



B. Sc. (Microbiology) Semester IV

Course Code	US04CMIC51	Title of the Course	Fundamentals of Microbiology-II
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<ul style="list-style-type: none">• To know about diversity in microorganisms.• To know general characteristics and significance of eukaryotic microbes: fungi, algae and protozoa.• To understand about viruses as acellular microbes.• To know about sub viral entities like PRIONS and viroids.• To make student know about bacteria with unusual properties.• To make students know about normal microbiota found in healthy human and what is their significance.• Students can know the process of microbial infection. Also come to know properties of microbes that make them virulent.• Students understand about non specific defence mechanisms of human and know about role of blood components in immune system.
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Course Content		
Unit	Description	Weightage* (%)
1.	<p>Eukaryotic Microbes and acellular microorganisms</p> <p>a) Fungi: Introduction, Importance, morphology, reproduction, physiology and cultivation.</p> <p>b) Algae: introduction, occurrence, Biological and economical importance, morphology, pigments, motility, reproduction.</p> <p>c) Protozoa: occurrence, ecology, symbiotic protozoa, importance, morphology, reproduction.</p> <p>d) Acellular microorganisms:</p> <p>i. Viruses: General properties of viruses: Introduction, Morphology, chemical properties, viral multiplication and cultivation of viruses.</p> <p>ii. Sub viral particles: Introduction to PRIONS and Viroids.</p>	25%





2.	<p>Procaryotes with different / unusual properties</p> <p>a) Bacteria with unusual morphology</p> <ul style="list-style-type: none">i. Budding and appendaged bacteriaii. Filamentous bacteria: actinomycetesiii. Sheathed bacteriaiv. Mycoplasmav. Cyanobacteriavi. Spirochaetes <p>b) Bacteria with gliding motility: introduction, Myxobacters and Baggiotoa</p> <p>c) Rickettsia and Chlamydia</p> <p>d) Archaeobacteria</p>	25%
3.	<p>Introduction to medical microbiology: Human Microbe interactions</p> <p>a) Microbiota of Human body:</p> <ul style="list-style-type: none">i. Origin of the normal flora, Normal Flora and human host.ii. Germfree and Gnotobiotic life, Effect of Antimicrobial Agents. Characteristics of normal flora organisms.iii. Distribution and occurrence of normal flora of skin, eye, respiratory tract, mouth, Intestinal tract, Genitourinary tract. <p>b) The process of Infection:</p> <ul style="list-style-type: none">i. Pathogenicity, Virulence and infection.ii. Microbial Adherence: Examples of Adherence of pathogenic bacteria, Examples of adherence of viruses.iii. Penetration of epithelial cell layers: Passive penetration into the body Active penetration into the body.iv. Events in infection following penetration: Growth in underlying Tissue, Infection of the lymphatic system, Infection of the blood.v. Microbial virulence factors: Antiphagocytic factors, Exotoxins, Endotoxins, Other virulence factors.	25%





4.	<p>Introduction to Immunology</p> <p>a. Natural resistance and its types_: species resistance, Racial resistance, individual resistance, External defense mechanisms</p> <p>b. Non specific defenses against Microbial Infections: Physical barriers, Chemical defense, Phagocytosis, Inflammatory response, Fever.</p> <p>c. Components of blood and their functions</p>	25%

Teaching-Learning Methodology	<p>The teaching- learning process will consist of lectures (large group) in which the teacher will use aids such as chalk as well as make power point presentation to introduce the topics encompassing the basic concepts of the subject.</p> <p>Growing fungi in labs, observing protozoa and algae in hay infusion and other natural samples. Can also arrange photography sessions and can have albums of various fungi and mushrooms in rainy season at their natural habitat.</p>
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Projects, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain knowledge of general characteristics and importance of fungi, algae, protozoa, viruses, PRIONS and viroids.
2.	Give examples of bacteria with unusual properties and can get knowledge of diverse groups of bacteria with distinguish characteristics.
3.	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.
4.	Understand types of infections, differentiate infection and disease, and have idea of process of infection.
5	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.

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.	Text book of Microbiology –Anantnarayan and Paniker 10 th Edition, University Press:2017
3.	Principles of Microbiology, Ronald m. Atlas, 2 nd Edition, Wm. C. Brown publishers, 1995
4.	Prescott L, Harley J P, and Klein D A, Microbiology, 7 th edition. Wm C.Brown - McGraw Hill, Dubuque, IA ltd.
5.	Medical laboratory technology, KI Mukherjee VOL-1

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

On-line Resources





B. Sc. (Microbiology) Semester IV

Course Code	US04CMIC52	Title of the Course	Applied Microbiology
Total Credits of the Course	04	Hours per Week	04

Course Objectives:	<p>To make the students familiar with :</p> <ul style="list-style-type: none">• 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• 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.
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Course Content		
Unit	Description	Weightage* (%)
1.	<p>Soil microbiology</p> <p>(a) Introduction</p> <p>(b) Physical characteristics of soil.</p> <p>(c) Microbial flora of soil.</p> <p>(d) Functions of microorganisms in soil, Rhizosphere.</p> <p>(e) Humus.</p> <p>(f) Interactions among soil microorganisms: mutualism, synergism, commensalism, competition, amensalism, parasitism.</p> <p>(g) Biogeochemical role of soil microorganisms:</p> <ul style="list-style-type: none">i. Nitrogen cycle: nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction.ii. Sulphur cycle, microbes involved in sulphur cycle.iii. Carbon cycle, microbial degradation of cellulose, hemicelluloses, lignin and chitin.iv. phosphorus cycle.	25%





2.	<p>Water and waste water Microbiology</p> <ul style="list-style-type: none">a) Types of natural watersb) Marine microbiologyc) 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) Waste water microbiology: chemical characteristics, BOD, COD, microbiological characteristics.e) Wastewater treatment and disposal:<ul style="list-style-type: none">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. Solids waste management: sources and types of solid waste; Solids processing: anaerobic sludge digestion, composting, sanitary landfills	25%
3.	<p>Food Microbiology</p> <ul style="list-style-type: none">a) Food as a substrate for Microorganisms.b) Microbial flora of food.c) Factors affecting kinds and numbers of microorganisms : intrinsic and extrinsic parameters of food.d) Microbial Spoilage of food and Food Poisoning, Role of <i>Clostridium botulinum</i> and <i>Salmonella</i> spp.e) Preservation of food and Milk<ul style="list-style-type: none">A. General principlesB. Methods of preservation:<ul style="list-style-type: none">i. Use of aseptic handlingii. High temperature: Sterilization, canningiii. Low temperature: Refrigeration and freezingiv. Dehydration	25%





	<p>v. Osmotic pressure</p> <p>vi. Preservatives</p> <p>vii. Radiations: Ionizing and non-ionizing radiation</p> <p>f) Indian Fermented food products: Pickles and Idli.</p> <p>g) Microbes as food: Mushrooms and Spirulina.</p>	
4.	<p>Microbiology of milk and milk products</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>	25%

Teaching-Learning Methodology	<p>The teaching- learning process will consist of lectures (large group) in which the teacher will use aids such as chalk as well as make power point presentation to introduce the topics encompassing the basic concepts of the subject.</p> <p>Arranging competition of preparation of various fermentation food dishes and enlisting role of microbes in that food dish. Performing Experiments related to food and milk quality analysis.</p>
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Projects, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%





Course Outcomes: Having completed this course, the learner will be able to

1.	Demonstrate the significance of microbes in soil and their role in agriculture and also study microbial interactions and biogeochemical cycles
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
3.	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
4.	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.	“General Microbiology”, by C.B. Powar and H.F. Dagainawala, volume-II, Himalaya Publishing House, Reprint-2002
3	‘Microbiology’ Prescott L, by Harley J P, and Klein D A, 6 th edition. Wm C. Brown - McGraw Hill, Dubuque, IA ltd.
4	Food and Dairy Microbiology by Vivek Upasani, Nirav Prakashan, Ahmedabad

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

On-line Resources





B.Sc. (Microbiology) Semester IV

Course Code	US04CMIC53	Title of the Course	Practicals: Fundamentals of Microbiology – II and Applied Microbiology
Total Credits of the Course	04	Hours per Week	08

Course Objectives:	<p>To demonstrate:</p> <ul style="list-style-type: none">• The existence of microorganisms in different environment.• Study of Microbial flora of Air: qualitatively and quantitatively.• Microbiological examination of milk for its quality check.• Qualitative and quantitative analysis of drinking water.• Study of soil micro organisms.• Study of various other types of microorganisms like yeast, moulds and bacteriophage.• Cultivation and study of Nitrogen fixing bacteria.
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Course Content		
No.	SECTION-1 : Based on US04CMIC51: Fundamentals of Microbiology – II	Weight age* (%)
1.	Study of eukaryotic microbes in hay infusion	
2.	Isolation and cultivation of yeast.	
3	Study of morphological and colony characters of fungi: <i>Aspergillus</i> , <i>Penicillium</i> , <i>Rhizopus</i> and <i>Mucor</i> . (mounting from ready plates)	
4	Cultivation of Actinomycetes : filamentous bacteria	
5	Study of skin flora and mouth flora (Gram staining of teeth and tongue surface bacteria)	
6	Spirochaete staining by Fontana's method (as mouth flora and as prokaryotes with different morphology)	
7.	Study of Microbial flora of air.	
	SECTION-2 : Based on US04CMIC52: Applied Microbiology	
1.	Microbiological analysis of water: (i) Standard plate count (ii) Presumptive test confirmed and completed tests. iii) Detection of coli forms in water by MPN test.	
	Microbiological analysis of milk :	





2.	(i) Standard plate count ii) Determination of microbial load by use of MBRT iii) Detection of acid fast bacteria in milk.	100%
3.	Study of soil bacteria: isolation and cultivation of symbiotic nitrogen fixing bacteria: <i>Rhizobium</i>	
4.	Study of soil bacteria: isolation and cultivation of non symbiotic nitrogen fixing bacteria: <i>Azotobacter</i> .	
5.	Demonstration: Measurement of microscopic object by use of micrometry.	
6.	Demonstration: Study of types of white blood cell by showing differential count of WBC by Field's method.	
7.	Study of pigment producing bacteria	
SECTION-3 ONLINE / IN PRESENCE DEMONSTRATIONS		
1.	Study of viral and fungal diseases of plants (online/ in presence demonstrations of slides of diseased plant parts to get knowledge of : (i) TMV, Potato virus Y, Tomato spotted wilt virus (ii) Rust, smut, powdery mildew	

Teaching-Learning Methodology	<ul style="list-style-type: none">• 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 along with power point presentation.• Demonstration of the practical is also carried out to develop proper skills required in microbiological experiments.• Possibility of various results and their interpretation is also discussed.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weight age
1.	University Examination: there should be at least two exercises for performance; it should be two days practical examination of total 6 (six) hours. Student should have a certified journal duly signed by head of department and the teacher in charge at the time of examination.	100 %





Course Outcomes: Having completed this course, the learner will be able to:

1.	Comprehend the occurrence, abundance and distribution of microorganisms from different sources.
2.	Conceptualize microbial diversity as well as the omnipresence of microorganisms.
3.	Enumerate the bacteria in the original sample.
4.	Determine the quality of milk and water for consumption.
5.	Apply the concept in different fields like dairy, pharmaceutical, cosmetics, water purification plants as a quality control measure.
6.	Understand the necessity of bacteriological assessment of indoor air at hospitals, pharmaceutical, food industries etc.

Suggested References:

Sr. No.	References:
1.	Experimental Microbiology - Rakesh J. Patel and 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

