Bauer method
7. Determination of minimal inhibitory concentration of an antibiotic
8. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
9. Study of various stages of malarial parasite in RBCs using permanent mounts.

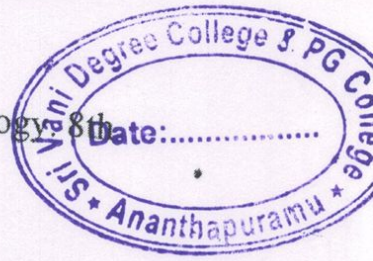
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PRINCIPAL
Sri Vani Degree & PG College,
ANANTAPURAMU.

Pallavi
16/1/21

SUGGESTED READING:

- Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology, 8th edition, University Press Publication.
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- Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
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- Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.



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PRINCIPAL
Sri Vani Degree & PG College,
ANANTAPURAMU.

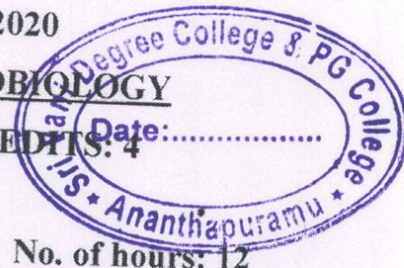
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B.Sc MICROBIOLOGY (CBCS) REVISED SYLLABUS - 2020

MBT V: MICROBIAL ECOLOGY AND INDUSTRIAL MICROBIOLOGY

TOTAL HOURS: 60

CREDITS: 4



UNIT I: Microorganisms in environment

No. of hours: 12

Role of microorganisms in Biogeochemical cycles (Carbon, nitrogen, phosphorus)
Microbe-microbe interactions Synergism, mutualism, commensalism, antagonism,
competition, parasitism, predation,
Plant- Microbe interactions Plant growth promoting Microorganisms, Plant pathogens
Extremophilic microorganisms

UNIT II : Microorganisms in Food and Water

No. of hours: 12

Microbes in waste management- solid and liquid waste (aerobic and anaerobic)
Microbes in degradation of Xenobiotics
Microbes in drinking water- detection of potability by (a) standard qualitative procedure:
presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane
filter technique, Microbes in food intrinsic and extrinsic parameters that affect microbial
growth in food

UNIT III: Industrial Microbiology

No. of hours: 12

Microorganisms of industrial importance yeasts (*Saccharomyces cerevisiae*), moulds
(*Aspergillus niger*) bacteria (*E.coli*), actinomycetes (*Streptomyces griseus*).
Screening techniques.
Industrially important Primary and secondary microbial metabolites - Techniques involved in
selection of industrially important metabolites from microbes.

UNIT IV: Fermentation processes

No. of hours: 12

Design of fermenter (for control of pH, temperature, dissolved oxygen, foaming and aeration)
Types of fermenter batch, continuous and fed batch.
Types of fermentation processes solid state, liquid state, batch, fed-batch, continuous.
Fermentation media (Crude and synthetic media; molasses, corn- steep liquor, sulphite waste
liquor, whey, yeast extract and protein hydrolysates)
Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.

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UNIT V: Microbial Productions

No. of hours: 12

Microbial production of Industrial products: Citric acid, Ethanol, Penicillin, Glutamic*acid, vitamin B12, Amylase, Yogurt
Microbial cells as food- SCP



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PRINCIPAL
Sri Vani Degree & PG College,
ANANTAPURAMU.

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Total hours: 30

Credits: 1

1. Microbial fermentation for the production and estimation of ethanol
2. Isolation of amylase producing microorganisms from soil
3. Production of amylase from bacteria and fungi
4. Assay of amylase
5. Demonstration of fermenter
6. Production of wine from grapes
7. Growth curve and kinetics of any two industrially important microorganisms.
8. Microbial fermentation for the production and estimation of citric acid



The syllabus, Pg. No. 1 to 19 of this document is approved w.e.f the current academic year 2020-21 for the students admitted from academic year 2020-21 onwards.

Dr. C. Madhavi

Member, BOS

Lecturer in Microbiology

Govt. College, Autonomous

Anantapuramu

Dr. H. Pallavi

Chairperson, BOS

Lecturer in Microbiology

Govt. College, Autonomous

Anantapuramu

Dr. Sai Ramalinga Reddy

Assistant professor

Department of Microbiology

SSBN Degree & P.G College, Autonomous

Anantapuramu

PRINCIPAL

Sri Vani Degree & PG College,
ANANTAPURAMU.

Recommended Format for Question Paper

MICROBIOLOGY

Time: 2 1/2 Hours

[Max. Marks :75]

Section-A [5X5=25]

Answer any **FIVE** of the following questions.



- 1 Contents of **Unit-I**
- 2 Contents of **Unit-II**
- 3 Contents of **Unit-III**
- 4 Contents of **Unit-IV**
- 5 Contents of **Unit-V**
- 6 Contents of **Unit-I to Unit V**
- 7 Contents of **Unit-I to Unit V**
- 8 Contents of **Unit-I to Unit V**

Section-B [5X10=50]

Answer **FIVE** questions

9 a Contents of **Unit-I**

(OR)

9 b Contents of **Unit-I**

10 a Contents of **Unit-II**

(OR)

10 b Contents of **Unit-II**

11 a Contents of **Unit-III**

(OR)

11 b Contents of **Unit-III**

12 a Contents of **Unit-IV**

(OR)

12 b Contents of **Unit-IV**

13 a Contents of **Unit-V**

(OR)

13 b Contents of **Unit-V**

y. vishal
PRINCIPAL
Sri Vani Degree & PG College,
ANANTAPURAMU.

Pallavi
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**B.Sc MICROBIOLOGY (CBCS) SYLLABUS
FIRST YEAR – SEMESTER- I**

MBT- 101 INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 48

CREDITS: 4

UNIT-I

No. of hours: 12

History and mile stones in microbiology.
Contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky.
Importance and applications of microbiology.
Classification of microorganisms – Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese.
Outline classification of bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology.

UNIT – II

No. of hours: 10

General characteristics of Bacteria, Archaea, Mycoplasmas and Cyanobacteria.
Ultra structure of Prokaryotic cell- Variant components and invariant components.
General characteristics of viruses.
Morphology, Structure and replication of TMV and HIV.

UNIT-III

No. of hours: 10

General characteristics and outline classification of Fungi, Algae and Protozoa.
Principles of microscopy - Bright field and Electron microscopy (SEM and TEM).

UNIT-IV


No. of hours: 8

Staining Techniques – Simple and Differential (Gram Staining and Spore Staining).
Sterilization and disinfection techniques - Physical methods – autoclave, hot- air oven, pressure cooker, laminar air flow, filter sterilization, Radiation methods – UV rays, Gamma rays.
Chemical methods – alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites.

UNIT –V

No. of hours: 8

Isolation of Microorganisms from natural habitats.
Pure culture techniques – dilution-plating, Streak-plate, Spread-plate, Pour-Plate and micromanipulator. Enrichment culturing.
Preservation of microbial cultures – subculturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.


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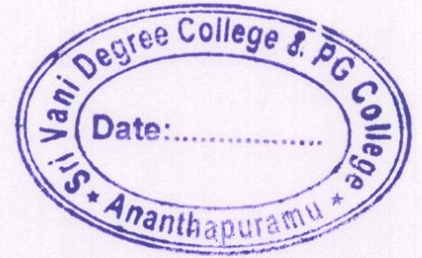
MBP- 101 INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 48

CREDITS: 2

1. Microbiology Good Laboratory Practices and Biosafety.
2. Preparation of culture media for cultivation of bacteria
3. Preparation of culture media for cultivation of fungi
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Light compound microscope and its handling
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram -ve bacilli), Cyanobacteria, Algae and Fungi.
8. Simple staining
9. Gram's staining
10. Hanging-drop method.
11. Isolation of pure cultures of bacteria by streaking method.
12. Preservation of bacterial cultures by various techniques.
13. Diagramatic or Electron photomicrographic observation of TMV, HIV, T4 phage and adenovirus


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**B.Sc MICROBIOLOGY (CBCS) SYLLABUS
FIRST YEAR – SEMESTER- II**

MBT- 201 : MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 48

CREDITS: 4

UNIT-I

No. of hours: 10

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)
lipids (spingolipds, sterols and phospholipids).

UNIT-II

No. of hours: 8

Principle and applications of -
Colorimerty
Chromatography (paper, thin-layer and column),
Spectrophotometry (UV & visible),
Centrifugation and
Gel Electrophoresis.

UNIT-III

No. of hours: 10

Properties and classification of Enzymes.
Biocatalysis- induced fit and lock and key models.
Coenzymes and Cofactors.
Factors affecting catalytic activity.
Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.

UNIT-IV


No. of hours: 10

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

UNIT-V

No. of hours: 10

Aerobic respiration -Glycolysis, HMP path way, ED path way, TCA cycle, Electron transport, oxidative and substrate level phosphorylation.
Anaerobic respiration (Nitrate).
Fermentation - Alcohol and lactic acid fermentations.
Outlines of oxygenic and anoxygenic photosynthesis in bacteria.


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

MBT- 301 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS:48

CREDITS: 4

UNIT-I

10

No. of hours:

DNA and RNA as genetic material.
Structure and organization of prokaryotic DNA.
Extrachromosomal genetic elements – Plasmids and transposons.
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.
Genetic recombination in bacteria – Conjugation, Transformation and Transduction.

UNIT-III

No. of hours: 10

Concept of gene – Mutton, Recon and Cistron. One gene one enzyme and one gene one polypeptide hypotheses.
Types of RNA and their functions.
Genetic code.
Structure of ribosomes.

UNIT-IV

No. of hours: 8


Types of genes – structural, constitutive, regulatory
Protein synthesis – Transcription and translation.
Regulation of gene expression in bacteria – *lac* operon.

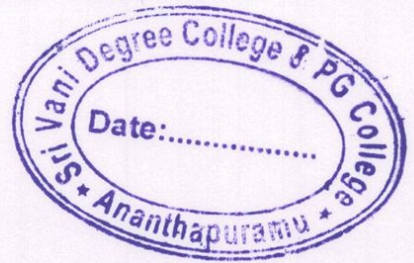
UNIT-V

10

No. of hours:

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.


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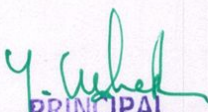


MBP- 301 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

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.
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.
8. Induction of mutations in bacteria by UV light.
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR

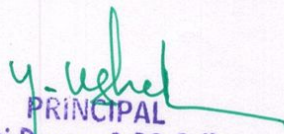

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PRACTICALS : B T P : 3 0 2 - METABOLISM & BIOPHYSICAL TECHNIQUES

1. Spectrophotometric analysis of DNA denaturation.
2. Determination of absorption spectrum of oxy- and deoxyhemoglobin and methemoglobin.
3. Protein estimation by E280/E260 method.
4. Paper chromatography of amino acids/sugars.
5. TLC of sugars/amino acids.
6. Cellular fractionation and separation of cell organelles using centrifuge.
7. Isolation of mitochondria and assay of marker enzyme.
8. Estimation of Urea by diacetyl monoxime method.
9. Estimation of Sugars by Nelson Somagi method
10. Verification of Beer's law for colorimetric method (Bromophenol blue/ alkaline creatinine).
11. Absorption spectrum of NAD & NADH
12. Preparation of standard buffers and determination of pH of a solution
13. Titration of a mixture of amino acid (glycine, histidine)
14. Paper electrophoresis of proteins
15. Gel electrophoresis of proteins.
16. SDS-PAGE of an oligomeric protein.
17. Calculation of mean, median, and mode (manual/computer aided).
18. Calculation of standard deviation and standard error (manual/computer aided).
19. Biostatistical problem based on standard deviation.

Note: - Mandatory to perform atleast 10 practicals


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**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.
Identification and function of 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.
Antibodies – basic structure, types, properties and functions of immunoglobulins.
Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, 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


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.


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UNIT-V

General account on microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention and control

No. of hours: 10

Bacterial diseases – Tuberculosis and Typhoid

Fungal diseases – Candidiasis.

Protozoal diseases – Malaria.

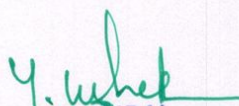
Viral Diseases - Hepatitis- A and AIDS

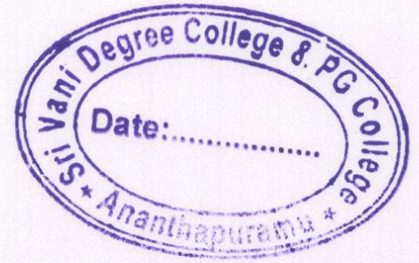
MBP- 401 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 48

CREDITS: 2

11. Identification of human blood groups.
22. Separate serum from the blood sample (demonstration).
33. Estimation of blood haemoglobin.
44. Total Leukocyte Count of the given blood sample.
55. Differential Leukocyte Count of the given blood sample.
66. Immunodiffusion by Ouchterlony method.
77. Identify bacteria (*E. coli*, *Pseudomonas*, *Staphylococcus*, *Bacillus*) using laboratory strains 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
10. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
19. Study of various stages of malarial parasite in RBCs using permanent mounts.


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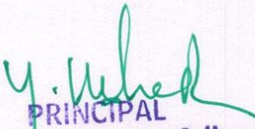


MBP- 501 ENVIRONMENTAL & AGRICULTURAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 2

1. Analysis of soil – pH, Moisture content and water holding capacity.
2. Isolation of microbes (bacteria and fungi) from soil.
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.
5. Determination of Biological Oxygen Demand (BOD) of waste water samples.
6. Isolation of *Rhizobium* from root nodules.
7. Staining and observation of Vesicular Arbuscular Mycorrhizal (VAM) fungi.
8. Observation of plant diseases of local importance - Citrus canker, Tikka disease of Groundnut, Bhendi yellow vein mosaic, Rusts, Smuts, Powdery mildews, Tomato leaf curl.


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**B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – 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.


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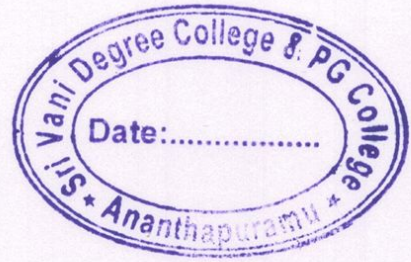
MBP- 502 FOOD AND INDUSTRIAL MICROBIOLOGY

TOTAL HOURS: 36

CREDITS: 2

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

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**B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER- V
MBT- 502 FOOD AND INDUSTRIAL MICROBIOLOGY**

TOTAL HOURS: 36

CREDITS: 3

UNIT- I

No. of hours: 8

Intrinsic and extrinsic parameters that affect microbial growth in food
Microbial spoilage of food - fruits, vegetables, milk, meat, egg, bread and canned foods
Food intoxication (botulism).
Food-borne diseases (salmonellosis) and their detection.

UNIT – II

No. of hours: 7

Principles of food preservation - Physical and chemical methods.
Fermented Dairy foods – cheese and yogurt.
Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw). Probiotics and their benefits.

UNIT – III

No. of hours: 6

Microorganisms of industrial importance – yeasts, moulds, bacteria, actinomycetes.
Isolation and Screening of industrially-important microorganisms.
Outlines of strain improvement.

UNIT – IV

No. of hours: 8

Types of fermentation processes – solid state, liquid state, batch, fed-batch, continuous.
Design of fermenter.
Ingredients of Fermentation media
Downstream processing - filtration, centrifugation, cell disruption, solvent extraction.

UNIT – V

No. of hours: 7

Microbial production of Industrial products - Citric acid, Ethanol, amylases, penicillin, glutamic acid and vitamin B12.

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MBP- 701AI MICROBIAL DIAGNOSIS IN HEALTH CLINICS

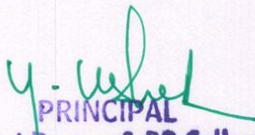
TOTAL HOURS: 36

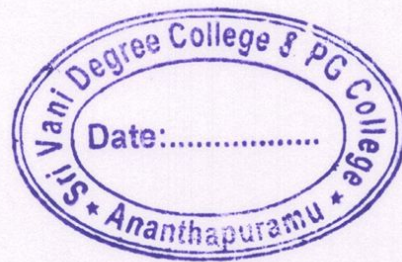
CREDITS: 2

1. Collection transport and processing of clinical specimens (Blood, Urine, Stool and Sputum). Receipts, Labeling, recording and dispatching clinical specimens.
2. Isolation of bacteria in pure culture and Antibiotic sensitivity.
3. Identification of common bacteria by studying their morphology, cultural character, Biochemical reactions, slide agglutination and other tests.
4. 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.


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THIRD YEAR – SEMESTER -VI

MBT- 701AI MICROBIAL DIAGNOSIS IN HEALTH CLINICS

TOTAL HOURS: 36

CREDITS: 3

UNIT- I

No. of hours: 8

Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, 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 - 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- IV


No. of hours: 6

Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes.
Kit methods for rapid detection- Typhoid, Dengue and HIV

UNIT- V

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


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**B.Sc MICROBIOLOGY (CBCS) SYLLABUS
THIRD YEAR – SEMESTER- VI**

**MBT- 701AII 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 technique, Detection of specific microorganisms - on XLD agar, *Salmonella Shigella* Agar, Manitol 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 centres (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.


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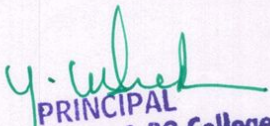


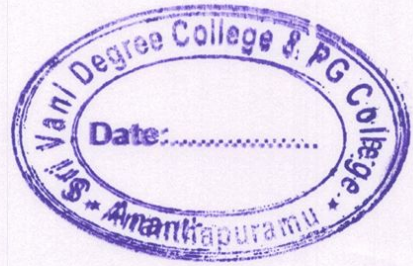
Project: MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES

TOTAL HOURS: 36

CREDITS: 2

1. Sterility tests for Instruments – Autoclave & Hot Air Oven
2. Disinfection of selected instruments & Equipments
3. Sterility of Air and its relationship to Laboratory & Hospital sepsis.
4. Sterility testing of Microbiological media
5. Sterility testing of Pharmaceutical products –Antibiotics, Vaccines & fluids
6. Standard qualitative analysis of water.
7. Analysis of food samples for Mycotoxins


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MB project-701AIII MANAGEMENT OF HUMAN MICROBIAL DISEASES

TOTAL HOURS: 36

CREDITS: 2

PROJECT:

Submission of project work and viva.

Suggested Readings

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. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition.

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THIRD YEAR – SEMESTER –VI

MBT-701AIII MANAGEMENT OF HUMAN MICROBIAL DISEASES

TOTAL HOURS: 36

CREDITS: 3

Unit I

No of Hours: 8

Definition and concept of health, disease, Infection and Pathogen.

Types of human microbial diseases and their transmission, causative agents and symptoms of human microbial diseases: Respiratory microbial diseases, gastrointestinal microbial diseases, nervous system diseases, skin diseases, eye diseases, urinary tract diseases, sexually transmitted diseases, mosquito borne disease

Unit II

No of Hours: 6

Microbial mediated cancers
Nosocomial infections.

Recent outbreaks of human microbial diseases (SARS/ Swine flu/Ebola) – causes, spread and control.

Unit III

No of Hours: 8

Various serological and molecular methods for diagnosis of microbial diseases. Detection by diagnostic kits based on ELISA, Immunofluorescence, Agglutination tests, PCR, DNA probes (illustrate each with one example).

Unit IV

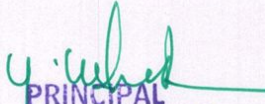
No of Hours: 8

Treatment using antibiotics: Mechanism of action of antibiotics belonging to different classes: beta lactam antibiotics (penicillin, cephalosporins), quinolones, polypeptides and aminoglycosides. Judicious use of antibiotics, importance of completing antibiotic regimen, Concept of DOTS, emergence of antibiotic resistance, current issues of MDR/XDR microbial strains. Treatment using antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine. Concept of HAART

Unit V

No of Hours: 6

General preventive measures, Importance of personal hygiene, environmental sanitation and methods to prevent the spread of infectious agents transmitted by direct contact, food, water and insect vectors. Vaccines: Importance, types, vaccines available against microbial diseases, vaccination schedule (compulsory and preventive) in the Indian context.


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