

B. Sc ACADEMIC

BATCH

2023 – 26



Bhavan's Vivekananda College of Science, Humanities and Commerce, Sainikpuri, Secunderabad

Autonomous College (Affiliated to Osmania University)

(Accredited with "A" Grade by NAAC)

Department of Microbiology

Template for B Sc Microbiology under CBCS

(With effect from academic year 2023-24)

Semester 1

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	Environmental Studies	AECC-1	2		2	2		2
	English	CC-1A	4		4	4		4
	Second Language	CC-2A	4		4	4		4
MB131 / MB 131P	Optional 1 General Microbiology	DSC-1A	4	3	7	4	1	5
	Optional 2	DSC-2A	4	3	7	4	1	5
	Optional 3	DSC-3A	4	3	7	4	1	5
					31			25

Semester 2

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	Computer Skills	AECC-2	2		2	2		2
	English	CC-1B	4		4	4		4
	Second Language	CC-2B	4		4	4		4
MB231/ MB231 P	Optional 1 Microbial Diversity	DSC-1B	4	3	7	4	1	5
	Optional 2	DSC-2B	4	3	7	4	1	5
	Optional 3	DSC-3B	4	3	7	4	1	5
					31			25

Semester 3

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1C	3		3	3		3
	Second Language	CC-2C	3		3	3		3
MB331 / MB331 P	Optional 1 Food and Environmental Microbiology	DSC-1C	4	3	7	4	1	5
	Optional 2	DSC-2C	4	3	7	4	1	5
	Optional 3	DSC-3C	4	3	7	4	1	5
	Skill Enhancement Course-1 Communication Skills	SEC-1	2		2	2		2
SE331A/ SE331B	Skill Enhancement Course-2 Mushroom Cultivation/Microbial products-Biofertilizers and Biopesticides	SEC-2	2		2	2		2
					31			25

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Semester 4

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1D	3		3	3		3
	Second Language	CC-2D	3		3	3		3
MB431 / MB431 P	Optional 1 - Medical Microbiology & Immunology	DSC-1D	4	3	7	4	1	5
	Optional 2	DSC-2D	4	3	7	4	1	5
	Optional 3	DSC-3D	4	3	7	4	1	5
	Skill Enhancement Course-3 Universal Human Values	SEC-3	2		2	2		2
SE431A / SE431B	Skill Enhancement Course-4 Clinical Microbiology/Interactions with Entrepreneurs in Microbial Technology and start-ups	SEC-4	2		2	2		2
					31			25

Semester 5

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1E	3		3	3		3
	Second Language	CC-2E	3		3	3		3
MB 531 / MB531P MB531A / MB531 A P	Optional 1- A/B A. Molecular Biology & Microbial Genetics (or) B. Microbial Omics	DSE-1E	4	3	7	4	1	5
	Optional 2	DSE-2E	4	3	7	4	1	5
	Optional 3	DSE-3E	4	3	7	4	1	5
GE531	Generic Elective -Microbiology and Human Health	GE-1	4		4	4		4
					31			25

Semester 6

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1F	3		3	3		3
	Second Language	CC-2F	3		3	3		3
MB631 / MB631 P MB631A / MB631A P	Optional 1- A/B A. Industrial Microbiology (or) B. Pharmaceutical Microbiology	DSE-1F	4	3	7	4	1	5
	Optional 2	DSE-2F	4	3	7	4	1	5
	Optional 3	DSE-3F	4	3	7	4	1	5
MB631_O/MB631_P	Optional paper/Project Applied Microbiology and Artificial Intelligence		4	-	4	4	-	4
					31			25
	Total Credits = 150							

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B. Sc MICROBIOLOGY

B. Sc. I YEAR SYLLABUS (2023 onwards)
SUBJECT -MICROBIOLOGY
I SEMESTER (4 HPW-4Credits)
MB131 Paper I GENERAL MICROBIOLOGY

Overall course objective:

To familiarize the students with the concepts of microscopy staining, general characters of microorganisms and microbial growth & nutrition.

Unit Wise Course Objectives:

- COb1.** Gives insight to the world of microorganisms in the aspect of historical developments and familiarize with the concepts of microscopy, staining and motility.
- COb2.** Discuss the characteristics of various bacteria and illustrate structure of viruses
- COb3.** Discuss the nutritional requirements and familiarize with the concepts of bacterial metabolism
- COb4.** Basics on sterilization, isolation and preservation of microorganism's along with the growth of bacteria.

UNIT-1: INTRODUCTION TO MICROBIOLOGY**15 Hrs**

Meaning, definition and scope. History of microbiology: Contribution of Louis Pasteur and Robert Koch. Importance and application of Microbiology. **5 Hrs**

Principles of Microscopy-Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM). **5 Hrs**

Principles and types of stains-simple stain, differential stain, negative stain. Structural stain-spore, capsule, flagella. **4 Hrs**

Bacterial motility - Hanging drop method. **1 Hr**

UNIT-2: STRUCTURE OF BACTERIA, VIRUSES & PURE CULTURE CONCEPT**15Hrs**


Prokaryotes—Ultra structure of eubacteria-Invariant components - Cell Wall, Cell Membrane, Ribosomes, Nucleoid. Variant components - Capsule, Flagella, Fimbriae, Endospore and Inclusion bodies. **5 Hrs**

Morphology and structure of TMV and HIV. Structure and multiplication of lambda bacteriophage. **4 Hrs**

Isolation of Pure culture techniques- Enrichment culturing, Dilution plating, streak plate, spread plate, Pour plate and Micromanipulator. Preservation of Microbial cultures – Sub culturing, overlaying cultures with minerals oils, lyophilization, sand cultures, and storage at low temperature. **6 Hrs**


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UNIT-3: MICROBIAL NUTRITION AND METABOLISM

15 Hrs

Microbial Nutrition – Nutritional requirement, Uptake of nutrients by cell.

7 Hrs

Nutritional groups of microorganisms – Autotrophs, Heterotrophs, Mixotrophs.

Components and types of bacterial growth media – Simple and Complex media.

Enzymes – Properties, Nomenclature, Classification, Models of enzyme substrate interactions

Respiration – Glycolysis, HMP Pathway, ED Pathway, TCA Cycle and

Anaplerotic reaction, Electron Transport, Oxidative and substrate level phosphorylation. 8 Hrs

UNIT-4: STERILIZATION TECHNIQUES AND MICROBIAL GROWTH

15 Hrs

Sterilization and disinfection techniques

8Hrs

Physical methods- Autoclave, Hot-air oven, Pressure cooker, Tyndallisation, Laminar air flow, Filter sterilization

Radiation methods-UV rays, Gamma rays, Ultra sonic methods, Microwaves

Chemical methods- Use of alcohols, aldehydes, fumigants, phenols, halogens, hypochlorites

Microbial growth- Different phases of growth in batch culture

7Hrs

Factors influencing microbial growth

Synchronous, Continuous, Biphasic Growth

Methods for measuring microbial growth – Direct Microscopic, Viable count, Turbidometry, Biomass.

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 Panicker, Medical Microbiology.


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I SEMESTER PRACTICALS (3 HPW-1Credit)
MB131 P Paper I General Microbiology

3HPW-Credits-1

1. Handling and calibration of light microscope.
2. Simple and differential staining (Gram staining), Spore staining.
3. Microscopic observation of Cyanobacteria (*Nostoc*, *Spirulina*), algae and fungi (*Saccharomyces*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Fusarium*).
4. Isolation of T2 bacteriophage from sewage sample.
5. Preparation of media for culturing autotrophic and heterotrophic microorganisms – algal medium, mineral salts medium, nutrient agar medium, McConkey agar and blood agar.
6. Sterilization techniques: Autoclave, Hot air oven and filtration.
7. Enumeration of bacterial numbers by serial dilution and plating (viable count)
8. Isolation of pure cultures by streak, spread and pour plate techniques
9. Preservation of microbial cultures- Slant, Stab, Sand cultures, mineral oil overlay and glycerol stocks
10. Turbidometric measurement of bacterial growth and plotting growth curve.

References:

1. Experiments in Microbiology by K.R. Aneja.
2. Gopal Reddy.M., Reddy. M.N., Sai Gopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.
3. Dubey, R.C. and Maheshwari, D.K. Practical Microbiology, S. Chand and Co New Delhi.
4. Alcamo, I.E. Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers, USA.

Course Outcomes:


At the end of the course student will be able to

MB131.CO1. Acquaint with historical account and apply microscopy and staining techniques.

MB131.CO2. Able to classify microorganisms based on salient characteristics and summarize characteristics of various bacteria and compare different types of viruses.

MB131.CO3. Understand the nutritional requirements of different types of bacteria and importance of various metabolic pathways in food and energy production.

MB131.CO4. Able to identify, isolate, and preserve the microorganisms.


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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc. MICROBIOLOGY
B.Sc. I YEAR SYLLABUS (2023 Onwards)
SUBJECT -MICROBIOLOGY
II SEMESTER (4 HPW - 4 Credits)
MB231 Paper II MICROBIAL DIVERSITY

Overall Course Objective: To explain the relevance of the microbial biodiversity concepts and ecosystems.

Unit wise Course Objectives:

- COb1.** Discuss about diversification of microorganisms
- COb2.** Explain about the physiological diversity of bacteria
- COb3.** Basic insights into few unique characteristics of protozoa, fungi and algae.
- COb4.** Discuss various microbial ecosystems and their interactions

UNIT 1: CONCEPT OF BIODIVERSITY **15 Hrs**


Basic concept of Biodiversity and Conservation – Elements of Biodiversity- Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity. **3Hrs**
Economic Value of Biodiversity & Legal, Ethical and Conservation issues related to uses of biodiversity. **3Hrs**
Classification of living organisms; Haeckel, Whittaker and Carl Woese systems. **4 Hrs**
Differentiation of prokaryotes and eukaryotes. **1Hr**
Classification of bacteria as per the second edition of Bergey's manual of systematic bacteriology. **4 Hrs**


UNIT 2: PROKARYOTIC MICROBIAL DIVERSITY **15 Hrs**

General characteristics of Eubacteria, Rickettsia, Mycoplasma. **4 Hrs**
Microbial richness: exploration, significance, conservation and applications. **3 Hrs**
Structural and physiological diversity of Archaea bacteria, metabolic characteristics of extremophiles (Methanogens, Halophiles, Thermoacidophiles). **8 Hrs**
Gram negatives: Cyanobacteria and Proteobacteria, Gram positives and heterogenous members including Firmicutes, Actinobacteria, Bacteroidetes, Acidobacteria and Planctomycetes

UNIT 3: EUKAROTYIC MICROBIAL DIVERSITY **15 Hrs**

Eukaryotic microbial diversity. Structural, physiological and metabolic characteristics of Algae - Cyanophyta, Chlorophyta, Bacillariophyta, Phacophyta, Rhodophyta **6 Hrs**
Fungi -Phycomycetis, Basidiomycetis, Zygomycetes, Oomycetes, Ascomycetes, Deuteromycetes (imperfect and perfect stages) and **5 Hrs**
Protozoa - Giardia, Entamoeba and Plasmodium **4Hrs**


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UNIT 4: MICROBIAL ECOSYSTEMS

15 Hrs

Microbial interactions: Symbiosis, neutralism, commensalism, competition, antagonism, synergism, parasitism. **6 Hrs**

Understanding microbial diversity with Cultivated vs Uncultivated microorganisms. **2 Hrs**

The Great Plate count anomaly.

Cultivation independent methods to assess microbial diversity. **2 Hrs**

Preserved and perturbed microbial ecosystems, microbiome for sustainable agro-ecosystems and Human microbiome **5 Hrs**

Reference Books

1. Pelczar Jr. M.J. Chan. E.C.S and Kreig.N.R (2006)."Microbiology"- 5th Edition McGraw Hill Inc. New York.
2. David, B.D., Delbecco,. R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology" 5th Edition. Harper & Row, New York.
3. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (1986). "General Microbiology" -Mac Milan Education Ltd. London.
4. Brown J.W. (2015) Principles of Microbial Diversity, ASM Press
5. Epstein S.S. (2009) Uncultivated microorganisms, Springer-Verlag Publishers
6. Madigan M.T., Bender K.S., Buckley D.H., Sattley W.M. and Stahl D.A. (2017) Brock Biology of Microorganisms, 15th Edn. (Global Edn.)Pearson Education



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II SEMESTER PRACTICALS (3 HPW-1Credit)
MB231 P Paper I Microbial Diversity

3HPW-Credits-1

1. Isolation of Methanogenic bacteria from manure by anaerobic culturing
2. Isolation and enumeration of halophiles from saline environment
3. Isolation of bacteria from diversified habitats to demonstrate antagonism, commensalism and synergism
4. Isolation of *Cyanobacteria* and fungi from different habitats
5. Identification of fungi by staining techniques
6. Microscopic observation of soil algae and Protozoa
7. Winogradsky's column to demonstrate microbial diversity
8. Visit and observe any nearby unique ecosystems to understand the role of microorganisms
9. Demonstration of the great plate count anomaly

References:

1. Aneja, K.R. (2001). Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd., New Delhi.
2. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
3. Burns, R.G. and Slater, J.H. (1982). Experimental Microbiology and Ecology. Blackwell Scientific Publications, USA.
4. Peppler, I.L. and Gerba, C.P. (2004). Environmental Microbiology – A Laboratory Manual. Academic Press. New York.
5. Gupte, S. (1995). Practical Microbiology. Jaypee Brothers Medical Publishers Pvt. Ltd.
6. Kannan, N. (2003). Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers. Panima Publishing Co., New Delhi.
7. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
8. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, SriPadmavathi Publications, Hyderabad

Course Outcomes:


The student will be able to


MB231.CO1. Understand and appreciate the diversity of microorganism and conservation, for the substance of life on Earth in general.

MB231.CO1. Able to classify and compare various bacteria

MB231.CO1. Aware of general characteristics of protozoa, fungi, algae and their economic importance

MB231.CO1. Appreciate the microbial communities inhabiting a multitude of habitats and occupying a wide range of ecological habitats.


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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B. Sc II YEAR SYLLABUS (2023 onwards)
SUBJECT-MICROBIOLOGY
III SEMESTER (4 HPW-4Credits)
MB331 Paper III Food and Environmental Microbiology

OVERALL COURSE OBJECTIVE:

Explain role of microbes in food industry, bioremediation and Sewage treatment methods.

UNIT WISE COURSE OBJECTIVES:

- COb1.** Discuss the significance of fermented foods and microbes as food
- COb2.** Elucidate the importance of food quality control.
- COb3.** Describe the role of microbes in the area of environmental pollution.
- COb4.** Explain the role of PGPR (Plant Growth promoting Microorganisms) and Bioremediation.

UNIT-1 Fermented Foods & Microbes as food 15hrs


Introduction to fermented foods	1hr
Health benefits of fermented foods	1hr
Concept of probiotics and prebiotics	2hr
Cereal based fermented foods- Idly & Bread	2hr
Fermented vegetables- processing and fermentation of Sauerkraut and Pickles	2hr
Microbes in milk and their significance	1hr
Fermented milk products- Yoghurt, Bulgarian milk, Kefir and Cheese	4hr
Microorganisms as food- Single cell protein, Edible mushrooms	2hr


UNIT-2 Microbial Food Spoilage and Quality Control 15 hrs

Microbial spoilage of milk, meat, fruits and canned foods	3hr
Microbial food Poisoning, risks & hazards	2hr
Mycotoxins and their toxicity	1hr
Food preservation methods and food safety issues	4hr
Food quality- importance and functions of quality control	2hr
Microbiological analysis of food-Screening, enumeration and detection of pathogens.	3hr

UNIT-3 Air and Water Microbiology 15 hrs

Microorganisms in air and their importance- A brief account	3hr
Microorganisms in water pollution- waterborne pathogenic microorganisms and their transmission	3hr
Sanitary quality of water- Coliform test, MPN	3hr
Water pollution due to degradation of organic matter- Aerobic and Anaerobic sewage treatment.	6hr


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UNIT - 4 Soil Microbiology

15 hrs

Soil properties - Physical, chemical and biological	2hr
Soil microorganisms- methods of enumeration and activity of microbes in soil	3hr
Microbes and plant interactions- Rhizosphere, Phyllosphere, Mycorrhizae	3hr
Introduction to microbial bioremediation- microbial degradation of organic pollutants	3hr
Biogeochemical cycles- Carbon cycle, Nitrogen cycle	4hr

TEXT AND REFERENCE BOOKS

1. Casida. L. E. Industrial Microbiology (1999).10th edition. New Age International Publication, NewDelhi.
2. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, AdityaBooks (P) Ltd. New Delhi.
3. Doyle, M.P., Beuchat, L.R. and Montville, T.J. (1997). Food Microbiology: Fundamentals andFrontiers. ASM Press, Washington D.C., USA.
4. Frazier, W.C. and Westhoff, D.C. (1988). Food Microbiology, McGraw-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, NewDelhi.
8. Paul, E.A. and Clark, F.E. (1989). Soil Microbiology and Biochemistry, Academic Press, USA.
9. Lynch, J.M. and Poole, N.J. (1979). Microbial Ecology - A Conceptual Approach, BlackwellScientific Publications, USA
10. Alexander Martin. Soil Microbiology (2001).
11. Reddy, M.N., Uma Maheshwara Rao., Naga Padma, P., Raghuram, M, Charitha Devi, M. (2012) Applied Microbiology, Telugu Akademy.

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III SEMESTER PRACTICALS (3 HPW-1Credit)
MB331 P Paper III Food and Environmental Microbiology

1. Isolation and identification of probiotic bacteria and yeast
2. Determination of microbiological quality of milk by MBRT method
3. Preparation of fermented foods: Yoghurt, Sauerkraut
4. Microbiological analysis of food- Isolation, Enumeration & Detection of pathogens
5. Extraction of mycotoxins from contaminated grains/ food
6. Detection of Mycotoxins
7. Isolation of microorganisms from air by impingement method
8. Microbiological examination of water by Coliform test
9. Determination of biological oxygen demand
10. Isolation & Enumeration of microbes from Rhizosphere and Phyllosphere

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.

COURSE OUTCOMES:

The Student will be able to

MB331.CO1. Understand the process fermented food production

MB331.CO2. Analyze the microbiological quality of food samples

MB331.CO3. Evaluate the sanitary quality of air and water.

MB331.CO4. Summarize the role of microbes in plant growth and bioremediation

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B.SC II YEAR SYLLABUS (2023 onwards)

SUBJECT-MICROBIOLOGY

III SEMESTER (2 HPW-2Credits)

SE331 A: MUSHROOM CULTIVATION

OVERALL COURSE OBJECTIVE:

To provide theoretical and practical details of mushroom cultivation.

COURSE OBJECTIVES:

COB1. Explain mushroom cultivation method

COB2. Outline methods of mushrooms preservation

Unit-1

15 hrs

Introduction to mushroom cultivation. Importance and history of mushroom cultivation in India.

Global status of mushroom production.

Food value of mushroom.

Unit-2

15 hrs

Steps in mushroom cultivation

- Selection of site and types of mushroom
- Mushroom farm structure, design layout
- Principle and techniques of compost and composting
- Principle of spawn production
- Casing and crop production
- Harvesting and marketing
- Pest and pathogens of mushrooms
- Post-harvest handling and preservation of mushrooms

REFERENCES:

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 OUTCOMES:

SE 331A. CO1. Summarize mushroom cultivation in methods.

SE 331A. CO2. Tabulate the nutritional value of mushrooms


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III SEMESTER (3 HPW-2Credits)

SE331 B: MICROBIAL PRODUCTS - BIO-FERTILIZER & BIO-PESTICIDES

OVERALL COURSE OBJECTIVE:

To provide theoretical and practical details of various Biofertilizers and Biopesticides.

COURSE OBJECTIVES:

COb1. Explain about various Biofertilizers

COb2. Outline methods of production of Biofertilizers and Biopesticides

UNIT-1

15 hrs

Biofertilizers: General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.

Symbiotic N₂ fixers: Rhizobium - Isolation, characteristics, inoculum production and field application.

Cyanobacteria as bio-fertilizers- Isolation, characterization, mass multiplication, mass inoculums production and field application

A brief account on Phosphate Solubilizers and Mycorrhizal Bio-fertilizers

UNIT-2

15 hrs

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

REFERENCES


1. Eldor A. Paul. Soil Microbiology. Ecology and Biochemistry. VI Edition: Academic Press, (2007).
2. Eugene L. Madsen. Environmental Microbiology: From Genomes to Biogeochemistry. Edition, Wiley Blackwell Publishing. (2008).
3. Agrios, G. N. Plant pathology. Harcourt Asia Pvt. Ltd. (2000).
4. Shalini Suri. Biofertilizer and Biopesticide Aph Publishing Corporation (2011)


COURSE OUTCOMES

SE 331B. CO1. Students will develop a very good understanding of practical aspects of production of Biofertilizers.

SE 331B. CO2. Students will develop a very good understanding of practical aspects of the production of Biopesticides/bioinsecticides


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SUBJECT-MICROBIOLOGY

IV SEMESTER (4 HPW-4Credits)

MB 431 Paper IV Medical Microbiology and Immunology

Overall Course Objective: Describe various infectious diseases in humans and study of immune responses against infections.

UNIT WISE COURSE OBJECTIVES:

COB1. Discuss the role of microbiota in human health and disease

COB2. Outline transmission and pathogenesis of various viral and parasitic diseases

COB3. List components of immune systems and types of immunity.

COB4. Explain immunological disorder and antigen-antibody reactions

Unit-1

Medical Bacteriology

15hrs

Microbiota of human body

1hr

Infection; Properties of pathogenic microorganisms

2hr

Airborne diseases- Tuberculosis

3hr

Food and waterborne diseases- Cholera, Typhoid

2hr

Contact diseases- Syphilis, Gonorrhoea

3hr

General account on Nosocomial infections- *Staphylococcus aureus*; MRSA & *Pseudomonas*

3hr

Antimicrobial Resistance

1hr

Unit-2 Medical Virology and Parasitology

15 hr

Water borne diseases- Poliomyelitis

2hr

Insect borne diseases- Malaria, Dengue, Filariasis

5 hr

Zoonotic diseases- Rabies, Toxoplasmosis

2hr

Contact Diseases- Hepatitis B, HIV

3hr

Air borne diseases- Influenza, SARS-CoV 2 (COVID-19)

3hr

Unit-3 Introduction to Immunology

15 hrs

Concept of haematopoiesis

1hr

Cells of immune system

2hr

Organs of immune system- primary and secondary lymphoid organs,

Structure and classification of antigens, Factors affecting antigenicity

3hr

Antibodies- Basic structure, types, properties and functions of immunoglobulin

2hr

Types of immunity- innate and acquired, humoral and cell mediated immune responses.

3hr


Vaccines and its types

3hr

Major Histocompatibility complex- Class I and II

1hr


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Unit-4 Immunological Disorders and Ag-Ab reactions **15 hrs**

Types of hypersensitivity- immediate and delayed	3hr
Systemic and localized autoimmune disorders	3hr
Complement pathways- classical and alternate	2hr
Types of Antigen- Antibody reactions- Agglutination, precipitation, neutralization, complement fixation tests. Labelled antibody based techniques- ELISA, RIA and Immunofluorescence	4hr
Polyclonal and monoclonal antibodies production and application	3hr

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, New Delhi.
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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IV SEMESTER PRACTICALS (3 HPW-1Credit)
MB 431P Paper IV Medical Microbiology and Immunology -Practicals

1. Determination of Blood grouping and Rh typing
2. Total count of RBC and WBC
3. Differential count of Blood leucocytes
4. WIDAL test for typhoid(slide test) by Ag-Ab reactions
5. VDRL test for typhoid(slide test) by Ag-Ab reactions
6. Ouchterlony double diffusion test
7. Separation of serum and plasma
8. IMVIC test- Indole test, methyl red test, VogesProskauer test, Citrate utilization test
9. Oxidase test
10. Catalase test
11. Antibiotic sensitivity test- disc diffusion method
12. Observation of Malarial Parasite

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. 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 Graw Hill Publishing Co. Ltd., New Delhi.
6. Cappuccino (2000), Microbiology Lab manual, Oxford University Press

COURSE OUTCOMES:

The student will be able to

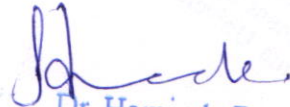
MB 431. CO1. Summarize on various infectious diseases

MB 431. CO2. Interpret the disease based on symptoms and predict the diagnosis

MB 431. CO3. Evaluate the antimicrobial activity of antibiotics experimentally.

MB 431. CO4. Summarize methods of serological diagnosis.


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B. Sc MICROBIOLOGY (CBCS STRUCTURE)
SE 431A: CLINICAL MICROBIOLOGY
IV SEMESTER (2 HPW-2Credits)

OVERALL COURSE OBJECTIVE:

Discuss the techniques and procedures in diagnosis of an infectious disease

UNIT WISE COURSE OBJECTIVES

This paper provides

COB1. Introduction to infectious diseases, specimen collection and media used to culture bacterial pathogens

COB2. Conceptual study of Kit based serological detection and Molecular methods of various human pathogens

Unit-1:

15Hrs

Overview of infectious diseases-bacterial, viral, fungal, parasitic

Diagnostic Microbiology: Collection of clinical specimens and their processing -blood sample, Separation of blood components. Sputum, CSF, Stool, Urine, Swabs, Biopsy

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, Sabarouds Medium Distinct colony properties of various bacterial pathogens.

Unit-2


15Hrs

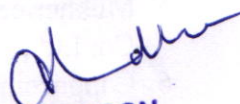
Kit based serological detection of Pathogens - Typhoid, Dengue, HIV, Swine flu, Syphilis.


Molecular methods of Diagnosis - PCR, Western blotting


Testing for Antibiotic sensitivity in Bacteria


Monitoring of Sanitation in Community – Biohazard Disposal.


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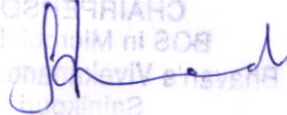
1. Jawetz. Medical Microbiology and Immunology (2000), 6th Edition. Mc Graw Hill, New York.
2. Greenwood, David. Medical Microbiology (1997).15th Edition. Churchill Livingstone, New Delhi.
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COURSE OUTCOMES

SE 431A. CO1. Acquaint knowledge on methods of clinical specimen collection, processing and culturing.

SE 431A. CO2. Understand various serological and molecular techniques to detect pathogenic Infections.


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**B. Sc MICROBIOLOGY (CBCS STRUCTURE)
IV SEMESTER (2 HPW-2Credits)**

**SE431 B: INTERACTIONS WITH ENTREPRENEURS IN MICROBIAL
TECHNOLOGY AND STARTUPS**

Overall Course Objective:

Facilitate students to develop entrepreneurial skills in the field of microbial biotechnology


Submission of a project report by students after interaction with industry experts/enterprises/ Start-up companies in the field of Microbial Technology. The report must include novel ideas, innovations in production, development and commercialization of microbial products.


COURSE OUTCOMES:


By the conclusion of this course, the students

SE 431B. CO1. Understand the potential for commercialization in the field of Microbial Technology.

SE 431B. CO2. Design strategies for initiating microbial product based startup and development of commercial enterprise.


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B.Sc. III YEAR SYLLABUS (2023 onwards)
SUBJECT -MICROBIOLOGY
V SEMESTER (4 HPW-4Credits)
MB531 Paper MOLECULAR BIOLOGY & MICROBIAL GENETICS**

Overall course objective:

To discuss DNA replication, transcription, translation and recombinant DNA technology

Unit Wise Course Objectives:

- COb1:** Describe the structure of DNA and explain mechanisms of DNA replication, transcription and translation
- COb2:** Categorise types of mutagens and summarize DNA repair mechanisms
- COb3:** Discuss gene expression and regulation
- COb4:** Explain various steps involved in recombinant DNA technology

UNIT-1: MICROBIAL GENETICS 15hr

- DNA and RNA as genetic material 4hr
- Structure of DNA –Watson and Crick model 2hr
- Extra chromosomal genetic elements- Plasmids and Transposons 4hr
- Replication of DNA-Semi conservative mechanism 5hr


UNIT-2: MUTATIONS AND GENETIC RECOMBINATION 15hr

- Mutations-Spontaneous and induced 2hr
- Base pair changes, Frameshift, Deletion, Inversion, Tandem duplication, Insertion 3hr
- Various physical and chemical mutagens 4hr
- Outline of DNA damage and repair mechanism 3hr
- Brief account on gene transfer among bacteria –Transformation, Transduction and Conjugation 3hr

UNIT-3-GENE EXPRESSION 15hr

- Concept of gene – Muton, Recon and Cistron 2hr
- One gene-one enzyme, One gene-one Polypeptide, One gene-one product Hypothesis. 1hr
- Types of RNA and their functions 2hr
- Outline of RNA transcription in Prokaryotes 3hr
- Genetic code, Structure of Ribosomes and brief account on Protein synthesis 2hr
- Type of genes –Structural, Constitutive, Regulatory 2hr
- Operon concept. Regulation of gene expression in bacteria –Lac Operon. 3hr

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UNIT-4-RECOMBINANTDNA TECHNOLOGY

15hr

Basic principles of genetic engineering- Restriction endo-nucleases,
DNA polymerases and Ligases, Vectors

4hr

Outline of gene cloning methods. Genomic and cDNA libraries

5hr

General account on application of genetic engineering in industry,
agriculture and medicine

4hr

Introduction to concept of Genome editing- CRISPR-Cas

2hr


References:


1. Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
2. Crueger, W. and Crueger, A. (2000). Biotechnology: A Text Book of Industrial Microbiology, Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
4. Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
5. Strickberger, M.W. (1967). Genetics. Oxford & IBH, New Delhi.
6. Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). Principles of Genetics. 5th Edition. McGraw Hill, New York.
7. Glazer, A.N. and Nikaido, H. (1995). Microbial Biotechnology—Fundamentals of Applied Microbiology, W.H. Freeman and company, New York.
8. Old, R.W. and Primrose, S.B. (1994) Principles of Gene Manipulation, Blackwell Science Publication, New York.
9. 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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V SEMESTER PRACTICALS (3 HPW-1Credit)
MB531 P Paper V Molecular Biology and Microbial Genetics (3HPW-Credits-1)

1. Colorimetric estimation of proteins by Biuret method.
2. Colorimetric estimation of DNA by Diphenyl amine method.
3. Colorimetric estimation of RNA by Orcinol method.
4. Extraction of genomic DNA
5. Extraction of plasmid DNA
6. Separation and observation of genomic DNA by Agarose gel Electrophoresis
7. Separation and observation of plasmid DNA by Agarose gel Electrophoresis

References:

1. Experiments in Microbiology by K.R. Aneja.
2. Gopal Reddy.M., Reddy. M.N., SaiGopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.
3. Dubey,R.C. and Maheshwari, D.K. Practical Microbiology, S. Chand and Co New Delhi.
4. Alcamo,I.E. Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers, USA.
5. Mahy,B.W.J. and Kangro, H.O. Virology –Methods Manual Academic Press, USA.
6. Bursleson etal Virology– A Laboratory Manual. AcademicPress,USA.

Course Outcomes:

At the end of the course student will be able to


MB531.CO1: Summarize the mechanisms of replication, transcription and translation

MB531.CO2: Prepare a mind map of types of mutagens and their mechanism of action

MB531.CO3: Extract DNA from bacteria and estimate molecular weight of isolated DNA

MB531.CO4: Prepare a pictorial representation of various steps involved in Recombinant DNA technology and present applications of Recombinant DNA technology in various fields


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B.Sc. III YEAR SYLLABUS (2023 onwards)
SUBJECT -MICROBIOLOGY
V SEMESTER (4 HPW-4Credits)
MB531 A Paper MICROBIAL OMICS**

Overall course objective:

To know the basics of omics, proteomics, genomics and bioinformatics

Unit Wise Course Objectives:

COb1: Understand the concept of omics.

COb2: Explain the methods of proteomics.

COb3: Learn the techniques in genomics.

COb4: Outline the basics of bioinformatics.

UNIT1: INTRODUCTION TO OMICS

15hr

Introduction to molecular biology. Structure of DNA, RNA.

3hr

Multiomics approach for analysis of Microbial biology:

5hr

Genomics, Transcriptomics (RNA-Seq), Proteomics, Metabolomics, Metagenomics and their applications.

2hr

Basic Concepts in high throughput sequencing or Next-Generation Sequencing methods for use in food-microbiology, diagnostics and Human health.

5hr

UNIT2: PROTEOMICS

15hr

Protein structure – Different levels of protein structure, Protein Folding and unfolding.

4hr

Protein secondary and 3D structure prediction methods.

3hr

X-ray crystallography, NMR and homology modeling.

3hr

Protein microarrays-Protein Markers, Clinical Proteomics,

Protein engineering, Proteomic strategies in Cancer, Prions.

5hr

UNIT3: GENOMICS

15hr

An introduction of functional genomics; Site-directed mutagenesis, Transposon mutagenesis, DNA microarray, RNA interference, and Chromatin immune precipitation.

6hr

Genome annotation, Applications of functional genomics in vaccine And drug designing.

4hr

Genome editing tools such as CRISPR/Cas9.

2hr

Databases of Microbial Genomics; Microbial genome projects

3hr

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UNIT 4: BIOINFORMATICS

15hr

Introduction to Bioinformatics and Molecular Databases,	1hr
Primary Databanks – NCBI, EMBL, DDBJ;	2hr
Secondary Databases – UNIPROT;	1hr
Structural Database –PDB; Database similarity search (FASTA, BLAST)	2hr
Alignment: Pairwise and Multiple sequence alignment;	2hr
Whole genome sequence; Genome Annotation and Gene Prediction;	4hr
Primer Designing; Phylogenetic analysis and Tree construction.	3hr

References:

1. Principles of Protein structure, Schultz, G. E., and Schirmer, R. H. Dr. ShaktiSahi
2. Proteomics, Daniel C. Leibler
3. Microbial Proteomic, MarjoPoutanen
4. Proteins: Structures and Molecular Principles (2d ed.), TE Creighton
5. Organic spectroscopy, William Kemp
6. Proteome Research: Two-Dimensional Gel Electrophoresis and Detection Methods (Principles and Practice), T. Rabilloud (Editor), 2000, Springer Verlag
7. Introduction to Protein Architecture: The Structural Biology of Proteins, M.Lesk, 2001, Oxford University Press.
8. Molecular Biotechnology by Bernard R. Glick and Jack J Pasternak
9. DNA Microarrays Ed. M. Schena.

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V SEMESTER PRACTICALS (3 HPW-1Credit)
MB531A P Paper V Microbial Omics (3HPW-Credits-1)

1. Protein isolation from *E.coli*.
2. Sequence analysis of proteins (by BLAST, ClustalW and Phylip).
3. Protein structure prediction by Homology modeling.
4. Isolation of Genomic DNA from *E.coli* and its demonstration by OD and Agarose electrophoresis.
5. Isolation of plasmid DNA from *E.coli* and its demonstration by OD and Agarose electrophoresis.
6. DNA molecular size determination.
7. Primer designing using online software.
8. PCR amplification of genes and detection of amplicon by Agarose gel electrophoresis.

References:

1. Molecular biotechnology by Chanarayppa
2. Methods in Molecular Cloning by Sambrook.
3. Gopal Reddy, M., Reddy, M.N., SaiGopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.

Course Outcomes:

At the end of the course student will be able to

MB531A. CO1: Discuss the concept of omics.

MB531A. CO2: List the methods to study proteomics.

MB531A. CO3: Outline the methods in genomics.

MB531A. CO4: Execute the applications of bioinformatics.


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B.Sc. III YEAR SYLLABUS (2023 onwards)
SUBJECT -MICROBIOLOGY
V SEMESTER (4 HPW-4Credits)
GE 531 MICROBIOLOGY AND HUMAN HEALTH**

Overall course objective:

To explain the relevance of microorganisms in daily life

Unit Wise Course Objectives:

GE 531.COb1: Overview on history of microbiology, cultivation and staining of microbes.

GE 531.COb2: Study of various infectious diseases.

GE 531.COb3: Learn the significance of immune system.

GE 531.COb4: Understand the safe disposal of industrial and Biomedical waste.

UNIT-1: INTRODUCTION

15hr

Historic developments of Microbiology

1hr

Contributions of Van Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch.

4hr

Types of microorganisms

2hr

Morphological characteristics of bacteria, staining

3hr

Cultivation methods of bacteria, Culture Media used for the growth of microorganisms.

4hr

UNIT-2: MICROORGANISMS: GOOD AND BAD

15hr

Microorganisms related to human health.

1hr

Normal microbial flora, Human microbiome concept.

4hr

Bacterial disease: Typhoid, Tuberculosis, Syphilis

10hr

Viral diseases: Flu, MERS, SARS, CoV-2, HIV

Insect borne: Malaria and Dengue

UNIT-3: IMMUNITY AND HEALTH

15hr

Introduction to immune system

1hr

Understanding the terms: Disease, Infection, Pathogenicity, Prophylaxis, Host resistance.

4hr

Innate immunity and Acquired immunity.

4hr

Epidemics, Endemics and Pandemics.

1hr

Importance of probiotics and vaccines for human health.

5hr

UNIT-4: WASTE MANAGEMENT AND HEALTH HAZARDS

15hr

Health hazards associated with dumpage of Industrial and Biomedical waste.

3hr

National and international guidelines for the disposal of waste.

1hr

Guidelines of Central Pollution Control Board (CPCB).

1hr

Safe disposal and pretreatment of wastes.

5hr

Mechanical and chemical treatment of the waste. Autoclaving, incineration.

5hr

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References:

1. Michael J.Pelczar,Jr. E.C.S. Chan, NoelR.Krieg Microbiology Tata Mc Graw-Hill Publisher.
2. Prescott,M.J., Harly,J.P. and Klein Microbiology 5th Edition,WCB Mc GrawHill, NewYork.
3. Madigan,M.T., Martinkl,J.MandParker, j.BrochBiologyofMicroorganism,9thEdition,MacMillan Press, England.
4. Dube,R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.
5. Ananthanarayanand Panikar. Text book of Microbiology. Universities Press.

Course Outcomes:

At the end of the course student will be able to


GE 531. CO1: Learn the outlines of history and techniques in microbiology.

GE 531. CO2: Classify the beneficial and non-beneficial microbes.


GE 531. CO3: Acquire the knowledge on immunity and health.


GE 531. CO4: Summarize on the methods on waste management.


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B.Sc. III YEAR SYLLABUS (2023 onwards)
SUBJECT -MICROBIOLOGY
VI SEMESTER (4 HPW-4Credits)
MB631 INDUSTRIAL MICROBIOLOGY**

Overall course objective:

To discuss industrially important microbes and its products

Unit Wise Course Objectives:

COb1: Describe the methods for Bioprospecting industrially important microbes.

COb2: Provide outlines of design of fermentor and optimization of fermentation conditions.

COb3: Elaborate various types of fermentations.

COb4: Discuss various microbial products.

UNIT-1: MICROORGANISMS AND SELECTION

15hr

Introduction to Industrial Microbiology

2hr

Microorganisms of industrial importance-Yeast, Molds, Bacteria, Actinomycetes.

2hr

Screening and selection of industrially useful microbes.

4hr

Steps to maintain seed culture and inoculation strategies for enhanced product yield.

3hr

Strain improvement strategies.

2hr

Immobilization methods – Adsorption and Entrapment.

2hr

UNIT-2: FERMENTATION

15hr

Design of Bioreactor. Limitations of bioreactor

2hr

Fermentation equipment and its use. Agitation, Aeration, Antifoam, pH and Temperature control.

4hr

Physico-chemical standards used in bioreactors.

3hr

Type of fermentor, Stages of fermentation process. -Raw materials used in fermentation industry and their processing, Inoculation media and fermentation media; Downstream processing.

6hr

UNIT-3: TYPES OF FERMENTATION

15hr

Types of fermentations: Batch, Fed batch, continuous types

4hr

Submerged, Surface, Solid state, Dual and Multiple fermentations

4hr

Advantages and disadvantages of Solid substrate and Liquid fermentations.

3hr

Common Microbial fermentation- Alcohol and Lactic acid fermentation.

4hr

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UNIT-4: MICROBIAL PRODUCTS

15hr

Industrial products derived from microbes: Vitamin-B12	3hr
Vaccines: Recombinant vaccines (Hepatitis B)	2hr
Production of alcoholic beverages (Ethanol and Beer)	3hr
Biofuels (Biogas) Enzymes (Amylase), Antibiotics (Penicillin), Amino acids (Glutamic acid), Organic acid (Citric acid).	6hr
Disposal of industrial waste.	1hr


References:


1. Patel, A.H.(1984). Industrial Microbiology, Mac Milan India Ltd., Hyderabad.
2. Cassida,L.E.(1968).IndustrialMicrobiology, WileyEasternLtd.&NewAgeInternational Ltd., New Delhi.
3. Crueger, W.andCrueger,A.(2000).Biotechnology– ATextBookofIndustrialMicrobiology, Panima Publishing Corporation, New Delhi
4. Reedy, G. (Ed.) (1987). Prescott & Dunn’s Industrial Microbiology, 4th Edition, CBS Publishers & Distributors,New Delhi.
5. Reddy,S.R. and SingaraCharya,M.A.(2007).ATextBookofMicrobiology- AppliedMicrobiology.Himalaya Publishing House, Mumbai.
6. Singh,R.P. (2007) Applied Microbiology. Kalyani Publishers, New Delhi


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VI SEMESTER PRACTICALS (3 HPW-1Credit)
MB631 P Paper V Industrial Microbiology (3HPW-Credits-1)

1. Screening for amylase producing microorganisms.
2. Screening for organic acid producing microorganisms.
3. Estimation of Ethanol by potassium dichromate method.
4. Production of Citric acid by submerged fermentation.
5. Estimation of Citric acid by titrimetric method.
6. Microbial production of Penicillin.
7. Bacterial slides-*Bacillus*, *Lactobacillus*, *Yeast*, *Aspergillus*, *Penicillium*.

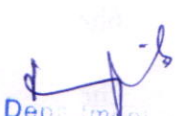
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1. Patel, A.H.(1984). Industrial Microbiology, Mac Milan India Ltd., Hyderabad.
2. Cassida, L.E.(1968). Industrial Microbiology, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
3. Crueger, W. and Crueger, A.(2000). Biotechnology – Text Book of Industrial Microbiology, Panima Publishing Corporation, New Delhi
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6. Singh, R.P. (2007). Applied Microbiology. Kalyani Publishers, New Delhi.
7. Demain, A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology and Biotechnology, ASM Press, Washington, D.C., USA.

Course Outcomes:

At the end of the course student will be able to

- MB631. CO1:** Isolate microbes producing industrially important compounds.
MB631. CO2: Elucidate steps of various microbial fermentation procedures.
MB631. CO3: List the various types of fermentations.
MB631. CO4: Explain the production of various microbial products.


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**SCHEME FOR CHOICE BASED CREDIT SYSTEM IN
B.Sc. MICROBIOLOGY
B.Sc. III YEAR SYLLABUS (2023 onwards)
SUBJECT - MICROBIOLOGY
VI SEMESTER (4 HPW-4Credits)
MB631 A Paper PHARMACEUTICAL MICROBIOLOGY**

Overall course objective:

To elaborate on various chemotherapeutic agents, their mode of action, genetics of resistance development in microbes and methods to determine antibiotic sensitivity.

Unit Wise Course Objectives:

COb1: Discuss the concepts of chemotherapy and anti-microbial agents.

COb2: Present the concept of antibiotics and its uses.

COb3: Elaborate various types of fermentations.

COb4: Review the methods in microbiological assays.

UNIT-1: INTRODUCTION TO CHEMOTHERAPY 15hr

History of chemotherapy–Plants and arsenicals as therapeutics 3hr

Paul Ehrlich and his contributions 3hr

Selective toxicity and target sites of drug action in microbes. 4hr

Development of synthetic drugs–Sulphanamides, antitubercular compounds, nitrofurans, nalidixic acid, metronidazole group of drugs. 5hr

UNIT-2: ANTIBIOTICS 15hr

The origin, development and definition of antibiotics as drugs 2hr

Types of antibiotics and their classification. 3hr

Non-medical uses of antibiotics. 2hr

Principles of chemotherapy – Clinical and lab diagnosis, sensitivity testing, choice of drug, dosage, route of administration, combined/ mixed multi drug therapy, control of antibiotic/drug usage. 8hr

UNIT-3: DRUG RESISTANCE 15hr

The phenomenon of drug resistance, Clinical basis of drug resistance, Biochemistry of drug resistance, Genetics of drug resistance in bacteria. 6hr

Mode of action of important drugs –Cell wall inhibitors (Beta lactam – e.g., Penicillin), 2hr

Membrane inhibitors (Polymyxins), macromolecular synthesis inhibitors (Streptomycin) 5hr

Antifungal antibiotics (Nystatin) 2hr

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UNIT-4: MICROBIOLOGICAL ASSAYS **15hr**

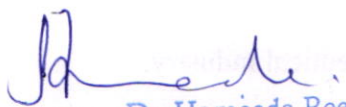
Assays for growth promoting substances, nutritional mutants and their importance.	5hr
Drug sensitivity testing methods and their importance.	4hr
Assay for antibiotics – Determination of MIC, the liquid tube assay, Solid agar tube assay, Agar plate assay (disc diffusion, agar well and cylinders cup method).	6hr

References:

1. Ananthanarayan, 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. Biochemistry of antimicrobial action. Franklin, DJ. And Snow, GA. Pub: Chapman & Hall. Antibiotics and Chemotherapy. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Publ: Churchill Livingstone.
4. Antibiotics. Lancini, G. and Parenti, F. publ: Springer-Verlag. The Molecular Basis of antibiotic action. Ga. e, EF. Etal. Publ: Wiley, New York. Antimicrobial Drug action. Williams, RAD., Lambart, PA. & Singleton, P. Pub: BiosSci. Microbiological Assays. Hewitt.



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VI SEMESTER PRACTICALS (3 HPW-1Credit)

MB631A P Paper VI Pharmaceutical Microbiology (3HPW-Credits-1)

1. Tests for disinfectants (Phenol coefficient/RWC).
2. Determination of antibacterial spectrum of drugs/antibiotics.
3. Chemical assays for antimicrobial drugs.
4. Testing for antibiotic/drug sensitivity/resistance.
5. Determination of MIC for antimicrobial compounds.
6. Microbiological assays for antibiotics (Liquid tube assay, Agar tube assay, Agar plate assays).

References:

1. Disinfection, sterilization and preservation. Block, S.S. (ed). Lea and Febigor, Baltimore
2. Pharmaceutical Microbiology. Hufe, W.B. and Russel, AD. Blackwell Scientific, Oxford
3. Inhibition and destruction of microbial cell by Hugo, WB. (ed). Pub: Academic Press, NY
4. Manual of Clinical Microbiology. Lennette, EH. (ed). Pub: American Society for Microbiology, Washington.
5. Principles and Practices of disinfection. Russell, AP., Hugo, WB., and Ayliffe, GAJ. (eds). Publ. Blackwell Sci.
6. Biochemistry of antimicrobial action. Franklin, DJ. And Snow, GA. Pub: Chapman & Hall.
7. Antibiotics and Chemotherapy. Garrod, L.P., Lambert, HP. And C'Grady, F. (eds). Publ: Churchill Livingstone.
8. The Molecular Basis of antibiotic action. Ga. e, EF. Et al. Publ: Wiley, New York.
9. Antimicrobial Drug action. Williams, RAD., Lambart, PA. & Singleton, P. Pub: Bios Sci.

Course Outcomes:

At the end of the course student will be able to

MB631A.CO1: Discriminate the mode of action of various antimicrobial agents.

MB631A.CO2: Apply practical skills and determine the antimicrobial spectrum of antibiotics.

MB631A.CO3: Test the microbial drug resistance.

MB631A.CO4: Perform microbiological assays in pharmaceutical industry.

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN
B.Sc. MICROBIOLOGY
B.Sc. III YEAR SYLLABUS (2023 onwards)
SUBJECT - MICROBIOLOGY
VI SEMESTER (4 HPW-4 Credits)
MB 631_O APPLIED MICROBIOLOGY AND ARTIFICIAL INTELLIGENCE

Overall course objective:

To discuss commercial applications of microbial products, artificial intelligence in biology and medicine, intellectual property rights and patenting procedures.

Unit Wise Course Objectives:

CO1: Discussion of various commercially important microbes and their multiplication methods for application in agriculture.

CO2: Understand the utility of metabolic engineering for production of microbial products.

CO3: Outline the concept of artificial intelligence for its application in biology and medicine.

CO4: Provide insights on IPR, types of patents and its filing procedures.

UNIT-I: Microbial Products for Small Scale Entrepreneurs **15hr**

Maintenance of type strains or reference strain of microorganisms:

Culture collection centres (ATCC, MTCC) 2hr

Microorganisms in agriculture. Nitrogen fixers and Phosphate solubilizers. 3hr

Biofertilizers-Production of *Azolla*, *Rhizobium* and *Mycorrhizae*. 3hr

Bio fungicides- Mass production of *Trichoderma* and *Pseudomonas*

Biopesticides-Bacterial- *Bacillus thuringensis* BT, 3hr

Fungal- *Trichoderma* and Viral- Nuclear Polyhedrosis Virus NPV 4hr

UNIT-2: Metabolic Engineering for Microbial Products **15hr**


Production of microbial pigments (Prodigiosin, Violacein, Monascin). 3hr

Bacterial and Algal carotenoids 2hr

Microorganisms for flavour and aroma production. 4hr

Biotransformation and metabolic engineering of microorganisms to produce compounds such as esters, terpenes, aldehydes, lactones, geosmin, vanillin, coumarin. 6hr


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UNIT-3: Applications of Artificial Intelligence (AI) in Biology **15hr**

Basic concepts, terminologies and workflow of AI	2hr
Role of AI in pharmaceutical industry for improvement of drug designing and medicine	3hr
AI in health diagnostics for monitoring health and disease	3hr
Importance of AI in transforming agriculture	3hr
Future prospects of AI in healthcare and research, risks involved and ethical concerns in its application	4hr

UNIT- 4: Intellectual Property Rights and Patenting **15hr**

Introduction to intellectual property rights	2hr
Patents, types, trademarks, copyrights, industrial designs and traditional knowledge	6hr
Legal protection of biotechnological inventions, world intellectual property rights	3hr
Grant of patent and patenting authorities, Introduction to patent filing procedures, Indian patent act 1970 and recent amendments	4hr

References:

1. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, Aditya Books (P) 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. Dr Parag Suresh Mahajan (2019). Artificial intelligence in healthcare, 2nd Edition.
5. R.C. Dubey and D.K. Maheswari (2010). A textbook of Microbiology. S. Chand & Co., New Delhi.

Course Outcomes:

At the end of the course student will be able to

MB 631_O.CO1: List various microbial products and their commercial applications.

MB 631_O.CO2: Understand the process of producing microbial pigments and flavours.

MB 631_O.CO3: Evaluation of concept of AI to apply in biology, medicine, diagnostics.

MB 631_O.CO4: Acquaint with IPR and patent filing procedures.

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Department of Microbiology

(B.Sc. Life Sciences) Semester –VI CBCS

W.e.f 2023-24 onwards

PROJECT WORK

Credits: 4

Paper Code: T632_PW

No of Hours: 60 (4hr/wk)

1. Basic concepts of Project planning
 - a) Selection of Project topic and defining objectives
 - b) Planning of methods/approaches

2. Guidelines for Project writing
 - Title of the Project, Name of the Student & Supervisor
 - Declaration by the Student & Supervisor
 - Objectives of the project
 - Introduction & Review of Literature
 - Methodology
 - Results and Discussion
 - Conclusion
 - References

Course Objectives:

COB 1: To select a research topic and execute the planned work using correct methodology.

COB 2: To organize the completed work in the form of project dissertation and submit.

1. Project work will involve experimental work/data collection and it has to be completed in the stipulated time by the student.
2. Students will be asked their choice for Project work at the beginning of Semester VI and all formalities of topic and mentor selection will be completed. Project work will be offered as per the expertise and infrastructural facilities available in the department.
3. Project work may be allotted to students as individual or as group project (not exceeding 5 students per group).

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4. The completed work and compiled data would be presented in the form of results and submitted in the form of a dissertation/project report.
5. Final evaluation of the project work will be through a panel consisting of internal and external examiners.
6. Guidelines provided for execution and evaluation of project work would be strictly adhered.
7. The grading would be based on evaluation of punctuality, experimental work, record keeping, academic inputs, data presentation, interpretation etc.

Course Outcome

At the end of the course, students will be able to

CO1: Plan and execute a project effectively in the stipulated time

CO2: Develop analytical skills, statistical data handling skills, paper writing and oral presentation skills.

PROJECT WORK EVALUATION SCHEME

Presentation of Thesis Dissertation to External Examiner - 70 Marks

Continuous Evaluation by the Internal Examiner - 30 Marks

Total - 100 Marks

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11th BOS

**DEPARTMENT OF MICROBIOLOGY
VALUE ADDED COURSE
STRUCTURAL BIOLOGY TECHNIQUES**

Course objectives

COB1: To discuss principles and applications of techniques involved in structural elucidation of biological molecules

COB2: To explain various computational methods for molecular visualization

Unit-1

- Basics of Structural Biology
- Introduction to X-ray Crystallography
- UV-Vis spectroscopy
- Basic Principles of NMR spectroscopy and its importance in structural elucidation
- Introduction to Cryo-Electron Microscopy (Cryo-EM)

Unit-2

- Molecular Visualizations:3D visualization using Pymol
- Molecular Dynamic Simulation
- Introduction to Structure-Based Drug Discovery (SBDD)- Docking Based Virtual Screening

Outcomes

Course Outcomes:

At the end of the course student will be able to

CO1: Understand basics of X-ray Crystallography,UV-Vis & NMR Spectroscopy and Cryo-Electron Microscopy.

CO2: Understand Structure-Based Drug Discovery.

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**DEPARTMENT OF MICROBIOLOGY
VALUE ADDED COURSE
BASICS IN NANOBIO TECHNOLOGY**

Course objectives:

- COB1:** To cover the synthesis, characterization, studying properties and processing of Nanoparticles.
- COB2:** The students will summarize the applications of Nanobiotechnology.

UNIT 1: Structure, properties and synthesis of nanoparticles

- Introduction and development of Nanobiotechnology. Classification of nanoparticles. Properties of nanoparticles- carbon nanotubes, quantum dots, metal-based nanostructures, protein-based nanostructures.
- Synthesis of nanoparticles: Physical method- High energy ball milling, Chemical method- Sol-gel, biological method- Using plant extracts and microorganisms.
- Characterization of nanoparticles- Optical methods (UV, XRD), Imaging and size (SEM, TEM), Vibrational analysis (FTIR, DLS).

UNIT 2: Applications of nanoparticles

- Nanobiotechnological applications in
 - water purification and desalination
 - Environmental bioremediation
 - Medicine- cancer therapy, drug delivery and Nano biosensors
- Ethical issues in Nanobiotechnology

Course outcomes:

- CO1:** Review the properties of nanoparticles and compare various methods involved in the synthesis of nanoparticles
- CO2:** The students will be able to learn the concepts in nanotechnology

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