



**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. [Sem-I & II]

Course Structure

Under Choice Based Credit System (CBCS)

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

| | |
|--|--|
| Name of Program | B.Sc. [Microbiology] |
| Level | UG |
| No of Semesters | 06 |
| Year of Implementation | 2023-24 |
| Program Specific Outcomes (PSO) | <ol style="list-style-type: none"> 1] Learner shall know the various branches of Microbiology. 2] Learner shall know the role of microorganism in day to day life. 3] Learner shall able to Understand and identify the various Microorganisms. 4] Learner shall able to isolate and propagate various microorganisms. 5] Learner shall able to control microbial growth. 6] Learner shall know the fermentation of various fermented food products and industrial products by using microorganisms. 7] Learner should know the importance of microorganisms in infectious diseases. |
| 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 has great importance in a 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
(Department of Microbiology)
Under Choice Based Credit System (CBCS), Course Structure (Autonomous)
(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> | |
| 23_USMB101 | Fundamentals Of Microbiology | 02 | 23_USMB201 | Basics of Microbiology | 02 |
| 23_USMB102 | Basic Techniques In Microbiology | 02 | 23_USMB202 | Exploring Microbiology | 02 |
| 24_USMBP103 | Microbiology Practical | 02 | 24_USMBP203 | Microbiology Practical | 02 |
| | <i>Minor</i> | | | <i>Minor</i> | |
| 23_USCH101 | Physical and Inorganic chemistry I | 02 | 23_USCH201 | Physical and Inorganic chemistry II | 02 |
| 23_USCH102 | Organic and Inorganic Chemistry I | 02 | 23_USCH202 | Organic and Inorganic Chemistry II | 02 |
| | | | 23_USCH203 | Chemistry Practical II | 02 |
| | <i>Generic / Open Elective</i> | | | <i>Generic / Open Elective</i> | |
| | To be selected from OE list | 02 | | To be selected from OE list | 02 |
| | <i>Indian Knowledge System(IKS)</i> | | | | |
| 23_USIKS101 | History of science and Technology in India | 02 | | | --- |
| | <i>Vocational Skill Course (VSC)</i> | | | | |
| 23_USCH104 | Laboratory skills in Chemical science (P) | 02 | | | --- |
| | | | | <i>Skill Enhancement Course (SEC)</i> | |
| | | ---- | | To be selected from SEC list | 02 |
| | <i>Ability Enhancement Course (AEC)</i> | | | <i>Ability Enhancement Course (AEC)</i> | |
| 24_UAAECENG 102 | Communication Skills in English I (T) | 02 | 24_UAAECEN G202 | Communication Skills in English II (T) | 02 |
| | <i>Value Education Course (VEC)</i> | | | <i>Value Education Course (VEC)</i> | |
| 24_USBOTVEC 1 | Environmental Studies – I (T) | 02 | 24_USBOTVEC 1 | Environmental Studies – II (T) | 02 |
| | <i>Co-Curricular</i> | | | <i>Co-Curricular</i> | |
| | Any one course from the Table 2 given below | 02 | | Any one course from the Table 2 given below | 02 |
| Total Credits | | 22 | Total Credits | | 22 |

Table 1. Open Electives (Offered by Science & Arts faculty)

| <i>Open Elective (Any One)</i> | | <i>Open Elective (Any One)</i> | |
|--------------------------------|---|--------------------------------|---|
| 24_USOEIT101 | Google workspace and multimedia apps (P) | 24_USOE201 | Basics of Excel (P) |
| 24_USOEBT102 | Introduction to Food Science (T) | 24_USOEBT202 | Introduction to Bioinformatics (T) |
| 23_USOEZO103 | Health and Hygiene I (T) | 23_USOE204 | Health and Hygiene II (T) |
| 24_USOEPH104 | Introduction to Basic Astronomy (T) | 24_USOEPH204 | Observational Astronomy (T) |
| | | 23_USOE203 | Basic Computer System (T) |
| | | 24_USOEIT206 | Social Media Awareness (P) |
| 24_UAOEMAR101 | भाषिककौशल्ये (Language Skills): भाग १ (T) | 24_UAOEMAR201 | भाषिककौशल्ये (Language Skills): भाग २ (T) |
| 24_UAGESF101 | Science Fiction I (T) | 24_UAGESF201 | Science Fiction II (T) |
| 24_UAGEAP102 | Art of Presentation I (T) | 24_UAGEAP202 | Art of Presentation II (T) |

Table 2. Skill enhancement courses for Science, IT, BT, CS Faculty

| <i>Skill Enhancement Courses</i> | |
|----------------------------------|--|
| 23_USCH204 | Skills in Chemical Analysis I (P) |
| 23_USZOSEC204 | Aquarium Fish Keeping (P) |
| 24_USBOTSEC1 | Propagation OF Horticulture Plants I (P) |
| 23_USPH204 | Basic Measurement skills and data analysis (P) |
| 25_USMTS205 | Basic Maths for competitive Exams (P) |
| 23_USCSS207 | LINUX Practical (P) |
| 23_USBTS207 | Bio-analytical Techniques (P) |
| 23_USITS208 | Computer Skills-2 Practical (P) |

Table 3: Co-curricular Course

| Course Code | Semester I | Course Code | Semester II |
|-------------|-------------------------------|-------------|-------------------------------|
| 25_GJCC101 | National Service Scheme (NSS) | 25_GJCC201 | National Service Scheme (NSS) |
| 24_GJCC102 | National Cadet Corps (NCC) | 24_GJCC202 | National Cadet Corps (NCC) |
| 24_GJCC103 | Sports & Yoga | 24_GJCC203 | Sports & Yoga |
| 24_GJCC104 | Cultural | 24_GJCC204 | Cultural |
| 24_GJCC105 | Career Katta | 24_GJCC205 | Career Katta |
| 24_GJCC106 | Life Long Learning | 24_GJCC206 | Life Long Learning |
| 25_GJCC107 | Research Club | 25_GJCC207 | Research Club |
| 24_GJCC108 | Science Association | 24_GJCC208 | Science Association |
| 24_GJCC109 | Film Club | 24_GJCC209 | Film Club |
| 24_GJCC110 | Infosys Courses | 24_GJCC210 | Infosys Courses |

Syllabus for (F. Y. B. Sc. Microbiology) Autonomous from the year 2023-24

| | |
|--|---|
| Name of the Course | Fundamentals Of Microbiology |
| Course Code | 23_USMB101 |
| Class | F.Y.B.Sc. |
| Semester | I |
| No of Credits | 02 |
| Nature | Theory |
| Type | Major |
| Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words | <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:

| Unit | Title | Learning Points | No of Lectures |
|------|--|--|----------------|
| 1 | History, Introduction & Scope Of Microbiology | <p>1.1 a. Discovery of microorganisms b. Conflict over spontaneous generation c. Golden Age Of Microbiology-Koch Postulate, Medical Microbiology, Immunology</p> <p>1.2 Prokaryotic Cell Structure and functions: a. Cell wall b. Cell membrane c. Components external to cell wall-Capsule, Slime layer, Flagella, Pili, Fimbriae d. Cytoplasmic matrix-Inclusion bodies, magnetosomes, ribosomes, gas vesicles e. Nucleoid, Plasmids f. Bacterial endospores and their formation</p> | 10 |
| 2 | Eukaryotic Cell Structure | <p>2.1 a. Overview of Eucaryotic cell structure b. The plasma membrane and membrane Structure c. Cytoplasmic matrix, microfilaments, intermediate filaments, and microtubules d. Organelles of the Biosynthetic-secretory and endocytic pathways –Endoplasmic reticulum & Golgi apparatus. Definitions of Lysosome, Endocytosis, Phagocytosis, Autophagy, Proteasome e. Eucaryotic ribosomes f. Mitochondria g. Chloroplasts h. Nucleus –Nuclear Structure i. External Cell Coverings: Cilia And Flagella j. Comparison Of Prokaryotic And Eukaryotic Cells</p> <p>2.2 Biosafety In Microbiology: a. Means of laboratory infection b. Potentially hazardous procedures c. Safety equipments d. Immunization and medical records e. Levels of Containment</p> | 10 |
| 3 | Macromolecules | <p>3.1 Chemical foundations: 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</p> | 10 |

| | | | |
|--|--|--|--|
| | | <p>cells.</p> <p>d. Configuration and Conformation with definitions and suitable examples only.</p> <p>e. Types of Stereoisomers and importance of stereoisomerism in biology.</p> <p>f. Types of bonds and their importance: Electrovalence, covalent, ester, phosphodiester, thioester, peptide, glycosidic</p> <p>3.2 Water- Structure, properties in brief.</p> <p>3.3 Carbohydrates: Definition, Classification, Biological role. Monosaccharides, oligosaccharides (maltose, cellobiose, lactose) and polysaccharide (starch, peptidoglycan)</p> <p>3.4 Lipids: Fatty acids as basic component of lipids and their classification (Lehninger), nomenclature, storage lipids and structural lipids.</p> <p>3.5 Amino acids & proteins: 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>3.6 Nucleic acids: 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> | |
|--|--|--|--|

Learning Resources recommended:

1. Prescott, Hurley, Klein-Microbiology, 7th 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 12th 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 [20 Marks]

| Method | Marks |
|--|-----------|
| Class Test: Unit Test (MCQ / Descriptive – Based on Theory – 1 unit test of 10 Marks) | 10 |
| Assignment | 05 |
| Attendance & Class performance | 05 |
| Total | 20 |

B. Semester End Evaluation (Paper Pattern) [30 Marks –1 Hour]

| Question No | Unit | Marks |
|--------------|--------|-----------|
| 1 | Unit 1 | 10 |
| 2 | Unit 2 | 10 |
| 3 | Unit 3 | 10 |
| Total | | 30 |

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.

Syllabus for (F.Y.B.Sc. Microbiology) Autonomous from the year 2023-24

| | |
|---|--|
| Name of the Course | Basic Techniques In Microbiology |
| Course Code | 23_USMB102 |
| Class | F.Y.B.Sc. |
| Semester | I |
| No of Credits | 02 |
| Nature | Theory |
| Type | Major |
| Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words | 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:

| Unit | Title | Learning Points | No of Lectures |
|------|---|--|----------------|
| 1 | Microscopy & Staining | <p>1.1 Microscopy: History of microscopy, Optical spectrum, Lenses and mirrors: Simple and compound light microscope, Dark field Microscopy, Phase contrast</p> <p>1.2 Staining procedures a. Dyes and stains: Types, Physicochemical basis Fixatives, Mordants, Decolorizers b. Simple and differential staining (Monochrome staining & Gram staining) c. Special staining (Cell wall, Lipid granules & Flagella)</p> | 10 |
| 2 | Control Of Microorganisms | <p>2.1 Definition of frequently used terms & Rate of microbial death, Factors affecting the effectiveness of antimicrobial agents & Properties of an ideal disinfectant</p> <p>2.2 Evaluation of disinfectant –Phenol coefficient</p> <p>2.3 Physical methods of microbial control a. Dry & moist heat – mechanisms, instruments used and their operations b. Electromagnetic radiations – Ionizing radiations, mechanisms –advantages & disadvantages c. Bacteria proof filters d. Osmotic pressure e. Desiccation</p> <p>2.4 Chemical methods of microbial control - mechanism & advantages & 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>2.5 Chemotherapeutic agents - List types of agents active against various groups & mention the site of action(Detailed mode of action not to be done)</p> | 10 |
| 3 | Microbial Nutrition, Cultivation, Isolation and Preservation | <p>3.1 Nutritional requirements – Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur and growth factors.</p> <p>3.2 Nutritional types of microorganisms</p> <p>3.3 Types of Culture media with examples</p> | 10 |

| | | | |
|--|--|---|--|
| | | 3.4 Isolation of microorganisms 3.5 Preservation of microorganisms | |
|--|--|---|--|

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 [20 Marks]

| Method | Marks |
|---|-----------|
| Class Test: | |
| Unit Test (MCQ / Descriptive – Based on Theory – 1 unit test of 10 Marks) | 10 |
| Assignment | 05 |
| Attendance & Class performance | 05 |
| Total | 20 |

B. Semester End Evaluation (Paper Pattern) [30 Marks –1 Hour]

| Question No | Unit | Marks |
|--------------|--------|-----------|
| 1 | Unit 1 | 10 |
| 2 | Unit 2 | 10 |
| 3 | Unit 3 | 10 |
| Total | | 30 |

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.

Syllabus for (F.Y.B.Sc. Microbiology) Autonomous from the year 2023-24

| | |
|--|--|
| Name of the Course | Microbiology Practical |
| Course Code | 24_USMB103 |
| Class | F.Y.B.Sc. |
| Semester | I |
| No of Credits | 02 |
| Nature | Practical |
| Type | Major |
| Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words | 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:

| Paper | Learning points | No. of clock hours |
|--------------|--|---------------------------|
| I and II | <ol style="list-style-type: none">1. Cell wall staining2. Metachromatic granules staining3. Demonstrate presence of microbes in Air, cough, table surfaces, finger tips.4. Qualitative tests for carbohydrate5. Qualitative tests for protein6. Qualitative tests for amino acid7. Qualitative tests for nucleic acid8. Spores staining9. Use of micropipettes10. Disposal of highly pathogenic samples11. Determination of capsules12. Lipid staining13. Safety inoculation hood and laminar air flow14. Measure to be taken on accidental spillage or breakage of culture container15. Assignments16. Negative staining17. Differential staining18. Physical methods of control of microorganisms19. Effect of UV rays20. Effect of osmotic pressure21. Oligodynamic methods of action of heavy metals22. Chemical methods of control of microorganisms23. Microbiological culture media preparation24. Inoculation technique and study of growth pattern25. Colony characteristics of microorganisms26. Use of differential and selective media27. Parts of compound microscope28. Simple staining29. Introduction to safety measures in laboratory30. Methods of preparation and sterilization of glassware and other materials | 60 |

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 | 10 |
| Viva | 05 |
| Class performance | 05 |
| Total | 20 |

B. Semester End Evaluation (Practical Exam)

| Question No | Marks |
|--------------------|--------------|
| 1 | 10 |
| 2 | 10 |
| 3 | 10 |
| Total | 30 |

Syllabus for (F. Y. B. Sc. Microbiology) Autonomous from the year 2023-24

| | |
|--|--|
| Name of the Course | Basics of Microbiology |
| Course Code | 23_USMB201 |
| Class | F.Y.B.Sc. |
| Semester | II |
| No of Credits | 02 |
| Nature | Theory |
| Type | Major |
| Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words | 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. These 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 of different groups of microorganisms.

Curriculum:

| Unit | Title | Learning points | No. of lectures |
|------|--|--|-----------------|
| I | Study Of Different Groups Of Microbes-I: | <p>1.1 Viruses: 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. 1.2 Rickettsia, Coxiella, Chlamydia, Mycoplasma: general features, medical significance 1.3 Actinomycetes: General features of Streptomyces Importance: ecological, commercial and medical 1.4 Archaea: Archaeal lipids and membranes, Ecological importance</p> | 10 |
| II | Study Of Different Groups Of Microbes-II: | <p>Classification, Morphological characteristics, cultivation, reproduction and significance 2.1 Protozoa- Major Categories of Protozoa Based on motility, reproduction. 2.2 Algae – Characteristics of algae: morphology, Pigments, reproduction Cultivation of algae. Economic importance of Algae. Differences between Algae and Cyanobacteria 2.3 Fungi and Yeast-Characteristics: Structure, Reproduction. Cultivation of fungi and yeasts. Life cycle of yeast. 2.4 Slime molds and Myxomycetes</p> | 10 |
| III | Microbial Growth: | <p>3.1 a. Definition of growth, Mathematical Expression, Growth curve b. Measurement of growth c. Direct microscopic count – Breed’s count ,Petroff – Haussercounting 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, 7th 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 12th 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.
8. Outlines of Biochemistry 5/E, Conn P. Stumpf, G. Bruening and R. Doi. John Wiley & Sons. New York 1995.
9. Microbiology An Introduction. 6th Edition. Tortora, Funke and Case. Addison Wesley Longman Inc. 1998.

Evaluation Pattern**A. Continuous evaluation [20 Marks]**

| Method | Marks |
|--|-----------|
| Class Test: Unit Test (MCQ / Descriptive – Based on Theory – 1 unit test of 10 Marks) | 10 |
| Assignment | 05 |
| Attendance & Class performance | 05 |
| Total | 20 |

B. Semester End Evaluation (Paper Pattern) [30 Marks –1 Hour]

| Question No | Unit | Marks |
|--------------|--------|-----------|
| 1 | Unit 1 | 10 |
| 2 | Unit 2 | 10 |
| 3 | Unit 3 | 10 |
| Total | | 30 |

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.

Syllabus for (F.Y.B.Sc. Microbiology) Autonomous from the year 2023-24

| | |
|---|--|
| Name of the Course | Exploring Microbiology |
| Course Code | 23_USMB202 |
| Class | F.Y.B.Sc. |
| Semester | II |
| No of Credits | 02 |
| Nature | Theory |
| Type | Major |
| Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words | 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:

| Unit | Title | Learning points | No. of Lectures |
|------|--|--|-----------------|
| I | Microbial interaction | <p>1.1 Types of Microbial Interactions : Mutualism, Cooperation, Commensalisms, Predation Parasitism, Amensalism, Competition</p> <p>1.2 Human Microbe Interactions .</p> <p>a) Normal flora of the human body : Skin, Nose & Nasopharynx, Oropharynx, Respiratory tract, Eye, External ear, Mouth, Stomach, Small intestine, Large intestine, Genitourinary tract .</p> <p>b) Relationship between microbiota & the host .</p> <p>1.3 Microbial associations with vascular plants</p> <p>a) Phyllosphere</p> <p>b) Rhizosphere & Rhizoplane</p> <p>c) Mycorrhizae</p> <p>d) Nitrogen fixation : Rhizobia, Actinorhizae</p> <p>e) Fungal & Bacterial endophytes</p> <p>f) Plant pathogen- Agrobacterium</p> | 10 |
| II | Microbes & Human Health: | <p>2.1 Difference between infection & disease. Important terminology: Primary infection, secondary infection. Contagious infection, occupational disorder, clinical infection, subclinical infection, Zoonoses, genetic disorder, vector borne infection.</p> <p>2.2 Factors affecting infection: Microbial factors: adherence, invasion, role of virulence factors in invasion, colonization & its effects.</p> <p>2.3 Individual resistance: Factors influencing individual resistance: Age, nutrition, personal hygiene, stress, hormones, Addiction to drugs/ alcohol.</p> <p>2.4 Host defense against infection: Overview i) First line of Defence: for skin, respiratory tract, gastrointestinal tract, genitourinary tract, eyes. ii) Second line of defence: Biological barriers: Phagocytosis, Inflammation iii) Third line of defence: Brief introduction to antibody mediated & cell mediated immunity.</p> | 10 |
| III | Advance Techniques In Microbiology & Instrumentation: | <p>3.1 Electron Microscope: TEM, SEM,</p> <p>3.3 Fluorescent Microscope, Confocal Microscope</p> <p>3.4 pH meter</p> <p>3.5 Colorimeter</p> <p>3.6 Autoclave & Hot air Oven</p> <p>3.7 Concepts :Laminar air flow systems, Biosafety cabinets , Walk in Incubators, Industrial autoclaves, Cold Room.</p> | 10 |

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 [20 Marks]**

| Method | Marks |
|--|--------------|
| Class Test: Unit Test (MCQ / Descriptive – Based on Theory – 1 unit test of 10 Marks) | 10 |
| Assignment | 05 |
| Attendance & Class performance | 05 |
| Total | 20 |

B. Semester End Evaluation (Paper Pattern) [30 Marks –1 Hour]

| Question No | Unit | Marks |
|--------------------|-------------|--------------|
| 1 | Unit 1 | 10 |
| 2 | Unit 2 | 10 |
| 3 | Unit 3 | 10 |
| Total | | 30 |

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.

Syllabus for (F.Y.B.Sc. Microbiology) Autonomous from the year 2023-24

| | |
|--|--|
| Name of the Course | Microbiology Practical |
| Course Code | 24_USMB203 |
| Class | F.Y.B.Sc. |
| Semester | II |
| No of Credits | 02 |
| Nature | Practical |
| Type | Major |
| Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words | 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 built 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.
- The learner will get trained to handle pH meter.

Curriculum:

| Paper | Learning points | No. of Clock hours |
|----------|---|--------------------|
| I and II | <ol style="list-style-type: none"> 1. Study of Bacteriophages 2. Study of Actinomycetes 3. Cultivation of Yeast and Fungi 4. Fungal wet mount and study of morphological characteristics 5. Growth of microorganism under static and shaker culture 6. Growth curve 7. Breed count method 8. Haemocytometer method 9. Viable count method 10. Opacity tube method | 60 |

| | | |
|--|--|--|
| | 11. Effect of temperature and pH on growth of microorganisms 12. Micrometry – Demonstration 13. Dark field microscopy 14. Phase contrast light microscope 15. Bacteria proof filtration 16. Normal flora of Skin 17. Study of Lichen- Demostration 18. Study of Rhizobia 19. Study of Azotobacter 20. Detection of virulence factor: Coagulase 21. Detection of virulence factor: Haemolysin 22. Detection of virulence factor: Lecithinase 23. Study and preparation of buffers 24. Study of pH meter 25. Verification of Beer-Lamberts law 26. Autoclave and Hot air oven 27. Evaluation of disinfectant 28. Determination of efficacy of a disinfectant 29. Assignment 30. Visit to a microbiological laboratory in research institute | |
|--|--|--|

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.

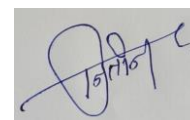
Evaluation Pattern

A. Internal Evaluation

| Method | Marks |
|-------------------|-----------|
| Journal | 10 |
| Viva | 05 |
| Class performance | 05 |
| Total | 20 |

B. Semester End Evaluation (Practical Exam)

| Question No | Marks |
|--------------|-----------|
| 1 | 10 |
| 2 | 10 |
| 3 | 10 |
| Total | 30 |



Chairperson,
(Dr. Nitin Potdar)
BoS, Microbiology