Vitthalbhai Patel & Rajratna P. T. Patel Science College
(Autonomous)
(Reaccredited with 'A' Grade by NAAC (CGPA 3)13
Affiliated to SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
Syllabus effective from June 2025

B.Sc Microbiology (Major subject)

Course Code	US04MAMIC01	Title of the Course	**Microbial flora of human host and Microbiology of food and milk.**
Total Credits of the Course	4	Hours per Week	4

Course Objectives:

- To make students know about normal micro biota found in healthy human and what is their significance.
- Students can know the process of microbial infection. Which properties of microbes make them virulent?
- Students understand about non specific defence mechanisms of human and know about role of blood components in immune system.
- To make student know involvement of microbes in food making, spoilage and food borne diseases.
- To impart knowledge of microbiology of milk, importance and concepts of food and milk preservation techniques.

Course Content

Unit	Description:	Weightage %
1.	**Introduction to Medical Microbiology: Human Microbe interactions** A. Microbial flora of human host: a. Origin of the normal flora b. Normal Flora and human host. c. Germ free and Gnotobiotic life d. Effect of Antimicrobial Agents e. Characteristics of normal flora organisms f. Distribution and occurrence of normal flora : (skin, eye, respiratory tract, intestinal tract, mouth, genitourinary tract) B. The process of Infection: a. Pathogenicity, Virulence and types of infection. b. Microbial adherence. c. Penetration of epithelial cell layers. d. Events in infection following penetration: (Growth in underlying Tissue, Infection of the lymphatic system, Infection of the blood) e. Microbial virulence factors: (Antiphagocytic factors, Exotoxins, Endotoxins, Other virulence factors)	25%

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2	**Immunology and Haematology.** A) Natural resistance and its types: (species resistance, Racial resistance, individual resistance, External and internal defence mechanisms) B) Non specific defences against Microbial Infections: (Complement system, Phagocytosis, Inflammatory response, Natural killer cells, Interferons) C) Components of blood and their functions	25%
3.	**Food Microbiology** A) Microbial flora of fresh foods. Meat, Poultry, eggs, fruits and vegetables, Shellfish and Finfish. B) Factors affecting kinds and numbers of microorganisms : intrinsic and extrinsic parameters of food. C) Microbial Spoilage of food. Fresh foods and Canned foods. D) Preservation of food and Milk a. General principles b. Methods of preservation: i. Use of aseptic handling ii. High temperature: Sterilization, canning iii. Low temperature: Refrigeration and freezing iv. Dehydration v. Osmotic pressure vi. chemicals vii. Radiations: Ionizing and non-ionizing radiation E) Microorganisms as food: Single cell protein.	25%
4.	**Microbiology of milk and milk products** A) Introduction B) Sources of contamination of milk C) Types of microorganisms in milk on the basis of : a) Biochemical activities b) Temperature response c) Ability to cause infection and disease. D) Microbiological examination of milk a) Standard plate count b) Direct microscopic count c) Reductase test (MBRT and Resazurin test) E) Pasteurization of milk, Phosphatase test. F) Some dairy milk products: Butter, Cheese. G) Introduction to probiotics, prebiotics, synbiotics.	25%

Teaching-Learning Methodology	• The major teaching- learning consists of lectures and discussions (large group) in which the teacher makes a use of chalk and talk as well as power point presentation to introduce the learning objectives related to the basic concepts of the subject. • These sessions incorporate space for participation and involvement of students through questions.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage %
1.	CEE: Internal Continuous Assessment in the form of Practical, Viva-voce, Quiz, Seminars, Assignments, Attendance, etc	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to:	
1.	Understand importance of normal microbiota of human body and can give examples of bacteria and other microbes present in various parts of the healthy human body.
2.	Understand types of infections, differentiate infection and disease, and have idea of process of infection.
3	Understand what immunity is and get idea regarding natural immunity and non specific defence mechanisms of human. Get idea about various components of blood and their functions.
4.	Understand the significance of Microbial spoilage of food, food borne diseases and the methods of preservation of food. Correlate microbial food spoilage and proper handling of food at home
5.	Learn the microbiology of milk and other dairy products and microbes involved in dairy food fermentations. Understand the concept Microbiological Examination and pasteurization of Milk.

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Suggested References:	
Sr. No.	References:
1.	"Microbiology" – Michael J. Pelczar, E.C.S.Chan and Noel R. Krieg , 5th edition, Tata McGRAW –HILL Edition,1993.
2.	General Microbiology by Powar and Daginawala Vol-II
3.	Microbiology" Prescott, by Harley, and Klein ,7th edition..
4	Medical laboratory technology, K L Mukherjee VOL-1
5	Food Microbiology By Frazier

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Course Code	US04MAMIC02	Title of the Course	Environmental Microbiology
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	To make the students familiar with the knowledge regarding …. • The presence of microbes in air and their control. • Microbes and their ecosystem along with extreme environment • The normal flora of soil, interaction of microbes in soil and their role in transformation of nutrients. • Types of water and its purification • Disposal of sewage • The microbial Biodegradation and Bioleaching processes.

Course Content		
Unit	Description	Weightage %
1	**Microbial Environment** A) Aero microbiology a) Introduction b) Number and types of microorganisms in air c) Enumeration of bacteria in air • Impingement in liquids • Impaction on solid surfaces • Filtration • Sedimentation • Centrifugation and electrostatic precipitation d) Significance of microorganisms in air e) Control of air-borne microorganisms B Extremophilic microorganisms on the basis of: • Temperature • pH • Osmotic pressure • Salinity C Biofilms	25 %

2	**Soil microbiology** A) Introduction B) Physico-chemical characteristics of soil C) Microbial flora of soil. D) Functions of microorganisms in soil E) Rhizosphere F) Humus. G) Interactions among soil microorganisms: neutralism, mutualism, commensalism, competition, amensalism, parasitism H) Biogeochemical role of soil microorganisms: a) Nitrogen cycle: b) Sulphur cycle c) Carbon cycle d) Phosphorus cycle	25%
3.	**Water and waste water Microbiology** A) Natural waters and its types B) Marine microbiology C) Bacteriological examination of domestic water: presumptive test /MPN test, confirmed and completed test for faecal coliforms, IMViC test, membrane filter technique D) Purification of water (sedimentation, filtration and disinfection) E) Waste water microbiology a) Chemical characteristics, BOD,COD, microbiological characteristics b) Waste water treatment and disposal: i. Waste water treatment processes: single dwelling units, Municipal treatment processes [primary treatment- sedimentation, secondary (biological) treatment- trickling filter, the activated sludge process, oxidation ponds, advanced treatment, final treatment] ii. Solid waste management: • Sources and types of solid waste • Solid processing: anaerobic sludge digestion, composting, sanitary land fills	25%

4	**Microbial Biodegradation and Bioleaching** A) Biodegradation of Environmental Pollutants : Alkyl Benzyl Sulfonates, Oil pollutants B) Concept of Biomagnification: Biomagnification of DDT C) Microbial Transformation of Mercury (Heavy metals) D) Bioleaching: Introduction, Microorganisms involved, Mechanism and Commercial process E) Bioleaching of Copper, Uranium and other metals F) Biosorption G) Microbial Enhanced Oil Recovery (MEOR)	25%

Teaching-Learning Methodology	• The teaching- learning process will consist of lectures (large group) in which the teacher will use aids such as chalks as well as make powerpoint presentation to introduce the topics encompassing the basic concepts of the subject.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage %
1.	Internal Examination (CCE)	50%
2.	University Examination	50%

Course Outcomes :Having completed this course, the learner will be able to	
1.	Conceptualize the understanding of Ecosystem and extreme environments and Gain the knowledge of microbiology of air and control of bio aerosols
2.	Demonstrate the significance of microbes in soil and their role in agriculture and also study microbial interactions and biogeochemical cycles
3.	Use the information of water microbiology for microbiological analysis at laboratory level and thereby determine the quality of water samples Use the knowledge and its application for liquid waste management as well as solid waste management
4.	Describe the role of microorganisms in Biodegradation and Bioleaching

Suggested References:	
Sr. No.	References
1.	"Microbiology" – Michael J. Pelczar, E.C.S.Chan and Noel R. Krieg , 5th edition,TataMcGRAW–HILLEdition,1993
2.	"General Microbiology", by C.B.Powar and H.F.Daginawala, volume -II, Himalaya Publishing House, Reprint-2002
3	"Microbiology" Prescott, by Harley J. P,and Klein ,7thedition.WM C. Brown-McGraw Hills.
4	Principles of Microbiology – R.M Atlas 2nd Edition
5	Biotechnology by U. Satyanarayan

B.Sc Microbiology (Major subject)

Course code	US04MAMIC03	Title of the Course	Practical in Microbiology for SEM-4 Section 1 and 2
Total Credits of the Course	04	Hours per Week	08
Course Objectives:	• To make student handle various samples of water, milk and food for bacteriological analysis • Students learn to handle multiple glasswares and samples simultaneously in aseptic environment • Students learn Cultivation of nitrogen fixing and other important bacteria from environment to understand their characteristics and importance • Students Understand importance of skin and air microbial flora		

Course Content		
No.	**Practicals**	Weightage (%)
	SECTION-1	50%
1	Bacteriological analysis of food (i) Standard plate count (ii) Detection of coliforms (Presumptive test, confirmed test and completed tests). iii) Enumeration of coliforms (MPN)	
2.	Bacteriological analysis of milk – (i) Standard plate count ii) Determination of microbial load by use of MBRT iii) Detection of acid fast bacteria in milk.	

3.	Bacteriological analysis of water: (i) Standard plate count (ii) Detection of coliforms (Presumptive test, confirmed test and completed tests). iii) Enumeration of coliforms (MPN)	
4	Demonstration of types of White blood cells by showing differential count of WBC by Field's method	
5	Demonstration of skin flora	
6.	Study of mouth flora : 1. Gram staining of teeth and tongue surface bacteria 2. Spirochete staining	
	SECTION-2	
7	Bacteriological analysis of Air i) Quantitative analysis ii) Qualitative analysis	50%
8	Measurement of dissolved oxygen by Winkler's method	
9	Study of soil bacteria: isolation and cultivation of symbiotic nitrogen fixing bacteria: *Rhizobium*	
10	Study of soil bacteria: isolation and cultivation of non symbiotic nitrogen fixing bacteria: *Azotobacter.*	
11	Demonstration of a biofilm	
12	Measurement of Bacterial /Yeast /Fungal spore by use of micrometry.	

Teaching-Learning Methodology	• By briefing them with the theoretical aspects as well as providing them with the protocol (Aim, Requirements and Procedure) of the experiment to be performed using chalk and duster as well as power point presentation. • Students are trained for microscope observations and its handling. • Demonstrations of the practical are also carried out and care is taken for aseptic handling and skill development for microbiological work in the laboratory. • Possibility of various results and their interpretation is also discussed.

Evaluation Pattern		
Sr.No.	Details of the Evaluation	Weightage
1.	Internal Examination (CCE)	50%
2.	University Examination	50%
	During practical examination; student should have a certified journal duly signed by head of department and the teacher in charge at the time of examination.	

Course Outcomes: Having completed this course, the learner will be able to:	
1.	Analyse quality of various samples of water bacteriologically
2.	Analyse quality of Food
3.	Analyse qualitatively and quantitatively samples of milk
4.	Can get knowledge of skin and air microbial flora
5.	Get knowledge of air microbial flora
6	Understand types and functions of various White blood cells

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Suggested References:	
Sr. No.	References
1.	Experimental Microbiology – Rakesh J.Patel & Kiran R. Patel, Volume -I
2.	Practical Microbiology- Dr. R.C. Dubey and Dr. D.K. Maheshwari (Revised edition), S. Chand publication
3.	Microbiology : A Practical Approach – Dr. Bhavesh Patel and Dr. Nandini Phanse