



**R.P. Gogate College of Arts & Science  
and R.V. Jogalekar College of  
Commerce, Ratnagiri (Autonomous)**

**Bachelor of Science (B.Sc.) Program  
In Microbiology**

***F.Y.B.Sc. [Semester - I & II]***

***Course Structure***

**Under Choice Based Credit System (CBCS)**

**To be implemented from Academic Year-  
2023-2024**

Name of Program	<b>B.Sc. [Microbiology]</b>
Level	UG
No of Semesters	06
Year of Implementation	<b>2023-24</b>
Program Specific Outcomes (PSO)	<ol style="list-style-type: none"> <li>1] Learner shall know the various branches of Microbiology.</li> <li>2] Learner shall know the role of microorganism in day to day life.</li> <li>3] Learner shall able to Understand and identify the various Microorganisms.</li> <li>4] Learner shall able to isolate and propagate various microorganisms.</li> <li>5] Learner shall able to control microbial growth.</li> <li>6] Learner shall know the fermentation of various fermented food products and industrial products by using microorganisms.</li> <li>7] Learner should know the importance of microorganisms in infectious diseases.</li> </ol>
Relevance of PSOs to the local, regional, national, and global developmental needs (200 words)	<p>Microorganism's role in nature is indispensable. They involved in biodegradation, Fermentation, Antibiotic production, etc. Likewise some are involved in disease generation too. Therefore the understanding of microorganisms becomes essential to propagate or to control its number. As microorganism is responsible for food spoilage, food borne diseases so the maintenance of quality standard high is important from local level to global level. With respect to this learner should know the branches of microbiology. As microorganisms are ubiquitous so learner should know the role of microorganism in day to day life. There are millions of different microbes present on earth so identification of those microbes is globally important. In addition to that such identification skills have great importance in an infectious diseases control. Industrial fermentation processes requires pure culture of microbes so the knowledge of isolation of pure culture and its propagation is essential. Contamination by unwanted microbes is a worldwide problem. Learners must know the methods of microbial growth control. The various decontamination methods is not only locally important but also it is globally essential. In a sterilized/controlled conditions only a good quality fermented food product can be prepared by specific microorganisms. Therefore learners should know skill and knowledge of such fermentation processes.</p> <p>Summarizing, graduates of B.Sc. Microbiology program will be informed citizens who can understand and apply basic microbiological technique at local to global level. It will be able to pursue wide range of careers including biological and life science research in higher educational institutions as well as careers in public health, clinical research, food, pharmaceutical and biotechnological industries.</p>

**B.Sc. Program**  
**Under Choice Based Credit System (CBCS), Course Structure (Autonomous)**  
**Department of Microbiology**  
**(To be implemented from Academic Year-2023-24)**

No. of Courses	Semester I	Credits	No. of Courses	Semester II	Credits
	<i>Discipline Specific Course (DSC)</i>			<i>Discipline Specific Course (DSC)</i>	
	<i>Major</i>			<i>Major</i>	
USMB101	Fundamentals Of Microbiology	02	USMB201	Basics of Microbiology	02
USMB102	Basic Techniques In Microbiology	02	USMB202	Exploring Microbiology	02
USMBP103	Microbiology Practical	02	USMBP203	Microbiology Practical	02
	<i>Minor</i>			<i>Minor</i>	
USCH101	Physical and Inorganic chemistry I	02	USCICH201	Physical and Inorganic chemistry II	02
USCH102	Organic and Inorganic Chemistry I	02	USCICH202	Organic and Inorganic Chemistry II	02
			USCICH203	Chemistry Practical II	02
	<i>Generic / Open Elective</i>			<i>Generic / Open Elective</i>	
USOE1	Google Workspace and Multimedia applications	02	USOE2	Introduction to Food Biotechnology	02
	<i>Indian Knowledge System( IKS)</i>				
USIKS	History of science and Technology in India	02			---
	<i>Vocational Skill Course (VSC)</i>			<i>Vocational Skill Course (VSC)</i>	
USCH104	Laboratory skills in Chemical science	02			---
	<i>Skill Enhancement Course (SEC)</i>			<i>Skill Enhancement Course (SEC)</i>	
		----	USCH204	Introduction to Separation Techniques	02
	<i>Ability Enhancement Course (AEC)</i>			<i>Ability Enhancement Course (AEC)</i>	
USAEC1	Communication Skills I	02	USAEC2	Communication Skills II	02
	<i>Value Education Course (VEC)</i>			<i>Value Education Course (VEC)</i>	
USVEC1	Environmental Studies - I	02	USVEC2	Environmental Studies - II	02
	<i>Co-Curricular</i>			<i>Co-Curricular</i>	
USCC1	Anyone course from the Table 2 given below	02	USCC2	Anyone course from the Table 2 given below	02
	<b>Total Credits</b>	<b>22</b>		<b>Total Credits</b>	<b>22</b>

**Table 2. Co curricular Activities**

<b>10. Co-Curricular (Any One)</b>		<b>10. Co-Curricular ( Any One)</b>	
<b>1</b>	<b><i>National Social Service (NSS)</i></b>	<b>1</b>	<b><i>National Social Service (NSS)</i></b>
<b>2</b>	<b><i>National Cadet Corps (NCC)</i></b>	<b>2</b>	<b><i>National Cadet Corps (NCC)</i></b>
<b>3</b>	<b><i>Sports</i></b>	<b>3</b>	<b><i>Sports</i></b>
<b>4</b>	<b><i>Cultural</i></b>	<b>4</b>	<b><i>Cultural</i></b>
<b>5</b>	<b><i>Yoga</i></b>	<b>5</b>	<b><i>Yoga</i></b>
<b>6</b>	<b><i>Life Long Learning</i></b>	<b>6</b>	<b><i>Life Long Learning</i></b>
<b>7</b>	<b><i>Shodhavedh / Avishkar</i></b>	<b>7</b>	<b><i>Shodhavedh</i></b>
<b>8</b>	<b><i>Publications</i></b>	<b>8</b>	<b><i>Publications</i></b>
<b>9.</b>	<b><i>Marathi Vidnyan Parishad</i></b>	<b>9.</b>	<b><i>Marathi VidnyanParishad</i></b>
<b>10.</b>	<b><i>Nature Club</i></b>	<b>10.</b>	<b><i>Nature Club</i></b>
<b>11.</b>	<b><i>Science Association</i></b>	<b>11.</b>	<b><i>Science Association</i></b>
<b>12.</b>	<b><i>Astronomy Club</i></b>	<b>12.</b>	<b><i>Astronomy Club</i></b>

## Syllabus for F. Y. B. Sc. Microbiology Semester I

From the year 2023-24

<b>Name of the Course</b>	Fundamentals Of Microbiology
<b>Course Code</b>	USMB101
<b>Class</b>	F. Y. B. Sc.
<b>Semester</b>	I
<b>No of Credits</b>	02
<b>Nature</b>	Theory
<b>Type</b>	Major
<b>Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words</b>	<p>Restructuring of syllabus has been done to ensure a smooth and logical flow of content throughout the curriculum. It also facilitates the logical progression of subjects which allows learners to build their understanding of subject progressively and systematically and to grasp contents more effectively.</p> <p>Microbiology related careers are found in a diverse range of employment sectors such as; healthcare organizations, environmental organizations, industry – food and drink, pharmaceuticals, toiletries, water and biotechnology companies, forensic science laboratories, publicly funded research organizations, higher education institutions etc.</p>

**Nomenclature:** Fundamentals of Microbiology

### **Course Outcomes:**

- The learner will understand the history and opportunities in microbiology.
- The learner will know the contribution of scientists in the field of microbiology.
- At the end of the course students will be able to understand the concept of prokaryotic and eukaryotic cell and know the structural features of the bacterial and human cell.
- The learner will come across with the knowledge related to laboratory safety techniques.
- The learner shall understand the structures of different biomolecules present in living system.

## Curriculum:

<b>USMB101 - Fundamentals Of Microbiology</b>			
<b>Unit</b>	<b>Title</b>	<b>Learning Points</b>	<b>No of Lectures</b>
<b>1</b>	<b>History, Introduction &amp; Scope Of Microbiology</b>	<p><b>1.1</b></p> <ul style="list-style-type: none"> <li>a. Discovery of microorganisms</li> <li>b. Conflict over spontaneous generation</li> <li>c. Golden Age Of Microbiology-Koch Postulate, Medical Microbiology, Immunology</li> </ul> <p><b>1.2 Prokaryotic Cell Structure and functions:</b></p> <ul style="list-style-type: none"> <li>a. Cell wall</li> <li>b. Cell membrane</li> <li>c. Components external to cell wall-Capsule, Slime layer, Flagella, Pili, Fimbriae</li> <li>d. Cytoplasmic matrix-Inclusion bodies, magnetosomes, ribosomes, gas vesicles</li> <li>e. Nucleoid, Plasmids</li> <li>f. Bacterial endospores and their formation</li> </ul>	<b>10</b>
<b>2</b>	<b>Eukaryotic Cell Structure</b>	<p><b>2.1</b></p> <ul style="list-style-type: none"> <li>a. Overview of Eukaryotic cell structure</li> <li>b. The plasma membrane and membrane Structure</li> <li>c. Cytoplasmic matrix, microfilaments, intermediate filaments, and microtubules</li> <li>d. Organelles of the Biosynthetic-secretory and endocytic pathways –Endoplasmic reticulum &amp; Golgi apparatus. Definitions of Lysosome, Endocytosis, Phagocytosis, Autophagy, Proteasome</li> <li>e. Eukaryotic ribosomes</li> <li>f. Mitochondria</li> <li>g. Chloroplasts</li> <li>h. Nucleus –Nuclear Structure</li> <li>i. External Cell Coverings: Cilia And Flagella</li> <li>j. Comparison Of Prokaryotic And Eukaryotic Cells</li> </ul> <p><b>2.2 Biosafety In Microbiology:</b></p> <ul style="list-style-type: none"> <li>a. Means of laboratory infection</li> <li>b. Potentially hazardous procedures</li> <li>c. Safety equipments</li> <li>d. Immunization and medical records</li> <li>e. Levels of Containment</li> </ul>	<b>10</b>

3	Macromolecules	<p><b>3.1 Chemical foundations:</b>  a. Biomolecules as compounds of carbon with a variety of functional groups.  b. Universal set of small molecules.  c. Macromolecules as the major constituents of cells.  d. Configuration and Conformation with definitions and suitable examples only.  e. Types of Stereoisomers and importance of stereoisomerism in biology.  f. Types of bonds and their importance: Electrovalence, covalent, ester, phosphodiester, thioester, peptide, glycosidic</p> <p><b>3.2 Water- Structure, properties in brief.</b></p> <p><b>3.3 Carbohydrates:</b>  Definition, Classification, Biological role. Monosaccharides, oligosaccharides (maltose, cellobiose, lactose) and polysaccharide (starch, peptidoglycan)</p> <p><b>3.4 Lipids:</b>  Fatty acids as basic component of lipids and their classification, nomenclature, storage lipids and structural lipids.</p> <p><b>3.5 Amino acids &amp; proteins:</b>  General structure and features of amino acids (emphasis on amphoteric nature) Classification by R-group  Peptides and proteins- Definition and general features and examples with biological role. Primary, secondary, tertiary, quaternary structures of proteins- Brief outline.</p> <p><b>3.6 Nucleic acids:</b>  Nitrogenous bases- Purines, Pyrimidines  Pentoses-Ribose, Deoxyribose, Nomenclature of Nucleosides and nucleotides, N-β-glycosidic bond, polynucleotide chain to show bonding between nucleotides (Phosphodiester bonds).  Basic structure of RNA and DNA.</p>	10
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**Learning Resources recommended:**

1. Prescott, Hurley, Klein-Microbiology, 7<sup>th</sup> edition, International edition, McGraw Hill.
2. Kathleen Park Talaro & Arthur Talaro - Foundations in Microbiology International edition 2002, McGraw Hill.

3. Michael T.Madigan & J.M.Martin, Brock, Biology of Microorganisms 12<sup>th</sup> Ed. International edition 2006, Pearson Prentice Hall.
4. A.J.Salle, Fundamental Principles of Bacteriology.
5. Stanier.Ingraham et al, General Microbiology 4th & 5th Ed. 1987, Macmillan Education Ltd
6. Microbiology TMH 5th Edition by Michael J.Pelczar Jr., E.C.S. Chan, Noel R. Krieg
7. BIS: 12035.1986: Code of Safety in Microbiological Laboratories

## Evaluation Pattern

### A. Continuous evaluation [40 Marks]

Method	Marks
Class Test: Unit Test (MCQ / Descriptive – Based on Theory - Online/Offline – 1 unit test of 20 marks / 2 unit tests of 10 marks each / 3 unit tests of 10 marks each and best two out of three will be considered)	20
Assignment	10
Attendance & Class performance	10
<b>Total</b>	<b>40</b>

### B. Semester End Evaluation (Paper Pattern) [60 Marks – 2Hours]

Question No	Unit	Marks
1	Unit 1,2,3	15
2	Unit 1	15
3	Unit 2	15
4	Unit 3	15
<b>Total</b>		<b>60</b>

### Guidelines for paper pattern for Semester End Evaluation:

1. All questions will be compulsory and may be divided into sub-questions.
2. Descriptive type of questions, short notes, diagrammatically explain, Justify, brief descriptions etc., will contain internal options.
3. MCQs, fill in the blanks, answer in one or two lines, match the following, define, true or false, etc., type of questions will not contain internal options.



<b>Name of the Course</b>	Basic Techniques In Microbiology
<b>Course Code</b>	USMB102
<b>Class</b>	F.Y.B.Sc.
<b>Semester</b>	I
<b>No of Credits</b>	02
<b>Nature</b>	Theory
<b>Type</b>	Major
<b>Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words</b>	As part of the curriculum, we explored first year undergraduate students' understanding of some basic concepts in biology—types of cells and their forms, growth and control of microorganisms, etc. The course will help the student for basic research and industrial applications the he learned in the theory. Indeed, the study of bacterial growth has long been considered an essential foundational concept in microbiology, one that all learners will become sharp both in theory and practice. The insights into alternative conceptions held by students may also be useful for building tools such as concept inventories.

### **Nomenclature:** Basic Techniques in Microbiology

#### **Course Outcomes:**

- The learner will acquire the knowledge and importance of microscopy and its use its field of microbiology and will understand the staining techniques.
- The student shall understand the requirement of nutrients for the growth of microorganisms.
- At the end of the course students will be able to define the use of disinfectants and different sterilization techniques in control of microorganisms.

## Curriculum:

<b>USMB102 - Basic Techniques in Microbiology</b>			
<b>Unit</b>	<b>Title</b>	<b>Learning Points</b>	<b>No of Lectures</b>
<b>1</b>	<b>Microscopy &amp; Staining</b>	<p><b>1.1 Microscopy:</b> History of microscopy, Optical spectrum, Lenses and mirrors: Simple and compound light microscope, Dark field Microscopy, Phase contrast</p> <p><b>1.2 Staining procedures</b> a. Dyes and stains: Types, Physicochemical basis Fixatives, Mordants, Decolorizers b. Simple and differential staining (Monochrome staining &amp; Gram staining) c. Special staining (Cell wall, Lipid granules &amp; Flagella)</p>	<b>10</b>
<b>2</b>	<b>Control Of Microorganisms</b>	<p><b>2.1 Definition</b> of frequently used terms &amp; Rate of microbial death, Factors affecting the effectiveness of antimicrobial agents &amp; Properties of an ideal disinfectant</p> <p><b>2.2 Evaluation of disinfectant</b> –Phenol coefficient</p> <p><b>2.3 Physical methods of microbial control</b> a. Dry &amp; moist heat – mechanisms, instruments used and their operations b. Electromagnetic radiations – Ionizing radiations, mechanisms –advantages &amp; disadvantages c. Bacteria proof filters d. Osmotic pressure e. Desiccation</p> <p><b>2.4 Chemical methods of microbial control</b> - mechanism &amp; advantages &amp; disadvantages (if any) applications. a. Phenolics b. Alcohols c. Halogens d. Quaternary ammonium compounds e. Dyes f. Surfaces active agents/Detergents g. Sterilizing gases</p> <p><b>2.5 Chemotherapeutic agents</b> - List types of agents active against various groups &amp; mention the site of action (Detailed mode of action not to be done)</p>	<b>10</b>

<b>3</b>	<b>Microbial Nutrition, Cultivation, Isolation and Preservation</b>	<b>3.1</b> Nutritional requirements – Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur and growth factors. <b>3.2</b> Nutritional types of microorganisms <b>3.3</b> Types of Culture media with examples <b>3.4</b> Isolation of microorganisms <b>3.5</b> Preservation of microorganisms	<b>10</b>
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### Learning Resources recommended:

1. Microbiology TMH 5th Edition by Michael J. Pelczar Jr., E.C.S. Chan, Noel R. Krieg
2. A.J. Salle, Fundamental Principles of Bacteriology, McGraw Hill Book Company Inc. 1984
3. Cruikshank, Medical Microbiology, Volume -II
4. Prescott, Hurley, Klein-Microbiology, 5th & 6th edition, International edition 2002 & 2006, McGraw Hill.
5. Michael T. Madigan & J.M. Martin, Brock, Biology of Microorganisms 11th Ed. International edition, 2006, Pearson Prentice Hall.

### Evaluation Pattern

#### A. Continuous evaluation [40 Marks]

Method	Marks
Class Test: Unit Test (MCQ / Descriptive – Based on Theory - Online/Offline – 1 unit test of 20 marks / 2 unit tests of 10 marks each / 3 unit tests of 10 marks each and best two out of three will be considered)	20
Assignment	10
Attendance & Class performance	10
<b>Total</b>	<b>40</b>

#### B. Semester End Evaluation (Paper Pattern) [60 Marks – 2Hours]

Question No	Unit	Marks
1	Unit 1,2,3	15
2	Unit 1	15
3	Unit 2	15
4	Unit 3	15
<b>Total</b>		<b>60</b>

**Guidelines for paper pattern for Semester End Evaluation:**

1. All questions will be compulsory and may be divided into sub-questions.
2. Descriptive type of questions, short notes, diagrammatically explain, Justify, brief descriptions etc., will contain internal options.
3. MCQs, fill in the blanks, answer in one or two lines, match the following, define, true or false, etc., type of questions will not contain internal options.

<b>Name of the Course</b>	Microbiology Practical
<b>Course Code</b>	USMB103
<b>Class</b>	F.Y.B.Sc.
<b>Semester</b>	I
<b>No of Credits</b>	01
<b>Nature</b>	Practical
<b>Type</b>	Major
<b>Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words</b>	The course will inculcate the importance of microbiology lab skills and is reflected in the requirement for a microbiology lab course for admission to some professional programs, and hands-on skills are expected for graduate studies or laboratory-based jobs in microbiology-related fields. The course ensuring that students possess essential technical competencies, including safe working practices in the lab, is critical to ensure that our programs provide the skills employers expect and meet the educational goals of our learners. We strongly stress that while innovative and valuable new tools and approaches will be developed during this time, these resources should be viewed as important alternatives to traditional resource intensive laboratories supporting fundamental skill development. Microbiology is a necessarily sensory discipline, and we must be able to deliver this essential, hands-on experience to our students when it is again safe to do so.

### **Nomenclature:** Microbiology Practical

### **Course Outcomes:**

- At the end of the course students will be able handle the microbial samples aseptically.
- At the end of the course students will be able to handle instruments like microscope and centrifuge.
- The learner will understand the protocols of different staining techniques.
- The student shall know the handling of instruments.

## Curriculum:

<b>USMBP1 - Microbiology Practical</b>		
<b>Paper</b>	<b>Learning points</b>	<b>No. of Clock Hours</b>
I and II	<ol style="list-style-type: none"><li>1. Cell wall staining</li><li>2. Metachromatic granules staining</li><li>3. Demonstrate presence of microbes in Air, cough, table surfaces, and finger tips.</li><li>4. Qualitative tests for carbohydrate</li><li>5. Qualitative tests for protein</li><li>6. Qualitative tests for amino acid</li><li>7. Qualitative tests for nucleic acid</li><li>8. Spores staining</li><li>9. Use of micropipettes</li><li>10. Disposal of highly pathogenic samples</li><li>11. Determination of capsules</li><li>12. Lipid staining</li><li>13. Safety inoculation hood and laminar air flow</li><li>14. Measure to be taken on accidental spillage or breakage of culture container</li><li>15. Assignments</li><li>16. Negative staining</li><li>17. Differential staining</li><li>18. Physical methods of control of microorganisms</li><li>19. Effect of UV rays</li><li>20. Effect of osmotic pressure</li><li>21. Oligodynamic methods of action of heavy metals</li><li>22. Chemical methods of control of microorganisms</li><li>23. Microbiological culture media preparation</li><li>24. Inoculation technique and study of growth pattern</li><li>25. Colony characteristics of microorganisms</li><li>26. Use of differential and selective media</li><li>27. Parts of compound microscope</li><li>28. Simple staining</li><li>29. Introduction to safety measures in laboratory</li><li>30. Methods of preparation and sterilization of glassware and other materials</li></ol>	<b>60</b>

## Learning Resources recommended:

1. Microbiology TMH 5th Edition by Michael J. Pelczar Jr., E.C.S. Chan, Noel R. Krieg
2. Prescott, Hurley, Klein-Microbiology, 5th & 6th edition, International edition 2002 & 2006, McGraw Hill.

3. Michael T.Madigan & J.M.Martin,Brock,Biology of Microorganisms 11th Ed. International edition, 2006, Pearson Prentice Hall.

## Evaluation Pattern

### A. Internal Evaluation

Method	Marks
Journal	20
Viva	10
Class performance	10
<b>Total</b>	<b>40</b>

### B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
3	20
4	10
<b>Total</b>	<b>60</b>

## Syllabus for F. Y. B. Sc. Microbiology Semester II

From the year 2023-24

<b>Name of the Course</b>	Basics of Microbiology
<b>Course Code</b>	USMB201
<b>Class</b>	F.Y.B.Sc.
<b>Semester</b>	II
<b>No of Credits</b>	02
<b>Nature</b>	Theory
<b>Type</b>	Major
<b>Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words</b>	A key aim of undergraduate microbiology course is to train scientific literacy in the subject of microbiology where the students gain an ability to evaluate the quality of basic scientific study and apply it in real-world situations. This course will help the students to improve understanding of the subject and extend the knowledge in research related to all microbe types. The students will have a clear understanding on the general features of different group of microorganisms, their size, shape, host range, symmetry and basis for classification. The same knowledge can be applied in microbial understanding for its research.

**Nomenclature:** Basics of Microbiology

### **Course Outcomes:**

- At the end of the course students will be able understand different groups of microbes.
- The student shall understand the growth pattern of microorganisms.
- The learner will understand the economic use of different groups of microbes. And also learn the pathogenic effects on the different groups of microorganisms.



## Curriculum:

USMB201 – Basics of Microbiology			
Unit	Title	Learning points	No. of lectures
I	<b>Study Of Different Groups Of Microbes-I:</b>	<p><b>1.1 Viruses:</b>            a) Historical highlights, General properties of viruses, Prions, Viroids            b) Structure of viruses-capsids, envelopes, genomes,            d) Bacteriophages: Lytic cycle, Lysogeny, Structure of T4 phage.</p> <p><b>1.2 Rickettsia, Coxiella, Chlamydia, Mycoplasma:</b> general features, medical significance</p> <p><b>1.3 Actinomycetes:</b> General features of Streptomyces Importance: ecological, commercial and medical</p> <p><b>1.4 Archaea:</b> Archaeal lipids and membranes, Ecological importance</p>	10
II	<b>Study Of Different Groups Of Microbes-II:</b>	<p>Classification, Morphological characteristics, cultivation, reproduction and significance</p> <p><b>2.1 Protozoa-</b> Major Categories of Protozoa Based on motility, reproduction.</p> <p><b>2.2 Algae</b> –Characteristics of algae: morphology, Pigments, reproduction Cultivation of algae. Economic importance of Algae. Differences between Algae and Cyanobacteria</p> <p><b>2.3 Fungi and Yeast-</b>Characteristics: Structure, Reproduction, Cultivation of fungi and yeasts. Life cycle of yeast.</p> <p><b>2.4 Slime molds and Myxomycetes</b></p>	10
III	<b>Microbial Growth:</b>	<p><b>3.1</b> a. Definition of growth, Mathematical Expression, Growth curve            b. Measurement of growth            c. Direct microscopic count – Breed’s count, Petroff – Hausser counting chamber- Haemocytometer.            d. Measurements of cell constituents.            e. Turbidity measurements – Nephelometer and spectrophotometer techniques            f. Synchronous growth, Continuous growth (Chemostat and Turbidostat)            g. Influence of environmental factors on growth.            h. Quorum sensing (Definition)</p>	10

## Learning Resources recommended:

1. Prescott, Hurley, Klein-Microbiology, 7<sup>th</sup> edition, International edition, McGraw Hill.
2. Kathleen Park Talaro & Arthur Talaro - Foundations in Microbiology International edition 2002,| McGraw Hill.
3. Michael T. Madigan & J.M. Martin, Brock Biology of Microorganisms 12<sup>th</sup> Ed. International edition 2006, Pearson Prentice Hall.
4. A.J. Salle, Fundamental Principles of Bacteriology.
5. Stanier, Ingraham et al, General Microbiology 4<sup>th</sup> & 5<sup>th</sup> Ed. 1987, Macmillan Education Ltd
6. Microbiology TMH 5<sup>th</sup> Edition by Michael J. Pelczar Jr., E.C.S. Chan, Noel R. Krieg
7. BIS: 12035.1986: Code of Safety in Microbiological Laboratories.
8. Outlines of Biochemistry 5/E, Conn P. Stumpf, G. Bruening and R. Doi. John Wiley & Sons. New York 1995
9. Microbiology an Introduction. 6<sup>th</sup> Edition. Tortora, Funke and Case. Addison Wesley Longman Inc. 1998.

## Evaluation Pattern

### A. Continuous evaluation [40 Marks]

Method	Marks
Class Test: Unit Test (MCQ / Descriptive – Based on Theory - Online/Offline – 1 unit test of 20 marks / 2 unit tests of 10 marks each / 3 unit tests of 10 marks each and best two out of three will be considered)	20
Assignment	10
Attendance & Class performance	10
<b>Total</b>	<b>40</b>

### B. Semester End Evaluation (Paper Pattern) [60 Marks – 2Hours]

Question No	Unit	Marks
1	Unit 1,2,3	15
2	Unit 1	15
3	Unit 2	15
4	Unit 3	15
<b>Total</b>		<b>60</b>

### Guidelines for paper pattern for Semester End Evaluation:

1. All questions will be compulsory and may be divided into sub-questions.
2. Descriptive type of questions, short notes, diagrammatically explain, Justify, brief descriptions etc., will contain internal options.
3. MCQs, fill in the blanks, answer in one or two lines, match the following, define, true or false, etc., type of questions will not contain internal options.

<b>Name of the Course</b>	Exploring Microbiology
<b>Course Code</b>	USMB202
<b>Class</b>	F. Y. B. Sc.
<b>Semester</b>	II
<b>No of Credits</b>	02
<b>Nature</b>	Theory
<b>Type</b>	Major
<b>Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words</b>	The course will offer diverse range of employment sectors such as; healthcare organizations, environmental organizations, industry like food and drink, pharmaceuticals, water and forensic science laboratories, publicly funded research organizations, higher education institutions etc. The learner will understand host-pathogen interactions in this course which will make them its use in microbiology laboratories. Study of microorganisms with respect to their etiology, pathogenesis and prophylactic measures will help the student to extend their learning in the field of medical microbiology. Learning importance of Clinical samples; Performing Microscopy, Culturing are valuable tools which will make the student to enable them to work in medical sectors.

### **Nomenclature:** Exploring Microbiology

### **Course Outcomes:**

- At the end of the course students will be able understand the use of advance instruments in the study of microbes.
- The student will know the concept of microbial interactions among different groups of organisms.

## Curriculum:

<b>USMB202 – Exploring Microbiology</b>			
<b>Unit</b>	<b>Title</b>	<b>Learning points</b>	<b>No. of Lectures</b>
<b>I</b>	<b>Microbial interaction</b>	<p><b>1.1 Types of Microbial Interactions</b> :Mutualism, Cooperation, Commensalisms, Predation Parasitism, Amensalism, Competition</p> <p><b>1.2 Human Microbe Interactions.</b> a) Normal flora of the human body : Skin, Nose &amp; Nasopharynx, Oropharynx, Respiratory tract, Eye, External ear, Mouth, Stomach, Small intestine, Large intestine, Genitourinary tract. b) Relationship between microbiota &amp; the host.</p> <p><b>1.3 Microbial associations with vascular plants</b> a) Phyllosphere b) Rhizosphere &amp; Rhizoplane c) Mycorrhizae d) Nitrogen fixation : Rhizobia, Actinorhizae e) Fungal &amp; Bacterial endophytes f) Plant pathogen- Agrobacterium</p>	<b>10</b>
<b>II</b>	<b>Microbes &amp; Human Health:</b>	<p><b>2.1 Difference between infection &amp; disease.</b> Important terminology: Primary infection, secondary infection, Contagious infection, occupational disorder, clinical infection, subclinical infection, Zoonoses, genetic disorder, vector borne infection.</p> <p><b>2.2 Factors affecting infection:</b> Microbial factors: adherence, invasion, role of virulence factors in invasion, colonization &amp; its effects.</p> <p><b>2.3 Individual resistance:</b> Factors influencing individual resistance: Age, nutrition, personal hygiene, stress, hormones, Addiction to drugs/ alcohol.</p> <p><b>2.4 Host defense against infection: Overview</b> i) First line of Defense: for skin, respiratory tract, gastrointestinal tract, genitourinary tract, eyes. ii) Second line of defense: Biological barriers: Phagocytosis, Inflammation iii) Third line of defense: Brief introduction to antibody mediated &amp; cell mediated immunity.</p>	<b>10</b>
<b>III</b>	<b>Advance Techniques In Microbiology</b>	<p><b>3.1</b>Electron Microscope: TEM, SEM <b>3.3</b>Fluorescent Microscope, Confocal Microscope</p>	<b>10</b>

	<b>&amp;Instrumentation:</b>	<b>3.4</b> pH meter <b>3.5</b> Colorimeter <b>3.6</b> Autoclave & Hot air Oven <b>3.7</b> Concepts: Laminar air flow systems, Biosafety cabinets, Walk in Incubators, Industrial autoclaves, Cold Room.	
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### Learning Resources recommended:

1. Microbiology TMH 5th Edition by Michael J. Pelczar Jr., E.C.S. Chan, Noel R. Krieg
2. A. J. Salle, Fundamental Principles of Bacteriology, McGraw Hill Book Company Inc.1984
3. Cruikshank, Medical Microbiology, Vol -II
4. Prescott, Hurley, Klein-Microbiology, 5th & 6th edition, International edition 2002 & 2006, McGraw Hill.
5. Michael T. Madigan & J. M. Martin, Brock Biology of Microorganisms 11th Ed. International edition, 2006, Pearson Prentice Hall.

### Evaluation Pattern

#### A. Continuous evaluation [40 Marks]

Method	Marks
Class Test: Unit Test (MCQ / Descriptive – Based on Theory - Online/Offline – 1 unit test of 20 marks / 2 unit tests of 10 marks each / 3 unit tests of 10 marks each and best two out of three will be considered)	20
Assignment	10
Attendance & Class performance	10
<b>Total</b>	<b>40</b>

#### B. Semester End Evaluation (Paper Pattern) [60 Marks – 2Hours]

Question No	Unit	Marks
1	Unit 1,2,3	15
2	Unit 1	15
3	Unit 2	15
4	Unit 3	15
<b>Total</b>		<b>60</b>

**Guidelines for paper pattern for Semester End Evaluation:**

1. All questions will be compulsory and may be divided into sub-questions.
2. Descriptive type of questions, short notes, diagrammatically explain, Justify, brief descriptions etc., will contain internal options.
3. MCQs, fill in the blanks, answer in one or two lines, match the following, define, true or false, etc., type of questions will not contain internal options.

<b>Name of the Course</b>	Microbiology Practical
<b>Course Code</b>	USMB203
<b>Class</b>	F. Y. B. Sc.
<b>Semester</b>	II
<b>No of Credits</b>	01
<b>Nature</b>	Practical
<b>Type</b>	Major
<b>Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words</b>	Skill enhancement related to good laboratory practices will ensure employability in microbiology laboratories. Microbiology has many practical applications that can benefit society. Student microbiologists will learn a critical role in developing vaccines, producing antibiotics, and testing food and water for harmful bacteria. Studying microbiology can give students the skills and knowledge needed to make a real difference in the world. Learning hands on training will make students to build a career in research and non-research fields. The practical knowledge will make the students trained in; microbiological laboratory and safe practices, determining microbes in food/pharmaceutical samples.

### **Nomenclature: Microbiology Practical**

### **Course Outcomes:**

- At the end of the course students will be able to understand the detection of virulence factor.
- The student will understand the use of haemocytometer, pH meter and other instruments.
- The learner will get trained to do cultivation of various microorganisms.

## Curriculum:

<b>USMBP2 - Microbiology Practical</b>		
<b>Paper</b>	<b>Learning points</b>	<b>No. of Clock Hours</b>
I and II	<ol style="list-style-type: none"><li>1. Study of Bacteriophages</li><li>2. Study of Actinomycetes</li><li>3. Cultivation of Yeast and Fungi</li><li>4. Fungal wet mount and study of morphological characteristics</li><li>5. Growth of microorganism under static and shaker culture</li><li>6. Growth curve</li><li>7. Breed count method</li><li>8. Haemocytometer method</li><li>9. Viable count method</li><li>10. Opacity tube method</li><li>11. Effect of temperature and pH on growth of microorganisms</li><li>12. Micrometry – Demonstration</li><li>13. Dark field microscopy</li><li>14. Phase contrast light microscope</li><li>15. Bacteria proof filtration</li><li>16. Normal flora of Skin</li><li>17. Study of Lichen- Demonstration</li><li>18. Study of Rhizobia</li><li>19. Study of Azotobacter</li><li>20. Detection of virulence factor: Coagulase</li><li>21. Detection of virulence factor: Haemolysin</li><li>22. Detection of virulence factor: Lecithinase</li><li>23. Study and preparation of buffers</li><li>24. Study of pH meter</li><li>25. Verification of Beer-Lamberts law</li><li>26. Autoclave and Hot air oven</li><li>27. Evaluation of disinfectant</li><li>28. Determination of efficacy of a disinfectant</li><li>29. Assignment</li><li>30. Visit to a microbiological laboratory in research institute</li></ol>	<b>60</b>

### Learning Resources recommended:

1. Prescott, Hurley, Klein-Microbiology, 5th & 6th edition, International edition 2002 & 2006, McGraw Hill.
2. Michael T. Madigan & J. M. Martin, Brock Biology of Microorganisms 11th Ed. International edition, 2006, Pearson Prentice Hall.



## Evaluation Pattern

### A. Internal Evaluation

Method	Marks
Journal	20
Viva	10
Class performance	10
<b>Total</b>	<b>40</b>

### B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
3	20
4	10
<b>Total</b>	<b>60</b>



Chairperson,  
(Dr. Nitin Potdar)  
BoS, Microbiology