

VANITA VISHRAM WOMEN'S UNIVERSITY

(Managed By: Vanita Vishram, Surat)

1st Women's University of Gujarat



**VANITA VISHRAM
WOMEN'S UNIVERSITY**

SURAT

SCHOOL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF MICROBIOLOGY

B.Sc. MICROBIOLOGY (HONORS)

SYLLABUS

AS PER NEP-2020

W.E.F 2024-25

VANITA VISHRAM WOMEN'S UNIVERSITY, SURAT
SCHOOL OF SCIENCE AND TECHNOLOGY
Department of Microbiology
B.Sc. Microbiology Program
S.Y. B.Sc.
Semester III

MBM205-2C: Taxonomy and Systematics (T)

Credit 3T+1P

Contact Hour per week 3+2

Outline of the Course:

Course type	Theory+ Practical
Level of the Course	200-299 Intermediate level
Course category	Discipline specific course (Major)
Purpose of Course	The purpose of a bacterial taxonomy and systematics course is to teach students about the classification, identification, and evolutionary relationships of bacteria. It provides essential knowledge for understanding microbial diversity, evolution, and ecology, which are crucial for various fields such as microbiology, biotechnology, medicine, and environmental science.
Course Objectives	<ul style="list-style-type: none"> • The aim of the course is to give the students a broad knowledge regarding taxonomic ranks and geographical distribution of prokaryotes. • Course also covers knowledge about identification and classification of bacteria and other prokaryotes.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	April 2024
Pre-requisite	Elementary knowledge of Biology.
Teaching Methodology	Class Room Teaching, Discussion and Assignments, laboratory practical

Evaluation Method	Continuous and Comprehensive Evaluation (CCE) (50%)
	Semester End Evaluation (SEE) (50%)

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	Microbial Taxonomy & Diversity 1.1 Introduction and terminology related to microbial taxonomy, 1.2 Classification: Phenetic, Genotypic & Phylogenetic, Taxonomic ranks, Classical & Molecular Characterization in microbial taxonomy, 1.3 Concept & Evolution of Microbial species, Phylogenetic Tree, 1.4 Bergey's manual of systematic bacteriology	20 %	09
2	Proteobacteria and photosynthetic bacteria 2.1 <i>Alphaproteobacteria</i> (Purple Phototrophic Bacteria and Order <i>Rhizobiales</i>), 2.2 <i>Betaproteobacteria</i> (Order <i>Hydrogenophilales</i>), <i>Gammaproteobacteria</i> (Order <i>Enterobacteriales</i>), <i>Deltaproteobacteria</i> (Order <i>Bdellovibrionales</i>) <i>Epsilonproteobacteria</i>	28 %	13
3	Low and High G+C Gram positive Bacteria & Gram Negative Bacteria 3.1 Low G + C Gram Positive Bacteria (Firmicutes) - Class <i>Clostridia</i> , Class <i>Bacilli</i> , <i>Staphylococcus</i> 3.2 High G + C Gram Positive Bacteria - <i>Actinobacteria</i> (Order <i>Frankiales</i> , <i>Bifidobacteriales</i> , <i>Streptomyetales</i> , <i>Micrococcales</i>) 3.3 Class <i>Mollicutes</i> (<i>mycoplasma</i>), <i>Spirochaetes</i>	32 %	14
4	Taxonomy of Archaea 4.1 Overview of Archeal Taxonomy, 4.2 Archeal Metabolism, 4.3 Phylum <i>Crenarchaeota</i> , Phylum <i>Euryarchaeota</i>	20 %	09
MBM205-2C: Taxonomy and Systematics (P)			
Practical			
1. Study of various biochemical tests for identification of bacteria			

2. Study of pure cultures of bacteria: *Bacillus subtilis*, *Bacillus cereus*, *Bacillus megaterium*, *Staphylococcus aureus*, *Staphylococcus epidermidis*
3. Study of pure cultures of bacteria: *Escherichia coli*, *Enterobacter aerogenes*
4. Study of pure cultures of bacteria: *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Serratia marcescens*
5. Cultivation of anaerobes using thioglycollate broth.

References Books:

1. Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore, (2004).
2. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 10th Edition WCB McGraw Hill, New York, (2002).
3. Black J.G. Microbiology- Principles and Explorations. John Wiley & Sons Inc. New York, (2002).
4. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.
5. Madigan, Martinko, Bender, Buckley, Stahl. Brock Biology of Microorganisms. Pearson
6. Eugene W. Nester, Denise G. Anderson, C. Evans Roberts, Martha T. Nester. Microbiology, a Human Perspective, 6th Edition, Mc GRAW-HILL.
7. AN ASPEN PUBLICATION® Aspen Publishers, Inc. Gaithersburg, Maryland. H. A. Modi. Handbook of Elementary Microbiology Vol.1. Akta Prakashan
8. Patel, R. J., & Patel, R. K., (2015). Experimental Microbiology, Vol. 1, 9th ed., Aditya.
9. Cappuccino, J.G., (2016). Microbiology: A Laboratory Manual, 11th ed., Pearson Education (Singapore) Pvt. Ltd.
10. Aneja, K.R., (2003). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, 4th ed., New Age International Publishers.

COURSE OUTCOMES:

CO1	Students will Develop a good knowledge evolutionary relationships and able to classify them on their molecular basis.
CO2	Students will know about different proteobacteria and their ecological role.
CO3	Students can identify the role of various high and low G+C content microorganisms and their role in diseases and ecology
CO4	Students will gain knowledge of archea, their metabolism and importance

COURSE OUTCOMES MAPPING

Unit No	Title of the Unit	Course Outcome			
		CO1	CO2	CO3	CO4

1	Microbial Taxonomy & Diversity				
2	Proteobacteria and photosynthetic bacteria				
3	Low and High G+C Gram positive Bacteria & Gram-Negative Bacteria				
4	Taxonomy of Archaea				

COURSE ARTICULATE MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						
CO4						

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Semester III

MBM206-2C: Soil and Agriculture Microbiology (T)

Credit 3T+1P

Contact Hour per week

3+2

Outline of the Course:

Course type	Theory+ Practical
Level of the Course	200-299 Intermediate level
Course category	Discipline specific course (Major)
Purpose of Course	The students at the end the course should be able to understand soil as a living environment and how microorganisms function in the soil ecosystem. Also the importance of microorganisms in rhizosphere, rhizoplane and root nodules, biogeochemical cycling will be understood.
Course Objectives	<ul style="list-style-type: none"> • The aim of the course is to give the students a broad knowledge regarding the role of microorganisms in Soil and applied agriculture. • Course also covers knowledge about sustainable approach of plant pathogen control and economical role of microbes in agriculture.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	April 2024
Pre-requisite	Elementary knowledge of Biology.
Teaching Methodology	Class Room Teaching, Discussion and Assignments, laboratory practical
Evaluation Method	Continuous And Comprehensive Evaluation (CCE) (50%) Semester End Evaluation (SEE) (50%)

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	<p>Microbial Ecology of Soil</p> <p>1.1 Soil biota, Soil as an important microbial habitat, Factors influencing the soil microflora</p> <p>1.2 Biogeochemical cycling – Carbon cycle, Nitrogen cycle, Phosphorus cycle, Sulphur Cycle.</p>	20 %	09
2	<p>Microbial interactions</p> <p>2.1 Different interfaces of interactions - Plant-microbe, microbe-microbe, soil microbe,</p> <p>2.2 soil-plant-microbe interactions (Mutualism, Cooperation, Commensalism, Parasitism, Predation, Amensalism, and Competition).</p> <p>2.3 microorganism -association with vascular plants- phyllosphere & rhizosphere – Biological Nitrogen fixation, denitrification, Mycorrhizae, VAM and their importance in agriculture.</p>	28 %	13
3	<p>Agricultural Microbiology</p> <p>3.1 Microbes and their importance in maintenance of soil structure and its fertility, Bio fertilizers – Azotobacter, Azolla-anabena, Cyanobacteria</p> <p>3.2 Vermicompost</p> <p>3.3 Plant growth promoting rhizobacteria (PGPR)</p>	20%	09
4	<p>Plant diseases and their etiological studies</p> <p>4.1 Diseases of some important cereals, vegetables and crops.</p> <p>4.2 Genetical basis of plant diseases: Genetics of host-pathogen interactions, resistance genes, resistance</p>	32 %	14

	<p>mechanism in plants, transgenic approach for plant protection.</p> <p>4.3 Biocontrol – Concept, types, mode of action, uses and practical constraints & applications of biocontrol agents.</p> <p>4.4 Biocontrol agent for sustainable agriculture. Different types of biocontrol agents. Biopesticides and bioherbicides, Biopesticides- classification, advantages. Major biopesticides based on bacteria, viruses & fungi (<i>Bacillus thuringiensis</i> (Bt) toxin).</p>		
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MBM206-2C: Soil and Agriculture Microbiology (P)

Practical

1. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane.
2. Isolation of *Rhizobium* from root nodules.
3. Isolation of nonsymbiotic nitrogen fixing *Azotobacter* species from soil.
4. Isolation and identification of *Actinomyces* from Soil.
5. Isolation of protozoa from soil.
6. Isolation and identification of plant pathogenic bacteria from citrus canker.

References books:

1. R. C. Dubey, 2005 A Textbook of "Biotechnology" S. Chand and Company, New
2. Dubey R.C., and Maheswari, D. K. Textbook of Microbiology, S. Chand & Co.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 10th Edition WCB McGraw Hill, New York, (2002).
4. Black J.G. Microbiology- Principles and Explorations. John Wiley & Sons Inc. New York, (2002).
5. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.
6. Madigan, Martinko, Bender, Buckley, Stahl. Brock Biology of Microorganisms. Pearson
7. Eugene W. Nester, Denise G. Anderson, C. Evans Roberts, Martha T. Nester. Microbiology, a Human Perspective, 6th Edition, Mc GRAW-HILL.
8. Stanier, R. Y., M. Doudoroff and E. A. Adelberg. General Microbiology, 5th edition, The Macmillan press Ltd
9. AN ASPEN PUBLICATION® Aspen Publishers, Inc. Gaithersburg, Maryland. H. A. Modi. Handbook of Elementary Microbiology Vol.1. Akta Prakashan
10. Patel, R. J., & Patel, R. K., (2015). Experimental Microbiology, Vol. 1, 9th ed., Aditya.
11. Cappuccino, J.G., (2016). Microbiology: A Laboratory Manual, 11th ed., Pearson Education (Singapore) Pvt. Ltd.
12. Aneja, K.R., (2003). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, 4th ed., New Age International Publishers.

COURSE OUTCOMES:

CO1	Students will Develop a good knowledge of microbial role in ecology of soil and environment.
CO2	Students will know about different microbial interaction and their ecological role.
CO3	Students can identify the role microbes in agriculture and their economic applications.
CO4	Students will gain knowledge plant pathogenic microbes and their control in sustainable manner.

COURSE OUTCOMES MAPPING

Unit No	Title of the Unit	Course Outcome			
		CO1	CO2	CO3	CO4
1	Microbial Ecology of Soil				
2	Microbial interactions				
3	Agriculture Microbiology				
4	Plant diseases and their etiological studies				

COURSE ARTICULATE MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						
CO4						

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Semester III

MBM207-2C: Environmental Microbiology (T)

Credit 3T+1P

Contact Hour per week

3+2

Outline of the Course:

Course type	Theory+ Practical
Level of the Course	200-299 Intermediate level
Course category	Discipline specific course (Major)
Purpose of Course	<p>This course offers an exploration into the rich diversity of microbial communities thriving in air, water environments, providing a comprehensive understanding of their ecological roles. The subject delves deeper into the characteristics of wastewater and explores its treatment utilizing microbial processes.</p> <p>Additionally, students will delve into diverse biodegradation, bioremediation and bioenergy processes aimed at addressing environmental challenges through microbial activities.</p>
Course Objectives	<ul style="list-style-type: none">• Develop an understanding of the fundamental principles and concepts that form the basis of air microbiology.• Demonstrate a thorough understanding of microbial dynamics in domestic and waste water systems, facilitating effective management strategies for waterborne pathogens and contaminants.• Possess a comprehensive understanding of microbial processes involved in the degradation of environmental pollutants, empowering them to design and implement effective remediation strategies.

	<ul style="list-style-type: none"> Gain a deep understanding of the microbial processes involved in biofuel production, enabling them to contribute to the development of sustainable energy solutions.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	April 2024
Pre-requisite	Elementary knowledge of Biology.
Teaching Methodology	Class Room Teaching, Discussion and Assignments, laboratory practical
Evaluation Method	Continuous and Comprehensive Evaluation (CCE) (50%) Semester End Evaluation (SEE) (50%)

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	Microbiology of air 1.1 Introduction, Number and kinds of organisms in air 1.2 Enumeration of bacteria in air 1.3 Air sanitation 1.4 Aeroallergens and aeroallergy 1.5 Phylloplane Microflora	25 %	11
2	Microbiology of Domestic and waste water 2.1 Purification and Sanitary Analysis 2.2 Wastewater Treatment 2.3 Advanced Wastewater Treatment 2.4 Water Distribution Systems	25 %	12
3	Biodegradation and Bioremediation 3.1 Bioremediation (in situ and ex-situ) 3.2 Bioremediation of hydrocarbon	25%	11

	3.3 Biodegradation of pesticides and herbicides 3.4 Biodegradation of xenobiotic compounds 3.5 Biodegradation of Industrial Wastes 3.6 Microbial leaching		
4	Bio-Energy 4.1 Useful features, undesirable features of biofuels and area to focus for future research 4.2 Modes of utilization of Biomass 4.3 Petroleum Plants 4.4 Alcohols: The liquid Fuel 4.5 Gaseous Fuels: Biogas and Hydrogen 4.6 Biodiesel 4.7 Microbial Fuel Cells	25 %	11
MBM207-2C: Environmental Microbiology (P)			
Practical			
<ol style="list-style-type: none"> 1. Microbiological analysis of drinking water by PA test from drinking water 2. Study of air microflora by settling plate technique 3. Microbiological analysis of drinking water by MPN test from drinking water 4. To determination of Faecal Indicator Enterococcus faecalis in drinking water 5. To determine the acidity and alkalinity of water sample. 6. To determine the Biological Oxygen demand (BOD) of water sample. 7. To determine the Chemical Oxygen Demand COD of water sample. 			
References books:			
<ol style="list-style-type: none"> 1. Madigan, M. T., Martinko, J. M., Stahl, D. A., & Clark, D. P. (2012). Brock biology of microorganisms, Global Edition. San Francisco, TX: Pearson Benjamin Cummings. 2. Dubey, R. C., & Maheshwari, D. K. (2006). A textbook of Microbiology. S. Chand Publishing. 3. Pelczar M. J., Chan E. C. S and Krieg N. R., (2001). Microbiology, Fifth Edition, McGraw-Hill Education. 4. Wiley, J., Sandman, K. and Wood, D. (2023). Prescott's Microbiology, 12th Ed, McGraw-Hill Professional. 5. Dubey, R. C. (2010). Textbook of Biotechnology, 1st Ed., S. Chand, Multicolor. 6. Singh, B. D., Singh, B. D., & Singh, B. D. (2005). Biotechnology. Campus Books International 			

COURSE OUTCOMES:

CO1	Develop an understanding of the fundamental principles and concepts that form the basis of air microbiology.
CO2	Demonstrate a thorough understanding of microbial dynamics in domestic and waste water systems, facilitating effective management strategies for waterborne pathogens and contaminants.
CO3	Possess a comprehensive understanding of microbial processes involved in the degradation of environmental pollutants, empowering them to design and implement effective remediation strategies.
CO4	Gain a deep understanding of the microbial processes involved in biofuel production, enabling them to contribute to the development of sustainable energy solutions.

COURSE OUTCOMES MAPPING

Unit No	Title of the Unit	Course Outcome			
		CO1	CO2	CO3	CO4
1	Air Microbiology				
2	Microbiology of Domestic and waste water				
3	Biodegradation and Bioremediation				
4	Bio-Energy				

COURSE ARTICULATE MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						
CO4						

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Semester III
MDC203-2C: Personal Finance (T)

Credit 4T

Contact Hour per week 4

Outline of the Course:

Course type	Theory+ Practical
Level of the Course	200-299 Intermediate level
Course category	Multidisciplinary subject
Purpose of Course	On the successful completion of this course the student will be able to gain knowledge of importance of Personal Financial Planning and understanding of the various avenues available for the same.
Course Objectives	CO 1. Familiarize students with different aspects of personal financial planning CO 2. Generate an understanding for savings and its importance. CO 3. Ability to assess various investment avenues and appropriately select the correct investment option. CO 4. Develop ability to use Tax Provisions as a tool for Tax Saving and Financial Planning. CO 5. Develop understanding of the concept of Insurance, its importance and selection of proper Insurance Plan CO 6. Create awareness about necessity of retirement planning and also have an idea of retirement benefit investment options.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	April 2024
Pre-requisite	Elementary knowledge of Tax Planning and different Investment Avenues

Teaching Methodology	Class Room Teaching, Discussion and Assignments, laboratory practical
Evaluation Method	Continuous and Comprehensive Evaluation (CCE) (50%) Semester End Evaluation (SEE) (50%)

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	Introduction to Financial Planning <ul style="list-style-type: none"> • Financial Goals • Time Value of Money • Steps in Financial Planning • Personal Finance / Loans • Introduction to Savings and its importance • Managing Spendings • Concepts of Net Banking, UPI, Digital Wallets • Awareness of possible cyber frauds like Phishing, card cloning and skimming 	20 %	12
2	Investment Planning <ul style="list-style-type: none"> • Objective & Process of Investment • Risk – Return Analysis & Cost – Benefit Analysis of Investment options • Diversification & Portfolio Building • Investment Avenues in Banking, Real Estate, Share Market, Commodities Market, Mutual Funds and SIPs, • International Investment Avenues 	20 %	12
3	Personal Tax Planning <ul style="list-style-type: none"> • Tax Structure in India for Individuals • Scope of personal tax planning • Overview of Exemptions and Deductions available to Individuals under various provisions of Income Tax Act, 1961 	20%	12

1	Introduction to Financial Planning						
2	Investment Planning						
3	Personal Tax Planning						
4	Insurance Planning						
5	Retirement Benefits Planning						

COURSE ARTICULATE MATRIX

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						
CO4						
CO5						
CO6						