

ATMIYA UNIVERSITY
Faculty of Science
Department of Microbiology
B. Sc. Microbiology
Syllabus (Semester I)

For the students admitted from A.Y. 2023-2024 & onwards

Department: Microbiology

Program: B.Sc. Microbiology

Semester –I		
Course Code	Course Title	Credit
23UGMB101	Basic Microbiology	4 Credits

Course Description: Introduction to Microbiology is appropriate for students with some background in the fundamentals of the omnipresent microbes in biosphere. This is a career path intersects the study of microbes or simply have an interest in microbiology. This course introduces the basic principles of microbiology that examining the microbes and their effect on the environment. Introduction to Microbiology explores the impact through the lens of all areas of microbiology. From this subject student will be able identify challenges and opportunities that arise from the understanding of historical era, distribution pattern of microbes into the biosphere, nutritional parameters for the cultivation and preservation of microbes through the lectures, group activities, class test and homework projects.

Course Purpose:

The course aims to provide the basic understanding on Identify major contributions of the early scientists, their contributions that laid the groundwork for modern microbiology. The course highlights on bacterial classification, characteristics of prokaryotic cells and eukaryotic cells and major groups of microorganisms. Outline the structural and functional differences among all the microbes such as morphological features of bacterial cell and its organelles. The course aspect to understand the influence of microbes in their natural environments on maintenance of the nutritional requirements of microbes.

Course Outcomes: Upon completion of this course, the learner will be able to

CO No.	CO Statement	Bloom's taxonomy Level(K₁ to K₆)
CO ₁	Identify the pioneers of the subject and interpret their contributions that laid the groundwork for modern microbiology.	K1
CO ₂	Demonstrate and relate the characteristic features of prokaryotic and eukaryotic cells and major groups of microorganisms and diversity of microbial world.	K2
CO ₃	Interpret the flow of structural and functional differences among all the microbes and their nutritional requirements for the microbial growth.	K2

CO ₄	Identify the influence of microbiology and 21 st century challenges and opportunities that arise from our changing relationship with and understanding of microbes.	K1
CO ₅	Relate the science of microbes and the social issues and concerns relevant to the field of microbiology.	K2

Course Content	Hours
Module-I: History and Scope of Microbiology	12hrs
<ul style="list-style-type: none"> History and development of microbiology: Contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, John Tyndall Establishment in the fields of medical microbiology and immunology through the work of Paul Ehrlich, Edward Jenner Spontaneous generation versus biogenesis: Experiment of germ theory of disease Beneficial activities of microorganisms Harmful impact of microorganisms in the biosphere 	
Module-II: Biology of Microorganisms	12 hrs
<ul style="list-style-type: none"> Cell wall of bacteria: Size, Shape and Arrangement of bacteria, Structure and chemical composition of Gram negative and Gram-positive bacteria cell wall Bacterial structures: Internal to cell wall- Cell Membrane, Protoplast, Spheroplast, Membranous intrusions, Cytoplasm, Vacuoles, Nuclear Material Bacterial components: External to cell wall- Capsule, Slime layer, Flagella, Pili, Fimbriae Bacterial Spores & Cyst: Types of spores, Structure and formation of endospores (Sporogenesis) 	
Module-III: Diversity of Microbial World	12 hrs
<ul style="list-style-type: none"> Classification of living organisms: Heckle, Whittaker and Carl Woese systems Classification of bacteria as per the second edition of Bergey's manual of systematic bacteriology Prokaryotic microorganisms: General characteristics of bacteria, Rickettsia, Mycoplasma, Cyanobacteria Eukaryotic microorganisms: Fungi, Algae, Protozoa General properties of T4 Bacteriophage and Archaeobacteria 	
Module-IV: Microbial Growth and Nutrition	12hrs
<ul style="list-style-type: none"> Introduction and definition of growth & bacterial growth curve 	

<ul style="list-style-type: none"> • Intrinsic factors of growth curve • Nutritional requirements in bacteria • Nutritional categories • Measurement of bacterial growth by turbidity method 	
Unit-V: Growth Control of Microorganisms	12hrs
<ul style="list-style-type: none"> • Characteristics of an ideal antimicrobial agent • Chemotherapeutic agents: General properties • Classification of microbial growth inhibitors: Cell wall synthesis inhibitor, Protein synthesis inhibitor, Nucleic acid inhibitor with examples • Physical conditions required for growth – Air, pH, Temperature & Salinity • Chemical conditions required for growth – Carbon source, Nitrogen source, Growth Factors, Vitamins, Micro & Macronutrients 	

Pedagogic tools:

- Chalk and Board
- PPT and Videos.
- Assignment
- Class Activity: Think-Pair-Share / Class Test

Text Books:

1. Pelczar, M.J., Chan, E.C.S., Kreig, N.R. (2001). Microbiology, 5th Edition. New Delhi: Tata Mc Graw Hill Publishing Company Ltd.
2. Roger, Stanier Y., John, Ingraham, L., Mark, Weelis, L., and Page, Painter, R. (2013). General Microbiology, 5th Edition, MacMillan Press Ltd.
3. General Microbiology Vol I and II –Pawar and Daginawala.

Reference Books:

1. Presscott, M.J., Harley, J.P., Klein, D.A. (2002). Microbiology, 5th Edition, New York: WCB Mc GrawHill publication.
2. Pommerville, J.C. (2013). Alcamo's Fundamentals of Microbiology, 10th Edition: Jones and Barlett learning LLC.
3. Black, J.G. (2005). Microbiology: Principles and Explorations. New York: Wiley publication
4. Tortora, G.J., Funke, B.R., Case, C.L. (2004). Microbiology: An Introduction. Singapore: Pearson Education.

5. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms.

Suggested reading / E-resources

- Bacterial Growth Curve Protocol | Protocols | Microbe Notes
- NPTEL :: Biotechnology - Microbiology
- Microbial Growth - Biology LibreTexts
- Lecture notes, lecture 1 - Micro Chapter The microbial world The microbes - StuDocu

Suggested MOOCs

- General Microbiology - Course (swayam2.ac.in)
- Food Microbiology and Food Safety - Course (swayam2.ac.in)

Methods of assessing the course outcomes

Components of CIA: 30 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Test 1	1 st & 2 nd Units	1 ^{1/2} hours	30	05
	Test 2	All 5 units	3 hours	70	15
B	Assignment (Group Activity / Class Test)	2 nd & 5 th Units	1 ^{1/2} hours	10	05
C	Class Activity-Exhibition	1 st Unit	1hour	10	05
Grand Total					30
Assignment		Group Activity - Think-Pair-Share Class Test- Unit Wise			
Class Activity		Exhibition (Chart / Model Presentation) Current Affairs- Group Discussion			

23UGMB102	Basic Microbiology Practical	4 hrs / week	2 Credits
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Course Description:

The course is a prerequisite of Basic Techniques in Microbiology I. It encompasses the basic skills that are employed in the field of microbiology. The focus includes the study of basic instruments, methods for studying microorganisms, staining techniques, observation of various phases of growth at stressed condition, antibiotic sensitivity and to prepare experimental design and data interpretation and report writing.

Course Objectives:

The objectives of this course is to introduce students to understand and utilize basic instruments and their working perquisites. It also aid in an exposureof students to the various methods of staining, microbial growth observation and antibiotic sensitivity. It also helps to provide students with opportunities to prepare reports, experimental design and data interpretation.

Course Outcomes: Upon completion of this course, the learner will be able to		
CO No.	CO Statement	Bloom's taxonomy Level(K ₁ to K ₆)
CO ₁	Identify the various microbiological instruments and explains their working principles.	K2
CO ₂	Select and identify the various staining techniques for studying microorganisms	K1
CO ₃	Understand the steps and procedure of growth phases of bacterial population and plot a bacterial growth curve	K2
CO ₄	Compare and interpret the effect of physical parameters on growth of bacteria	K2
CO ₅	Recognize the effect of antibiotic on microbial growth sensitivity	K1

List of Practical:

1. Good microbiological Laboratory Practices
2. Principles, working and uses of the following laboratory instruments:
 - a) Compound Microscope
 - b) pH meter
 - c) Water Bath
 - d) Weighing Balance

- e) Incubator
 - f) Refrigerator
 - g) Colorimeter & Spectrophotometer
 - h) Colony counter
 - i) Laminar Air Flow
 - j) Hot air oven
 - k) Autoclave
3. Media preparation: Solid and liquid media
 4. Isolation techniques: streak, spread, pour plate method
 5. Enumeration of bacteria by Direct Microscopic Count, Total Viable Count
 6. Differential Staining: Gram's Staining
 7. Preservation techniques: Slant preparation, butt preparation, oil layer, Glycerol stock, Lyophilizer (Demonstration)

Reference Books:

1. Aneja, K.R. (2003). Experiential Microbiology, plant Pathology and Biotechnology, New Age International Publishers.
2. Dubey, R.C., Maheshwari, D.K. (2005). Practical Microbiology. New Delhi: S. Chand & Company Limited.
3. Sharma, K. (2005). Manual of Microbiology – Tools and Techniques. New Delhi: Ane books.
4. Patel. R.J., Patel. K.R. (2009). Experimental Microbiology, Vol-I, Ahmedabad: Aditya Publications.
5. Benson, H.J. (2002). Microbiological Applications – Laboratory Manual in General Microbiology – 8th edition: McGraw Hill Company.

Suggested reading / E-resources

- Virtual Lab: Bacterial Isolation Simulation Virtual Lab | Labster
- Cover (microbiologyonline.org)
- General_MicrobiologyCSP_Proof012417.PDF (dspmuranchi.ac.in)
- <https://openlab.citytech.cuny.edu/bio-oer/>

Suggested MOOCs

- <https://www.mooc-list.com/university-entity/british-society-antimicrobial-chemotherapy-bsac>

Methods of Assessing the course outcomes

Components of CIA: 50 marks

Sr. No.	Component	Content	Duration (if any)	Marks	Sub Total
A	Practical CIA 1	70% of practical completion	3 hours	30 (Set for 40)	30
B	Laboratory Record				05
C	Journal				05
D	Assignment				05
E	Laboratory Activity				05
Grand Total					50
Assignment		Group Activity - One minute Quiz / Paper / Written Assignment			
Class Activity		Class Test – Poster / Model Exhibition / Mind map			