Shri Vile Parle Kelavani Mandal's

MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS (AUTONOMOUS)

NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),
Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India,
Best College (2016-17), University of Mumbai

Affiliated to the

UNIVERSITY OF MUMBAI

Program: Bachelor of Science

Course: Microbiology

Semester: III & IV

Choice Based Credit System (CBCS) with effect from the Academic year: 2022-23

A.C. No. 12

Agenda No. 4(V)

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

On completion of the B.Sc. in Microbiology, the learners should be enriched with knowledge and be able to-

PSO1: Articulate and communicate in the specialized terminology pertaining to microbiology.
PSO2: Define and explain the theories and practices of the various fields/ disciplines in microbiology.
PSO3: Explain the technologies and methods commonly used in microbiology.
PSO4: Acquire the requisite skills applicable to microbiological analysis.
PSO5: Describe the genetic and ecological relationships between microorganisms.
PSO6: Discuss the applications of microorganisms in the various areas of biotechnology.

Preamble

The grant of autonomy along with DBT star funding has provided a platform for designing a curriculum that is dynamic which meets the need of the hour. The inherent freedom under autonomy provides for a multisensory learning experience.

The revised syllabus of S.Y.B.Sc. reflects continuity in the flow of information from the F.Y.B.Sc. syllabus. The module on Medical Microbiology and Immunology intends to make the learner aware of the sources and spread of infection. It also elucidates how the immune system protects the body from pathogens.

Microbes are ubiquitous, residing in different types of environments. Adaptations to such environments have led to biodiversity, which has been reflected in a module on microbial diversity and taxonomy.

The current syllabus will also introduce the learner to metabolism and laws of thermodynamics and how they are obeyed by biological systems. This will build a base to learn metabolic pathways in details at T.Y.B.Sc. level.

In view of the increasing demand for training manpower in the area of Applied Microbiology, this course will give a good insight into the field of Industrial, Food and Dairy Microbiology.

The courses are as follows: -

Semester III:	USMAMB301:	Medical Microbiology & Immunology
	USMAMB302:	Environmental Microbiology
	USMAMB303:	Biology of Macromolecules and metabolism
Semester IV:	USMAMB401:	Applications and Research in Microbiology
	USMAMB402:	Industrial, Food & Dairy Microbiology
	USMAMB403:	Molecular biology & Enzymology

I profusely thank all the committee members for their efforts in drafting the syllabus.

N.B.-(i) The duration of each theory lecture will be of 60 minutes. A course consists of 3 Modules. For each Module the number of hours allotted are 10. The total number of lecture hours for each course will thus be 30.

(ii) There will be one practical per batch for each course. The duration of each practical will be of 2 hours, i.e., of 120-minutes.

For practical component the value of One Credit is equal to 30 learning hours.

(iii) Thus, in a week, a student will study 6 hours of theory and 6 hours of practicals.

Course Name	Course code	Number of hours/week	Total number of hours	Number of credits
Medical Microbiology & Immunology	USMAMB301	2	2 X 15= 30	2
Environmental Microbiology	USMAMB302	2	2 X 15= 30	2
Biology of Macromolecules and metabolism	USMAMB303	2	2 X 15= 30	2
Microbiology Practical	USMAMBP3123	6	6 X 15= 90	3
Applications and Research in Microbiology	USMAMB401	2	2 X 15= 30	2
Industrial, Food & Dairy Microbiology	USMAMB402	2	2 X 15= 30	2
Molecular biology & Enzymology	USMAMB403	2	2 X 15= 30	2
Microbiology Practical	USMAMBP4123	6	6 X 15= 90	3

Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) Details of Continuous Assessment (CA)

25% of the total marks per course:

Continuous Assessment	Details	Marks
Component 1 (CA-1)	Assignment	15 marks
Component 2 (CA-2)	Class test	10 marks

b) Details of Semester End Examination

75% of the total marks per course. Duration of examination will be two and half hours.

Question Number	Description	Marks	Total Marks
1	Subjective questions based on module 1	3 questions of 7 marks each to be attempted out of 4 questions	21
2	Subjective questions based on module 2	3 questions of 7 marks each to be attempted out of 4 questions	21
3	Subjective questions based on module 3	3 questions of 7 marks each to be attempted out of 4 questions	21
4	Subjective questions based on modules 1-3	3 questions of 4 marks each to be attempted out of 4 questions	12
		Total Marks	**75**

Dr. Geeta Narayan
HOD

Dr. Meenakshi Vaidya
Approved by Vice –Principal

Dr. Krutika Desai
Approved by Principal

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B. Sc.			**Semester : III**	
Course: Medical Microbiology and Immunology			**Course Code: Theory USMAMB 301**	
Teaching Scheme			**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Percentage)**	**End Semester Examinations (ESE) (Percentage)**
2	-	2	25	75

Learning Objectives:

In the first year, learners were introduced to the importance of microbiology in medical filed. In the second year, a learner will be introduced to defense mechanism and the role of microbiologist in the diagnosis of various infections. They will learn insight of clinical microbiology procedures.

Course Outcomes:

After completion of the course, students would be able to:

CO1: Appreciate the several lines of defense and how they come in to play during an immune response.

CO2: Build upon the knowledge of host normal biota and its role in host defense.

CO3: Elaborate upon intricacies of the collection of pathological samples and cultivation of pathogens in the laboratory.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Innate Immunity & Immune System**	**10**
2	**Microbe-host Interaction**	**10**
3	**Diagnostic And Clinical Microbiology**	**10**
	Total	**30**

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Module	Topic and Description	No. of hours	No. of Credits
1	**INNATE IMMUNITY& IMMUNE SYSTEM** Basic concepts in Immunology-Introduction Principles of Innate & Adaptive immunity-Primary, Secondary & Tertiary Barriers Components of the immune system - Cells and organs of the immune system Phagocytosis and inflammation-Mechanisms and link to immunity Connection between innate and adaptive immunity	**10** **01** **02** **03** **03** **01**	
2	**Microbe-host Interaction** Normal flora, Normal biota, Factors that determine the normal biota Sites of normal biota, Is the normal biota helpful or harmful? Microbial interactions – terminology, symbiosis, examples of animal-microbe partners (tabular form) Koch's postulates, Portal of entre, Penetration of host defenses	**10** **07** **03**	
3	**Diagnostic And Clinical Microbiology** Overview of the Clinical Microbiology Laboratory Isolation of pathogens from clinical specimens: Growth media and Culture Collection of specimens, handling and transport Types of specimens and their culture - Blood, Urine, faeces, sputum, cerebrospinal fluid, pus, genital specimens Culture of anaerobes. Identification of microorganisms from specimens: Microscopy, Growth-dependent Identification Methods, Introduction to Rapid Methods of Identification Bacteriophage typing Regulation of microbiological laboratory – accreditation agencies	**10** **01** **03** **04** **01** **01**	
	TOTAL	**30**	**2**

ESSENTIAL READING

1. Fahim Khan. The Elements of Immunology1st edition 2009 Pearson Education
2. Jerome J. Perry and James T. Staley Microbiology: Dynamics & Diversity 1997 Saunders College Publishing.
3. Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton Prescott's Microbiology
4. 8thEdition McGraw Hill International Edition
5. Madigan Martinko, Dunlap Clark Brock Biology of Microorganisms12thEdition
6. Pearson International Edition.

SUPPLEMENTARY READING

1. Thomas J Kindt; Richard A Goldsby; Barbara Anne Osborne; Janis Kuby; Kuby Immunology 6th Edition 2006 W H Freeman and Company
2. John L Ingraham & Catherine A Ingraham Introduction to microbiology 2nd edition 2002 Thomson Brooks/Cole.
3. Gerard Tortora, Berdell Funke and Christine Case Microbiology an Introduction 6th edition 1998 Adisson Weley Longman Inc
4. ***Any other reference sources as recommended by the course instructor***

To develop scientific temper and interest by exposure through industrial visits and study/industrial tours is recommended in each semester

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B. Sc.			**Semester : III**	
Course : Environmental Microbiology			**Course Code: Theory USMAMB 302**	
Teaching Scheme			**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Percentage)**	**End Semester Examinations (ESE) (Percentage)**
2	-	2	25	75

Learning Objectives:

Microorganisms are ubiquitous and play a significant role in various ecosystems. The microbiologist can play an important part in the environmental monitoring, which is the need of the hours. This course has been designed to help the learner to understand the presence of microorganisms and their function in the natural environment and how they can be used to control environmental pollution.

Course Outcomes:

After completion of the course, students would be able to:

CO1: Understand existence of various microorganisms in the biosphere.

CO2: Explain the role of microorganisms in various ecological niches.

CO3: Learn the methods to study various ecological niches.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Air and Sewage Microbiology**	**10**
2	**Freshwater and Marine Microbiology**	**10**
3	**Soil and Geo Microbiology**	**10**
	Total	**30**

Module	Topic and Description	No. of hours	No. of Credits
1	**AIR & SEWAGE MICROBIOLOGY** **Air Microbiology:** Origin, distribution, number and kinds of microorganisms in air factors affecting microbial survival in air. Enumeration of microorganisms in air: Impingement in liquids, impaction on solids, filtration, sedimentation, centrifugation, electrostatic precipitation. Air borne pathogens and diseases (Tabulation), concept of droplets and droplet nuclei. Air sanitation methods and applications. **Sewage Microbiology:** Types of waste water (self study) Characteristics of waste water (self study) Modern waste-water treatment: Primary, Secondary and tertiary treatment. Sludge processing Septic tanks Disposal of solid waste, modern sanitary landfills, composting Over view of advanced sewage treatment	**10** **03** **07**	
2	**FRESH WATER AND MARINE MICROBIOLOGY** Ecosystems of lakes, river, marshes, deep sea, hydrothermal vents and subterranean water (self study). Microorganisms in fresh water (lakes, rivers, marshes) and marine environments. Factors affecting microorganisms found in aquatic (fresh and marine) environments. Sampling & microbiological examination methods of fresh and marine water. Potable water, pathogens transmitted through water, microorganisms as indicators of faecal pollution and water purification methods.	**10** **01** **02** **03** **04**	
3	**SOIL & GEO MICROBIOLOGY** Terrestrial environment: Soil – Definition, composition, function, textural triangle Types of soil microorganisms & their activities (Tabular form) Methods of studying soil microorganisms: Sampling, cultural methods, other methods to be listed (physiological methods, immunological methods, nucleic acid-based methods, radioisotope techniques) Biogeochemical Cycles: Carbon cycle, Nitrogen cycle, Sulphur cycle, Phosphorus cycle (Schematic with examples)	**10** **02** **03** **05**	
	Total	**30**	**2**

ESSENTIAL READING:

1. A. H. Salle,. Fundamental Principles of Bacteriology 7thedn McGraw-Hill Book Company
2. Joanne Willey, Linda Sherwood and Christopher J. Woolverton Prescott, Harley and Klein's Microbiology 8thEdition McGraw Hill International Edition
3. Michael J. Pelczar Jr., E.C.S. Chan, Noel R. Krieg Microbiology 5th Edition McGraw Hill Education (India) Pvt. Ltd

SUPPLEMENTARY READING:

1. N.S. SubbaRao. Soil Microorganisms and Plant Growth 4th edition Oxford and IBH Pub Co.
2. Barbara Kolwzan, Waldemar Adamiak, Kazimierz Grabasand Adam Pawelczyk Introduction To Environmental Microbiology 2006 OficynaWydawniczaPolitechnikiWrocławskiej
3. R. M. Maier. I. L. Pepper & C. P. Gerba, Academic Press. Environmental Microbiology, 3rd edition Elsevier
4. ***Any other reference sources as recommended by the course instructor***

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SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B. Sc.			**Semester : III**	
Course : Biology of Macromolecules and metabolism			**Course Code: Theory USMAMB 303**	
Teaching Scheme			**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Percentage)**	**End Semester Examinations (ESE) (Percentage)**
2	-	2	25	75

Objectives:

One of the important areas of microbiology is the understanding of microbial biochemistry. It forms the basis for several applications of microbes. This course has been designed such that it forms the foundation for the understanding of microbial metabolism, the details of which will be dealt with at T.Y.B. Sc. level. The paper also includes thermodynamic principles applicable to biological system and the techniques to analyze macromolecules.

Course Outcomes:

After completion of the course, students would be able to:

CO1: Understand the structural chemistry of amino acids, proteins and nucleic acids

CO2: Understand the relevance of thermodynamics in the biological system

CO3: Analyze various biomolecules

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Biological macromolecules-II**	**10**
2	**Thermodynamics of biological systems and introduction to metabolism**	**10**
3	**Techniques in biochemistry**	**10**
	Total	**30**

Module	Topic and Description	No. of hours	No. of Credits
1	**BIOLOGICAL MACROMOLECULES-II** **Amino acids and protein** Classification and properties of amino acids, Primary secondary, tertiary and Quaternary structure of protein, **Nucleic acid chemistry**, Sugar, nitrogenous bases, phosphate, unusual nitrogen bases, Tautomeric form of nitrogenous bases, Nucleosides, Nucleotides, Importance of nucleotides in cell, Nucleic acids, Double stranded DNA, Hydrogen bonding Stabilization of double stranded structure, Right-handed helix, Major and minor grooves in Ds DNA, Importance of major groove, Watson and Crick model of DNA, Different forms of DNA, Unusual structures in DNA, Nucleic acid chemistry- hyperchromicity, hypochromacity, denaturation and renaturation of DNA, Tm, hybridization of DNA Structure and organization of RNA	**10** **06** **04**	
2	**THERMODYNAMICS OF BIOLOGICAL SYSTEMS AND INTRODUCTION TO METABOLISM** Thermodynamics of biological systems, First, second and third law of thermodynamics and its relevance in biological systems, Enthalpy in biological systems, Free energy change, Role of thermodynamic parameters in biochemical event. High energy molecules, Group transfer potential List of high energy molecules, Phosphoric acid anhydrides and carboxylic anhydrides, Enol phosphates, ATP -energy shuttling molecule. Factors affecting free energy changes-pH, metal ions, concentration, Importance of coupled processes in biological system. Introduction to metabolism, Metabolic diversity among organisms, Flow of energy in the biosphere- linkage between carbon and oxygen cycles Metabolism, Anabolism and catabolism, Energy relationship between anabolism and catabolism, Intermediary metabolism, Amphibolic pathway, Difference in corresponding pathways of catabolism and anabolism, Thermodynamics Dictates the Direction and, Regulatory Capacity of Metabolic Pathways, Control of metabolic flux, Role of NAD and NADPH in metabolism, ATP in cellular energy cycle.	**10** **02** **03** **04**	
3	**TECHNIQUES IN BIOCHEMISTRY** Electrophoretic techniques: General Principles**,** Support media**,** Types of electrophoretic techniques: Agarose electrophoresis and polyacrylamide electrophoresis- basic technique-overview Chromatographic techniques: General principles, Types of chromatographic techniques: Planer, Column- Adsorption, Ion exchange, Molecular exclusion, GC	**10** **04** **06**	
	Total	**30**	**2**

ESSENTIAL READING:

1. James D. Watson, Tania A. Baker, Stephen P. Bell Alexander Gann ,Michael Levine Richard Losick Molecular Biology of the Gene 7th Edition 2014 Pearson
2. Reginald H. Garrett, Charles M. Grisham Biochemistry 5th edition. 2013 Mary Finch
3. D. Nelson and M. Cox Lehninger: Principles of Biochemistry 5th Edition 2008 W.H. Freeman & Co
4. Keith Wilson & John Walker Principles and Techniques of Biochemistry and Molecular Biology 7th edition 2010 Cambridge University press

SUPPLEMENTARY READING:

1. Donald Voet and Judith Voet Biochemistry 4th edition 2010 John Wiley and Sons
2. David Plummer An Introduction to Practical Biochemistry 3rd edition 2001 Tata McGraw Hill Publishing Company
3. J. Jayaraman Laboratory Manual in Biochemistry 2003 New Age International Publishers
4. ***Any other reference sources as recommended by the course instructor***

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SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B. Sc.			**Semester : III**	
Course : Practicals			**Course Code: USMAMBP 3123**	
Teaching Scheme			**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Percentage)**	**End Semester Examinations (ESE) (Percentage)**
-	6	3	20	80

PRACTICALS		**3 Credits (90 hours)**
	PAPER -1	**1 Credit (30 hours)**
	Differential staining of blood by the Field's staining method	
	Use of Selective and Differential Solid Media: Mac Conkey's agar, SS agar, SIBA, Salt Mannitol agar	
	Handling and processing of biological samples: Urine, Stool, Blood, CSF	
	Microscopic tests for identification of organisms – Capsule staining, metachromatic granules staining and acid fast staining	
	Bacteriophage typing	
	Rapid Identification of a Pathogen using a Kit (Demonstration)	
	PAPER-2	**1 Credit (30 hours)**
	Enumeration of microorganisms in air and study of its load after fumigation	
	Routine analysis of water	
	Biochemical tests for detection of coliforms: Carbohydrate fermentation, Indole test, Methyl red test, Vogues Proskauer test, Citrate utilization test, TSI agar	
	Rapid detection of *E.coli* by MUG technique-Demonstration	
	Study of marine flora	
	Determination of total solid of sewage	
	Determination of chemical oxygen demand and biochemical oxygen demand	

	Visit to a sewage treatment plant	
	of soil microbial flora- bacteria, actinomycetes, fungi	
	Total viable count of soil flora	
	Enrichment and isolation of : Cellulose degraders, sulphate reducers and phosphate solubilisers from soil	
	Preparation of Winogradsky Column [Group experiment]	
	PAPER – 3: (Practicals based on Unit I, II & III)	**1 Credit (30 hours)**
	Problems on Thermodynamics/ Bioenergetics	
	Estimation of reducing sugars by DNSA method	
	Estimation of proteins by Biuret method	
	Electrophoresis of DNA [demonstration]	
	Paper Chromatography of amino acid/sugar	
	Thin layer chromatography of amino acids/sugar	
	Column chromatography – Demonstration	

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B. Sc.	**Semester : IV**
Course : Microbial Diversity, Microbial Taxonomy & Instrumentation	**Course Code: Theory USMAMB 401**

Teaching Scheme			**Evaluation Scheme**	
Lecture (Hours per week)	**Practical(Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Percentage)**	**End Semester Examinations (ESE) (Percentage)**
2	-	2	25	75

Learning Objectives:

This course has been designed to help learners understand the basis of taxonomy of microorganisms and methodologies used therein. Students will also appreciate the versatility of metabolic activities of microbes. Learners will understand the principle and the use of some of the instruments used in the analysis of various biomolecules. Students will get exposure to scientific writing.

Course Outcomes:

After completion of the course, students would be able to :

CO1: Describe methodologies used for bacterial taxonomy and use of Bergey's manual of systematic bacteriology in classification.

CO2: Appreciate the contemporary issues in Microbiology

CO3: Handle and use some the instruments

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Microbial Taxonomy**	**10**
2	**Contemporary issues in Microbiology**	**10**
3	**Instrumentation and Introduction to research methodology**	**10**
	Total	**30**

Module	Topic	No. of Hours	No. of Credits
1	**MICROBIAL TAXONOMY** Introduction to microbial taxonomy, Taxonomic ranks, Techniques for determining Microbial Taxonomy Microscopic & macroscopic morphology and biochemical characteristics Chemical Analysis, Serological analysis, Genetic & molecular analysis: - G+C content, DNA-DNA hybridization Introduction to Numerical Taxonomy, Carl Woese's classification of organisms, Use of Bergey's Manual of Systematic Bacteriology in bacterial taxonomy	**10** **01** **01** **04** **02** **02**	
2	**CONTEMPORARY ISSUES IN MICROBIOLOGY** Biodeterioration of paper, textile, paint, metal, rubber Bioremediation –Methods (*in-situ* and *ex-situ* bioremediation) Microbiology in news; case study on a microbiology-based enterprise	**10** **03** **03** **04**	
3	**INSTRUMENTATION AND INTRODUCTION TO RESEARCH METHODOLOGY** Spectroscopic techniques: Visible and UV spectrophotometry, Principles, Instrumentation, Applications Centrifugation techniques, Preparative centrifugation & techniques, Analytical centrifugation & applications Research in biosciences: Definition of Research General characteristics, objectives & classification of research, Steps of action research, Difference between action research and fundamental research Scientific Writing, the research report, need of research report, General format of research report, Mechanics of report writing, writing research abstract: Need of an Abstract, Format and Characteristics of a good Abstract, Writing research papers: Format of a research paper, Advantages of a research paper, Ethics and plagiarism	**10** **02** **03** **02** **03**	
	Total	**30**	**2**

ESSENTIAL READING

1. J. M. Willey, L. M. Sherwood & C. J. Woolverton, Prescott's Microbiology 8th edition McGraw-Hill International Edition.
2. Roger Stanier General Microbiology 5th edition 1999 Palgrave Macmillan
3. P. Laake, H Benestad and B. Olsen Research Methodology in medical and biological Sciences 1stedition 2007 Academic Press
4. Madigan Martinko, Dunlap Clark, Brock Biology of Microorganisms 12th Edition Pearson International Edition
5. Ed. Keith Wilson & John Walker Practical Biochemistry (Principles & Techniques) 7th Edition Cambridge University Publication

SUPPLEMENTARY READING

1. Ronald M.Atlas and Richard Bartha Microbial Ecology: Fundamentals and Ecology 4th edition 1998 Benjamin Cummings Publishing company Inc.
2. Dennis Allsopp, K.J.Seal, C. Gaylarde Introduction to Biodeterioration 2nd ed. 2004 Cambridge University Press
3. Pradip Kumar Sahu Research methodology: A guide for Research in Agricultural sciences, social Sciences, and other related fields 2013 Springer India
4. ***Any other reference sources as recommended by the course instructor***

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SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B. Sc.	**Semester :IV**
Course : Industrial, Food & Dairy Microbiology	**Course Code: Theory USMAMB 402**
Teaching Scheme	**Evaluation Scheme**

Lecture (Hours per week)	**Practical(Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Percentage)**	**End Semester Examinations (ESE) (Percentage)**
2	-	2	25	75

Objectives: This course covers three broad area of applied microbiology such as food, dairy and industrial microbiology. The course has been designed for learner to understand importance of microorganisms in food and dairy products, food -borne microorganisms, microbiology of food and milk preservation and microbiological examination of milk, milk products as well as various food. This course introduces basics of industrial microbiology such as screening of industrially important microorganisms, fermentation media and types of fermentation process, the details of the production of different products will be dealt in T.Y.B. Sc.

Outcomes:

After completion of the course, students would be able to :

The learner should be able to-

CO1: Understand interaction of microorganism in food, milk & milk products as well as

CO2: Factors affecting their growth in food.

CO3: Describe milk and food -borne pathogens.

CO4: Discuss the role of microorganisms in food spoilage.

CO5: Explain methods of preservation of milk, milk products and various types of food and food products

CO6: Comprehend screening of industrially important microorganisms from various environments, types of fermentation and media.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Industrial Microbiology**	**10**
2	**Food Microbiology**	**10**
3	**Dairy Microbiology**	**10**
	Total	**30**

Module	Topic	No. of Hours	No. of Credits
1	**INDUSTRIAL MICROBIOLOGY** Strains of industrially important microorganisms: Desirable characteristics of an industrial strain, Principles and methods of primary and secondary screening. Types of fermentations: Aerobic, Anaerobic, Solid state fermentations Types of fermentation processes: Surface and Submerged, Batch, continuous and fed-batch Media and scale up: Media components: - Carbon source, nitrogen source, amino acids and vitamins, minerals, water, buffers, antifoam agents, precursors, inhibitors, chelators and inducers, Crude media, Inoculum and production media. Inoculum development and Scale up	**10** **03** **01** **01** **04** **01**	
2	**FOOD MICROBIOLOGY** Introduction: food as a substrate and sources, Microbial growth in foods, Intrinsic and extrinsic factors, General principles of spoilage: Spoilage of fresh foods: fruits& vegetables, eggs, meat, poultry and seafood (tabular form) General principles of food preservation including (principle of each method and example of foods only): High temperature, Low temperature, Drying, Radiations, Food additives and preservatives (tabular form), Asepsis with introduction to HACCP. Food borne diseases and intoxications (tabular form) Methods of detection of microorganisms in food: overview of cultural, microscopic, physical, chemical and introduction to bioassay methods. Use of GMOs for the production of alternative foods	**10** **01** **01** **03** **03** **02**	
3	**Dairy Microbiology** Milk- Definition, composition, sources of contamination, Pasteurization of milk-LTLT, HTST method Milk products - production and spoilage of: Yoghurt, Butter, Cheese-Cheddar, Paneer Quality control of milk, Rapid platform test – MBRT & RRT Microbiological analysis of milk: - SPC, Coliform count, LPC, Psychrophiles, Thermophilic count, DMC & efficiency of pasteurization (phosphatase test)	**10** **01** **02** **04** **03**	
	Total	**30**	**2**

ESSENTIAL READING:

1. Casida L. E. Industrial Microbiology 2009 Reprint New Age International (P) Ltd. Publishers New Delhi
2. A. H. Patel Industrial Microbiology 1984 MacMillan New Delhi
3. William Frazier and Dennis Westhoff, Food Microbiology 5thEdition 2014 Tata McGraw Hill
4. Joanne Willey and Kathleen Sandman and Dorothy Wood Prescott's Microbiology 8thEdition McGraw Hill
5. Sukumar De Outlines of Dairy Technology 2001 Oxford University Press

SUPPLEMENTARY READING:

1. Stanbury P. F., Whitaker A. and Hall S. J Principles of Fermentation Technology 2ndEdition 1997 Aditya Books Pvt. Ltd, New Delhi.
2. Reed, G. (ed) Prescott and Dunn's Industrial Microbiology 4th Edition 1982 McMillan Publishers
3. H. A. Modi Fermentation Technology-Vol 2 2009 Pointer Publications, India
4. Jay, James M., Loessner, Martin J., Golden, David A. Modern Food Microbiology 5th Edition Springer
5. Clarence Henry Eckles,Willes Barnes Combs,Harold Macy Milk and Milk products 2004 McGraw-Hill
6. ***Any other reference sources as recommended by the course instructor***

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SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B. Sc.	**Semester : IV**
Course : Molecular Biology & Enzymology	**Course Code: Theory USMAMB 403**
Teaching Scheme	**Evaluation Scheme**

Lecture (Hours per week)	**Practical(Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Percentage)**	**End Semester Examinations (ESE) (Percentage)**
2	-	2	25	75

Learning Objectives:

This course is designed for the understanding of genetic information, structure of DNA. Chromosomal DNA in different of types of organisms, extrachromosomal DNA. The packaging of DNA as chromatin, the organization of chromosome, concept of a gene. A learner will also study genetic information pathways such as transcription and translation. This course also introduces the learner to enzymology which is an important area of microbiology as it forms a basis for several applications of microbes.

Course Outcomes:

After completion of the course, students would be able to:

CO1: Explain how DNA encodes genetic information
CO2: Describe structure and properties of different classes of RNA.
CO3: Discuss how DNA directs RNA and protein synthesis
CO4: Explain the process of transcription and translation in prokaryotes and eukaryotes
CO5: Discuss differences in transcription and translation
CO6: Understand the basic concepts in Enzymology

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Genetic Information**	**10**
2	**Genetic information pathways-Transcription and translation**	**10**
3	**Enzymology**	**10**
	Total	**30**

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Module	Topic	No. of Hours	No. of Credits
1	**GENETIC INFORMATION** Concept of gene, Gene and its function, central Dogma of life, DNA supercoiling, linking number, superhelical density, topoisomerases, Chromosomal DNA in viruses, bacteria, eukaryotes, Eukaryotes DNA-introns, repetitive DNA, telomeres, The C-Value Paradox. Structure and organization of chromosome, Higher order chromatin structure, Polyteny, Puffs, and Balbiani Rings, Lamp brush chromatin, Chromosomal banding, Centromere and telomere Extra chromosmonal DNA-plasmid, transposons	**10** **04** **04** **02**	
2	**GENETIC INFORMATION PATHWAYS-TRANSCRIPTION AND TRANSLATION** Transcription in bacteria, DNA dependent RNA synthesis, RNA polymerase, Initiation, elongation and termination of transcription, Transcription in eukaryotes, Types of RNA polymerases, Initiation elongation and termination of transcription, Translation, Genetic code, Structure of ribosome in prokaryotes and eukaryotes, Five stages of protein synthesis, Post-translation modification of protein	**10** **03** **02** **05**	
3	**ENZYMOLOGY** Introduction to enzymes: General properties of enzymes, Coenzymes: Different types and reactions catalyzed by coenzymes (tabular form), Rate law for a simple catalyzed reaction, Michaelis-Menten equation and its derivation, Classification of enzymes Enzyme saturation kinetics - Effect of temperature, pH and substrate Effect of Inhibitors- Reversible and irreversible, competitive, Non-competitive and uncompetitive inhibitors, Multi substrate reactions-Ordered, Random and Pingpong reactions, Isozymes, Metalloenzymes	**10** **05** **05**	
	Total	**30**	**2**

ESSENTIAL READING:

1. D. Nelson and M. Cox Lehninger: Principles of Biochemistry 5th Edition 2008 W.H. Freeman & Co
2. Robert Tamarin Principles of Genetics 7thEdition 2010 Robert Tamarin
3. P L Bonner, Trevor Palmer Enzymes: Biochemistry, Biotechnology, Clinical Chemistry 2007 Woodhead Publishing

SUPPLEMENTARY READING:

1. Eric Conn,Paul Stumpf, George Bruening and Roy Doi Outlines of Biochemistry 5th edition 1987 Wiley india Pvt. Ltd
2. ***Any other reference sources as recommended by the course instructor.***

To develop scientific temper and interest by exposure through industrial visits and study/industrial tours is recommended in each semester

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B. Sc.	**Semester : III**
Course : **Practicals**	**Course Code:** **Practicals USMAMBP 4123**
Teaching Scheme	**Evaluation Scheme**

Lecture (Hours per week)	**Practical (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Percentage)**	**End Semester Examinations (ESE) (Percentage)**
-	6	3	20	80

PRACTICALS		**3 Credits (90 hours)**
	PAPER-1	**1 Credit (30 hours)**
	Visit to a vermicomposting plant	
	Enrichment and isolation of hydrocarbon degraders	
	Isolating an organism from soil and identifying the same using Bergey's Manual	
	Writing a literature survey/ abstract / short review	
	PAPER-2	**1 Credit (30 hours)**
	Isolation of antibiotic producers from soil	
	Isolation of food spoilage agent	
	Determination of TDT and TDP	
	Determination of MIC of salt and sugar	
	Rapid platform tests of raw and pasteurized milk	
	Microbiological analysis of raw and pasteurized milk	
	Microbiological analysis of dairy products	
	Visit to a food/dairy industry	
	PAPER-3	**1 Credit (30 hours)**
	Isolation of DNA from onion/*E. coli*	

	Electrophoresis of DNA (demonstration)	
	Enzyme production (Invertase)	
	Determination of Km of Invertase(Lineweaver-Burke plot, Michaelis-Menten graph)	
	Effect of variables on enzyme activity (temperature, pH, enzyme concentration, inhibitor)	