

B. Sc ACADEMIC
BATCH

2022 – 25

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 2022-23)

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	Skill Enhancement Course-2 Mushroom Cultivation	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
SE431B	Skill Enhancement Course-4 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 / MB531A 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		3	3	4	3	1	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 (2020 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)	5Hrs
Principles and types of stains-simple stain, differential stain, negative stain.	4 Hrs
Structural stain-spore, capsule, flagella	
Bacterial motility - Hanging drop method	1 Hr
UNIT-2:STRUCTURE OF BACTERIA, VIRUSES & PURE CULTURE CONCEPT	15 Hrs
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, 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

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. Physical methods – Autoclave, Hot-air oven, Pressure cooker, Tyndallization, Laminar air flow, Filter sterilization 4 Hrs

Radiation methods – UV rays, gamma rays, Ultra sonic methods, Microwave. 4 Hrs

Chemical methods – Use of Alcohols, Aldehydes, Fumigants, Phenols, Halogens, and Hypochlorites.

Microbial growth – Different Phases of Growth in Batch culture. Factors influencing microbial growth. Synchronous, Continuous, Biphasic Growth. Methods for measuring microbial growth – Direct Microscopic, Viable count, Turbidometry, Biomass 7 Hrs

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 McGrawHill, 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. Anthanarayan and Panicker, Medical Microbiology.

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General Microbiology Practical

Paper I: MB131P

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. GopalReddy.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.

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 (2020 Onwards)
SUBJECT -MICROBIOLOGY
II SEMESTER (4 HPW-4Credits)
MB 231 PaperII 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. Economic Value of Biodiversity & Legal, Ethical and Conservation issues related to uses of biodiversity	6 Hrs
Classification of living organisms; Haeckel, Whittaker and Carl Woese systems	4Hrs
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)	4 Hrs
Gram negatives: Cyanobacteria and Proteobacteria, Gram positives and heterogenous members including Firmicutes, Actinobacteria, Bacteroidetes, Acidobacteria and Planctomycetes	4 Hrs

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)	5 Hrs
Protozoa - Giardia, Entamoeba and Plasmodium	4 Hrs

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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. The Great Plate count anomaly	2 Hrs
Cultivation independent methods to assess microbial diversity	2 Hrs
Preserved and perturbed microbial ecosystems, microbiome for sustainable agroecosystems, Human microbiome	5 Hrs

Suggested Books

1. Pelczar Jr. M.J. Chan. E.C.S and Kreig.N.R (2006)."Microbiology"- 5th Edition McGraw Hill Inc. New York.
2. Dávid, 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

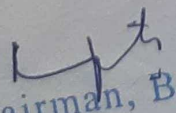
MICROBIAL DIVERSITY PRACTICALS

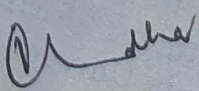
Paper-II MB231P

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

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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 sustenance of life on Earth in general.
- MB231.CO2.** Able to classify and compare various bacteria
- MB231.CO3.** Aware of general characteristics of protozoa, fungi, algae and their economic importance
- MB231.CO4.** 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 (2020 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	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
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, 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. 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, Blackwell Scientific 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.

III SEMESTER PRACTICALS (3 HPW-1Credit)
MB 331P 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. 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 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

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC II YEAR SYLLABUS (2020 onwards)
SUBJECT -MICROBIOLOGY
III SEMESTER (2 HPW-2Credits)

SE 331A: 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

Introduction to mushroom cultivation .Importance and history of mushroom cultivation in India 15 hrs
Global status of mushroom production
Food value of mushroom

Unit-2

Steps in mushroom cultivation 15 hrs
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 OUTCOME:

The student will be able to

- SE 331A.CO1** Summarize mushroom cultivation in methods.
- SE 331A.CO2** Tabulate the nutritional value of mushrooms

SE 331B: 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 Genome 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

SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B.SC II YEAR SYLLABUS (2020 onwards)
SUBJECT -MICROBIOLOGY
IV SEMESTER (4 HPW-4Credits)
MB431 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 micro biota 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
Concept of Microbiome and 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- <i>Staphylococcus aureus</i> & <i>Pseudomonas</i>	3hr
Antimicrobial Resistance	1hr
 Unit-2 Medical Virology and Parasitology	 15 hrs
Food and water borne diseases- Poliomyelitis, Amoebiasis	3hr
Insect borne diseases- Malaria, Dengue	4 hr
Zoonotic diseases- Rabies	2hr
Contact Diseases- Hepatitis B, HIV	3hr
Air borne diseases- Influenza, SARS, Corona	3hr

Unit-3	Introduction to Immunology	15 hrs
	Concept of haematopoeisis	1hr
	Cells of immune system	2hr
	Organs of immune system- primary and secondary lymphoid organs	3hr
	Structure and classification of antigens, Factors affecting antigenicity	2hr
	Antibodies- Basic structure, types , properties and functions of immunoglobulin	3hr
	Types of immunity- innate and acquired, humoral and cell mediated immune responses.	3hr
	Vaccines and its types	
	Major histocompatibility complex- class I and II	1hr
Unit-4	Immunological Disorders and Ag- Ab reactions	15 hrs
	Types of hypersensitivity- immediate and delayed	3 hrs
	Systemic and localized autoimmune disorders	3hrs
	Complement pathways- classical and alternate	2hrs
	Types of Antigen- Antibody reactions- Agglutination, precipitation, neutralization, complement fixation tests. Labeled antibody based techniques- ELISA, RIA and immunofluorescence	4 hrs
	Polyclonal and monoclonal antibodies production and application	3hrs

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

IV SEMESTER PRACTICALS (2 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

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 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.

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 examination
- Cob2.** Overview on media used to culture bacterial pathogens.
- Cob3.** Conceptual study of Kit based serological detection of various human Pathogens
- Cob4.** Insight into Molecular methods of disease diagnosis

Unit-1:

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-2

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

COURSE OUTCOMES

SE 431A.CO1 Comprehend about various microbial diseases

SE 431A.CO2 Acquaint knowledge on methods of clinical specimen collection, processing and culturing

SE 431A.CO3 Understand various serological and molecular techniques to detect pathogenic infections

SE 431A.CO4 Learn about antibiotic sensitivity

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

SE 431B: INTERACTIONS WITH ENTREPRENEURS IN MICROBIAL TECHNOLOGY AND STARTUPS

Overall Course Objective: Facilitate students to develop entrepreneurial skills in the field of microbial biotechnology

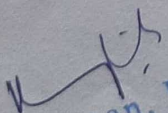
Submission of a project report by students after interaction with industry experts/enterprises/ Startup companies in the field of Microbial Technology. The report must include novel ideas, innovations in production, development and commercialization of microbial products.

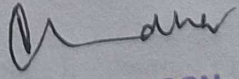
COURSE OUTCOMES:

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 (2022 onwards)
SUBJECT -MICROBIOLOGY
V SEMESTER (4 HPW-4Credits)
GE 531 Paper 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

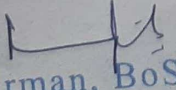
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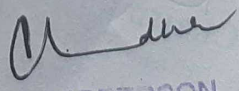
- Microorganisms related to human health. 1hr
 Normal microbial flora, Human microbiome concept. 3hr
 Bacterial disease: Typhoid, Tuberculosis, Syphilis 4hr
 Viral diseases: Flu, MERS, SARS, CoV-2, HIV 4hr
 Insect borne: Malaria and Dengue 4hr

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


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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

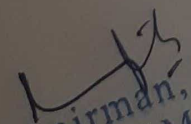
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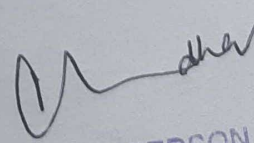
1. Michael J. Pelczar, Jr.E.C.S.Chan, NoelR.Krieg Microbiology Tata McGraw-HillPublisher.
2. Prescott, M.J., Harley,J.P.andKleinMicrobiology5thEdition,WCBMcGrawHill,NewYork.
3. Madigan, M.T.,Martinkl,J. MandParker, j.BrochBiologyofMicroorganism,9thEdition,MacMillan Press, England.
4. Dube,R.C. and Maheshwari, 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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SUBJECT -MICROBIOLOGY
V SEMESTER (4 HPW-4Credits)
MB 531 Paper MOLECULAR BIOLOGY & MICROBIAL GENETICS**

Overall course objective: To discuss DNA replication, transcription, translation and recombinant DNA technology

Unit Wise Course Objectives:

MB 531.Cob1: Describe the structure of DNA and explain mechanisms of DNA replication, transcription and translation

MB 531.Cob2: Categorise types of mutagens and summarize DNA repair mechanisms

MB 531.Cob3: Discuss gene expression and regulation

MB 531.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

Extrachromosomal 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, Frame shift, 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

3hr

and Conjugation

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	
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

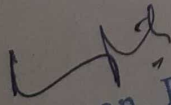
UNIT-4-RECOMBINANTDNA TECHNOLOGY

15hr

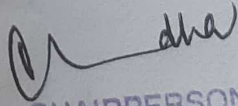
Basic principles of genetic engineering–	
Restriction endonucleases, DNA polymerases and Ligases, vectors	4hr
Outline of gene cloning methods. Genomic and cDNA libraries	5hr
General account on application of genetic engineering in industry, agriculture and medicine.	4hr
Introduction to concept of Genome editing- CRISPER-Cas	2hr

References:

1. Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, NewDelhi.
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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MOLECULAR BIOLOGY & MICROBIAL GENETICS

PRACTICALS MB531P

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. GopalReddy.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. Burleson et al Virology – A Laboratory Manual. Academic Press, 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 (2022 onwards)
SUBJECT -MICROBIOLOGY
V SEMESTER (4 HPW-4Credits)
MB 531A Paper MICROBIAL OMICS**

Overall course objective: To know the basics of omics, proteomics, genomics and bioinformatics

Unit Wise Course Objectives:

- MB 531A.COb1:** Understand the concept of omics
MB 531A.COb2: Explain the methods of proteomics
MB 531A COb3: Learn the techniques in genomics
MB 531A COb4: Outline the basics of bioinformatics

UNIT1: INTRODUCTION TO OMICS

15hr

Introduction to molecular biology. Structure of DNA, RNA.

3hr

Multi omics 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

5hr

Proteomic strategies in Cancer, Prions.

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.

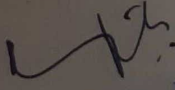
4hr

Genome editing tools such as CRISPR/Cas9.

2hr

Databases of Microbial Genomics; Microbial genome projects

3hr


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UNIT4: 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:

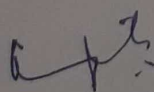
1. Principles of Protein structure, Schultz, G. E., and Schirmer, R. H.Dr. ShaktiSahi
2. Proteomics, Daniel C. Leibler
3. Microbial Proteomic, MarjoPoutanen
4. Proteins: Structures and Molecular Principles (2d ed.), TE Creighton
5. Organic spectroscopy, William Kemp
6. Proteome Research: Two-Dimensional 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.

MICROBIAL OMICS

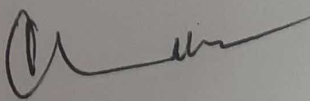
PRACTICALS MB 531AP

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. IsolationofGenomicDNAfrom*E.coli*anditsdemonstrationbyODandAgaroseelectrophoresis
5. IsolationofplasmidDNAfrom*E.coli*anditsdemonstrationbyODandAgaroseelectrophoresis
6. DNA molecular size determination
7. Primer designing using online software
8. PCR amplification of genes and detection of amplicon by Agarose gel electrophoresis


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References:

1. Molecular biotechnology by Chanarayappa
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:

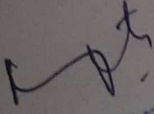
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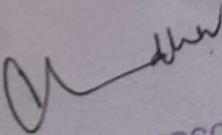
MB 531A.CO1: Discuss the concept of omics

MB 531A.CO2: List the methods to study proteomics

MB 531A.CO3: Outline the methods in genomics

MB 531A.CO4: Execute the applications of bioinformatics


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B.SC. III YEAR SYLLABUS (2022 onwards)
SUBJECT -MICROBIOLOGY
VI SEMESTER (4 HPW-4Credits)
MB 631 INDUSTRIAL MICROBIOLOGY**

Overall course objective: To discuss industrially important microbes and its products

Unit Wise Course Objectives:

- MB 631.COb1:** Describe the methods for bioprospecting industrially important microbes
MB631.COb2: Provide outlines of design of fermenter and optimization of fermentation conditions
MB 631.COb3: Elaborate various types of fermentations
MB 631.COb4: Discuss the 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

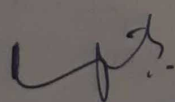
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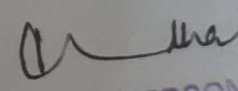
- Design of bioreactor. Limitations of bioreactor 2hr
 Fermentation equipment and its use.
 Agitation, Aeration, Antifoam, pH and Temperature control. 4hr
 Physico-chemical standards used in bioreactors. 3hr
 Type of fermenter, Stages of fermentation process. -Raw materials used in fermentation industry and their processing, Inoculation media and fermentation media; Downstream processing. 6hr

UNIT-3: TYPES OF FERMENTATON

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: vitamins-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).	
Disposal of industrial waste.	7hr

References:

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 – A Text Book of Industrial Microbiology, 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 Singara Charya, M.A. (2007). A Text Book of Microbiology - Applied Microbiology. Himalaya Publishing House, Mumbai.
6. Singh, R.P. (2007) Applied Microbiology. Kalyani Publishers, New Delhi

INDUSTRIAL MICROBIOLOGY

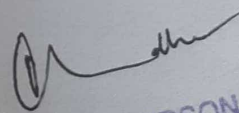
PRACTICALS MB 631P

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. Estimation of penicillin.
7. Bacterial slides - *Bacillus*, *Lactobacillus*, *Yeast*, *Aspergillus*, *Penicillium*


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References:

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3. Crueger, W. and Crueger, A.(2000). Biotechnology – A Text Book of Industrial Microbiology, Panima Publishing Corporation, New Delhi
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Course Outcomes:

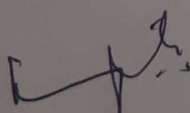
At the end of the course student will be able to

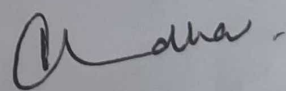
MB631.CO1: Isolate microbes producing industrially important compounds

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 (2022 onwards)
SUBJECT - MICROBIOLOGY
VI SEMESTER (4 HPW-4Credits)
MB 631A 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:

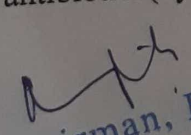
MB 631A.COb1: Discuss the concepts of chemotherapy and anti-microbial agents

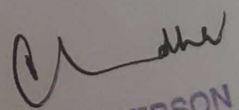
MB 631A.COb2: Present the concept of antibiotics and its uses

MB 631A.COb3: Elaborate various types of fermentations

MB 631A.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,	6hr
Genetics of drug resistance in bacteria.	
Mode of action of important drugs –	2hr
Cell wall inhibitors (Beta lactam – e.g., Penicillin)	5hr
Membrane inhibitors (polymyxins), macromolecular synthesis inhibitors (streptomycin)	2hr
Antifungal antibiotics(nystatin)	


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UNIT-4: MICROBIOLOGICAL ASSAYS

15hr

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

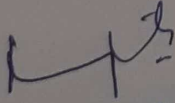
References:

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: Bios Sci. Microbiological Assays. Hewitt.

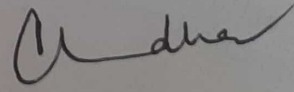
PHARMACEUTICAL MICROBIOLOGY (CBCS) PRACTICALSMB 631AP

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)


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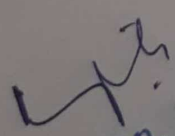
References:

1. Disinfection, sterilization and preservation. Block, S.S. (ed). Lea and Febiger, Baltimore
2. Pharmaceutical Microbiology. Hugg, 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
MB 631A.CO2: Apply practical skills and determine the antimicrobial spectrum of antibiotics
MB 631A.CO3: Test the microbial drug resistance
MB 631A.CO4: Perform microbiological assays in pharmaceutical industry


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B.SC. III YEAR SYLLABUS (2022 onwards)
SUBJECT - MICROBIOLOGY
VI SEMESTER (3 HPW-3Credits)
MB 631_O Paper APPLIED MICROBIOLOGY**

Overall course objective: To interpret the commercial applications of microbial products and explain the various disease diagnostic methods

Unit Wise Course Objectives:

MB 631_O. Cob1: Provide insights on IPR and Patent filing, various commercially important microbes and their multiplication methods

MB 631_O. Cob2: Understand the utility of metabolic engineering for production of microbial products

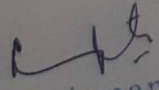
MB 631_O. Cob3: Impart practical knowledge on collection, processing and identification of clinical specimens

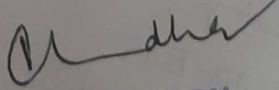
UNIT-1: MICROBIAL PRODUCTS FOR SMALL SCALE ENTREPRENEURS 15hr

Maintenance of type strains or reference strain of microorganisms:	15hr
Culture collection centers (ATCC, MTCC)	1hr
Patenting process and Basics of IPR.	2hr
Microorganisms in agriculture. Nitrogen fixers and Phosphate solubilizers.	2hr
Biofertilizers-Production of <i>Azolla</i> , <i>Rhizobium</i> and Mycorrhizae.	3hr
Bio fungicides- Mass production of <i>Trichoderma</i> and <i>Pseudomonas</i> .	3hr
Biopesticides-Bacterial- <i>Bacillus thuringensis</i> BT,	4hr
Fungal- <i>Trichoderma</i> 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 flavor and aroma production.	4hr
Biotransformation and metabolic engineering of microorganisms to produce compounds Such as esters, terpenes, aldehydes, lactones, geosmin, vanillin and coumarin.	6hr


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UNIT-3: MICROBIAL DIAGNOSTICS AND HEALTH

15hr

Diagnostic microbiology: collection, transport and culturing of clinical samples.	2hr
Preparation and use of culture media for detection of microbial pathogens.	2hr
Examination of sample by staining -Gram stain, Ziehl-Neelsen staining for tuberculosis, Blood smear for malarial parasite.	3hr
Serological methods for rapid detection of bacterial, fungal and viral pathogens.	4hr
Techniques used for the diagnosis of hospital acquired infections and multi drug resistant microorganisms	2hr
Monitoring of sanitation in community- Biohazard disposal	2hr

References:

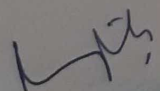
1. Stanbury, P.F., Whitaker, A. and Hall, S.J. (1997). Principles of Fermentation Technology, Aditya Books (P) Ltd. New Delhi.
2. Rangaswami, G. and Bhagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Edition, Prentice Hall of India, New Delhi.
3. Atlas, R.M. and Bartha, R. (1998). Microbial Ecology - Fundamentals and Applications, Addison Wesley Longman, Inc., USA.
4. Ananthanarayan R and Paniker CKJ (2009). Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
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6. Randhawa, VS, Mehta Gand Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd.

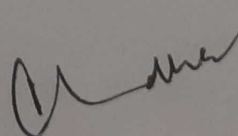
APPLIED MICROBIOLOGY

PRACTICALS MB 631 O P

3HPW-Credits-1

1. Isolation and enumeration of Rhizosphere microorganisms.
2. Isolation of Rhizobium from leguminous root nodules.
3. Staining & observation of mycorrhizal fungi.
4. Mass production of Rhizobium and Trichoderma using different carriers / substrates and methods to assay quality control of bioproducts
5. Gram's staining
6. Ziehl-Nielsen staining
7. Blood smear


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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 Maheshwari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
3. Atlas, R.M. and Bartha, R. (1998). Microbial Ecology - Fundamentals and Applications, Addison Wesley Longman, Inc., USA

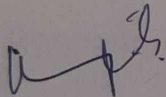
Course Outcomes:

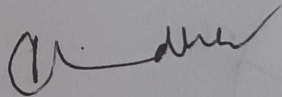
At the end of the course student will be able to

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: Perform various staining techniques and for identification of pathogens


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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)

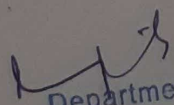
1. Basic concepts of Project planning
 - a) Selection of Project topic and defining objectives
 - b) Planning of methods/approaches
2. Guidelines for Project writing
 - Title of the Project, Name of the Student & Supervisor
 - Declaration by the Student & Supervisor
 - Objectives of the project
 - Introduction & Review of Literature
 - Methodology
 - Results and Discussion
 - Conclusion
 - References

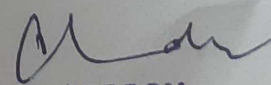
Course Objectives:

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

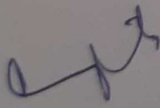
At the end of the course, students will be able to

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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