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

Semesters: I & II

Choice Based Credit System (CBCS) with effect from the Academic year 2020-2021

A.C. No. 8

Agenda No. 4.2

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

On completion of B.Sc. 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:
Autonomy provides the college the freedom to restructure the syllabus in an effort to systematically incorporate credit-based semester and grading system. This is geared towards the practice of 'Constructivist teaching' in lieu of 'Instructionist teaching'. This also provides continuous evaluation consisting of components of internal and external assessment.

The syllabus for F.Y.B.Sc. Microbiology has been framed taking into consideration the points of view of the external experts as well as student representatives. The syllabus is envisaged as a dynamic syllabus that will keep pace with the latest developments.

While designing the syllabus, it has been ensured that the experiential learning is coupled with the development of analytical skills thus igniting the spark of curiosity for the subject.

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 an End Semester Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and End Semester 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)	Multiple choice questions	15 marks
Component 2 (CA-2)	Online test	10 marks

b) Details of End Semester Examination

75% of the total marks per course. Duration of the 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 modules1-3	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 and Economics (Autonomous)

Program: B.Sc.				**Semester: I**	
Course: FUNDAMENTALS OF MICROBIOLOGY				**Course Code:USMAMB101**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (25 %)**	**End Semester Examinations (ESE) (75% in Question Paper)**
02	-	-	02	25	75

Learning Objectives:

Paper I, titled 'Fundamentals of Microbiology' introduces the learner to the world of microbes which involves the study of microbial cell structure and methods for their observation and cultivation.

Course Outcomes:

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

CO1: Describe the ultrastructure of the cell.

CO2: Acquire skills to observe and cultivate microorganisms..

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Microbiology today; Prokaryotic cell structure**	**10**
2	**Microscopy and staining techniques**	**10**
3	**Principles of microbial nutrition and cultivation**	**10**
	Total	**30**

Detailed Syllabus:			
Module	**Topic and Description**	**No. of hours**	**No. of Credits**
Module 1	**MICROBIOLOGY TODAY; PROKARYOTIC CELL STRUCTURE** History of microbiology in a tabular form Prokaryotic cell structure Cell wall and cell membrane Components external to the cell wall—capsule, slime layer, flagella, pili, fimbriae Cytoplasmic matrix- Inclusion bodies, magnetosomes, ribosomes, gas vesicles, nucleoids, plasmids, bacterial endospores	**10** 1 9	
Module 2	**MICROSCOPY AND STAINING TECHNIQUES** **Microscopy** Optical spectrum, Lenses and mirrors Simple and Compound Microscopes Parts of the microscope and their functions Types of condensers, objective lenses and eyepieces Working of the microscope, Limit of resolution, Numerical Aperture, Resolution power, Abberation **Dyes and stains** Definitions Chemical basis of staining Fixatives, mordants, decolourizers Simple staining methods Differential staining methods- Gram staining Acid fast staining	**10** **05** 1 1 3 **05**	
Module 3	**PRINCIPLES OF MICROBIAL NUTRITION AND CULTIVATION** Nutritional types Nutritional requirements C, N, P, S, H,O and growth factors Types of culture media Enriched, enrichment, selective, differential, transport Pure culture techniques Enrichment, Isolation and Anaerobic cultivation Preservation of cultures	**10** 1 3 2 2 2	
	Total	**30**	**02**

Essential Reading:

1. M. J. Pelczar, C. S. Chane and R. K. Noel, (1993), Microbiology, 5th Edition, McGraw-Hill Publishing Company, New Delhi.
2. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott (2008) Prescott, Harley, and Klein's Microbiology. 8th edition. McGraw-Hill Higher Education, New York.
3. Salle (1984), Fundamental Principles of Bacteriology, Tata McGraw-Hill Education

Supplementary Reading:

1. Cruickshank, Duguid, Marmion& Swain (1975), Medical Microbiology: The Practice of Medical Microbiology, 12th Ed. (Vol II), Churchill Livingstone, Edinburgh London & New York.
2. Collins, Grange, Lyne, Falkinham III (2004), Collins and Lyne's Microbiological Methods 8th Edition.
3. Forbes, Sahm, and Weissfeld (2002) Bailey and Scott's Diagnostic Microbiology, 11th Edition. St. Louis, MO: Mosby.

Any other reference sources as recommended by the course instructor.

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

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

Program: B.Sc.				**Semester: I**	
Course: APPLIED MICROBIOLOGY				**Course Code:USMAMB102**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (25%)**	**End Semester Examinations (ESE) (75% in Question Paper)**
02		-	02	25	75

Learning Objectives:

Paper II, titled 'Applied Microbiology' aims to make the learner aware of the measures required for biosafety and the control of microorganisms. This course will ensure that the learner develops a keen understanding of epidemiology and prevention of diseases.

Course Outcomes:

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

CO1: Describe the various means of controlling microorganisms and discuss the chemical agents that may do the same.

CO2: Apply the norms of biosafety whilst working with microorganisms.

CO3: Discuss the modes of transmission of various diseases.

CO4: Describe control measures to prevent the spread of these diseases.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Control of microorganisms**	**10**
2	**Chemical agents of control; Biosafety**	**10**
3	**Epidemiology**	**10**
	Total	**30**

Module	Topic	No. of Hours	No. of Credits
Module 1	**CONTROL OF MICROORGANISMS** Definitions, Rate of microbial death, D value, Factors affecting the effectiveness of antimicrobial agents Physical methods of control High Temperature Electromagnetic radiations Filtration Low temperature Osmotic Pressure Desiccation Chemical methods of control: Definition of terms, properties of ideal disinfectant Mechanism of control, advantages, disadvantages and applications of – Phenolics Alcohols Heavy Metals Halogens Quaternary Ammonium Compounds Detergents Dyes Aldehydes Peroxygens Sterilizing gases Chemotherapeutic agents- List in tabular form Evaluation of antimicrobial agents	**10** 01 03 01 04 01	
Module 2	**CHEMICAL AGENTS OF CONTROL; BIOSAFETY** Microbiology laboratory design Biosafety: Classification of microorganisms based on the risk Routes of infection Prevention of laboratory acquired infections Primary, secondary, tertiary barriers Biosafety cabinets Chemical, fire and electrical safety Disposal of hazardous waste Chemical, fire and electrical safety Disposal of hazardous waste Indian Standard: Code of Safety in Microbiological Laboratories	**10** 01 05 01 02 01	

Module 3	**EPIDEMIOLOGY** Epidemiology Terminology Mortality and morbidity Carriers and reservoirs Modes of transmission of infectious diseases Diseases spread by human contact and airborne transmission Water-, food- and soil-borne infections Sexually transmitted infections Vector-borne diseases Animal contact diseases Major Nosocomial (hospital-acquired) infections Public health measures Control measures for communicable diseases Reservoir control Quarantine Food and water measures Human and animal vaccination Antibiotic resistance World health and related problems	**10** 01 04 01 03 01	
	Total	**30**	**02**

Essential Reading:

1. M. J. Pelczar, C. S. Chane and R. K. Noel, (1993), Microbiology, 5th Edition, McGraw-Hill Publishing Company, New Delhi.
2. Staley, Gunsalus, Lory, Perry (2007), Microbial Life, 2nd Ed. Sinauer Associates Inc Publishers
3. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott (2008) Prescott, Harley, and Klein's Microbiology. 8th edition. McGraw-Hill Higher Education, New York.

Supplementary Reading:

1. Cruickshank, Duguid, Marmion & Swain (1975), Medical Microbiology: The Practice of Medical Microbiology, 12th Ed. (Vol II), Churchill Livingstone, Edinburgh London & New York.
2. Collins, Grange, Lyne, Falkinham III (2004),Collins and Lyne's Microbiological Methods 8th Edition
3. Forbes, Sahm, and Weissfeld (2002) Bailey and Scott's Diagnostic Microbiology, 11th Edition. St. Louis, MO: Mosby.

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 and Economics (Autonomous)

Program: B.Sc.				**Semester: I**	
Course: MICROBIOLOGY PRACTICALS				**Course Code: USMAMBP112**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA)**	**End Semester Examinations (ESE) (100% in Question Paper)**
-	04	-	02	-	100
PRACTICALS					**No of Hours**
	1. Parts of microscopes -demonstration 2. Understanding of handling of microscopes 3. Monochrome staining 4. Negative staining 5. Gram staining of cultures 6. Cell wall staining 7. Preparation of: Nutrient broth &agar; Sabouraud's broth & agar (group experiment) 8. Aseptic transfer 9. Preparation of plate, butt& slant 10. Inoculation techniques 11. Isolation on Nutrient agar and MacConkey's agar 12. Preservation of cultures (group experiment) 13. Working of autoclave, hot air oven, bacteria proof filters – demonstration. 14. Methods of preparation of glassware for sterilization (demonstration experiment). 15. Oligodynamic action of heavy metals. 16. 17. Effect of dyes, phenol, antibiotics on microorganisms. 18. Laminar air flow hood for handling microorganisms. - Demonstration 19. Safety measures to be taken in case of accidental spillage of microbial cultures - Assignment 20. Study of air microflora (group experiment). **21.** Isolation of microbes from fomites – Group experiment				
	Total				**90**

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

Program: B.Sc.				**Semester: II**	
Course: MICROBIAL CHEMISTRY				**Course Code: USMAMB201**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (25%)**	**End Semester Examinations (ESE) (75% in Question Paper)**
02	-	-	02	25	75

Learning Objectives:

Paper II, "Microbial Chemistry" provides an introduction to some of the building blocks of the cell. The techniques that are used to study the cells and their biomolecules are detailed in this course. The course also introduces the students to the fundamentals of microbial growth.

Course Outcomes:

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

CO1: Enlist the various types of carbohydrates and lipids.
CO2: Explain various microscopic methods used in the study of microorganisms.
CO3: Employ various instrumental techniques for the study of biomolecules.
CO4: Describe the various phases of microbial growth and calculate the growth rate.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Introduction to Biomolecules**	**10**
2	**Basic Techniques in Microbiology**	**10**
3	**Microbial Growth**	**10**
	Total	**30**

Module	Topic	No. of Hours	No. of Credits
Module 1	**INTRODUCTION TO BIOMOLECULES** Cellular and chemical foundation Structure of water and Properties of water Types of chemical bonds Carbohydrates – types, structure and function. Lipids - types, structure and function.	**10** 01 01 01 04 03	
Module 2	**BASIC TECHNIQUES IN MICROBIOLOGY** Contrast enhancement techniques Dark field Phase Contrast Fluorescence Electron microscope Principle and applications of Colorimeter pH meter Centrifuge	**10** 05 05 	
Module 3	**MICROBIAL GROWTH** Definitions-Growth, mathematical expression, generalised growth curve. Measurement of growth DMC -Breed's count Petroff and Hausser counting chamber and Haemocytometer Viable count Pour plate Turbidity measurements Nephelometer Synchronous, continuous growth Influence of environment—availability of water, pH, temperature, oxygen, radiations and pressure. Growth in natural environment	**10** 01 02 03 01 02 01	
	Total	**30**	**02**

Essential Reading:

1. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott (2010) Prescott, Harley, and Klein's Microbiology. 8th edition. McGraw-Hill Higher Education, New York.
2. Keith Wilson & John Walker (2010) Principles and techniques of biochemistry and molecular biology 7th Ed. Cambridge University Press.

3. Michael Cox and David Nelson (2005), Lehninger Principles of Biochemistry. 5th Ed., W.H. Freeman and Company, New York.

Supplementary Reading:

4. H. A. Modi (2014) A Handbook of Elementary Microbiology 1st edition, Shanti Prakashan.

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 and Economics (Autonomous)

Program: B.Sc.				**Semester: II**	
Course: EXPLORING MICROORGANISMS				**Course Code: USMAMB202**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (25%)**	**End Semester Examinations (ESE) (75% in Question Paper)**
02	-	-	02	25	75

Learning Objectives:

Paper I, "Microbial Chemistry" provides an introduction to some of the building blocks of the cell. The techniques that are used to study the cells and their biomolecules are detailed in this course. The course also introduces the learners to the fundamentals of microbial growth.

Course Outcomes:

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

CO1: Enlist the various types of carbohydrates and lipids.
CO2: Explain various microscopic methods used in the study of microorganism
CO3: Employ various instrumental techniques for the study of biomolecules.
CO4: Describe the various phases of microbial growth and calculate the growth rate.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	**Eucaryotic microorganisms**	**10**
2	**Types of microorganisms I**	**10**
3	**Types of microorganisms II**	**10**
	Total	**30**

Module	Topic	No. of Hours	No. of Credits
Module 1	**EUKARYOTIC MICROORGANISMS** **Ultrastructure of eukaryotic cell** Plasma membrane and Cytoplasmic matrix - Microfilaments, microtubules, intermediate filaments Endoplasmic reticulum and golgi apparatus Definitions- Lysosomes, endocytosis, phagocytosis, autophagy, proteasomes Eukaryotic ribosomes, mitochondria, chloroplasts, nucleus External cell covering -cilia, flagella Comparison of procaryotes and eucaryotes **Representative groups** **Fungi:** Structure, reproduction, cultivation of fungi and yeasts. Biological and economic importance of fungi. Life cycle of Mucor. **Protozoa:** Habitat, morphology, reproduction and Medical importance of protozoa. Life cycle of Entamoeba histolytica. **Algae:** Characteristics of Algae: Morphology, Pigments, reproduction Cultivation of algae. Biological and economic importance of algae. Difference between algae and cyanobacteria.	**10** **05** 01 01 02 01 **05** 02 02 01	
Module 2	**TYPES OF MICROORGANISMS I** **Viruses**- classification, symmetry, cultivation and examples; **Rickettsia, Chlamydia and Coxiella** – Properties and significance	**10** 05 05	
Module 3	**TYPES OF MICROORGANISMS II** **Archaebacteria** – Habitat, differences between eubacteria and archaea and bacteria, major groups, ecological, biological, industrial importance. **Actinomycetes**- General properties with special emphasis on Actinomycineae, Streptomycineae and Bifidobacteriales. **Delta- & Epsilonproteobacteria**	**10** 03 03 04	
	Total	**30**	**02**

Essential reading:

1. M. J. Pelczar, C. S. Chan and R. K. Noel, (1993), Microbiology, 5th Edition, McGraw-Hill Publishing Company, New Delhi.
2. Staley, Gunsalus, Lory, Perry (2007), Microbial Life, 2nd Ed. Sinauer Associates Inc Publishers.
3. Willey, Joanne M, Linda Sherwood, Christopher J. Woolverton, and Lansing M. Prescott (2008) Prescott, Harley, and Klein's Microbiology. 8th edition. McGraw-Hill Higher Education, New York.

Any other reference sources as recommended by the course instructor.

Supplementary reading:

1. Ronald Atlas: Principles of Microbiology (2015), 2nd Ed. (Indian), McGraw Hill Publishers.
2. Martin Frobisher (1974) Fundamentals of Microbiology 9th Ed. Philadelphia
3. Michael Madigan & John Martinko (2006) Brock Biology of Microorganisms 11th edition
4. Stanier, John L Ingraham, Mark L Wheelis &Rage R Painter (1992) General Microbiology, 5th Edition, Macmillan, Hampshire & London.

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

Program: B.Sc.				**Semester: II**	
Course: MICROBIOLOGY PRACTICALS				**Course Code:USMAMBP212**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA)**	**End Semester Examinations (ESE) (100% in Question Paper)**
-	04	-	02	-	100
PRACTICALS					**No of Hours**
	1. Qualitative tests for carbohydrates – a. Benedict's test b. Molisch's test 2. Qualitative tests for lipids 3. Preparation of dark field stop and its use to study motility (group experiment) 4. Beer and Lambert's law (group experiment) 5. Standardization of pH meter(demonstration experiment) 6. Surface spread technique 7. Pour plate technique 8. Breed's count 9. Haemocytometer 10. Nephelometry *11.* Growth curve of *E. coli* 12. Effect of pH, temperature, radiation on growth 13. Cultivation of fungi and observation 14. Wet mount of fungi 15. Permanent slides protozoa 16. Permanent slides algae 17. Slide culture technique- cultivation of actinomycetes/fungi 18. Cultivation of myxomycetes- demonstration 19. Demonstration – bacteriophage plaques 20. Chick embryo cultivation – demonstration				
	Total				**90**