

**SARDARPATELUNIVERSITY**  
**B.Sc. Microbiology Semester: IV**  
**With Effect From: June – 2024**  
**(Major subject)**

Course Code	US04MAMIC01	Title of the Course	<b>Microbiology of Food, milk and Human host</b>
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	<ul style="list-style-type: none"> <li>• To make students know about normal micro biota found in healthy human and what is their significance.</li> <li>• Students can know the process of microbial infection. Which properties of microbes make them virulent?</li> <li>• Students understand about non specific defence mechanisms of human and know about role of blood components in immune system.</li> <li>• To make student know involvement of microbes in food making, spoilage and food borne diseases.</li> <li>• To impart knowledge of microbiology of milk, importance and concepts of food and milk preservation techniques.</li> </ul>
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Course Content

Unit	Description:	weightage%
1.	<p><b>Introduction to medical microbiology: Human Microbe interactions</b></p> <p><b>A. Micro biota of Human body:</b></p> <p>a) Origin of the normal flora, Normal Flora and human host. Germ free and Gnotobiotic life, Effect of Antimicrobial Agents. Characteristics of normal flora organisms.</p> <p>b) Distribution and occurrence of normal flora : skin, eye, Respiratory tract, mouth, Intestinal tract, Genitourinary tract.</p> <p><b>B. The process of Infection:</b></p> <p>a. Pathogenicity, Virulence and infection.</p> <p>b. Events in infection following penetration: Growth in underlying Tissue, Infection of the lymphatic system, Infection of the blood.</p> <p>c. Microbial virulence factors: Anti phagocytic factors, Exotoxins, Endotoxins, Other virulence factors.</p>	



2	<p><b>Introduction to Immunology.</b></p> <p>a) Natural resistance and its types_: species resistance, Racial resistance, individual resistance, External defence mechanisms</p> <p>b) Non specific defences against Microbial Infections: Physical barriers, Chemical defence, Phagocytosis, Inflammatory response, Fever.</p> <p>c) Components of blood and their functions</p>	25
3.	<p><b>Food Microbiology</b></p> <p>a) Food as a substrate for Microorganisms.</p> <p>b) Microbial flora of food.</p> <p>c) Factors affecting kinds and numbers of microorganisms : intrinsic and extrinsic parameters of food.</p> <p>d) Microbial Spoilage of food and Food Poisoning, Role of <i>Clostridium botulinum</i> and <i>Salmonella</i> spp.</p> <p>e) Preservation of food and Milk</p> <p style="padding-left: 20px;">A. General principles</p> <p style="padding-left: 20px;">B. Methods of preservation:</p> <p style="padding-left: 40px;">i. Use of aseptic handling</p> <p style="padding-left: 40px;">ii. High temperature: Sterilization, canning</p> <p style="padding-left: 40px;">iii. Low temperature: Refrigeration and freezing</p> <p style="padding-left: 40px;">iv. Dehydration</p> <p style="padding-left: 40px;">v. Osmotic pressure</p> <p style="padding-left: 40px;">vi. Preservatives</p> <p style="padding-left: 40px;">vii. Radiations: Ionizing and non-ionizing radiation Indian</p> <p>f) Fermented food products: Pickles and Idli.</p> <p>g) Microbes as food: Mushrooms and Spirulina.</p>	25%
4.	<p><b>Microbiology of milk and milk products</b></p> <p>a) Sources of microorganism in milk</p> <p>b) Types of microorganisms in milk</p> <p>c) Milk borne diseases</p> <p>d) Microbiological examination of milk</p> <p>e) Pasteurization of milk, Phosphatase test, MBRT and Resazurin test</p> <p>f) Some dairy milk products: Butter, Cheese.</p> <p>g) Introduction to probiotics, prebiotics, Synbiotics.</p>	



Teaching-Learning Methodology	<ul style="list-style-type: none"> <li>• 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.</li> <li>• These sessions incorporate space for participation and involvement of students through questions.</li> </ul>
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	CEE: Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance, etc	50%
2.	University Examination	50%

Course Out comes: 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.



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.	A handbook of elementary Microbiology by H.A. Modi, Shanti Prakashan, Rohtak Haryana
3.	Principles of Microbiology, Ronald m. Atlas, 2 <sup>nd</sup> Edition, Wm. C. Brown publishers, 1995
4	Medical laboratory technology, KI Mukherjee VOL-1

On-line resources to be used if available as reference material



**SARDARPATELUNIVERSITY**  
**B.Sc. Microbiology Semester: IV**  
**With Effect From: June – 2024**  
**(Major subject)**

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

Course Objectives:	<p>To make the students familiar with the knowledge regarding ....</p> <ul style="list-style-type: none"> <li>• The presence of microbes in air and their control.</li> <li>• Microbes and their ecosystem along with extreme environment</li> <li>• The normal flora of soil, interaction of microbes in soil and their role in transformation of nutrients.</li> <li>• Types of water and its purification</li> <li>• Disposal of sewage</li> <li>• The microbial Biodegradation and Bioleaching processes.</li> </ul>
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CourseContent		
Unit	Description	Weightage* (%)
1	<p><b>Microbial Environment</b></p> <p><b>A Concepts of Microbial Environment</b></p> <p>a) The Physical Environment</p> <p>b) The Micro environment and Niche</p> <p>c) Biofilms and Microbial Mats</p> <p>d) Microorganisms and Ecosystems</p> <p>e) Microorganism Movement between Ecosystems</p> <p>f) Extreme Environments</p> <p><b>B Aero microbiology</b></p> <p>g) Introduction</p> <p>h) Characteristics of the atmosphere with viable particles</p> <p>i) Atmospheric dispersal of microbes</p> <p>j) Microbial diversity of air</p> <p>k) Enumeration of microorganisms in Air</p> <p>l) The control of Bioaerosol</p>	25 %



2	<p><b>Soil microbiology</b></p> <ul style="list-style-type: none"> <li>(a) Introduction</li> <li>(b) Physical characteristics of soil.</li> <li>(c) Microbial flora of soil.</li> <li>(d) Functions of microorganisms in soil , Rhizosphere.</li> <li>(e) Humus.</li> <li>(f) Interactions among soil microorganisms: mutualism, synergism, commensalism, competition, amensalism, parasitism.</li> <li>(g) Biogeochemical role of soil microorganisms: <ul style="list-style-type: none"> <li>i. Nitrogen cycle: nitrogen fixation, ammonification, nitrification, de-nitrification and nitrate reduction.</li> <li>ii. Sulphur cycle, microbes involved in Sulphur cycle.</li> <li>iii. Carbon cycle, microbial degradation of cellulose, hemicelluloses, lignin and chitin.</li> <li>iv. Phosphorus cycle.</li> </ul> </li> </ul>	25%
3.	<p><b>Water and waste water Microbiology</b></p> <ul style="list-style-type: none"> <li>a) Types of natural waters</li> <li>b) Marine microbiology</li> <li>c) Bacteriological examination of domestic water: presumptive test /MPN test, confirmed and completed test for faecal coli forms, IMViC test, membrane filter technique.</li> <li>d) Purification of water (sedimentation, filtration and disinfection) Waste water microbiology: chemical characteristics, BOD,COD, microbiological characteristics.</li> <li>e) Waste water treatment and disposal: <ul style="list-style-type: none"> <li>i. Waste water treatment processes: single dwelling units, Municipal treatment processes (primary treatment-sedimentation, secondary (biological) treatment: tricklingfilter, the activated sludge process, oxidation ponds; advanced treatment, final treatment.</li> <li>ii. Solids waste management: sources and types of solid waste; Solids processing: anaerobic sludge digestion, composting, sanitary land fills</li> </ul> </li> </ul>	25%
4	<p><b>Microbial Biodegradation and Bioleaching</b></p> <ul style="list-style-type: none"> <li>a) Biodegradation of Environmental Pollutants : Alkyl Benzyl Sulfonates, Bio-magnification of DDT</li> <li>b) Microbial Transformation of Mercury (Heavy metals)</li> <li>c) Bioleaching: Introduction, Microorganisms, Mechanism and Commercial process</li> <li>d) Bioleaching of Copper, Uranium and other metals</li> <li>e) Biosorption</li> <li>f) Oil Pollutants</li> <li>g) Microbial Enhanced Oil Recovery (MEOR)</li> </ul>	



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 power point presentation to introduce the topics encompassing the basic concepts of the subject.
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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 , 5 <sup>th</sup> edition ,Tata McGRAW–HILL Edition,1993
2.	“General Microbiology”,by C.B.Powar and H.F.Daginawala,volumeII, Himalaya Publishing House, Reprint-2002
3	‘Microbiology” PrescottL, byHarleyJP,andKlein DA,7 <sup>th</sup> edition.WmC.Brown-McGrawHill,Dubuque, IA ltd.
4	Principles of Microbiology – R.M Atlas 2 <sup>nd</sup> Edition
5	Biotechnology by U. Satyanarayan
6	Textbook of Environmental Microbiology by P.K.Mohapatra

On-line resources to be used if available as reference material

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**SARDARPATELUNIVERSITY**  
**B.Sc. Microbiology Semester: IV**  
**With Effect From: June – 2024**  
**(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:	<ul style="list-style-type: none"> <li>• To make student handle various samples of water, milk and food for bacteriological analysis</li> <li>• Students learn to handle multiple glass wares and samples simultaneously in aseptic environment</li> <li>• Students learn Cultivation of nitrogen fixing and other important bacteria from environment to understand their characteristics and importance</li> <li>• Students Understand importance of skin and air microbial flora</li> </ul>
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Course Content		
No.	Practicals :	Weight age* (%)
	<b>SECTION-1</b>	
1	Microbiological analysis of food (i) Standard plate count (ii) Detection and enumeration of coli forms	
2.	Microbiological 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.	Microbiological analysis of water: (i) Standard plate count (i) Presumptive test confirmed and completed tests. ii) Detection of coliforms in water by MPN test.	
4	Study of types of white blood cells by showing differential count of WBC by Field's method	
5	Study of skin flora	
6.	Study of mouth flora : 1. Gram staining of teeth and tongue surface bacteria 2. Spirochete staining	





SECTION-2		
7.	Study of qualitative and quantitative analysis of microbial flora of air by settling plate technique.	
8	Measurement of Dissolved oxygen by Winkler's Method.	
9	Study of soil bacteria: isolation and cultivation of symbiotic nitrogen fixing bacteria: <i>Rhizobium</i>	
10	Study of soil bacteria: isolation and cultivation of non symbiotic nitrogen fixing bacteria: <i>Azotobacter</i> .	
11	Study of a bio film	
12	Demonstration: Measurement of fungal spore by use of micrometry.	

Teaching-Learning Methodology	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Students are trained for microscope observations and its handling.</li> <li>• Demonstrations of the practical are also carried out and care is taken for aseptic handling and skill development for microbiological work in the laboratory.</li> <li>• Possibility of various results and their interpretation is also discussed.</li> </ul>
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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

Suggested References:

Sr. No.	References
1.	Experimental Microbiology - RakeshJ.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 NandiniPhanse

On-line resources to be used if available as reference material



**SARDARPATELUNIVERSITY**  
**B.Sc. Microbiology Semester: IV**  
**With Effect From: June – 2024**  
**(Minor subject)**

Course Code	US04MIMIC01	Title of the Course	Environmental Microbiology
Total Credits of the Course	2	Hours per Week	2

Course Content		
Unit	Description:	weightage%
1.	<p><b>Microbial Environment</b></p> <p><b>C Concepts of Microbial Environment</b></p> <p>m) The Physical Environment</p> <p>n) The Micro environment and Niche</p> <p>o) Biofilms and Microbial Mats</p> <p>p) Microorganisms and Ecosystems</p> <p>q) Microorganism Movement between Ecosystems</p> <p>r) Extreme Environments</p> <p><b>D Aero microbiology</b></p> <p>s) Introduction</p> <p>t) Characteristics of the atmosphere with viable particles</p> <p>u) Atmospheric dispersal of microbes</p> <p>v) Microbial diversity of air</p> <p>w) Enumeration of microorganisms in Air</p> <p>l) The control of Bioaerosol</p>	50%
2.	<p><b>Water and waste water Microbiology</b></p> <p>f) Types of natural waters</p> <p>g) Marine microbiology</p> <p>h) Bacteriological examination of domestic water: presumptive test /MPN test, confirmed and completed test for faecal coli forms, IMViC test, membrane filter technique.</p> <p>i) Purification of water (sedimentation, filtration and disinfection) Waste water microbiology: chemical characteristics, BOD,COD, microbiological characteristics.</p> <p>j) Waste water treatment and disposal:</p> <p>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.</p> <p>k) Solids waste management: sources and types of solid waste; Solids processing: anaerobic sludge digestion, composting, sanitary land fills</p>	50%



Teaching-Learning Methodology	<ul style="list-style-type: none"> <li>• 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.</li> <li>• These sessions incorporate space for participation and involvement of students through questions.</li> </ul>
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance, etc	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	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

Suggested References:	
Sr. No.	References:
1.	Microbiology - Michael J. Pelczar JR.; E.C.S.Chan; Noel R. Krieg. Fifth edition
2.	“Microbiology” Prescott L, Harley J P, and Klein D A, 6th edition. WmC.Brown - McGraw Hill, Dubuque, IA Ltd.
3	Principles of Microbiology – R.M Atlas 2 <sup>nd</sup> Edition
4	Textbook of Environmental Microbiology by P.K.Mohapatra

On-line resources to be used if available as reference material
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**SARDARPATELUNIVERSITY**  
**B.Sc. Microbiology Semester: IV**  
**With Effect From: June – 2024**  
**(Minor subject)**

Course Code	US04MIMIC02	Title of the Course	Microbiology Practicals
Total Credits of the Course	2	Hours per Week	4
Course Objectives:	<ul style="list-style-type: none"> <li>• To make student handle various samples of water for bacteriological analysis</li> <li>• Students learn to handle multiple glass wares and samples simultaneously in aseptic environment</li> <li>• Student understands about microbial flora of air, their characteristics and importance</li> </ul>		

Course Content:		
Sr. No.	Practicals:	Weightage (%)
1.	Study of qualitative and quantitative analysis of microbial flora of air by settling plate technique.	100 %
2.	Measurement of Dissolved oxygen by Winkler's Method.	
3.	Study of a biofilm	
4.	Microbiological analysis of water: Quantitative (i) Standard plate count	
5.	Microbiological analysis of water: Qualitative (i) Presumptive test confirmed and completed tests. ii) Detection of coli forms in water by MPN test.	

Teaching-Learning Methodology	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Students are trained for microscopic observations and its handling.</li> <li>• Demonstrations of the practical are also carried out and care is taken for aseptic handling and skill development for microbiological work in the laboratory.</li> <li>• Possibility of various results and their interpretation is also discussed.</li> </ul>
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Evaluation Pattern:		
Sr. No.	Details of the Evaluation:	Weightage %
1	Internal Examination (CCE)	50%
2	University Examination	50%
3	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.	can get knowledge of bio film
3.	Can get knowledge of air microbial flora

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

On-line resources to be used if available as reference material

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**SARDARPATELUNIVERSITY**  
**B.Sc. Microbiology Semester: IV**  
**With Effect From: June – 2024**  
**(Inter Disciplinary Subject)**

Course Code	US04IDMIC01	Title of the Course	<b>Water and Waste water microbiology</b>
Total Credits of the Course	2	Hours per Week	2

Course Content		
Unit	Description:	weightage%
1.	<p><b>Water Microbiology</b></p> <p>l) Types of natural waters</p> <p>m) Marine microbiology</p> <p>n) Bacteriological examination of domestic water: presumptive test /MPN test, confirmed and completed test for faecal coli forms, IMViC test, membrane filter technique.</p> <p>o) Purification of water (sedimentation, filtration and disinfection) Waste water microbiology: chemical characteristics, BOD,COD, microbiological characteristics.</p>	50%
2.	<p>Waste Water Microbiology</p> <p>a) Waste water treatment and disposal: 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.</p> <p>b) Solids waste management: sources and types of solid waste; Solids processing: anaerobic sludge digestion, composting, sanitary land fills</p>	50%

Teaching-Learning Methodology	<ul style="list-style-type: none"> <li>• 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.</li> <li>• These sessions incorporate space for participation and involvement of students through questions.</li> </ul>
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance, etc	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to:	
1.	Conceptualize the understanding of microbiology of drinking water and fresh water
2.	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

Suggested References:	
Sr. No.	References:
1.	Microbiology - Michael J. Pelczar JR.; E.C.S.Chan; Noel R. Krieg. Fifth edition
2.	“Microbiology” Prescott L, Harley J P, and Klein D A, 6th edition. WmC.Brown - McGraw Hill, Dubuque, IA Ltd.
3.	Principles of Microbiology – R.M Atlas 2 <sup>nd</sup> Edition

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**SARDARPATELUNIVERSITY**  
**B.Sc. Microbiology Semester: IV**  
**With Effect From: June – 2024**  
**(Inter Disciplinary Subject)**

Course Code	US04MIMIC02	Title of the Course	Microbiology Practicals
Total Credits of the Course	2	Hours per Week	4
Course Objectives:	<ul style="list-style-type: none"> <li>• To make student handle various samples of water for bacteriological analysis</li> <li>• Students learn to handle multiple glass wares and samples simultaneously in aseptic environment</li> <li>• Student understands about microbial flora of air, their characteristics and importance</li> </ul>		

Course Content:		
Sr. No.	Practicals:	Weightage (%)
1.	Collection of water samples from different locations for analysis.	100 %
2.	Measurement of Dissolved oxygen by Winkler's Method.	
3	Microbiological analysis of water: Quantitative (i)Standard plate count	
4	Microbiological analysis of water: Qualitative (i) Presumptive test confirmed and completed tests. ii) Detection of coli forms in water by MPN test.	
5	Report writing and submission of water samples analyzed.	

Teaching-Learning Methodology	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Students are trained for microscopic observations and its handling.</li> <li>• Demonstrations of the practical are also carried out and care is taken for aseptic handling and skill development for microbiological work in the laboratory.</li> <li>• Possibility of various results and their interpretation is also discussed.</li> </ul>
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Evaluation Pattern:		
Sr. No.	Details of the Evaluation:	Weightage %
1	Internal Examination (CCE)	50%
2	University Examination	50%
3	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.	can get knowledge of water quality according to presence of microbes
3.	Can get knowledge of analysis of water in laboratory

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

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