



**BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES
AND COMMERCE, SAINIKPURI, SECUNDERABAD.**

Autonomous College

Affiliated to Osmania University, Hyderabad

(Accredited with 'A' grade by NAAC)

Department of Microbiology

B.Sc CBCS Microbiology syllabus

(with effect from 2016)



Bharatiya Vidya
Bhavan

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COMMERCE, SAINIKPURI, SECUNDERABAD.**

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**Department of Microbiology
B.Sc core (optional) Subject: Microbiology, CBCS(2016-17)**

| YEAR | SEM | PAPER | CODE | COURSE TITLE | COURSE TYPE | HPW | CREDITS |
|------|-----|-------|--------|--|-------------|-----|---------|
| I | I | I | MB 131 | Introductory Microbiology | DSC-1A | 4+2 | 5 |
| | II | II | MB 231 | General Microbiology | DSC-1B | 4+2 | 5 |
| II | III | III | MB331 | Microbial Physiology | DSC-1C | 4+2 | 5 |
| | | | MB301 | Food adulteration | SEC-1 | 2 | 2 |
| | IV | IV | MB431 | Molecular Biology | DSC-1D | 4+2 | 5 |
| | | | MB401 | Fundamentals of Bioinformatics | SEC-2 | 2 | 2 |
| III | V | V | MB531 | Agricultural and Environmental Microbiology | DSC-1E | 3+2 | 4 |
| | | VI | MB532 | A. Immunology or B. Diagnostic microbiology | DSE-1E | 3+2 | 4 |
| | | | MB501 | Clinical Microbiology | SEC-3 | 2 | 2 |
| | | | MB502 | Microbes for human welfare | GE-1 | 2 | 2 |
| | VI | VII | MB631 | Medical Microbiology | DSC-1F | 3+2 | 4 |
| | | VIII | MB632 | A. Food and Industrial Microbiology or B. Microbial Technology | DSE-1F | 3+2 | 4 |
| | | | MB601 | Mushroom Cultivation | SEC-4 | 2 | 2 |
| | | | MB602 | Contagious diseases and Immunisation | GE-2 | 2 | 2 |


CHAIRPERSON
BOS in Microbiology
Bhavan's Vivekananda College
Sainikpuri


Dr. B. BHIMA, M.Sc., Ph.D.,
Associate Professor
Department of Microbiology, U.C.S.,
OSMANIA UNIVERSITY, HYD-7.

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. I YEAR SYLLABUS (2016-17)
SUBJECT -MICROBIOLOGY
I SEMESTER (4 HPW-4Credits)
MB131 Paper I INTRODUCTORY MICROBIOLOGY

Course Objectives:

This paper provides:

- Brief account on history of Microbiology
- Learn the contributions of various scientists in development of Microbiology
- Elucidate the different types of staining procedures and to learn principles, working and applications of various microscopes.
- Overview of cell structure, organization and functions of prokaryotic cell.
- Concept of sterilization and disinfection.
- Understand the basic microbiological techniques (concept of aseptic work, cultivation and identification of microorganism).
- Basic knowledge on virus properties, cultivation and classification of viruses.
- Learn the structure and virus replication strategies.

UNIT-I – History of Microbiology **15 hrs**

- | | | |
|---|---|-------|
| 1 | Meaning, Definition and Scope of Microbiology | 1 hr |
| 2 | History of Microbiology – An overview till 21 st century | 2 hrs |
| 3 | Contributions of Antony Von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Iwanowsky, Beijerinck, Winogradsky, Selman Walksman, Paul Ehrlich, and Alexander Fleming. | 9 hrs |
| 4 | Branches of Microbiology and Applications of Microbiology | 3 hrs |

UNIT-II- Microscopy and Prokaryotic Cell **15 hrs**

- | | | |
|---|--|-------|
| 1 | Principles of Microscopy. Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM). Micrometry -Units of microscopic measurements. | 6 hrs |
| 2 | Types of stains and Principles of staining - Simple stain, Differential stain, Negative stain, Structural stains - Spore, Capsule, Flagella and Storage granules. | 4 hrs |
| 3 | Motility in Bacteria. Hanging-drop method. | 1 hrs |
| 4 | Ultra structure of a bacterial cell: Invariant components - Cell Wall, Cell Membrane, Ribosomes, Nucleoid. Variant components - Capsule, Flagella, Fimbriae, Endospore and Inclusion bodies. | 4 hrs |

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UNIT-III- Microbial Sterilization Techniques **15 hrs**

- | | | |
|---|--|-------|
| 1 | Sterilization and Disinfection techniques. Principles and methods of Sterilization. | 3 hrs |
| 2 | Physical methods – Autoclave, Hot-air oven, Pressure cooker, Tyndallization Laminar air flow, Filter sterilization. | 3 hrs |
| 3 | Radiation methods – UV rays, gamma rays, Ultra sonic methods, Microwave. | 3 hrs |
| 4 | Chemical methods – Use of Alcohols, Aldehydes, Fumigants, Phenols, Halogens, and Hypochlorites. Phenol coefficient. | 6 hrs |

UNIT-IV- General characters of viruses **15 hrs**

- | | | |
|---|---|-------|
| 1 | General characteristics, Cultivation, Maintenance and ICTV Classification of Viruses- Plant, Animal and Bacteriophage. | 8 hrs |
| 2 | Structure of TMV | 1 hr |
| 3 | Structure of HIV | 1 hr |
| 4 | Structure of T2 bacteriophage | 1 hr |
| 5 | Structure and multiplication of lambda bacteriophage | 4 hr |

TEXT AND REFERENCE BOOKS:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.
2. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). General Microbiology, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
3. Madigan, M.T., Martinkl, J.M. and Parker, J. (2000). Brock Biology of Microorganisms, 9th Edition, MacMillan Press, England.
4. Black, J.G. (2005). Microbiology: Principles and Explorations, John Wiley, USA.
5. Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). Microbiology. 5th Edition, WCB Mc GrawHill, New York.
6. Tortora, G.J., Funke, B.R. and Case, C.L. (2004). Microbiology: An Intoduction. Pearson Education, Singapore
7. Power, C.B. and Dagainawala, H.F. (1986). General Microbiology Vol I & II (2nd Edition), Himalaya Publishing House, Mumbai
8. Ram Reddy, S. and Reddy, S.M. (2007). Essentials of Virology. Scientific Publishers India, Jodhpur.
9. Reddy, S.M. (2003). University Microbiology –I .Galgotia Publications New Delhi.
10. Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand ,New Delhi.
11. Rao, A.S. (1997). Introduction to Microbiology. Prentice-Hall of India Pvt Ltd., New Delhi.
12. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
13. Venkateswarlu, K. Ram Reddy, Vijaya Lakshmi M, Ramana V.V . (2013). Introductory Microbiology, Telugu Akademi. Bsc First Year


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I SEMESTER PRACTICALS (2 HPW-1Credit)
MB 131P Paper I INTRODUCTORY MICROBIOLOGY

- 1 Precautions to work in Microbiology laboratory
- 2 Light compound microscope and its handling
- 3 Calibrations of microscopic measurements (Ocular, Stage micrometers).
- 4 Measuring dimensions of Protozoa
- 5 Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram -ve bacilli), cyanobacteria (*Nostoc*, *Oscillatoria*, *Anaebena*, *Spirulina*), algae (*Scenedesmus* sp., diatoms), and fungi (*Saccharomyces*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*).
- 6 Simple and Differential staining (Gram staining).
- 7 Spore staining, Capsule staining, and Negative staining
- 8 Sterilization techniques: Autoclaving, Hot-air oven and Filtration
- 9 Hanging drop technique for observation of motility in Bacteria
- 10 Diagrammatic or Electron photo micrographic observation of TMV, HIV, T2 phage and Adenovirus.

REFERENCE BOOKS FOR LAB:


1. Gopal Reddy, M., Reddy, M.N., Sai gopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, . Himalaya Publishing House, Mumbai.
2. Aneja, K.R. (2001). Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd., New Delhi.
3. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology. S. Chand & Co. Ltd., New Delhi.
4. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
5. Kannan, N. (2003). Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers. Panima Publishing Co., New Delhi
6. Cappuccino (2000), Microbiology Lab manual, Oxford University Press
7. Mahy, B.W.J. and Kangro, H.O. (1996) Virology-Methods manual, academic press, USA.


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Course Outcomes:

- Understand the contribution of pioneer's in the field of Microbiology and impact of discoveries.
- Knowledge on branches and applications of Microbiology
- Understand the working and applications of various Microscopes. Able to use a bright field light microscope to view and interpret slides, aseptic techniques for the transfer and handling of microorganisms and instruments.
- Understand the nature and basic concepts of cell, skills in staining techniques.
- Acquire practical knowledge on aseptic techniques.
- Understand the procedures in chemical sterilisation.
- Understand the classification and structure of viruses.
- Conceptual learning of viral replication strategies.



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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. I YEAR SYLLABUS (2016-17)
SUBJECT -MICROBIOLOGY
II SEMESTER (4 HPW-4Credits)
MB 231 Paper II GENERAL MICROBIOLOGY

Course Objectives:
This paper provides:

- Identification and classification of bacterial taxonomy
- Understand the ecology and evolution of microorganisms
- Overview on the structure, physiology and functional diversity of bacteria, archeobacteria, rickettsia, mycoplasma, cyanobacteria.
- Understand the good aseptic techniques in culture transfer/inoculation/maintenance.
- Concept of pure culture.
- Learn the elements present in biomolecules found in living cells and their importance.
- This course will introduce some of the experimental techniques used in biochemistry.
- These include methods for analyzing biological molecules by electrophoresis, chromatography, colorimetry.

UNIT-I – Bacterial Taxonomy and General Characters of Prokaryotes & Eukaryotes 15 hrs

- | | | |
|---|--|-------|
| 1 | Outline classification of living organisms: Haeckel, Whittaker and Carl Woese Systems | 2 hrs |
| 2 | Outline classification for bacteria as per the second edition of Bergey's Manual Of Systematic Bacteriology (up to section level). | 3 hrs |
| 3 | Differentiation of Prokaryotes and Eukaryotes | 1 hr |
| 4 | Prokaryotes - General characteristics of Bacteria, Archaeobacteria, Rickettsia, Mycoplasma, Cyanobacteria and Actinomycetes | 6 hrs |
| 5 | Eukaryotes – General characteristics and classification (up to order level) of eukaryotic microorganisms – Protozoa, Microalgae, Molds and Yeast | 3 hrs |

UNIT-II - Pure Culture Techniques & Preservation 15 hrs

- | | | |
|---|---|-------|
| 1 | Concept of Pure cultures | 1 hr |
| 2 | Isolation of Pure culture techniques – Enrichment Culturing, Dilution-Plating, Streak Plate, Spread Plate, Pour Plate, Single cell isolation and Micromanipulator | 5 hrs |
| 3 | Culturing methods- Aerobic and Anaerobic methods | 4 hrs |
| 4 | Preservation of microbial cultures – Sub culturing, Overlaying cultures with mineral oils, Lyophilization, Sand cultures, Storage at low temperature | 5 hrs |

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UNIT-III - Biomolecules**15 hrs**

| | | |
|---|---|-------|
| 1 | Biomolecules of microorganisms and their significance | 1hr |
| 2 | Outline Classification and Properties of Carbohydrates (Monosaccharide, Disaccharides and Polysaccharides). | 4 hrs |
| 3 | Structure and properties of Amino acids and Proteins | 4 hrs |
| 4 | Structure and properties of Nitrogenous bases, Nucleotides, Nucleic acids | 3 hrs |
| 5 | Structure and Classification of lipids | 3 hrs |

UNIT-IV - Biochemical Techniques.**15 hrs**

| | | |
|---|---|-------|
| 1 | Buffers- types of buffers and their use in biological reactions. | 3 hrs |
| 2 | Hydrogen ion concentration in biological fluids, pH measurement | 2 hrs |
| 3 | Principle and application of Colorimetry | 3 hrs |
| 4 | Chromatography - Paper and Thin layer | 4 hrs |
| 5 | Electrophoresis – Paper electrophoresis, Agarose gel electrophoresis (AGE) | 3 hrs |

TEXT AND REFERENCE BOOKS:

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). *Introductory Mycology*, Wiley, New York
2. Dube, R.C. and Maheswari, D.K. (2000) *General Microbiology*. S Chand, New Delhi.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). *Microbiology*. 5th Edition, WCB Mc GrawHill, New York.
4. Madigan, M.T., Martinkl, J.M. and Parker, J. (2000). *Brock Biology of Microorganisms*, 9th Edition, MacMillan Press, England.
5. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). *General Microbiology*, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
Hans G. Schlegel(1996)Genera microbiology, Cambridge University Press.
6. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). *Principles of Biochemistry*, 2nd Edition, CBS Publishers and Distributors, New Delhi.
7. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). *Microbiology*. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.
8. Reddy, S.M. (2003). *University Microbiology –I*. Galgotia Publications New Delhi
9. Rao, A.S. (1997). *Introduction to Microbiology*. Prentice-Hall of India Pvt Ltd., New Delhi.
10. Black, J.G. (2005). *Microbiology: Principles and Explorations*, John Wiley, USA.
11. Voet, D. and Voet, J.G. (1995) *Biochemistry*, Wiley, New York.
12. Zubay, G. (1998). *Biochemistry* WCB. Mc GrawHill, Iowa.
13. Power, C.B. and Dagainawala, H.F. (1986). *General Microbiology Vol I & II* (2nd Edition), Himalaya Publishing House, Mumbai.

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14. Sullia, S.B. and Shantaram, S. (1998). General Microbiology, Oxford & IBH Publishing Pvt. Ltd., New Delhi.
15. Singh, R.P. (2007). General Microbiology. Kalyani Publishers, New Delhi.
16. Niclin, J. et al. (1999). Instant Notes in Microbiology. Viva Books Pvt. Ltd., New Delhi.
17. *Vashishta*, B R, A K Sinha, V P Singh (2001) Botany for degree students-ALGAE, S Chand Publishers.
18. Venkateswarlu, K. Ram Reddy, Vijaya Lakshmi M, Ramana V.V . (2013). Introductory Microbiology, Telugu Akademi. Bsc First Year.


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II SEMESTER PRACTICALS (2 HPW-1Credit)
MB 231P Paper II GENERAL MICROBIOLOGY

- 1 Isolation of single colonies on solid media
- 2 Enumeration of bacterial numbers by serial dilution and plating
- 3 Isolation of pure cultures by streak, spread and pour plate techniques
- 4 Preparation of culture media: Solid / Liquid
- 5 Preparation of culture media: Defined / Complex
- 6 Preservation of microbial cultures – Slants, Stabs, Sand cultures, Mineral oil overlay-Glycerol stocks
- 7 Aerobic culturing methods –Shake flask, Anaerobic method -McIntosh Jar, Pyrogallol method.
- 8 Qualitative tests for Carbohydrates
- 9 Qualitative tests for amino acids
- 10 Paper Chromatography separation of sugars/amino acids
- 11 Determination of pH
- 12 Preparation of Buffers
- 13 Verification of Beer Lambert's Law

REFERENCE BOOKS FOR LAB:

1. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, Himalaya Publishing House, Mumbai.
2. Aneja, K.R. (2001). Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd., New Delhi.
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6. Cappuccino (2000), Microbiology Lab manual, Oxford University Press
7. Shashidhar Rao, B, Vijay Deshpande, (2007). Experimental Biochemistry

Course Outcomes:

- Describe bacterial taxonomy and identify the culture up to species level.
- Understand the ecological importance of microorganisms and develop strategies to address sustainability of biosphere.
- Understand the concept of pure culture, isolation, preservation and maintenance.
- Understanding the concept of biomolecules.
- Knowledge of the molecular machinery of living cells.
- Understanding the role of biomolecules, their structure, classification and functions.
- Understand the principle and working of biochemical techniques.

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. II YEAR SYLLABUS
SUBJECT -MICROBIOLOGY
III SEMESTER (4 HPW-4Credits)
MB 331 Paper III MICROBIAL PHYSIOLOGY

Course Objectives:

This paper provides:


- Overview of nutritional requirements of microorganisms and mechanisms of nutrient uptake.
- Description of different phases of bacterial growth and study of batch and continuous culture systems.
- Study on enzyme properties, classification and assay methods.
- Overview on enzyme action and Enzyme Inhibition
- Outlines of Aerobic respiration pathways.
- Detailed account on Oxidative and substrate level phosphorylations and ETC.
- Basics of anaerobic respirations and fermentations.
- Fundamentals of oxygenic and anoxygenic photosynthesis.

UNIT-I – Nutrition and Growth


| | | 15 hrs |
|---|--|---------------|
| 1 | Microbial Nutrition - Nutritional requirements and uptake of nutrients by cells | 4 hrs |
| 2 | Nutritional groups of microorganisms - Autotrophs, Heterotrophs, Phototrophs Chemotrophs, Organotrophs, Lithotrophs, Mixotrophs, Methylotrophs. With example of each | 3 hrs |
| 3 | Growth media - Synthetic, Nonsynthetic, Selective, Enrichment and Differential media. | 2 hrs |
| 4 | Microbial growth - Different phases of growth in batch cultures | 2 hrs |
| 5 | Synchronous, continuous, biphasic growth | 1 hr |
| 6 | Factors influencing microbial growth | 1 hr |
| 7 | Methods for measuring microbial growth – Direct microscopy, Viable Count estimates, Turbidometry, Biomass. (DNA, Protein, Nitrogen content- Kjeldal method) | 2 hrs |

UNIT-II - Enzymes 15 hrs

| | | |
|---|---|-------|
| 1 | Enzymes - properties and classification, enzyme unit, enzyme assay methods | 5 hrs |
| 2 | Biocatalysis - Induced fit, Lock and key model, Types of catalysis, Coenzymes, Cofactors, Factors affecting catalytic activity of enzymes | 5 hrs |
| 3 | Inhibition of enzyme activity –Reversible, Competitive, Non competitive, uncompetitive and Irreversible, Allosteric. | 5 hrs |


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UNIT-III – Microbial Metabolism 1

| | |
|---|--|
| | 15 hrs |
| 1 | Aerobic respiration - Glycolysis, HMP pathway, ED pathway, TCA cycle |
| 2 | Electron transport, Oxidative and Substrate-level Phosphorylation.. |
| 3 | β -Oxidation of fatty acids |
| 4 | Glyoxylate cycle |
| | 7 5 2 1 |

UNIT-IV - Microbial Metabolism 2

| | |
|---|---|
| | 15 hrs |
| 1 | Anaerobic respiration (nitrate, sulphate respiration). |
| 2 | Fermentation - Common microbial fermentations with special reference to Ethyl alcohol, Butanol and lactic acid fermentations. |
| 3 | Photosynthetic apparatus in prokaryotes |
| 4 | Outlines of oxygenic and anoxygenic photosynthesis in bacteria. |
| | 2 hrs 6 hrs 2 hrs 5 hrs |

TEXT AND REFERENCE BOOKS:

1. Gottschalk, G. (1986). Bacterial Metabolism, Springer-Verlag, New-York.
2. Caldwell, D.R. (1995). Microbial Physiology and Metabolism, W.C. Brown Publications, Iowa, USA.
3. Moat, A.G. and Foster, J.W. (1995). Microbial Physiology, John-Wiley, New York.
4. Trevor Palmer, Enzymes, Biotechnology, Biochemistry and Clinical Chemistry, Eastwest Press private limited.
5. Reddy, S.R. and Reddy, S.M. (2004). Microbial Physiology, Scientific Publishers, Jodhpur, India.
6. Reddy, S.M. and Reddy, S.R. (2005). A Text Book of Microbiology Vol-II. Metabolism and Molecular Biology. Himalaya Publishing House, Mumbai.
7. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
8. Elliot, W.H. and Elliot, D.C. (2001). Biochemistry and Molecular Biology, 2nd edition.
9. Applied Microbiology, W.H. Freeman and company, New York.
10. Gopal Reddy, M., Naga Padma, P., Anuradha, K., Madhsudhan Reddy, D. (2013). Microbial Physiology, Genetics, Telugu Akademy


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III SEMESTER PRACTICALS (2 HPW-1Credits)
MB 331P Paper III MICROBIAL PHYSIOLOGY

- 1 Preparation of media for culturing Autotrophic and Heterotrophic microorganisms - Algal medium, Mineral salts medium, Nutrient agar medium, McConkey agar, and Blood agar
- 2 Enrichment culturing and isolation of Phototrophs and Chemoautotrophs
- 3 Setting and observation of Winogradsky Column
- 4 Determination of viable count of bacteria
- 5 Turbidometric measurement of bacterial growth
- 6 Bacterial growth curve
- 7 Factors affecting bacterial growth – pH, temperature, salts
- 8 Sugar fermentation
- 9 Starch hydrolysis and amylase assay (Quantitative method).

REFERENCE BOOKS FOR LAB:

1. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, . Himalaya Publishing House, Mumbai.
2. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology. S. Chand & Co. Ltd., New Delhi.
3. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
4. Kannan, N. (2003). Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers. Panima Publishing Co., New Delhi
5. Cappuccino (2000), Microbiology Lab manual, Oxford University Press

Course outcome:

- Understand the importance of media ingredients and culturing of different nutritional types of microbes.
- Awareness on factors effecting bacterial growth and methods adopted for microbial growth measurement.
- Enrich knowledge on different types of enzymes and their role in microbial metabolism
- Understand the applications of Enzyme Inhibitors for therapeutics.
- Conceptual understanding on Glycolysis, TCA and ETC
- Comprehend on different ATP generating mechanisms in microbes
- Understand the significance of different industrially important microbes and their metabolites.
- Describe the role of Photosynthetic microbes in maintaining ecological balance.


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B. Sc MICROBIOLOGY (CBCS STRUCTURE)
SEC-1: MB 301: FOOD ADULTERATION
III SEMESTER (2 HPW-2Credits)

Objectives

- Differentiate between adulterated and contaminated foods; permitted additives and adulterants.
 - Learn how food can be analyzed for presence of adulterants.
 - Learn about deleterious effects of various adulterants.
- Concept of Food Safety Act and FSSAI in preventing and punishing adulteration

Unit 1:

1. Definition and Introduction to food adulteration.
2. Types of Food Adulteration
3. Common Food adulterants
4. Causes of Food adulteration
5. Analysis of food

Unit 2:


1. Effects of Food Adulteration
2. Prevention of Food adulteration
3. Detection of Common food Adulterants.
4. Food Adulteration act-1954

REFERENCES:

1. Jesse Park Battershall. Food adulteration and its detection . Published by Book on Demand, Miami, 2015
2. R. B. Sethi's Prevention of food adulteration act
3. Dr. Sheela.S. Prevention of Food Adulteration

Outcomes

- Classify various types of adulterants.
- Perform simple lab tests for common adulterants
- Know the effect of adulteration on health.
- Understand the legal provisions to protect the Indian public from adulterated food.


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**BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND
COMMERCE, SAINIKPURI, SECUNDERABAD.**

Autonomous College-Affiliated to Osmania University, Hyderabad.
(Accredited with 'A' grade by NAAC)

**Department of Microbiology
B.Sc core (optional) Subject: Microbiology, CBCS(2016-17)**

| YEAR | SEM | PAPER | CODE | COURSE TITLE | COURSE TYPE | HPW | CREDITS |
|------|-----|-------|--------|--|-------------|-----|---------|
| I | I | I | MB 131 | Introductory Microbiology | DSC-1A | 4+2 | 5 |
| | II | II | MB 231 | General Microbiology | DSC-1B | 4+2 | 5 |
| II | III | III | MB331 | Microbial Physiology | DSC-1C | 4+2 | 5 |
| | | | MB301 | Food adulteration | SEC-1 | 2 | 2 |
| | IV | IV | MB431 | Molecular Biology | DSC-1D | 4+2 | 5 |
| | | | MB401 | Fundamentals of Bioinformatics | SEC-2 | 2 | 2 |
| III | V | V | MB531 | Agricultural and Environmental Microbiology | DSC-1E | 3+2 | 4 |
| | | VI | MB532 | A. Immunology or B. Diagnostic microbiology | DSE-1E | 3+2 | 4 |
| | | | MB501 | Clinical Microbiology | SEC-3 | 2 | 2 |
| | | | MB502 | Microbes for human welfare | GE-1 | 2 | 2 |
| | VI | VII | MB631 | Medical Microbiology | DSC-1F | 3+2 | 4 |
| | | VIII | MB632 | A. Food and Industrial Microbiology or B. Microbial Technology | DSE-1F | 3+2 | 4 |
| | | | MB601 | Mushroom Cultivation | SEC-4 | 2 | 2 |
| | | | MB602 | Contagious diseases and Immunisation | GE-2 | 2 | 2 |

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. II YEAR SYLLABUS
SUBJECT -MICROBIOLOGY
IV SEMESTER (4 HPW-4Credits)
MB 431 Paper IV MOLECULAR BIOLOGY

Course Objectives:

This paper provides:

- Emphasis on structure of DNA and RNA and methods of quantifying nucleic acids
- Fundamentals of replication, transcription and translation
- Basics of mutations and various types of mutagens
- Outlines of genetic recombination in bacteria
- Overview on gene and operon concept
- Description of functions of plasmids and transposons
- Description of enzymes involved in genetic engineering
- Conceptual study of genetic engineering and its applications

| | | |
|--|--|---------------|
| UNIT-I - Fundamentals of Microbial Genetics | | 15 hrs |
| 1 | DNA and RNA as genetic materials | 3 hrs |
| 2 | Structure of DNA – Watson and Crick model (B), A and Z forms of DNA, | 1 hr |
| 3 | Super coiling of DNA (positive and negative coiling, Topoisomerases /Gyrase) | 1hr |
| 4 | Replication of DNA – Semi conservative mechanism | 2 hrs |
| 5 | Types of RNA and their functions | 2 hrs |
| 6 | Outlines of RNA biosynthesis in prokaryotes | 3 hrs |
| 7 | Genetic code. Structure of ribosomes and a brief account of protein synthesis | 3 hrs |
| UNIT-II - Mutation and Genetic variation | | 15 hrs |
| 1 | Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions | 3 hrs |
| 2 | Various physical and chemical mutagens, Biological agents, Overview of Site directed Mutagenesis | 4 hrs |
| 3 | Outlines of DNA damage and repair mechanisms | 4 hrs |
| 4 | Genetic recombination in bacteria – Transformation, Transduction and Conjugation | 4 hrs |
| UNIT-III - Microbial Gene Expression | | 15 hrs |
| 1 | Concept of gene and its product. gene structure -Muton, Recon and Cistron | 2 hr |
| 2 | Operon concept. Regulation of gene expression in bacteria – lac operon | 3 hrs |

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- | | | |
|---|---|-------|
| 3 | Extra chromosomal Genetic elements: | 5 hrs |
| | a. Plasmids: Types F, R, Col Ti, Degradative etc, Properties and Functions | |
| | b. Transposons: IS, Composite, DNA, RNA and Retro transposons - Structure and Functions | 5 hrs |

UNIT-IV - Recombinant DNA Technology

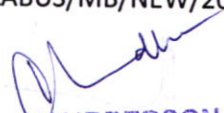
15 hrs

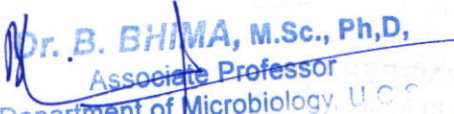
- | | | |
|---|---|-------|
| 1 | Basic principles of genetic engineering | 2 hrs |
| 2 | Enzymes in Genetic engineering, restriction endonucleases, DNA polymerases, ligases S1 nuclease, Reverse transcriptase, Alkaline phosphatase, Methylase | 4 hrs |
| 3 | Outlines of gene cloning methods-random cloning, shot gun, PCR and cDNA | 3hrs |
| 4 | Genomic and cDNA libraries.- construction and applications | 3 hrs |
| 5 | General account on application of genetic engineering in industry, agriculture Medicine, Environment. | 3 hrs |

TEXT AND REFERENCE BOOKS:

- White, D. (1995). The Physiology and Biochemistry of Prokaryotes, Oxford University Press, New York.
- Reddy, S.M. and Reddy, S.R. (2005). A Text Book of Microbiology Vol-II. Microbial Metabolism and Molecular Biology. Himalaya Publishing House, Mumbai.
- Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2nd Edition, CBS Publishers and Distributors, New Delhi.
- Elliot, W.H. and Elliot, D.C. (2001). Biochemistry and Molecular Biology, 2nd Edition, Oxford University Press, U.S.A. Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi.
- Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
- Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
- Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
- Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi.
- Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). Principles of Genetics. 5th Edition. McGraw Hill, New York.
- Old, R.W. and Primrose, S.B. (1994) Principles of Gene Manipulation, Blackwell Science Publication, New York.
- Smith, J.E. (1996). Biotechnology, Cambridge University Press.
- Snyder, L. and Champness, W. (1997). Molecular Genetics of Bacteria. ASM press, Washington, D.C., USA.
- Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers, London.
- Lewin, B. (2000). Genes VIII. Oxford University Press, England
- Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. (1998).
- Instant Notes in Molecular Biology, Viva Books Pvt., Ltd., New Delhi.
- Twynan, R.M. (2003). Advanced Molecular Biology. Viva books Pvt. Ltd. New Delhi.

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19. Nicholl, D.S.T. (2004). An Introduction to Genetic Engineering. 2nd Edition. Cambridge University Press, London.
20. Ram Reddy, S., Venkateswarlu, K. and Krishna Reddy, V. (2007) A text Book of Molecular Biotechnology. Himalaya Publishers, Hyderabad.
21. Gopal Reddy, M., Naga Padma, P., Anuradha, K., Madhsudhan Reddy, D. (2013). Microbial Physiology, Genetics, Telugu Akademy

IV SEMESTER PRACTICALS (2 HPW-1Credits)
MB 431P Paper IV MOLECULAR BIOLOGY

- 1 Colorimetric estimation DNA by diphenylamine method.
- 2 Colorimetric estimation RNA by orcinol method
- 3 Colorimetric estimation of proteins by Biuret method
- 4 Paper chromatographic separation of sugars or amino acids
- 5 Extraction of Genomic DNA
- 6 Agarose gel Electrophoresis
- 7 Problems related to DNA and RNA characteristics, Transcription and Translation


REFERENCE BOOKS FOR LAB:

1. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, . Himalaya Publishing House, Mumbai.
2. Wilson, K. and Walker, J. (1994). Practical Biochemistry. 4th Edition, Cambridge University Press, England.
3. Sawhney, S.K. and Singh, R. (2000). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
4. Plummer, D.T. (1988). An Introduction to Practical Biochemistry. 3rd Edition, Tata Mc GrawHill, New Delhi.
5. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad.
6. Jaya Babu (2006). Practical Manual on Microbial Metabolisms and General Microbiology. Kalyani Publishers, New Delhi.
7. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Ltd.

Course outcome:

- Knowledge on structure and estimation of nucleic acids
- Practical awareness on isolation and separation of DNA fragments
- Conceptual understanding of mutational biology
- Understand mechanism of transduction, transformation and conjugation
- Enrich knowledge on gene structure and expression
- Comprehend on extra chromosomal genetic elements
- Understand the role of various enzymes in gene cloning
- Awareness on applications of genetic engineering in various fields

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B. Sc MICROBIOLOGY (CBCS STRUCTURE)

SEC-2: MB 401: FUNDAMENTALS OF BIOINFORMATICS IV SEMESTER (2 HPW-2Credits)

Course Objectives

- Learn about the Human Genome Project (HGP).
- Concept of "Omics" Biology
- Learn about methods to sequence DNA and proteins.
- Introduce biology behind gene-editing technologies.

Unit 1: Introduction to Bioinformatics and Biological Databases

1. Human Genome Project.
2. Bioinformatics and overview of genomics, transcriptomics, and proteomics
3. Biological Databases: primary and secondary, knowledgebases, databases for sequence, structure, metabolic pathways. interactions
4. Searching databases with text and sequence queries (BLAST)
5. Pair-wise and multiple sequence alignment

Unit 2: Technologies for HTS

1. Methods to characterize the genome: first, second and third generation sequencing techniques for DNA
2. Methods to characterize the transcriptome: PCR and RNA sequencing
3. Methods to characterize the proteome: peptide sequencing and MS methods
4. Analytical methods: Microarrays to study the genome and transcriptome
5. Genome engineering using ZFN, TALENs, and CRISPR

REFERENCES:

1. Saxena Sanjay (2003) A First Course in Computers, Vikas Publishing House
2. Pradeep and Sinha Preeti (2007) Foundations of Computing, 4th ed., BPB Publications
3. Lesk M.A. (2008) Introduction to Bioinformatics. Oxford Publication, 3rd International Student Edition
4. Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2nd ed. Prentice Hall India Publication
5. Primrose and Twyman (2003) Principles of Genome Analysis & Genomics. Blackwell
6. Ghosh, Z. and Mallick, V. (2008) Bioinformatics- Principles and Applications. Oxford University Press.

Course Outcomes

- Understand the HGP has changed biology.
- Perform DNA/protein sequences from a database.
- Understand HT (High Throughput) methods.
- Understand CRISPR technology.

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY

V SEMESTER (3 HPW-3Credits)

MB 531 Paper V AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

Course Objectives:

This paper provides:

- Overview on characteristics of soil, Microorganisms of rhizosphere and Phyllosphere and role of Microbes in promoting plant growth.
- Outlines on biological nitrogen fixation process.
- Concepts on plant diseases caused by bacteria and viruses, symptoms and prevention.
- Study on control of plant diseases by biopesticides
- Role of microorganisms in biogeochemical cycles.
- An account on Microbial interactions. Air microflora and air sampling methods.
- Concepts on Microbiology of potable and polluted water.
- Learning on sewage treatment and solid waste disposal methods.

UNIT - I Agricultural Microbiology

12 Hrs

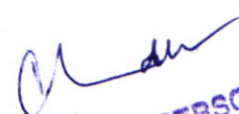
| | | |
|---|--|------|
| 1 | Physical and chemical characteristics of soil | 1 hr |
| 2 | Microorganisms of Soil | 1hr |
| 3 | Rhizosphere and phyllosphere | 2 hr |
| 4 | Plant growth-promoting microorganisms -Mycorrhizae, <i>Rhizobia</i> , <i>Azospirillum</i> , <i>Azotobacter</i> , <i>Cyanobacteria</i> , <i>Frankia</i> and Phosphate-solubilizing microorganisms | 5 hr |
| 5 | Outlines of biological nitrogen fixation (symbiotic, non-symbiotic). | 2hr |
| 6 | Biofertilizers - Production and application of Biofertilizers - <i>Rhizobium</i> and <i>Cyanobacteria</i> . | 1 hr |

UNIT – II Plant Diseases and Biocontrol

11 Hrs

| | | |
|---|---|------|
| 1 | Concept of disease in plants | 1 hr |
| 2 | Symptoms of plant diseases caused by fungi, bacteria, and viruses | 3hr |
| 3 | Plant diseases caused by fungi (Groundnut rust), bacteria (Angular Leaf Spot of Cotton) and viruses (Tomato Leaf Curl). | 3 hr |
| 4 | Principles of plant disease control | 1 hr |
| 5 | Biological control of plant diseases. Biopesticides – <i>Bacillus thuringiensis</i> , <i>Nuclear Polyhedrosis Virus</i> (NPV), <i>Trichoderma</i> | 3 hr |

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UNIT – III Environmental Microbiology **11 Hrs**

| | | |
|---|---|------|
| 1 | Role of microorganisms in nutrient cycling - carbon, nitrogen, sulphur, phosphorus . | 6 hr |
| 2 | Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation. | 2 hr |
| 3 | Microorganisms in Air | 1 hr |
| 4 | Air sampling methods | 2 hr |

UNIT – IV Environmental Pollution and Bioremediation **11 Hrs**

| | | |
|---|---|------|
| 1 | Microorganisms in water | 1 hr |
| 2 | Microbiology of potable and polluted waters. <i>E. coli</i> and <i>Streptococcus faecalis</i> as indicators of water pollution, Sanitation of potable water | 3 hr |
| 3 | Sewage treatment (primary, secondary and tertiary). | 3 hr |
| 4 | Outlines of biodegradation of environmental pollutants– pesticides | 2 hr |
| 5 | Solid waste disposal – sanitary landfills, composting | 2 hr |

REFERENCE BOOKS

1. Subba Rao, N.S. (1993). Biofertilizers in Agriculture and Forestry, 3rd Edition Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Rangaswami, G. and Bhagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Edition, Prentice Hall of India, New Delhi.
3. Atlas, R.M. and Bartha, R. (1998). Microbial Ecology - Fundamentals and Applications, Addison Wesley Longman, Inc., USA
4. Paul, E.A. and Clark, F.E. (1989). Soil Microbiology and Biochemistry, Academic Press, USA.
5. Lynch, J.M. and Poole, N.J. (1979). Microbial Ecology – A Conceptual Approach, Blackwell Scientific Publications, USA
6. Alexander Martin. Soil Microbiology (2001).
7. Reddy, M.N., Uma Maheshwara Rao., Naga Padma, P., Raghuram, M, Charitha Devi, M.(2012) Applied Microbiology, Telugu Akademy.

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Asst

V SEMESTER PRACTICALS (2 HPW-1Credits)

MB 531P Paper V AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

- 1 Isolation and enumeration of major groups of microorganisms from rhizosphere and non rhizosphere
- 2 Isolation and enumeration of major groups of microorganisms from phyllosphere.
- 3 Study of root nodules and isolation of *Rhizobium* from legume root nodules
- 4 Isolation of *Azospirillum* / *Azotobacter*
- 5 Staining and observation of vesicular-arbuscular mycorrhizal (VAM) fungi
- 6 Observation of plant diseases of local importance – Rusts, smuts, powdery mildews, tikka disease of groundnut, citrus canker, bhendi yellow vein mosaic, tomato leaf curl, little leaf of brinjal
- 7 Isolation of microorganisms of air by Petri plate exposure method
- 8 Determination of biological oxygen demand (BOD) of polluted water
- 9 Microbial testing of water by coliform test (Multiple Tube Fermentation method).

REFERENCE BOOKS FOR LAB:

1. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
2. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad
3. Aneja, K.R. (2001). Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd., New Delhi.
4. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
5. Burns, R.G. and Slater, J.H. (1982). Experimental Microbiology and Ecology. Blackwell Scientific Publications, USA.
6. Pepler, I.L. and Gerba, C.P. (2004). Environmental Microbiology – A Laboratory Manual. Academic Press. New York.

Course outcome:

- Knowledge on role of plant growth promoting rhizobacteria
- Understand the mechanism of biological nitrogen fixation and applications of biofertilisers.
- Awareness on different plant diseases and measures to prevent them.
- Understand the importance and applications of biopesticides like *Bacillus thuringensis*, *Trichoderma* etc.
- Able to understand the recycling of carbon, sulphur, phosphorus and Nitrogen in the environment.
- Practical skills on trapping air microorganisms.
- Gain practical knowledge on testing water samples by MPN technique.

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B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY**

**V SEMESTER (3 HPW-3Credits)
MB 532/A Paper VI IMMUNOLOGY**

Objectives:

This paper provides:

- Overview on history and recent developments of immunology
- Introduction to types of immunity and role of natural and recombinant vaccines in protecting against infections.
- Insight into process of Hematopoiesis for formation of different cells and their role in immunity.
- Study on structure and functions of primary and secondary lymphoid organs in inducing immune responses.
- Basic fundamental concepts on types of antigens and antibodies, properties and their functions.
- Detailed account on complement pathways and role of cytokines in Immune system.
- Learning on different types of antigen and antibody reactions. Production and applications of Monoclonal antibodies.
- Outlines on Hypersensitive reactions, Autoimmune disorders and role of MHC

| UNIT – I History and types of Immunity | | 11hrs |
|---|---|--------------|
| 1 | History of Immunology | 1 |
| 2 | Recent developments of immunology | 1 |
| 3 | Types of immunity – innate and acquired; active and passive | 6 |
| 4 | Humoral and Cell-mediated immunity | 1 |
| 5 | Vaccines – natural and recombinant | 2 |

| UNIT-II Components of Immune system | | 11 Hr |
|--|--|--------------|
| 1 | Process of Hematopoiesis | 1 |
| 2 | Cells of immune system - Identification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils, eosinophils, Mast cells and Dendritic cells | 4 |
| 3 | Process of Phagocytosis | 1 |
| 4 | Primary organs of immune system- Thymus, Bursa fabricus, Bone marrow | 2 |
| 5 | Secondary organs of immune system –, Spleen, Lymph nodes, Mucous Associated Lymphoid Tissue (MALT). | 3 |

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| | |
|---|--------------|
| UNIT-III Basics of Immunology | 11 Hr |
| 1 Antigens – types, chemical nature, antigenic determinants, haptens. Factors affecting antigenicity | 3 |
| 2 Antibodies – basic structure, types, properties and functions of immunoglobulins. | 3 |
| 3 Complement, Components of complement and activation of complement | 3 |
| 4 Role of Cytokines in Immune system | 2 |

| | |
|---|--------------|
| UNIT-IV Immunological processes | 12 Hr |
| 1 Types of antigen-antibody reactions – agglutination, precipitation, neutralization, complement fixation | 3 |
| 2 Labeled antibody based techniques – ELISA, RIA and Immunofluorescence, Western Blotting. | 3 |
| 3 Polyclonal and monoclonal antibodies – production (Hybridoma Technology) and applications | 1 |
| 4 Types of hypersensitivity – immediate and delayed | 2 |
| 5 MHC and its Role in graft rejection | 1 |
| 6 Autoimmunity and its significance | 2 |

REFERENCE BOOKS:

1. Reddy, S.R. and Reddy, K.R. (2006). A Text Book of Microbiology - Immunology and Medical Microbiology, Himalaya Publishing House, Mumbai.
2. Tizard, I.R. (1995). Immunology : An Introduction, WB Saunders, Philadelphia, USA.
3. Roitt, I.M. (1998). Essentials of Immunology, ELBS and Black Well Scientific Publishers, England.
4. Goldsby, Kindt, T.J. and Osborne, B.A. (2004). Kuby Immunology, 6th Edition, W.H.Freeman and Company, New York.
5. Lydyard, P.M., Whelan, A. and Fanger, M.W. (2000). Instant Notes in Immunology, Viva Books Pvt. Ltd., New Delhi.
6. Chakraborty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India.


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 BOS in Microbiology
 Sri Vivekananda College
 Sanikpuri

V SEMESTER PRACTICALS (2 HPW-1Credit)
MB 532P/A Paper VI IMMUNOLOGY

- 1 Total Count(TC)-RBC count, WBC count
- 2 Total Differential Count (DC)
- 3 Separation of serum and plasma
- 4 Erythrocyte Sedimentation Rate
- 5 Estimation of blood haemoglobin- Sahli's method
- 6 Determination of blood groups and Rh typing
- 7 Widal test – Qualitative and Semi-quantitative
- 8 VDRL test - Qualitative and Semi-quantitative
- 9 Ouchterlony double diffusion test
- 10 Radial Immuno diffusion
- 11 ELISA

REFERENCES:

1. GopalReddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
2. Talwar, G.P. and Gupta, S.K. (1992). A Hand Book of Practical and Clinical Immunology. CBS Publications, New Delhi.
3. Baren, E.J. (1994). Bailey and Scott's Diagnostic Microbiology, 9th Edition, Mosby Publishers.
4. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
5. Samuel, K.M. (Ed.) (1989). Notes on Clinical Lab Techniques, M.K.G. Iyyer & Son Publishers, Chennai.

Course outcome:

- Updates knowledge on recent developments in field of immunology.
- Understand the innate and acquired defense mechanisms against various invading pathogens and protection from diseases by vaccination procedures.
- Awareness on formation of immune cells in the body by lymphoid and myeloid lineages.
- Understand the role of Bone marrow and other lymphoid organs in maturation and proliferation of B and T cells.
- Understand the nature of antigens and their ability to induce antibody formation.
- Understand the role of chemical signaling molecules and role of complement in clearing immune complexes.
- Conceptual learning of different serological reactions in diagnosis of disease.
- Learn the induction of immune responses against self antigens and allergens.

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY
V SEMESTER (3 HPW-3Credits)
MB 532/B Paper VI DIAGNOSTIC MICROBIOLOGY

Course Objectives:

This paper provides:

- Overview of different human diseases and study of bacterial and viral diseases.
- An account on important fungal and parasitic diseases.
- Study of general principles and methods of diagnostic microbiology
- Elaborate study of Bacterial diagnosis by using microscopic, cultural and biochemical methods
- Concept of Serological and Molecular diagnosis.
- Overview on use of animals in laboratory diagnosis.
- Methods for viral diagnosis by cell culture and detection by cytopathic effects
- Basic outlines of mode of action of antibiotics

UNIT-I (Human diseases)

12 hr

| | | |
|---|--|---|
| 1 | Overview of different human diseases | |
| 2 | Bacterial diseases-TB,Enteric Fever, Tetanus, Syphilis | 5 |
| 3 | Viral diseases-Flu, Hepatitis, HIV,Rabies | 3 |
| 4 | Fungal diseases- Candidiasis, Systemic Mycosis | 2 |
| 5 | Parasitic diseases-Amoebiasis, Malaria, Filariasis | 2 |

UNIT-II (Diagnostic bacteriology)

11hrs

| | | |
|---|--|---|
| 1 | General principles of diagnostic microbiology-specimen collection, Transportation of specimen and processing | 4 |
| 2 | Bacterial diagnosis- Microscopic, cultural and Biochemical methods, Serological methods, Molecular methods | 4 |
| 3 | Use of laboratory animals in diagnosis | 2 |
| 4 | Diagnosis and report | 1 |

UNIT-III (Diagnostic Virology)

11 hrs

| | | |
|---|---|---|
| 1 | Direct examination of specimens-Electron Microscopic, Light Microscopic-histological, Antigen detection by ELISA and Immunoflourescence, Molecular techniques for the direct detection of Viral genomes | 4 |
|---|---|---|

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| | | |
|---|---|---|
| 2 | Indirect examination- Cell Culture - cytopathic effect, haemadsorption, interference, immunofluorescence etc. Eggs pocks on CAM - haemagglutination, inclusion bodies Animals disease or death confirmation by neutralization | 5 |
| 3 | Conventional and modern serological testing methods | 2 |

UNIT-IV (Tests for Drug sensitivity)**11 hrs**

| | | |
|---|--|---|
| 1 | Antibiotics and mode of action | 3 |
| 2 | Drug sensitivity testing methods and their importance-MIC and MBC, Liquid tube assays, Solid agar assays | 4 |
| 3 | Drug resistance mechanisms | 2 |
| 4 | Detection of Methicillin resistant Staphylococcus, Multi Drug resistant strains. | 2 |

REFERENCES:

1. Jawetz. Medical Microbiology and Immunology(2000), 6th Edition. Mc Graw Hill, New York.
2. Greenwood,David. Medical Microbiology (1997).15th Edition.Churchill Livingstone, New Delhi.
3. Chakraborty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India.
4. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
5. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
6. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical
7. Zaman, Hand book of Medical Parasitology 2nd Edition, K.C.publishers,Singapore.
8. Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
9. Singh, R.P. (2007). Immunology and Medical Microbiology. Kalyani Publishers, NewDelhi.
10. Franklin,DJ. and Snow GA. Biochemistry of antimicrobial action.Pub:Chapman & Hall.
11. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Antibiotics and Chemotherapy. Publ:Churchill Livingstone.
12. Williams, RAD., Lambart, PA. & Singleton, P. Antimicrobial Drug action. Pub:Bios Sci



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V SEMESTER (2 HPW-1Credit)
MB 532P/B Paper VI DIAGNOSTIC MICROBIOLOGY

- 1 Preparation of different culture media: Blood Agar, Chocolate Agar, MacConkey, Mannitol Salt agar, Cetrimide, Simmon Citrate Media
- 2 Staining techniques: Albert staining, Acid-fast staining of Mycobacteria (stained/permanent slides).
- 3 Isolation and identification of pathogenic bacteria (*E. coli*, *Klebsiella*, *Pseudomonas*, *Staphylococcus*) by cultural, microscopic and biochemical, enzymatic (Catalase, Coagulase) and serological (WIDAL, VDRL)
- 4 Examination of pathogenic bacteria/ Permanent slides.
- 5 Bacteriological examination of urine, pus, Throat swab from patient
- 6 Microscopic studies of virus infected materials (Pictures)
- 7 Parasites – Malarial parasite, *Entamoeba* (study of permanent slides).
- 8 Immunodiagnosics- tests for HIV, HBV, ELISA
- 9 Observation of fungal pathogen (*Candida*).
- 10 Antibiotic sensitivity testing – disc diffusion method

REFERENCES:

1. GopalReddy, M., Reddy, M.N., Saigopal, DVR and Mallaiiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
2. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
3. Samuel, K.M. (Ed.) (1989). Notes on Clinical Lab Techniques, M.K.G. Iyyer & Son Publishers, Chennai.
4. Wadher, B.J. and Reddy, G.L.B. (1995). Manual of Diagnostic Microbiology, Himalaya Publishing House, Mumbai
5. Mukherjee, K.L. (1996). Medical Laboratory Technology. Vol II. Tata Mc GrawHill Publishing Co. Ltd., New Delhi.
6. Cappuccino (2000), Microbiology Lab manual, Oxford University Press

Course outcome:

- Knowledge of various microbes involved in human diseases.
- Awareness on some of the fungi and parasites causing diseases.
- Understanding the general principles and methods of diagnostic microbiology.
- Learn the basic procedures in bacterial diagnosis by microscopic, cultural and biochemical methods.
- A brief understanding of concepts in serological and molecular diagnosis.
- Understand the processes used in animals for laboratory diagnosis.
- Acquire broad understanding in viral diagnosis by cell culture method.
- Understand the detection of viruses by cytopathic effects
- Acquire knowledge in mode of action of antibiotics and the their mechanism of inhibition of growth.

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B. Sc MICROBIOLOGY (CBCS STRUCTURE)
SEC-3: MB 501: CLINICAL MICROBIOLOGY
V SEMESTER (2 HPW-2Credits)

Objectives

This paper provides

- Introduction to infectious diseases, specimen collection and examination
- Overview on media used to culture bacterial pathogens.
- Conceptual study of Kit based serological detection of various human Pathogens
- Insight into Molecular methods of disease diagnosis

Unit-I:

1. Overview of infectious diseases-bacterial, viral, fungal, parasitic
2. Collection of clinical specimens and their processing -blood sample, Separation of blood components. Sputum, CSF, Stool , Urine, Swabs, Biopsy
3. Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria
4. Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Sabarouds Medium Distinct colony properties of various bacterial pathogens.

Unit-II

1. Kit based serological detection of Pathogens - Typhoid, Dengue, HIV, Swine flu, Syphilis.
2. Molecular methods of Diagnosis - PCR, Western blotting
3. Testing for Antibiotic sensitivity in Bacteria

REFERENCES:

1. Jawetz. Medical Microbiology and Immunology(2000), 6th Edition. Mc Graw Hill, New York.
2. Greenwood,David. Medical Microbiology (1997).15th Edition.Churchill Livingstone, New Delhi.
3. Chakraborty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India.
4. Samuel, K.M. (Ed.) (1989). Notes on Clinical Lab Techniques, M.K.G. Iyyer & Son Publishers, Chennai.
5. Wadher, B.J. and Reddy, G.L.B. (1995). Manual of Diagnostic Microbiology, Himalaya Publishing House, Mumbai

Outcome

- Comprehend about various microbial diseases caused to human beings
- Acquaint knowledge on methods of clinical specimen collection, processing and culturing
- Understand various serological and molecular techniques to detect pathogenic infections.
- Learn about antibiotic sensitivity

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B. Sc MICROBIOLOGY (CBCS STRUCTURE)

GE-1: MB 502: MICROBES FOR HUMAN WELFARE V SEMESTER (2 HPW-2Credits)

Course Objectives

This paper provides:

- Overview on significance of microbes in industries and agriculture
- Study of microbes role in research and development of various fields
- Descriptive study on importance of Normal flora of human body
- Introduction to concept of Antibiotics and drug resistance

Unit-1:

1. Introduction to microorganisms
2. Applications of microbes in food processing.
3. Applications of microbes in Industry
4. Applications of microbes in agriculture
5. Microbes in Research & Development

Unit-II:

1. Microorganisms related to human health-Sources of infection, disease, prevention and control.
2. Normal flora of human body and its significance.
3. Antibiotics and their use and Concept of drug resistance
4. Cosmetic microbiology

REFERENCES:

1. Michael J. Pelczar, Jr. E.C.S.Chan, Noel R. Krieg Microbiology Tata McGraw- Hill Publisher.
2. Prescott, M.J., Harley, J.P. and Klein Microbiology 5th Edition, WCB Mc GrawHill, New York.
3. Madigan, M.T., Martinkl, J.M and Parker, j. Broch Biology of Microorganism, 9th Edition, MacMillan Press, England.
4. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.
5. Ananthanarayan and Panikar. Text book of Microbiology. Universities Press.

Course Outcome

- Basic Knowledge about microbiology and role of microbes in daily life
- Conceptual understanding of role of microbiology in production of industrially important products.
- Acquaint with prevention and control strategies of microbial diseases
- Acquire basic knowledge on Cosmetic microbiology

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**SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY**

VI SEMESTER (3 HPW-3Credits)

MB 631 Paper VII MEDICAL MICROBIOLOGY

Course Objectives:

This paper provides:

- Description of the Normal flora of human body and its significance.
- An account on the role of non specific defence mechanisms of human body.
- Study of general principles and methods of diagnostic microbiology.
- Study of important bacterial and viral pathogens, epidemiology, diagnosis, prevention and their control.
- An introduction to nosocomial infections and its control measures.
- An overview of superficial and systemic fungal infections.
- Fundamentals in use of therapeutic drugs and their mode of actions.
- Detailed study of methods for evaluation of antimicrobial agents.
- Study of mechanisms in antimicrobial drug resistance.

UNIT-I Basics of Medical microbiology

11 hr

| | | |
|---|---|---|
| 1 | History of Medial microbiology | 1 |
| 2 | Normal flora of human body-Definition, Effects of Antibiotics, Distribution of normal flora | 3 |
| 3 | Definition and process of infection, non-specific defense mechanisms, mechanical barriers | 2 |
| 4 | Host-pathogen interactions. Bacterial toxins, virulence and attenuation | 3 |
| 5 | Anti-microbial substances of host – lysozyme, complement, properdin, antiviral substances, Phagocytosis, beta lysine, leukin, lactoperoxidase | 2 |

UNIT-II Diagnostic Microbiology & Medical Bacteriology

12hrs

| | | |
|---|---|-------|
| 1 | General principles of diagnostic microbiology | 1 hr |
| 2 | Collection, transport and processing of clinical samples | 2 hr |
| 3 | General methods of laboratory diagnosis – cultural, biochemical, serological and molecular methods | 2 hrs |
| 4 | General account of the following diseases – causal organisms, pathogenesis, epidemiology, diagnosis, prevention and control of: | 1 hr |
| | Air-borne diseases - Tuberculosis | 1 hr |
| | Food and water-borne diseases - Cholera, Typhoid. | 2 hr |
| | Contact diseases - Syphilis, Gonorrhoea | 2hr |

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|---|--|------|
| 5 | Zoonotic diseases – Anthrax | |
| 6 | General account of nosocomial infections- <i>Staphylococcus</i> and <i>Pseudomonas</i> | 1 hr |

UNIT-III Virology and Parasitology **11 hrs**

- | | | |
|---|---|-------|
| 1 | General account of the following diseases – causal organisms, pathogenesis, epidemiology, diagnosis, prevention and control of: Air-borne diseases - Influenza | 2 hr |
| 2 | Food and water-borne diseases - Hepatitis- A, Poliomyelitis, Amoebiasis | 3 hrs |
| 3 | Zoonotic diseases – Rabies | 2 hrs |
| 4 | Blood-borne diseases - Serum hepatitis, AIDS | 2 hrs |
| 6 | Insect Borne: Malaria, Dengue | 2 hrs |

UNIT-IV Chemotherapy **11 hrs**

- | | | |
|---|---|-------|
| 1 | Elements of chemotherapy – therapeutic drugs | 2 hrs |
| 2 | Mode of action of cell wall inhibitors(penicillin), antimetabolites (sulpha drugs), and their clinical use | 4 hrs |
| 3 | Drug resistance | 3 hrs |
| 4 | Tests for antimicrobial susceptibility | 1 hrs |
| 5 | General account of antiviral drugs | 1 hrs |

REFERENCES:

1. Jawetz. Medical Microbiology and Immunology(2000), 6th Edition. Mc Graw Hill, New York.
2. Greenwood,David. Medical Microbiology (1997).15th Edition.Churchill Livingstone, New Delhi.
3. Chakraborty, B. (1998). A Text Book of Microbiology, New Central Book Agency (P) Ltd, Calcutta, India.
4. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
5. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
6. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical
7. Zaman, Hand book of Medical Parasitology 2nd Edition, K.C.publishers,Singapore.
8. Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
9. Singh, R.P. (2007). Immunology and Medical Microbiology. Kalyani Publishers, NewDelhi.
10. Franklin,DJ. and Snow GA. Biochemistry of antimicrobial action.Pub:Chapman & Hall.
11. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Antibiotics and Chemotherapy. Publ:Churchill Livingstone.
12. Williams, RAD., Lambart, PA. & Singleton, P. Antimicrobial Drug action. Pub:Bios Sci

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VI SEMESTER PRACTICALS (2 HPW-1Credit)
MB 631P Paper VII MEDICAL MICROBIOLOGY

- 1 Media for isolation of bacterial pathogens: McConkey, Mannitol Salt agar, Cetrimide, Simmon Citrate Media
- 2 Isolation and identification of medically important bacteria (*E. coli*, *Klebsiella*, *Pseudomonas*, *Staphylococcus*) by cultural, microscopic and biochemical tests.
- 3 Antibiotic sensitivity testing – disc diffusion method
- 4 Parasites – Malarial parasite, *Entamoeba* (study of permanent slides).
- 5 Observation of fungal pathogen (*Candida*).
- 6 Tests for disinfectant (Phenol coefficient).

REFERENCES:

1. GopalReddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
2. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
3. Samuel, K.M. (Ed.) (1989). Notes on Clinical Lab Techniques, M.K.G. Iyyer & Son Publishers, Chennai.
4. Wadher, B.J. and Reddy, G.L.B. (1995). Manual of Diagnostic Microbiology, Himalaya Publishing House, Mumbai
5. Mukherjee, K.L. (1996). Medical Laboratory Technology. Vol II. Tata Mc GrawHill Publishing Co. Ltd., New Delhi.
6. Cappuccino (2000), Microbiology Lab manual, Oxford University Press

Course outcome:

- Understand the importance normal flora and its health benefits.
- Understanding the different types of diagnostic methods for identifying the pathogens and the principles of diagnosis.
- Understanding the control, prevention and pathogenesis of bacterial and viral pathogens.
- Awareness on the nosocomial infections and their control.
- A brief understanding of systemic and supercial mycotic infections.
- Conceptual understanding of Drug resistance.
- Understand mode of actions of antimicrobial agents and evaluation of the drugs.
- Understand the mechanisms of antiviral agents.

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY

VI SEMESTER (3 HPW-3Credits)

MB 632/A Paper VIII FOOD AND INDUSTRIAL MICROBIOLOGY

Course Objectives:

This paper provides:

- Description of different microbes involved in food spoilage and detailed study of various spoiled food materials.
- An account on the food poisoning and important food borne infections.
- Study of general principles and methods of food preservation and account on biochemical activities of microbes in milk.
- Detailed study of production of fermented foods.
- An overview on the Single Cell Proteins and production of edible mushrooms.
- General account on concept of probiotics and its production.
- Detailed study on screening of microorganisms used in industry, strain improvement and types of fermentations.
- Description of fermentor, types of raw materials in microbial fermentation.
- Basic outlines of industrial production of alcohol, beverages, enzymes, antibiotics, amino acids, organic acids, vitamins, biofuels and Insulin.

UNIT – I Food Microbiology 12 hrs

| | | |
|---|---|---|
| 1 | Microorganisms of food spoilage and their sources | 1 |
| 2 | Spoilage of different food materials - fruits, vegetables, meat, fish. Canned foods | 5 |
| 3 | Food poisoning (botulism and staph poisoning), Food borne diseases (Salmonellosis, Shigellosis, Listeria) and their detection | 4 |
| 4 | General methods of food preservation | 2 |

UNIT- II Applied Food Microbiology 11 hrs

| | | |
|---|---|---|
| 1 | Microbiological production of fermented foods – bread, cheese, yogurt | 3 |
| 2 | Biochemical activities of microbes in milk | 2 |
| 3 | Microorganisms as food – SCP, edible mushrooms. | 4 |
| 4 | Concept of probiotics and its production | 2 |

UNIT – III Industrial Microbiology 11 Hrs

| | | |
|---|--|---|
| 1 | Microorganisms of industrial importance – yeasts, molds, bacteria, actinomycetes | 3 |
| 2 | Screening and isolation of industrially-important microorganisms | 2 |
| 3 | Outlines of strain improvement | 2 |

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- 4 Types of fermentation – aerobic, anaerobic, batch, fed batch continuous, surface, submerged and solid state 4

UNIT – IV Microbial Biotechnology

11 Hrs

- | | | |
|---|---|---|
| 1 | Design of a stirred tank reactor fermentor | 1 |
| 2 | Fermentation media. Raw materials used in fermentation industry | 2 |
| 3 | Industrial production of alcohols (ethyl alcohol), beverages (beer), enzymes (amylases), antibiotics (penicillin), amino acids (glutamic acid), organic acids (citric acid), vitamins (B12), biofuels (biogas - methane). | 8 |

REFERENCES:

1. Casida, L.E. Industrial Microbiology (1999). 10th edition. New Age International Publication, New Delhi.
2. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, Aditya Books (P) Ltd. New Delhi.
3. Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). Food Microbiology: Fundamentals and Frontiers. ASM Press, Washington D.C., USA.
4. Frazier, W.C. and Westhoff, D.C. (1988). Food Microbiology, Mc Graw-Hill, New York.
5. Jay, J.M. (1996). Modern Food Microbiology, Chapman and Hall, New York.
6. Ray, B. (1996). Fundamentals of Food Microbiology, CRC Press, USA.
7. Adams, M.R. and Moss, M.O. (1996). Food Microbiology, New Age International (P) Ltd, New Delhi.
8. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology and Biotechnology, ASM Press, Washington, D.C., USA.
9. Wulf Crueger and Annelisse Crueger. biotechnology: Textbook of industrial Microbiology (2000), 2nd Edition. Panima Publishing Corporation, New Delhi.
10. V.K. Joshi and ashok Pandey. Biotechnology: Food Fermentation (1999), 2nd edition. educational Publishers distributors, New Delhi.
11. Patel, A.H. (1984). Industrial Microbiology, Mac Milan India Ltd., Hyderabad. Cassida, L.E. (1968). Industrial Microbiology, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
12. Prescott and Dunn. Industrial Microbiology (1987). CBS Publishers, New Delhi.
13. Reddy, M.N., Uma Maheshwara Rao., Naga Padma, P., Raghuram, M, Charitha Devi, M. (2012) Applied Microbiology, Telugu Akademy.


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VI SEMESTER PRACTICALS (2 HPW-1Credit)
MB 632P/A Paper VIII FOOD AND INDUSTRIAL MICROBIOLOGY

- 1 Observation and Isolation of fungi and bacteria from spoiled fruits and vegetables
- 2 MBRT –Test for microbiological quality of milk
- 3 Isolation of antagonistic microorganisms by crowded plate technique
- 4 Isolation of amylase-producing organisms
- 5 Alcohol production and estimation; Calculation of fermentation efficiency
- 6 Citric acid production and estimation
- 7 Preparation of fermented food- Yoghurt

REFERENCES:

1. GopalReddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
2. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad
3. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
4. Gupte, S. (1995). Practical Microbiology. Jaypee Brothers Medical Publishers Pvt. Ltd.

Course outcome:

- Knowledge of various microbes involved in the food spoilage and properties of spoiled foods.
- Awareness of food borne diseases , food poisoning and their detection.
- Understanding the general methods food preservation.
- Learn the basic principles in production of fermented foods like bread, cheese, youghurt.
- A brief understanding of biochemical activities of microbes in milk.
- Understand the processes in production of SCP ,edible mushrooms and probiotics.
- Acquire broad understanding in strain improvement and screening of industrially important microbes.
- Understand basic design of fermentor.
- Acquire knowledge in various microbial fermentation procedures involved in production of ethyl alcohol, glutamic acid, Beer, penicillin, citric acid, Vitamin B12, Biogas and Insulin.

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC. III YEAR SYLLABUS
SUBJECT -MICROBIOLOGY

VI SEMESTER (3 HPW- 3Credits)

MB 632/B Paper VIII MICROBIAL TECHNOLOGY

Course Objectives:

This paper provides:

- Overview of importance of production strains and strain development strategies.
- Introduction to bioreactor, fermentation media and process economics.
- Study on fermentative production of microbial enzymes , beverages and food additives
- Descriptive study on fermentative production of antibiotics, recombinant therapeutic products and industrial chemicals
- Detailed account on fermented foods, probiotics and prebiotics.
- Overview of microbial biomass- SCP, Mushroom and foods of increasing sophistication.
- Concept of GMP, GLP, SOP, QC and QA.
- Learning on food safety and quality assurance with an emphasis on government regulatory practices and policies.

UNIT –I Bioprocessing and Process economics

11Hrs

- | | | |
|----|---|---|
| 1. | An overview of industrially important microorganisms | 1 |
| 2. | Characterization of industrial strains and their strain development strategies . | 2 |
| 3. | Raw materials: Preparation of conventional and non-conventional substrates for microbial fermentation. Optimization of fermentation media | 3 |
| 4. | Bioreactors: Designing and development of a bioreactor. | 3 |
| 5. | An overview of process economics: | 2 |
| | a. Cost estimates b. Process Design optimization c. Operating Cost Estimates. d. Marketing Potential | |

UNIT –II Fermentation Technology

12Hrs

- | | | |
|----|--|---|
| 1 | Types of fermentation | 1 |
| 2. | Microbial Enzymes: a. Amylases b. Proteases | 2 |
| 3. | Beverages : a. Wine b. Beer | 3 |
| 4. | Food Additives and Supplements : a. Exopolysaccharide b. vitamin (B12) | 2 |
| 5. | Health Care Products : a. Antibiotic (Streptomycin) b. Recombinant therapeutic product (Humulin) | 2 |
| 6. | Industrial Chemicals : a. Ethanol b. Citric acid | 2 |

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| | |
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| UNIT –III Food biotechnology | 11Hrs |
| 1. Fermented foods: Bread, Idli, Cheese, Yoghurt | 3 |
| 2. Concept of probiotics and. prebiotics. | 2 |
| 3. Overview of microbial biomass for food and feed: Algal, bacterial, fungal and yeast biomass; Technologies for the production of SCP | 2 |
| 4. Mushrooms: Types of Mushrooms; Cultivation of White button and Oyester Mushrooms. | 2 |
| 5. Foods of increasing sophistication: Functional/bioactive foods, Nutraceuticals, GM foods. | 2 |

| | |
|--|---------------|
| UNIT –IV QC and QA in Microbial Technology | 11 Hrs |
| 1. Concept of Good Manufacturing Practices (GMP), Good Laboratory Practices (GLP) and Standard Operating Practices (SOP) | 2 |
| 2. Overview of Quality Control (QC) in fermentation processes:Principles of validation for pharmaceutical industry | 1 |
| 3. Tests used for quality assurance (QA) of finished product. i.Sterility testing ii.Pyrogen testing iii.Ames test and modified Ames test iv.Toxicity testing v.Shelf life testing | 3 |
| 4. An introduction to indicators of food safety,food quality and assurance. | 2 |
| 5. Quality assurance:Microbiological quality standards of food. Government regulatory practices and policies.FDA,EPA,HACCP,ISI. | 3 |

REFERENCES:

1. Casida.L.E.Industrial Microbiology(1999).10th edition.New Age International Publication, New Delhi.
2. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, Aditya Books (P) Ltd. New Delhi.
3. Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). Food Microbiology: Fundamentals and Frontiers. ASM Press, Washington D.C., USA.
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6. Ray, B. (1996). Fundamentals of Food Microbiology, CRC Press, USA.
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8. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology and Biotechnology, ASM Press, Washington, D.C., USA.
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10. V.K.Joshi and ashok Pandey. Biotechnology:Food Fermentation(1999), 2nd edition.educational Publishers distributors, New Delhi.
11. Patel, A.H. (1984). Industrial Microbiology, Mac Milan India Ltd., Hyderabad.Cassida, L.E. (1968). Industrial Microbiology, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
12. Prescott and Dunn. Industrial Microbiology (1987).CBS Publishers, New Delhi.

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13. Reddy, M.N., Uma Maheshwara Rao., Naga Padma, P., Raghuram, M, Charitha Devi, M.(2012) Applied Microbiology, Telugu Academy.
14. Batch Fermentation Modeling: Monitoring, and Control. Authors: Ali Cinar; Satish J. Parulekar; Cenk Undey
15. Brian McNeil, Linda Harvey, Wiley, Practical Fermentation Technology.
16. Nduka Okafor(2007);. Modern Industrial Microbiology and Biotechnology

VI SEMESTER PRACTICALS (2 HPW-1Credit)
MB 632P/B Paper VIII MICROBIAL TECHNOLOGY

1. Microscopic observation of industrially important Microorganisms.
2. Preparation of different fermentation media.
3. Industrial production of Amylase.
4. Industrial production of Wine.
5. Industrial production of Alcohol.
6. Industrial production of Citric acid.
7. Preparation of Yoghurt.
8. Microbial examination of idli batter.
9. Good Lab Practices and procedure of writing SOPs for instruments.
10. Quality assurance of Fermentation procedure by sterility testing.

REFERENCES:

1. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
2. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, Sri Padmavathi Publications, Hyderabad
3. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
4. Gupte, S. (1995). Practical Microbiology. Jaypee Brothers Medical Publishers Pvt. Ltd.
5. Daniel Lim, Microbiology, 2nd Edition; McGraw-Hill Publication
6. Ingraham J. L. and Ingraham C.A. (2004). Introduction to Microbiology. 3rd Edition. Thomson Brooks / Cole.

Course outcome:

- Acquaint with industrially important microorganisms and strain manipulation techniques.
- Understand the concepts on bioreactor and process economics
- Understand industrial production of microbial enzymes and beverages.
- Acquire practical skills on production of health care products and industrial chemicals.
- Perform requisite practical for fermented foods.
- Understand the process of biomass, Nutraceuticals and GM foods.
- Knowledge on QC and QA in microbial technology
- Understand Government regulatory practices and policies.

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B. Sc MICROBIOLOGY (CBCS STRUCTURE)

SEC-4: MB 601: MUSHROOM CULTIVATION VI SEMESTER (2 HPW-2Credits)

Course Objective:

This paper provides

- Introduction to mushroom cultivation
- Study on nutritional value of mushrooms
- Insight into various steps of mushroom cultivation
- Overview on methods of mushrooms preservation

Unit-1

1. Introduction to mushroom cultivation
2. Importance and history of mushroom cultivation in India
3. Global status of mushroom production
4. Food value of mushroom

Unit-2

1. Steps in mushroom cultivation
2. Selection of site and types of mushroom
3. Mushroom farm structure, design layout
4. Principle and techniques of compost and composting
5. Principle of spawn production
6. Casing and crop production
7. Harvesting and marketing
8. Pest and pathogens of mushrooms
9. Post-harvest handling and preservation of mushrooms

REFERENCE:

1. Mushroom cultivation in India by B.C. Suman and V.P. Sharma. Published by Daya Publishing House, New Delhi.
2. Mushrooms Cultivation, Marketing and Consumption by Manjit Singh Bhuvnesh Vijay Shwet Kamal G.C. Wakchaure Directorate of Mushroom Research (Indian Council of Agricultural Research) Chambaghat, Solan –173213 (HP)

Course Outcome:

- Knowledge on scope and importance of mushroom cultivation in India and worldwide.
- Comprehend on principles of mushroom spawn production.
- Awareness on mushroom cultivation procedure.
- Detailed Knowledge on pest management methods in mushroom cultivation.

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B. Sc MICROBIOLOGY (CBCS STRUCTURE)
GE-2: MB 602: CONTAGIOUS DISEASES AND IMMUNIZATION
VI SEMESTER (2 HPW-2Credits)

Course Objective:

This paper provides

- Overview of various kinds of infection.
- Introduction to sources of microbial infections.
- Conceptual study on immunity and immunization.
- Detailed learning about vaccination.

Unit-1: Contagious diseases

1. Types of Infections.
2. Sources of infections.
3. Mode of infections.
4. Overview of bacterial diseases.
5. Overview of Viral Diseases.

Unit-2: Immunization

1. Immunity.
2. Types of Immunity.
3. Immunization.
4. Types of immunization.
5. Vaccines- Live and killed vaccines.
6. Vaccination schedule.

REFERENCES:


1. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
2. Gupte, S. (1995). Short Text Book of Medical Microbiology, 8th Edition, Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
3. Annadurai, B. (2008). A Textbook of Immunology and Immunotechnology. S. Chand & Co. Ltd., New Delhi.
4. Dey, N., T.K. and Sinha, D. (1999). Medical Bacteriology Including Medical Mycology and AIDS. New Central Book Agency (P) Ltd. Calcutta, India.
5. Shetty, N. (1994). Imuunology – Introductory Textbook. New Age International Pvt. Ltd., New Delhi.
6. Singh, R.P. (2007). Immunology and Medical Microbiology. Kalyani Publishers, New Delhi.

Course Outcome:

- Awareness on bacterial and viral diseases
- Understand about mode of infections
- Acquaint Knowledge on types of immunity
- Knowledge on vaccination schedule

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