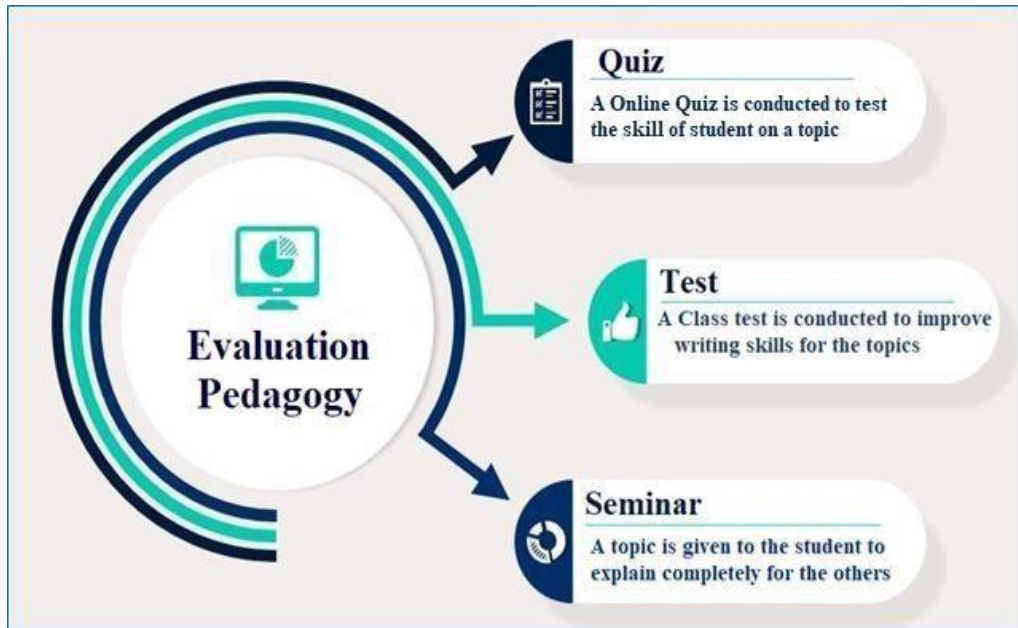


DEPARTMENT OF MICROBIOLOGY
Teaching Plan – 2022-2023



Course: B.SC	Year:I	Semester:I			
Subject	Introduction to microbiology and microbial diversity				
Units	1. History and mile stones in microbiology 2. Methods of sterilization 3. Staining Techniques 4. Isolation of Microorganisms from natural habitats. 5. Ultra structure of Prokaryotic cell				
Duration	60hours				
LearningObjectives	End of this course, students will gain knowledge on the following: <ul style="list-style-type: none"> ➤ Knowledge about history of microbiology. ➤ Various methods of sterilization and its uses. ➤ Using and handling of disinfected techniques. ➤ Ultra structure of prokaryotes and classification ➤ How to make culture different types of cultures and preservation of cultures 				
Units	U1	U2	U3	U4	U5
Hours Split:Total: 60	12	12	12	12	12
Internal valuation:25marks	5	5	5	5	5
Resource Material:	<p>Reference Books:</p> 1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). Introductory Mycology, Wiley, New York. 2. Atlas, R.A. and Bartha, R. (2000). Microbial Ecology. Fundamentals and Application, Benjamin Cummings, New York. 3. Dimmock, N.J., Easton, A.J. and Leppard, K.N. (2001). Introduction to Modern Virology, Blackwell Science Ltd, U.K. 4. Dube, R.C. and Maheswari, D.K. (2000) General Microbiology. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai <p>YouTube Links:</p> <p>https://youtu.be/L62s6I8zG8 https://youtu.be/qPdh7_1IGwU</p> <p>Power Point Presentations:</p> <p>https://1drv.ms/p/s!AtAmUHXnBqYRdj6449BCKL_jO2o</p>				

I Academic-Pedagogical-Evaluation:Unit-wisePedagogy

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<ul style="list-style-type: none"> ➤ History and mile stones in microbiology. ➤ Contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky. Importance and applications of microbiology ➤ Classification of microorganisms. Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese. ➤ Outline classification of bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology 	P1,P2,P3,P4,P7	P3,PT,P7
II	<ul style="list-style-type: none"> ➤ Methods of sterilization: Physical methods – Dry heat, moist heat, radiation methods, filtration methods, Chemical methods and their application. ➤ Microbial cultures: Concept of pure culture, Methods of pure culture isolation, Enrichment culturing techniques, single cell isolation, and pure culture development. ➤ Preservation of microbial cultures: Subculturing, overlaying cultures with mineral oils, lyophilization, and cultures, storage at low temperature 	P1, P2,P3,P7	P3,P7,PT
III	<ul style="list-style-type: none"> ➤ Staining Techniques - Simple and Differential staining techniques. ➤ Principles of microscopy - Bright field and Electron microscopy (SEM and TEM). ➤ Nutritional types of bacteria. Microbiological media-Natural and synthetic basal, defined, complex, enrichment, selective, differential, maintenance and transport media 	P1,P3,P4,P5,P7	P3,P5,PQ,PT
IV	<ul style="list-style-type: none"> ➤ Microbial growth: Principles of growth, Kinetics of growth ➤ Methods of measuring growth: Direct methods: viable plate counts, membrane filtration. Indirect methods: Metabolic activity – measurements of DNA, Protein, Microscopic counts, electronic counters, most probable number; Batch and continuous growth, Synchronous culture, Diauxic growth. 	P1,P2,P4,P5,P7	PQ,P3,PT

	<ul style="list-style-type: none"> ➤ Types of cultures-stock, batch, continuous and synchronous cultures. Cultivation of aerobes and anaerobes. Reproduction in bacteria and spore formation 		
V	<ul style="list-style-type: none"> ➤ Ultra structure of Prokaryotic cell- Variant components and invariant components. ➤ Cell wall of bacteria and fungi, Gram positive cell wall, Gram negative cell wall, Cell wall of fungi and yeasts. ➤ Morphology, Ultrastructure and chemical composition of bacteria, Actinomycetes, Spirochetes, Rickettsiae, Mycoplasma, Chlamydiae. ➤ Economic importance of algae and fungi. SCP 	P1,P3,P4,P5,P7	P3,PQ,PT

Course: B.SC	Year:I	Semester:II			
Subject	Microbial physiology and biochemistry				
Units	1. Carbohydrates 2. Amino acids 3. Nucleic acids 4. Aerobic respiration 5. Enzymes				
Duration	60hours				
LearningObjectives	<ul style="list-style-type: none"> ➤ Classification , properties and functions of carbohydrates. ➤ Classification ,structure and properties of amino acid . ➤ Metabolic pathways, types of fermentation and photosynthesis in bacteria. ➤ Properties and classification of enzymes. 				
Units	U1	U2	U3	U4	U5
Hours Split:Total: 60	12	12	12	12	12
Internal valuation:25marks	5	5	5	5	5

Resource Material:	<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company Caldwell, D.R. (1995). 2. Microbial Physiology and Metabolism, W.C. Brown Publications, Iowa, USA. 3. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry, 2 nd Edition, CBS Publishers and Distributors, New Delhi. 4. Sashidhara Rao, B. and Deshpande, V. (2007). Experimental Biochemistry: A student Companion. I.K. International Pvt. Lt <p>YouTube Links: https://youtu.be/JxK5rZxbyQY https://youtu.be/2MW-qc1ABss https://youtu.be/RoRLYmcbktk</p> <p>Power Point Presentations: https://1drv.ms/p/s!AtAmUHXnBqYRgOgdcA4Z7DeO59xC</p>
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I. Academic-Pedagogical-Evaluation:Unit-wisePedagogy

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<ul style="list-style-type: none"> ➤ Carbohydrates – Classification, chemistry, properties, and function – mono, di, oligo and polysaccharides. ➤ Lipids – classification, chemistry, properties and function – free fatty acids, triglycerides, phospholipids, glycolipids & waxe 	P1,P3,P2,P6 P7	PQ P7,PT
II	<ul style="list-style-type: none"> ➤ Aminoacids –classification, structure and function. ➤ Essential amino Acids & amphoteric nature of amino acids and reactions and functions of carboxyl and amino groups and side chains. ➤ Proteins– isolation and characterization of proteins. ➤ Structural levels of proteins– primary, secondary, tertiary and quaternary, denaturation of proteins. ➤ Hydrolysis of proteins. Outlines of Protein sequencing using various methods 	P1,P2,P3,P4,P7	P3,P7,PT
III	<ul style="list-style-type: none"> ➤ Nucleicacids–structure, function and their properties. ➤ Structural polymorphism of DNA, RNA. Chemical structure and base composition of nucleic acids. ➤ Chargaff's rules, Watson Crick Model (B-DNA), deviations from Watson-Crick model, other forms of DNA (A- and Z-DNA) ➤ Forces stabilizing nucleic acid structures, (hydrogen bonds and hydrophobic associations, base stacking). ➤ Structural characteristics of RNA. Types of RNA 	P1, P2,P3,P4,P7,P8	P3,PQ,PT

<p>IV</p>	<ul style="list-style-type: none"> ➤ Aerobic respiration - Glycolysis, HMP path way, ED path way, TCA cycle, Electron transport, oxidative and substrate level phosphorylation. Kreb's cycle, glyoxylate cycle, hexose monophosphate (HMP) shunt, gluconeogenesis. ➤ Anaerobic respiration Fermentation, Biochemical mechanisms of lactic acid, ethanol, butanol and citric acid fermentations. Nitrate and sulphate respiration. ➤ Outlines of oxygenic and anoxygenic photosynthesis in bacteria 	<p>P2,P3,P4,P6,P9</p>	<p>PX,P9, PT</p>
<p>V</p>	<ul style="list-style-type: none"> ➤ Properties and classification of Enzymes. ➤ Biocatalysis- induced fit and lock and key models. Coenzymes and Cofactors. ➤ Factors affecting catalytic activity. ➤ Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric. ➤ Enzyme kinetics: Michaelis-Menten equation, effect of substrate concentration, effect of enzyme concentration, effect of pH and temperature, temperature 	<p>P1,P2,P3,P4,P7</p>	<p>P3,P7,PT</p>

Course: B.SC	Year:II	Semester:III			
Subject	MEDICAL MICROBIOLOGY AND IMMUNOLOGY				
Units	1. General principles and methodology of laboratory diagnosis 2. General account on microbial diseases 3. Description and pathology of microbial diseases 4. Immunity 5. Antigens and antibodies				
Duration	60hours				
LearningObjectives	This course offers the knowledge about <ul style="list-style-type: none"> ➤ Bacterial diseases - Fungal diseases –protozoan diseases Viral Diseases ➤ Primary and secondary organs of immune system ➤ Types of antigen-antibody reactions ➤ Interferon – Nomenclature, types & classification, Induction of interferon, types of Inducers ➤ General account on nosocomial infection 				
Units	U1	U2	U3	U4	U5
Hours Split:Total: 60	12	12	12	12	12
Internal valuation:40marks	5	5	5	5	5

Resource Material:	<p>Reference Books:</p> <ol style="list-style-type: none"> Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication. 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. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford. <p>YouTube Links: https://youtu.be/WUIH-4BoLD8 https://youtu.be/NUn2vY0RGjY</p> <p>Power Point Presentations: https://1drv.ms/p/s!AtAmUHXnBqYReODzyodhuX6biuk https://1drv.ms/p/s!AtAmUHXnBqYRgQxXTTJuDdQ_F0ER</p>
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Academic-Pedagogical-Evaluation:Unit-wisePedagogy

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<ul style="list-style-type: none"> ➤ Normal flora of human body. ➤ Host pathogen interactions: infection, invasion, pathogen, pathogenicity, virulence and opportunistic infection. General account on nosocomial infection. ➤ General principles of diagnostic microbiology- collection, transport and processing of clinical samples. ➤ General methods of laboratory diagnosis - cultural, biochemical, serological and molecular methods. 	P1,P2,P3,P4,PQ,P7	PQ,P3,PT
II	<ul style="list-style-type: none"> ➤ General account on microbial diseases - causal organism, pathogenesis, epidemiology, diagnosis, prevention and control. ➤ Bacterial diseases - Tuberculosis and Typhoid ➤ Fungal diseases – Candidiasis, Aspergillosis, Yeast ➤ Protozoal diseases – Malaria, Filaria & Diseases spread by House Fly. ➤ Viral Diseases - Hepatitis- A & C and AIDS 	P1,P3,P4,P6,PQ	P3,P7,PQ
III	<ul style="list-style-type: none"> ➤ Description and pathology of diseases caused by Aspergillus, Penicillium. ➤ Description and pathology of diseases caused by hemoflagellates; Leishmania donavani, L.tropica, Trypanosoma gambiense. ➤ Principles of chemotherapy, ➤ Antibacterial drugs – Penicillin, Antifungaldrugs – Nystatin, Antiviralagents – Robovirin, Drug resistance in bacteria. ➤ Interferon – Nomenclature, types & classification, Induction of interferon, types of Inducer 	P1,P2,P3,P4,P9	P3,P9,PT
IV	<ul style="list-style-type: none"> ➤ Types of immunity - innate and acquired; active and passive; humoral and cell-mediated immunity. ➤ Primary and secondary organs of immune system - Thymus, Bursa fabricus, bone marrow, spleen and lymph nodes. ➤ Cells of immune system. Identifiication and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils 	P1,P2,P3,p4,p7	P3,P9PT

<p>V</p>	<ul style="list-style-type: none"> ➤ Antigens - types, chemical nature, antigenic determinants, haptens. Factors affecting antigenicity. ➤ Antibodies - basic structure, types, properties and functions of immunoglobulins. ➤ Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, complement fixation, blood groups. ➤ Labeled antibody based techniques - ELISA, RIA and Immuno fluorescence. ➤ Polyclonal and monoclonal antibodies - production and applications. Concept of Hypersensitivity and Autoimmunity. Hybridoma technology. 	<p>P1,p2,p3,p4,p9</p>	<p>P3,P5,PT</p>
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Course: B.SC	Year:II	Semester:IV			
Subject	Industrial microbiology				
Units	1. Microorganisms of industrial importance 2. Fermentation and fermenter 3. Microorganisms involved in Pharma and therapeutic enzymes 4. Industrial microorganisms 5. Bioreactors				
Duration	60hours				
LearningObjectives	<ul style="list-style-type: none"> ➤ How to use screening techniques and important microbial metabolites. ➤ Types of fermentor and its process , downstream processing. ➤ Production of therapeutic enzymes , role of microorganisms in leather and textile industries. ➤ Microbial production of industrial products. ➤ Types , structure and sterilization of bioreactor 				
Units	U1	U2	U3	U4	U5
Hours Split:Total: 60	12	12	12	12	12
Internal valuation:40marks	5	5	5	5	5

Resource Material:	<p>Reference Books:</p> <ol style="list-style-type: none"> 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. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley-Blackwell Scientific Publication, Oxford. 4. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York <p>YouTube Links:</p> <ol style="list-style-type: none"> 1. https://youtu.be/1m_p1ZRjoxE 2. https://youtu.be/MFQ6FjV4gCQ 3. https://youtu.be/fQOzHC828aM <p>Power Point Presentations: https://www.slideshare.net/MRakibulIslam/industrial-microorganisms</p>
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Academic-Pedagogical-Evaluation:Unit-wisePedagogy

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<ul style="list-style-type: none"> ➤ Microorganisms of industrial importance – yeasts (<i>Saccharomyces cerevisiae</i>), moulds (<i>Aspergillus niger</i>) bacteria (<i>E.coli</i>), actinomycetes (<i>Streptomyces griseus</i>). Industrially important ➤ Primary and secondary microbial metabolites. ➤ Screening techniques. Techniques involved in selection of industrially important metabolites from microbes 	P1,,P3,P4,P7 ,P8	PQ,P3,P7
II	<ul style="list-style-type: none"> ➤ Fermentation and fermentor: concept and discovery of fermentation. Fermenter: its parts and function. ➤ Types of fermenter – batch, continuous and fed batch. Types of fermentation processes – solid state, liquid state, batch, fed-batch, continuous. ➤ Basic concepts of Design of fermenter. Ingredients of Fermentation media. ➤ Downstream processing - filtration, centrifugation, cell disruption, solvent extraction 	P1,P2,P3,P4, P7	P3,PT,PT
III	<ul style="list-style-type: none"> ➤ Microorganisms involved in Pharma and therapeutic enzymes. ➤ Enzymes used in detergents, textiles and leather industries. Production of amylases and Proteases. ➤ Production of therapeutic enzymes. ➤ Role of microorganisms in bioleaching and textile industry 	P1,P2,P3,P4 ,P7	PQ,PT,P3
IV	<ul style="list-style-type: none"> ➤ Industrial microorganisms: cell growth, microbial growth kinetics, factors affecting growth, ➤ basic nutrition, principles of production media, components of media, chemical composition of media. ➤ Microbial production of Industrail products: Citric acid, Ethanol, Penicillin, Glutamic acid, and vitamin B12 	P1,P2,P3,P4 ,P9	P3,P9,PT

V	<ul style="list-style-type: none">➤ Bioreactors: basic structure of bioreactor, types of bioreactors,➤ kinetics and methodology of batch and continuous bioreactors.➤ Sterilization of bioreactors: fibrous filter sterilization. Aeration and agitation: agitation in shake flask and tube rollers	P1,P2,P3,P4, P7	PQ,P3,P7
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Course: B.SC	Year:II	Semester:IV			
Subject	Molecular biology and microbial genetics				
Units	1. DNA and RNA as genetic material 2. Mutations and mutagens 3. Concept of gene 4. Types of genes 5. Transcription and Translation				
Duration	60hours				
LearningObjectives	Students will understand the following upon the completion of this course <ul style="list-style-type: none"> ➤ Structure and organization of prokaryotic DNA ➤ Genetic recombination in bacteria ➤ Types of RNA and their functions, Genetic code, Structure of ribosome, Bacterial recombination ➤ Regulation of gene expression in bacteria ➤ Outline of Translation 				
Units	U1	U2	U3	U4	U5
Hours Split:Total: 60	12	12	12	12	12
Internal valuation:40marks	5	5	5	5	5

**Resource
Material:**

References;

1. Freifelder, D. (1990). Microbial Genetics. Narosa Publishing House, New Delhi.
Freifelder, D. (1997). Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
2. Glick, B.P. and Pasternack, J. (1998). Molecular Biotechnology, ASM Press, Washington D.C., USA.
3. Lewin, B. (2000). Genes VIII. Oxford University Press, England.
4. Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics, Jones and Bartlett Publishers, London.
5. Verma, P.S. and Agarwal, V.K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Co. Ltd., New Delhi

YouTube Links:

<https://youtu.be/VK90i2MHzX8>

<https://youtu.be/4ojuJTPJO2Y>

Power Point Presentations:

<https://in.docworkspace.com/d/sIDmb15vWAYmIpqUG?sa>

Academic-Pedagogical-Evaluation:Unit-wisePedagogy

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<ul style="list-style-type: none"> ➤ DNA and RNA as genetic material. Structure and organization of prokaryotic DNA. ➤ Watson and Crick model of DNA. ➤ Extra chromosomal genetic elements - Plasmids and transposons. ➤ Replication of DNA - Semi conservative mechanism ➤ Enzymes involved in replication 	P1,P2,P3,P4, P9	P3,P9,PT
II	<ul style="list-style-type: none"> ➤ Mutations - spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions. ➤ Mutagens - Physical and Chemical mutagens. Outlines of DNA damage and repair mechanisms ➤ . Genetic recombination in bacteria - Conjugation, Transformation and transduction 	P2,P3	P4,P9
III	<ul style="list-style-type: none"> ➤ Concept of gene Muton, Recon and Cistron. One gene one enzyme and one gene one polypeptide hypotheses. ➤ Types of RNA and their functions. Genetic code. Structure of ribosomes. ➤ Bacterial recombination – Bacterial transformation, Bacterial conjugation. ➤ Transduction–Generalized and specialized transductions 	P1,P2,P3	P9,P6
IV	<ul style="list-style-type: none"> ➤ Types of genes - structural, constitutive, regulatory, clustered genes and the control of gene expression. ➤ Regulation of gene expression in bacteria - operon concepts - Negative and positive control of the Lac Operon, trp operon. ➤ Poly and Mono cistronic m-RNA 	P1,P2,P3,P4	P4,P9

<p>V</p>	<ul style="list-style-type: none"> ➤ Transcription: Enzymatic Synthesis of RNA - Basic features of RNA synthesis, E.coli RNA polymerase, Classes of RNA molecules, processing of tRNA and rRNA in E.coli, Transcription in Eukaryotes, Eukaryotic rRNA genes, formation of eukaryotic tRNA molecules, RNA Polymerases of eukaryotes. ➤ Translation: Outline of Translation, The Genetic Code, The Decoding System, Codon Anticodon interaction. Protein Synthesis, Complex Translation units, Inhibitors and Modifiers of protein synthesis, Protein Synthesis in Eukaryotes 	<p>P2,P3,P4</p>	<p>P3,P6</p>
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Course:B.SC	Year:III	Semester:V			
Subject	6A. Food, agricultural and environmental microbiology				
Units	1. Microbial spoilage of food 2. Principles of food preservation 3. Soil microbiology 4. Beneficial microorganisms in Agriculture 5. Terrestrial Environment				
Duration	60hours				
Learning Objectives	Students will learn the following upon completion of this course <ul style="list-style-type: none"> ➤ Intrinsic and extrinsic parameters that affect microbial growth in food ➤ Fermented Dairy foods ➤ Management of soil biota for maintaining soil fertility ➤ Aquatic Environment 				
Units	U1	U2	U3	U4	U5
HoursSplit:Total: 60	12	12	12	12	12
Internal valuation:25marks	5	5	5	5	5

Resource Material:	Reference Books: <ol style="list-style-type: none"> 1. Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England 2. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning. 3. Lynch JM & Hobbie JE. (1988). Microorganisms in Action: Concepts & Application in Microbial Ecology. Blackwell Scientific Publication, U.K. 4. Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition. Pearson/ Benjamin Cumming YouTube Links: https://youtu.be/5hgyDPLLSol https://youtu.be/YIHVjeDyOSU Power Point Presentations: https://www.slideshare.net/HarishReddy280/food-spoilage-133126063
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Academic-Pedagogical-Evaluation:Unit-wisePedagogy

UNIT	DESCRIPTION	PEDAGOGY	INTERN AL EVALUATI ON
I	<ul style="list-style-type: none"> ➤ Intrinsic and extrinsic parameters that affect microbial growth in food Microbial spoilage of food - fruits, vegetables, milk, meat, egg, bread and canned foods Food intoxication (botulism). ➤ Food-borne diseases (salmonellosis) and their detection. 	P1,P2,P3,P7	P3,P7,PT
II	<ul style="list-style-type: none"> ➤ Principles of food preservation - Physical and chemical methods. Fermented Dairy foods – cheese and yogurt. ➤ Microorganisms as food – SCP, edible mushrooms (white button, oyster and paddy straw). ➤ Probiotics and their Benefits. 	P1,P3,P4,P7	P3,P7,PT
III	<ul style="list-style-type: none"> ➤ Soil Microbiology: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur, Biological nitrogen fixation. Microflora of Rhizosphere and Phyllosphere microflora, microbes in composting. ➤ Importance of mycorrhizal inoculums, types of mycorrhizae associated plants, mass inoculums. ➤ Production of VAM, field applications of Ectomycorrhizae and VAM 	P1,P3,P4,P9	P3,P9,PQ
IV	<ul style="list-style-type: none"> ➤ Beneficial microorganisms in Agriculture: Biofertilizer (Bacterial Cyanobacterial and Fungal), microbial insecticides ➤ Microbial agents for control of Plant diseases, ➤ Biodegradation, Biogas production, Biodegradable plastics, Plant – Microbe interactions. ➤ Diseases caused by bacteria and fungi to various commercial and food crops (2 examples each) Management of soil biota for maintaining soil fertility. ➤ Conversion of waste lands into fertile lands. Management of soil nutrient. 	P1,P3,P4,PX	P3,PX,PT

V	<ul style="list-style-type: none"> ➤ Terrestrial Environment: Soil profile and soil microflora. ➤ Aquatic Environment: Microflora of fresh water and marine habitats. Atmosphere: Aeromicroflora and dispersal of microbes. Extremophiles. ➤ Nutrient cycling - Carbon, nitrogen, phosphorus. ➤ Methods to detect portability of water samples. 	P1,P4 PT,P7	P3,p7,PT
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Course:B.SC	Year:III	Semester: V			
Subject	7A. food and dairy microbiology				
Units	1.Microbiology of foods 2.Microbial spoilage of food 3.Principles of food preservation 4.Fermented foods 5.Dairy microbiology				
Duration	60hours				
LearningObjectives	<ul style="list-style-type: none"> ➤ Understanding the key concepts in food and dairy microbiology. ➤ Identifying the types and nature of food spoilage caused by microorganisms ➤ Developing principles and methods for the microbiological examination and preservation of foods. ➤ Emphasizing the role of intrinsic and extrinsic factors On growth and survival of microorganisms in food and dairy industries. 				
Units	U1	U2	U3	U4	U5
HoursSplit:Total: 60	12	12	12	12	12
Internal valuation:25marks	5	5	5	5	5

Resource Material:	<p>Reference Books:</p> <ol style="list-style-type: none"> Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd. 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. Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier <p>YouTube Links: https://youtu.be/M-5pgPzyCS4 https://youtu.be/OqII8fBWJBs</p> <p>Power Point Presentations: https://www.slideshare.net/HiwrHastear/food-microbiology-60301420</p>
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UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<ul style="list-style-type: none"> ➤ Microbiology of foods as substrate for microorganisms . intrinsic and extrinsic parameters that affect the microbial growth in food. Survival of microbes in food. Natural flora and source of contamination of foods in general. Identification of specific groups Bacteria, viruses, Fungi and Protozoa . Food sanitation and control. 	P1,P2,P3,P7	P3,P7,PT
II	<ul style="list-style-type: none"> ➤ Microbial spoilage of food : Spoilage of canned food, cereals, fruits, vegetables, bread, eggs, meat and fish. ➤ Food intoxication Staphylococcal poisoning, botulism, Food infection Salmonellosis, shigellosis. Mycotoxins produced by fungi – Aflatoxins in stored food and grains. 	P1,P3,P4,P7	P3,P7,PT
III	<ul style="list-style-type: none"> ➤ Principals of food preservation – Method of food preservation- Physical method - high temperature, canning, freezing, dehydration and radiation . ➤ chemical method- salt, sugar organic acids, SO2, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins organic acids, nitrates and cresols. 	P1,P3,P4,P9	P3,P9,PQ
IV	<ul style="list-style-type: none"> ➤ Fermented Food: Dairy starter cultures, fermented dairy products : yogurt and (Type and Production), other fermented foods: acidophilus milk, kumiss, kefir, dahi, dosa, sauerkraut, soy sauce and tampeh, ➤ Microorganisms as food – single cell protein yeast, algae and fungal organisms ➤ Mushrooms: Type and cultivation. Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market. 	P1,P3,P4,PX	P3,PX,PT

V	<p>➤ Dairy Microbiology (Skill-based unit): Physical and chemical properties of milk, Microorganisms in milk, Sources of microbial contamination of milk – milch animals, utensils and equipment, water, milking environment.</p> <p>Methods of preservation of milk and milk products: Pasteurization, sterilization, dehydration. Fermentation in milk : Souring, lactic acid fermentation and proteolysis.</p>	P1,P4 PT,P7	P3,p7,PT
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