



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: IV

SUBJECT NAME: Environmental Microbiology

SUBJECT CODE: 4SC04ENM1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	4	8	6	30	1	70	3	30	---	70	200	

Objectives:- The primary objective of this course is to make people aware of the importance of environment microbiology.

Prerequisites:- Basic understanding of concepts related to environment and its interaction with microbes in ecology.

Course Content:

Sr. No.	Course contents	Teaching Hours
1	Microorganisms and their Habitats Structure and function of ecosystems Terrestrial Environment: Soil profile and soil microflora Aquatic Environment: Microflora of fresh water and marine habitats Atmosphere: Aeromicroflora and dispersal of microbes Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body. Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels. Microbial succession in decomposition of plant organic matter.	14
2	Microbial Interactions: Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation Microbe-Plant interaction: Symbiotic and non symbiotic interactions Microbe-animal interaction: Microbes in ruminants, nematophagus fungi and symbiotic luminescent bacteria	12
3	Biogeochemical Cycling: Carbon cycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin Nitrogen cycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction Phosphorus cycle: Phosphate immobilization and solubilisation Sulphur cycle: Microbes involved in sulphur cycle Other elemental cycles: Iron and manganese	12
4	Waste Management:	12



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	Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill) Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment	
5	Microbial Bioremediation: Principles and degradation of common pesticides, organic (hydrocarbons, oil spills) and inorganic (metals) matter, biosurfactants	05
6	Water Potability: Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for fecal coli forms (b) Membrane filter technique and (c) Presence/absence tests	05
Total Hours		60

Learning Outcomes:- The students are expected to Understand the basics of environmental microbiology.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session

Books Recommended:

1. **Atlas RM and Bartha R.** (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
2. **Madigan MT, Martinko JM and Parker J.** (2014). Brock Biology of Microorganisms. 14th edition. Pearson/ Benjamin Cummings
3. **Maier RM, Pepper IL and Gerba CP.** (2009). Environmental Microbiology. 2nd edition, Academic Press
4. **Okafor, N** (2011). Environmental Microbiology of Aquatic & Waste systems. 1st edition, Springer, New York
5. **Singh A, Kuhad, RC & Ward OP** (2009). Advances in Applied Bioremediation. Volume 17, Springer-Verlag, Berlin Hedeilberg
6. **Barton LL & Northup DE** (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA
Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
7. **Coyne MS.** (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
8. **Lynch JM & Hobbie JE.** (1988). Microorganisms in Action: Concepts & Application in Microbial Ecology. Blackwell Scientific Publication, U.K.



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PRACTICALS

S.No	Experiment
1	Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action.
2	Isolation of microbes (bacteria & fungi) from soil (28°C & 45°C).
3	Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane.
4	Assessment of microbiological quality of water.
5	Determination of BOD of waste water sample.
6	Study the presence of microbial activity by detecting (qualitatively) enzymes (dehydrogenase, amylase, urease) in soil.
7	Isolation of <i>Rhizobium</i> from root nodules.



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: IV

SUBJECT NAME: Food and Dairy Microbiology

SUBJECT CODE: 4SC04FDM1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	4	8	6	30	1	70	3	30	---	70	200	

Objectives:- The primary objective of this course is to make people aware of the importance of Food and Dairy Microbiology

Prerequisites:- Basic understanding of concepts related to food & dairy microbiology and its application for human health.

Course content:

Sr. No.	Course contents	Teaching Hours
1	Foods as a substrate for microorganisms: Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general.	8
2	Microbial spoilage of various foods Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods	10
3	Principles and methods of food preservation Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO ₂ , nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins	12
4	Fermented foods Dairy starter cultures, fermented dairy products: yogurt, acidophilus milk, kumiss, kefir, dahi and cheese, other fermented foods: dosa, sauerkraut, soy sauce and tampeh, Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market.	10
5	Food borne diseases (causative agents, foods involved, symptoms and preventive measures):	10



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	Food intoxications: <i>Staphylococcus aureus</i> , <i>Clostridium botulinum</i> and mycotoxins; Food infections: <i>Bacillus cereus</i> , <i>Vibrio parahaemolyticus</i> , <i>Escherichia coli</i> , Salmonellosis, Shigellosis, <i>Yersinia enterocolitica</i> , <i>Listeria monocytogenes</i> and <i>Campylobacter jejuni</i>	
6	Food sanitation and control: HACCP, Indices of food sanitary quality and sanitizers	5
7	Cultural and rapid detection methods of food borne pathogens in foods and introduction to predictive microbiology.	5
Total Hours		60

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Food and Dairy Microbiology

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. **Adams MR and Moss MO.** (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. **Banwart JM.** (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
3. **Davidson PM and Brannen AL.** (1993). Antimicrobials in Foods. Marcel Dekker, New York.
4. **Dillion VM and Board RG.** (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.
5. **Frazier WC and Westhoff DC.** (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
6. **Gould GW.** (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.
7. **Jay JM, Loessner MJ and Golden DA.** (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.
8. **Lund BM, Baird Parker AC, and Gould GW.** (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
9. **Tortora GJ, Funke BR, and Case CL.** (2008). Microbiology: An Introduction. 9th edition. Pearson Education



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PRACTICALS

S.No	Experiment
1	MBRT of milk samples and their standard plate count.
2	Alkaline phosphatase test to check the efficiency of pasteurization of milk.
3	Isolation of any food borne bacteria from food products.
4	Isolation of spoilage microorganisms from spoiled vegetables/fruits.
5	Isolation of spoilage microorganisms from bread.
6	Preparation of Yogurt/Dahi.



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: IV

SUBJECT NAME: Basics of Bioinformatics and Biostatistics

SUBJECT CODE: 4SC04BBB1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
2	2	0	4	3	15	1	35	3	---	---	---	50	

Objectives: -

To provide basic knowledge of Bioinformatics & Biostatistics.

Prerequisites:-

Basic knowledge of Computational skills is required.

Course content:

Sr. No.	Course contents	Teaching Hours
1	Introduction to bioinformatics, biological databases, pattern recognition and prediction, pair wise alignment technique; database searching NCBI, FASTA, BLAST etc. algorithms and program.	10
2	Primary and secondary sequence databases, composite protein sequence databases.	5
3	Comparison of two sequences, global and local alignment – multiple sequence alignment.	5
4	Biostatistics - definition - statistical methods - basic principles. Variables - measurements, functions, limitations and uses of statistics. Measures of central tendency - mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation - merits and demerits; Co-efficient of variations.	10
Total Hours		30

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of bioinformatics & biostatistics.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.



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Books Recommended:

1. **AH wood, T.K. Parry smith DJ**, Introduction to bioinformatics, 2001. Pearson education Asia.
2. **T.K. Altwood, D.J. Parry-Smith and S. Phukan**, Introduction to Bioinformatics.
3. **David. W. Mount**, Bioinformatics: Sequence and Genome Analysis.
4. **C.A. Orengo, D.T. Jones and J.M. Thornton**, Bioinformatics: Genes, Proteins, and Computers.
5. **Daniel, W.W.**, Biostatistic, 1987. New York, John Wiley Sons.
6. **SundarRao, P.S.S and Richards, J.**, An introduction to Biostatistics, 3rd edition, Christian Medical College, Vellore



**FACULTY OF SCIENCES
DEPARTMENT OF ENGLISH**

COURSE: B.Sc. SEMESTER-IV (All Sciences)

SUBJECT NAME: Communication Skills in English-II

SUBJECT CODE: 4SC04CSE1

Teaching & Evaluation Scheme:

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
2	0	0	2	2	30	1.5	70	3	--	--	--	100	

Objectives:

- To develop them for Interpersonal Skills, with importance of Active Listening and Reading Non-Verbal Cues.
- To compete them in communication skills related to production and presentation of messages in multiple formats.
- To enable and demonstrate their critical thinking skills related to the analysis, interpretation, and criticism of messages.
- To litigate them in skills related to the construction and analysis of argumentation and persuasive discourse.
- To make them display an understanding of multiple theoretical perspectives and diverse intellectual traditions in Communication.
- To compete them in human relational interactions at work place.
- To make them viable to analysis and practice of ethical communication.
- To develop their feasibility for free expression and the responsibilities it entails.

Prerequisites:

- Students should have basic knowledge of English Language and grammar.
 - Students should have ability to speak and write correct sentences in their day to day language.
 - Students should be familiar with correct usage of language.

Course outline:

Unit No.	Content In Details Including Its Sub Topics	Minimum Number of Hours		
		Theory	Practical	Total
01	Comprehension skills Selected texts will be given to the students for reading.	04	--	04
02	Fundamental Concepts of Reading Techniques of Reading: Scanning & Skimming Paraphrasing Reading selected text in the class room, where students will explore/express their own views/Ideas.	04	--	04
03	Story Making	03	--	03



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	Basics of Story Making Characteristics of Good Story Types of Stories Forms of story: Oral and Written			
04	Essay Writing Characteristics of good essay Classification of essays Hints on essay writing	02	--	02
05	Informal Report, Circular, Memorandum What is Report? Characteristics of Report Types of Informal Reports Objectives of circular and memorandum Drafting circular and memorandum	04	--	04
06	Official Letters Inquiry, reply, order, execution, complaint, adjustment, etc.	05	--	05
07	Section: B Literature <i>The Guide</i> – R. K. Narayan	08	--	08

Resources:

1. *An Intermediate English Grammar*, **Raymond Murphy**, Cambridge University Press.
2. *A High School English Grammar*, **Wren & Martin**, S. Chand Publication.
3. *Prerequisites of Business Communication*, **Dr. M. N. Padia**, Self-Publication.
4. *Contemporary English Grammar - Structures & Composition*, **David Green**, Macmillan Publishers India.
5. *The Guide*, **R. K. Narayan**, New Delhi: Penguin Books.



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: IV

SUBJECT NAME: MEDICAL MICROBIOLOGY AND IMMUNOLOGY

SUBJECT CODE: 4SC04MMI1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	4	8	6	30	1	70	3	30	---	70	200	

Objectives:- The primary objective of this course is to make people aware of the importance of Food and Dairy Microbiology

Prerequisites:- Basic understanding of concepts related to food & dairy microbiology and its application for human health.

Course content:

Sr. no	Course contents	Teaching Hours
1	<p>Normal microflora of the human body and host pathogen interaction:</p> <p>Normal microflora of the human body: Importance of normal microflora ,normal microflora of skin, throat,</p> <p>Gastrointestinal tract, urogenital tract Host pathogen interaction: Definitions-Infection, Invasion, Pathogen,</p> <p>Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections.</p> <p>Transmission of infection.</p>	10
	<p>Sample collection, transport and diagnosis:</p> <p>Collection, transport and culturing of clinical samples and their identification characteristics.</p>	5
3.	<p>Bacterial diseases: List of diseases of various organ systems and their causative agents.</p> <p>Viral diseases: List of diseases of various organ systems and their causative</p>	10



	<p>agents.</p> <p>Protozoandiseases: List of diseases of various organ systems and their causative agents.</p> <p>Fungaldiseases: Brief description of various types of mycoses.</p>	
4.	<p>Antimicrobial agents: General characteristics and mode of action:</p> <p>Antibacterialagents: Five modes of action with one example each: Inhibitor of nucleicacidsynthesis;</p> <p>Inhibitor of cellwall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis;</p> <p>Inhibitor of metabolism. Antifungalagents: Mechanism of action of AmphotericinB, Grise of ulvin.</p> <p>Antiviralagents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine.</p>	10
5.	<p>ImmuneCells and Organs : Structure, Functions and Properties of: ImmuneCells–Stemcell, Tcell, Bcell, NKcell,</p> <p>Macrophage, Neutrophil, Eosinophil, Basophil, Mastcell, Dendritic cell; and Immune Organs– Bone Marrow,</p> <p>Thymus, LymphNode, Spleen</p>	10
6.	<p>Antigens and Antibodies:</p> <p>Characteristics of an antigen (Foreignness, Molecularsize and Heterogeneity); Haptens; Epitopes</p> <p>(T&B cell epitopes),Adjuvants, Structure, Types and Functions of antibodies.</p> <p>Generation of Immune Response: Primary and Secondary Immune Response; Generation of Humoral</p> <p>Immune Response (Plasma and Memorycells); Generation of Cell Mediated Immune Response</p> <p>Immunological Techniques: PrinciplesofPrecipitation,Agglutination,Immunodiffusion,Immunoelctrophoresis, ELISA, ELISPOT.</p>	15
	Total hours	60

Learning Outcomes:-



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At the end of the course the student would have sufficient knowledge of bioinformatics & biostatistics.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. **Ananthanarayan R. and Paniker K.J.** (2009) Text book of Microbiology.8th edition, University Press Publication
2. **Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A.** (2013) Jawetz, Melnick and Adelberg's Medical Microbiology.26th edition. Mc Graw Hill Publication
3. **Goering R., Dockrell H., Zuckerman M. and Wakelin D.** (2007) Mims' Medical Microbiology.4th edition. Elsevier
4. **Willey J.M., Sherwood L.M. and Woolverton C.J.** (2013) Prescott, Harley and Klein's Microbiology.9th edition. Mc Graw Hill Higher Education
5. **Abbas A.K., Lichtman A.H., Pillai S.** (2007). Cellular and Molecular Immunology.6th edition Saunders Publication, Philadelphia.
6. **Delves P, Martin S, Burton D, Roitt M.** (2006). Roitt's Essential Immunology.11th edition Wiley- Black well Scientific Publication, Oxford.
7. **Goldsby R.A., Kindt T.J., Osborne B.A.** (2007). Kuby's Immunology.6th edition W.H. Freeman and Company, New York.
8. **Richard C and Geiffrey S.** (2009). Immunology.6th edition. Wiley Black well Publication.



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PRACTICALS

S.No	Experiment
1	Identify bacteria on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests
2	Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkeyagar, Mannitol Salt agar, Deoxycholate citrate agar, TCBS
3	Study of bacterial flora of skin by swab method
4	Perform antibacterial sensitivity by Kirby-Bauer method
5	Identification of human blood groups.
6	To perform Total Leukocyte Count of the given blood sample.
7	To perform Differential Leukocyte Count of the given blood sample.
8	To separate serum from the blood sample (demonstration).
9	To perform immunodiffusion by Ouchterlony method.



FACULTY OF SCIENCES

DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: IV

SUBJECT NAME: INDUSTRIAL AND FOOD MICROBIOLOGY

SUBJECT CODE: 4SC04IFM1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	4	8	6	30	1	70	3	30	---	70	200	

Objectives:- The primary objective of this course is to make people aware of the importance of Food and Dairy Microbiology

Prerequisites:- Basic understanding of concepts related to food & dairy microbiology and its application for human health.

Course content:

Sr. no	Course contents	Teaching Hours
1.	Introduction to Industrial microbiology: Brief history and developments in industrial microbiology Types of fermentation processes-solidstate, liquidstate, batch, fed-batch and continuous, Types of fermenters– laboratory, pilot-scale and production fermenters, Components of atypical continuously stirred tank bioreactor	10
2.	Isolation of Industrial Strains and Fermentation Medium: Primary and secondary screening Preservation and maintenance of industrial strains Ingredients used in Fermentation medium-molasses, corn steep liquor, whey & Yeast extract	8
3.	Microbialfermentationprocesses: Down stream processing -filtration, centrifugation, cell disruption, solvent extraction. Microbial production of Industrial products- citricacid, ethanol and penicillin. Industrial production	12



	and uses of the enzymes-amylases, proteases, lipases and cellulases.	
4.	Food as a substrate for microbial growth: Intrinsic and extrinsic parameters that affect microbial growth in food. Microbial spoilage of food-milk, egg, Bread and canned foods	9
5.	Principles and methods of food preservation and foods sanitation: Physical methods-high temperature, low temperature, irradiation, aseptic packaging Chemical methods-salt, sugar, benzoates, citric acid, ethylene oxide, nitrate and nitrite Food sanitation and control–HACCP	9
6.	Dairy products, probiotics and Food-borne Diseases: Fermented dairy products-yogurt, acidophilus milk, kefir, dahi and cheese Probiotics definition, examples and benefits. Food intoxication by <i>Clostridium botulinum</i> and <i>Staphylococcus aureus</i> Food infection by <i>Salmonella</i> and <i>E.coli</i> .	12
		60

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of bioinformatics & biostatistics.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.



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Books Recommended:

1. **Crueger W and Crueger A.**(2000). Biotechnology: A textbook of Industrial Microbiology. 2ndEdition. Panima Publishing Company, New Delhi
2. **Patel AH.**(1996). Industrial Microbiology. 1st Edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India
3. **Tortora GJ, Funke BR, and Case CL.**(2008). Microbiology: An introduction. 9th Edition. Pearson Education
4. **Willey JM, Sherwood LM AND Woolverton CJ**(2013), Prescott, Harley and Klein's Microbiology. 9th Edition. McGraw Hill Higher education
5. **Casida LE.**(1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
6. **Stanbury PF, Whitaker A and Halls J.**(2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
7. **Adams MR and Moss MO.**(1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
8. **Banwart JM.**(1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
9. **Frazier WC and Westhoff DC.**(1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
10. **Jay JM, Loessner MJ and Golden DA.**(2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.



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PRACTICALS

S. No	Experiment
1	Microbial fermentation for the production and estimation of amylase
2	Microbial fermentation for the production and estimation of citric acid
3	Microbial fermentation for the production and estimation of ethanol
4	Determination of the microbiological quality of milk sample by MBRT
5	Isolation of fungi from spoilt bread/fruits/vegetables
6	Preparation of Yogurt/ Dahi



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: IV

SUBJECT NAME: MICROBES IN ENVIRONMENT

SUBJECT CODE: 4SC04MIN1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
4	0	4	8	6	30	1	70	3	30	---	70	200	

Objectives:- The primary objective of this course is to make people aware of the importance of Food and Dairy Microbiology

Prerequisites:- Basic understanding of concepts related to food & dairy microbiology and its application for human health.

Course content:

Sr. No.	Course contents	Teaching Hours
1	<p>Microorganisms and their Habitats:</p> <p>Structure and function of ecosystems Terrestrial Environment: Soil profil and soil microflora, Aquatic Environment: Microflora of fresh water and marine habitats</p> <p>Atmosphere: Aeromicroflora and dispersal of microbes Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body.</p> <p>Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, High hydrostatic & osmotic pressures, salinity and low nutrient levels.</p>	14
2	<p>Microbial Interactions:</p> <p>Microbe interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, Predation, Microbe- Plant interaction: Symbiotic and non-symbiotic interactions. Microbe animal interaction: Microbes</p>	12



	inruminants, nematophagusfungi and symbiotic luminescent bacteria.	
3	Bio geochemical Cycling: Carboncycle: Microbial degradation of cellulose, hemicelluloses, lignin and chitin Nitrogencycle: Nitrogen fixation, ammonification, nitrification, denitrification and nitrate reduction. Phosphorus cycle: Phosphate immobilization and solubilisation. Sulphur cycle: Microbes involved in sulphur cycle. Other elemental cycles: Iron and manganese	12
4	Waste Management: Solid Waste management: Sources and types of solid waste, Methods of solid waste disposal (composting and sanitary landfill) Liquid waste management: Composition and strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, tricklingfilter, activated sludge process and septic tank) and tertiary Sewage treatment	12
5	MicrobialBioremediation: Principles and degradation of common pesticides, hydrocarbons (oilspills).	5
6	WaterPotability: Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPNtest, confirmed and completed tests for faecal coliforms (b)Membrane filter technique and (c)Presence/absencetests	5
Total Hours		60

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of bioinformatics & biostatistics.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.



Books Recommended:

1. **AtlasRMandBarthaR.** (2000). *MicrobialEcology:Fundamentals&Applications*. 4th edition. Benjamin/Cummings SciencePublishing, USA
2. **MadiganMT, MartinkoJandParkerJ.** (2014). *BrockBiologyofMicroorganisms*. 14th edition. Pearson/BenjaminCummings
3. **MaierRM, PepperlLandGerbaCP.** (2009). *EnvironmentalMicrobiology*. 2nd edition, Academic Press
4. **Okafor,N** (2011). *EnvironmentalMicrobiologyofAquatic&Wastesystems*. 1st edition, Springer, New York
5. **SinghA, Kuhad, RC&WardOP** (2009). *AdvancesinAppliedBioremediation*. Volume 17, Springer-Verlag, Berlin Heidelberg
6. **BartonLL&NorthupDE** (2011). *MicrobialEcology*. 1st edition, WileyBlackwell, USA
7. **CampbellRE.** (1983). *MicrobialEcology*. BlackwellScientificPublication, Oxford, England.
8. **CoyneMS.** (2001). *SoilMicrobiology:AnExploratoryApproach*. DelmarThomsonLearning
9. **LynchJM&HobbieJE.** (1988). *MicroorganismsinAction:Concepts&ApplicationinMicrobialEcology*. BlackwellScientificPublication, U.K.
10. **MartinA.** (1977). *AnIntroductiontoSoilMicrobiology*. 2nd edition. JohnWiley&SonsInc. New York&London.
11. **StolpH.** (1988). *MicrobialEcology:OrganismsHabitatsActivities*. CambridgeUniversity Press, Cambridge, England.
12. **SubbaRaoNS.** (1999). *SoilMicrobiology*. 4th edition. Oxford&IBHPublishingCo. New Delhi.
13. **WilleyJM, SherwoodLM, and WoolvertonCJ.** (2013). *Prescott'sMicrobiology*. 9th edition. McGrawHillHigherEducation.



PRACTICALS

Sr. No	Experiment
1	Analysis of soil pH, moisture content, water holding capacity, percolation, capillary action.
2	Isolation of microbes (bacteria & fungi) from soil (28°C&45°C).
3	Isolation of microbes (bacteria and fungi) from rhizosphere and rhizoplane.
4	Assessment of microbiological quality of water.
5	Determination of BOD of waste water sample.
6	Study the presence of microbial activity by detecting (qualitatively) enzymes (dehydrogenase, amylase, urease) in soil.
7	Isolation of <i>Rhizobium</i> from root nodules.



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. SEMESTER: IV
SUBJECT NAME: MICROBIAL DIAGNOSIS IN HEALTH CLINICS
SUBJECT CODE: 4SC04MDC1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
2	0	0	2	2	15	1	35	1.5	---	---	---	50	

Objectives:- The primary objective of this course is to make people aware of the importance of Food and Dairy Microbiology

Prerequisites:- Basic understanding of concepts related to food & dairy microbiology and its application for human health.

Course content:

Sr. No.	Course contents	Teaching Hours
1	Importance of Diagnosis of Diseases: Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis.	5
2	Collection of Clinical Samples: How to collect clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.	5
3	Direct Microscopic Examination and Culture. Examination of sample by staining-Gram stain, Ziehl Neelson staining for tuberculosis, Giemsa- stained thin blood film for malaria. Preparation and use of culture media-Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.	5
4	Serological and Molecular Methods Serological Methods-Agglutination, ELISA, immune fluorescence, Nucleic acid based methods- PCR, Nucleic acid probes	5
5	Kits for Rapid Detection of Pathogens Typhoid, Dengue and HIV, Swine flu	5
6	Testing for Antibiotic Sensitivity in Bacteria: Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method	5



Total Hours	30
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Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of bioinformatics & biostatistics.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Anantha narayan and Paniker CKJ (2009) Textbook of Microbiology, 8th edition Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Vivain Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
4. TilleP (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby
5. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier.



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: IV

SUBJECT NAME: Microbial Quality Control in Food and Pharmaceutical Industries

SUBJECT CODE: 4SC04MDC1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
2	0	0	2	2	15	1	35	1.5	---	---	---	50	

Objectives:- The primary objective of this course is to make people aware of the importance of Food and Dairy Microbiology

Prerequisites:- Basic understanding of concepts related to food & dairy microbiology and its application for human health.

Course content:

Sr. No.	Course contents	Teaching Hours
1	Microbiological Laboratory and Safe Practices: Good laboratory practices-Good laboratory practices, Good microbiological practices, Bio safety cabinets-Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3 .Discarding biohazardous waste Methodology of Disinfection, Autoclaving & Incineration	8
2	Determining Microbes in Food/Pharmaceutical Samples: Culture and microscopic methods Standard plate count, Most probable numbers, Direct microscopic counts, Biochemical and immunological methods: Limulus lysate test for endotoxin , gel diffusion, sterility testing for pharmaceutical products, Molecular methods-Nucleic acid probes, PCR based detection, biosensors.	10
3	Pathogenic Microorganisms of Importance in Food & Water : Enrichment culture technique, Detection of specific microorganisms-on XLD agar, Salmonella, Shigella Agar, Mannitol salt agar, EMB agar, McConkey Agar, Saboraud Agar, Assaying microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay)	8
4	HACCP for Food Safety and Microbial Standards: Hazard analysis of critical control point(HACCP)-Principles, flow diagrams, limitations, Microbial Standards for Different Foods and Water-BIS standards for common foods and drinking water	4
Total Hours		30

Learning Outcomes:-



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At the end of the course the student would have sufficient knowledge of bioinformatics & biostatistics.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. **Harrigan WF**(1998) Laboratory Methods in Food Microbiology, 3rd ed. Academic Press
2. **Garg N, Garg KL and Mukerji KG** (2010) Laboratory Manual of Food Microbiology IK International Publishing House Pvt. Ltd.
3. **Jay JM , Loessner MJ ,Golden DA** (2005) Modern Food Microbiology, 7th edition. Springer
4. **Baird RM, Hodges NA and Denyer SP** (2005) Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.



FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc.

SEMESTER: IV

SUBJECT NAME: MANAGEMENT OF HUMAN MICROBIAL DISEASES

SUBJECT CODE: 4SC04MHDC1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
2	0	0	2	2	15	1	35	1.5	---	---	---	50	

Objectives:- The primary objective of this course is to make people aware of the importance of Food and Dairy Microbiology

Prerequisites:- Basic understanding of concepts related to food & dairy microbiology and its application for human health.

Course content:

Sr. No.	Course contents	Teaching Hours
1	Human Diseases Infectious and non-infectious diseases, microbial and non-microbial diseases, Deficiency diseases, occupational diseases, Incubation period, Mortality rate, nosocomial infections	4
2	Microbial diseases Respiratory microbial diseases, gastro intestinal microbial diseases, Nervous System diseases, skin diseases, eye diseases, urinary tract diseases, Sexually transmitted diseases: Types, route of infection, clinical systems and general prevention methods, study of recent outbreaks of human diseases (SARS/ Swineflu /Ebola)–causes, spread and control, Mosquito borne disease–Types and prevention.	12
3	Therapeutics of Microbial diseases Treatment using antibiotics: beta lactam antibiotics (penicillin, cephalosporins), quinolones, polypeptides and aminoglycosides. Judicious use of antibiotics, importance of completing antibiotic regimen, Concept of DOTS, emergence of antibiotic resistance, urren tissues of MDR/XDR microbial strains. Treatment using antiviral agents: Amantadine, Acyclovir, Azidothymidine. Concept of HAART.	8
4	Prevention of Microbial Diseases General preventive measures, Importance of personal hygiene, environmental sanitation and methods to Prevent the spread of infectious agents transmitted by direct contact, food, water and insect vectors.	6



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	Vaccines: Importance, types, vaccines available against microbial diseases, Vaccination schedule (compulsory and preventive) in the Indian context.	
	Total Hours	30

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of bioinformatics & biostatistics.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session.

Books Recommended:

1. Ananthanarayan R. and Paniker C.K.J.(2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A.(2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Goering R., Dockrell H., Zuckerman M. And Wakelin D.(2007) Mims' Medical Microbiology. 4th edition. Elsevier
4. Willey JM, Sherwood LM, and Woelverton CJ.(2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
5. Madigan MT, Martinko JM, Dunlap PV and Clark DP.(2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition