



**RAJARSHI SHAHU MAHA VIDYALAYA (AUTONOMOUS),
LATUR**

B. Sc. GENERAL (SEMESTER PATTERN)

B. Sc. FIRST YEAR

SUBJECT: MICROBIOLOGY

CURRICULUM (CBCS)

Effective progressively from June 2017

UNDER ACADEMIC AUTONOMOUS STATUS 2013 -2018

w. e. f. JUNE, 2017-18

RAJARSHI SHAHU MAHAVIDYALAYA (Autonomous), LATUR

CBCS Syllabus for B.Sc. First year

Under academic autonomy from 2013 -18

Core Course: Microbiology

Effective progressively from June 2017

Sr. No.	Semester	Paper No	Title of paper	Total periods/week	Total period	Total Marks	Credits
1	I	Theory Paper I	Introductory Microbiology (U-MIB-151)	06	90	100	04
		Theory Paper II	Methods in Microbiology (U-MIB-152)				
		Practical Paper-I	Lab Course –I (U-MIB-153)	06	12 practical	50	01
2	II	Theory Paper III	Basic Microbiology, Biomolecules (U-MIB-252)	06	90	100	04
		Theory Paper IV	Microbial Nutrition and Growth (U-MIB-253)				
		Practical Paper II	Lab Course –I (U-MIB-254)	06	12 practical	50	01

The syllabus is based on six (3x2) theory periods and 4 practical periods per batch per week. Candidates should require passing separately in theory and practical examination.

Note: B.Sc. First year practical includes studies of growth of microorganisms and life activities of microorganisms. These studies needs two consecutive days for completion of practical.

RAJARSHI SHAHU MAHAVIDYALAYA (Autonomous), LATUR
CBCS PATTERN

Syllabus for B.Sc. First year (Semester- I)

Effective progressively from June 2017

Core Course: Microbiology

Credits: 04(Four)

Periods: 45

Title of Course: INTRODUCTORY MICROBIOLOGY
(Course Code: U-MIB-153)

Course Objectives:

- Learn scope of microbiology and role of microorganism
- Learn Historical developments in microbiology.
- To learn types of microorganisms and their characteristics. To learn taxonomy of Microbes. Methods of their classification

Course Outcomes:

After completing first semester, the Microbiology students will be able to describe the scope and historical developments in microbiology, Characteristics of different types of microorganisms and methods of their classification

UNIT I: Scope of Microbiology

Periods: 08

- 1.1 Definition and concept
- 1.2 General characters of Microorganisms
- 1.3 Distribution of Microorganisms in nature.
- 1.4 Role of microorganisms in applied and advanced fields of microbiology.
- 1.5 Harmful role of Micro-organisms with suitable examples.

UNIT II: Historical developments in microbiology

Periods: 15

- 2.1 Discovery of microbial world and microscope.
- 2.2 Conflict of spontaneous generation - Contribution of different scientists
- 2.3 Recognition of microbial role in diseases – Robert Koch and contribution of Louis Pasteur, Edward Jenner.
- 2.4 Recognition of microbial role in fermentation.
- 2.5 Discovery of pure culture concept
- 2.6 Aseptic surgery
- 2.7. Contributions of Elie. Matchnikoff, Alexander Flemming, Winogradsky and Beijerinck

UNIT III: Types of microorganisms and their characteristics

Periods: 12

- 3.1 The eukaryotic cell : algae, Fungi and protozoa
- 3.2 Prokaryotic cell structure.
- 3.3 Comparison between Eukaryotic and Prokaryotic cell
- 3.4 Prokaryotic groups with unusual characteristics – Photosynthetic bacteria, Rickettsia, Chlamydia and Mycoplasma.
- 3.5 Characteristics of Archae .

UNIT IV: Taxonomy of Microbes

Periods: 10

- a) Microbial Classification and Nomenclature. Whittaker's five kingdom concept.
 - b) Taxonomic Groups.
 - c) Goals of classification.
 - d) Nomenclature.
- 4.2 Polyphasic taxonomy.
- 4.3 Bergey's Scheme of classification-a brief account

RAJARSHI SHAHU MAHAVIDYALAYA (Autonomous), LATUR

Syllabus for B.Sc. First year (Semester- I)

Effective progressively from June 2017

Core Course: Microbiology

Credits: 04(Four)

Periods: 45

Paper II: Methods in Microbiology

(Course Code: U-MIB-154)

Course Objectives:

- Understand principle and working of light microscope.
- Gain knowledge about microbial staining technique
- Understand cultivation and management of bacterial growth.
- Learn control of microbial growth.

Course Outcomes:

Completing first semester, the Microbiology students will be able to understand and use methods of visualizing microorganisms, controlling growth of microorganisms, isolation of microorganisms from different sources and their maintenance.

UNIT I: Bio-imaging

12L

1.1 Principles of Microscopy

- a) Metric units and properties of light.
- b) Definition: Magnification, Resolving power, Depth of focus, Focal length. Angular aperture, Numerical aperture
- c) Objectives (Low, High, Oil immersion) and Oculars Function
- d) Condensers: Abbes, Cardioids, Parabolic and their functions

1.2 Principle and applications of Compound, Dark field, Phase Contrast and Fluorescent microscope.

1.3 Electron Microscope (SEM and TEM).

UNIT II: Microbial Staining Techniques

10L

2.1 Definition: Stain, Dye, Acidic stain, Basic stain, Auxochrome, Chromophore, Mordant, Chromogen, Leuco compound, Natural stain, Flurochrome, Decolorizing agent and Counter stain.

2.2 Theories of Staining

2.3 Principles, Mechanism, Procedure and Observation of

- a) Simple staining: Monochrome & Negative staining
- b) Differential staining: Gram's & Acid Fast staining
- c) Structural staining: Cell wall, Capsule, endospore, Flagella.

d) PHB and Metachromatic granule Staining.

UNIT III – Sterilization and disinfection

13L

3.1 Definition of Sterilization, Disinfection, Antiseptic, Germicide, Sanitizer, Fungicide, Vermicide, Bacteriostatic and Bactericidal agent.

3.2 Chemical Disinfectants

a) Characterization of an ideal disinfectant

b) Chemical Agents: Phenol and Phenolic compounds, Alcohols,

Gaseous sterilizing Agents: Formaldehyde, Ethylene Oxide, β - Propiolactone.

3.3 Evaluation of Disinfectant by Phenol Coefficient method.

3.4 Sterilization by Physical Agent

a) Heat: Moist Heat: Steam under pressure(Autoclaving) , Boiling, Tyndallization, Pasteurization

Dry heat: Incineration, Hot air Oven.

b) Radiation: - Ionizing and Non-ionizing radiations.

c) Filtration:- Types of filters (Bacteriological)

UNIT IV: Isolation and management of bacterial culture

10L

4.1 Pure culture Techniques.

a) Definition and Significance of Streak plate, Pour plate, Spread plate,. Single Cell isolation.

4.2 Cultivation of Bacteria

a) Properties of a good culture medium.

b) General ingredients of culture media and their role

c) Definition, Concept, Use and Types of different culture media – Living and Nonliving media, Synthetic, Non-synthetic, Natural, Selective, Differential, Enriched, Enrichment, Assay, Minimal, Maintenance and Transport Medium. Buffers in culture medium

4.3 Cultivation of anaerobes: GasPak method, Anaerobic jar

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

B. Sc. First year (Semester – I)
Semester Pattern effective from June -2013
Microbiology

Credits: 01 (One)

Experiments : 12

Lab Course-01 **(Course Code: U-MIB-153)**

Course Objectives:

Gain insight into microbial morphology

To Gain knowledge about microbial staining technique

Understand principles involved in working of light microscope and related bioinstruments

Course outcomes

A student successfully completing **Lab course MB01** will exhibit ability to: Appropriately prepare slides for microbiological analysis; Use a light microscope to observe and interpret smears Appropriately use aseptic techniques for the transfer and handling of microorganisms and instruments; Prepare and use appropriate microbiological culture media and test systems; Estimate the number of microbes in a sample using serial dilution and other related techniques; Use standard microbiology laboratory equipments properly

- 1) Biosafety in microbiology laboratory
- 2) Microscopy- Different parts of compound microscope. Use care & of compound microscope
- 3) Study of laboratory equipments used for Sterilization
 - a) Autoclave
 - b) Hot air oven
 - c) Bacterial filters
- 4) Study of laboratory equipments used for Cultivation
 - a) Incubator
 - b) Anaerobic jar
- 5) Study of laboratory equipments used for other purposes
 - a)pH meter
 - b) High speed centrifuge
 - c) Colorimeter/Spectrophotometer
 - d) Laminar air flow
- 6) Simple staining : Monochrome, Negative
- 7) Differential: Gram's staining
- 8) Structural staining:
 - I. Capsule staining (Manvel's Method)
 - II. Cell wall staining (Chance's method)
 - III. Endospore staining (Schaefer and Fulton's Method)
- 9) Micro chemical Staining: PHB staining (Burdon's method.)/ Metachromatic

Granule staining

- 10) Hanging drop technique.
- 11) Measurement of bacterial cell size: Micrometry
- 12) Preparation of culture media
 - a) Nutrient broth and Agar
 - b) MacConkey's Broth and Agar
 - c) Sugar Media

RAJARSHI SHAHU MAHAVIDYALAYA (Autonomous), LATUR

CBCS Syllabus for B.Sc. First year (Semester- II)

Effective progressively from June 2017

Core Course: Microbiology

Credits: 04(Four)

THEORY PAPER-III

Periods: 45

BASICS OF MICROBIOLOGY and BIOMOLECULES

(Course Code: U-MIB-252)

Course Objectives:

Understand structure of cell, cell organelles and their function.

Understand viral structure , replication and cultivation.

Understand biomolecules.

Course Outcomes: Completing second semester, the Microbiology students will be able to

Describe ultra structure of bacterial cell, structures, characteristics and importance of viruses,

Importance of functional and informational bio molecules

UNIT I: Ultra structure of bacterial cell

Periods: 15

1.1 Structure, Chemical composition and function of following:-

- a) Capsule and slimes
- b) Cell wall and cytoplasmic membranes
- c) Flagella and Motility, fimbriae and pili
- d) Nuclear material, Plasmids, Mesosome, , Ribosome
- e) Reserve materials and other cellular inclusions.
- f) Dormant forms of prokaryote: Endospore and cyst

UNIT II: The viruses: Distribution and structure

Periods: 10

- 2.1) Viruses:history
- 2.2) General characteristics of viruses
- 2.3)Bacterial , plant and animal viruses
- 2.4) Multiplication of Virulent phage: The lytic cycle
- 2.5) The development of temperate phages: Lysogeny
- 2.6)Cultivation of viruses
- 2.7) viruses like agent :Viroids Prion, Satellites

UNIT III: Biomolecules

3.1 Carbohydrates

Periods: 10

- a) Definition and classification
- b) Triose, Pentose, Hexose (Examples and Structure)
- c) Disaccharides:- Glycoside linkage (Lactose, Maltose and Sucrose)
- d) Oligosaccharides:- Trisaccharides (Structure of Raffinose)
- e) Polysaccharides:- Homo and Heteropolysaccharides Structure (Starch, Cellulose, Mucopolysaccharides)

UNIT IV: Functional and Informational Biomolecules

Periods: 10

4.1 Proteins:

- a) Definition and Classification
- b) Peptide bond: Configurations of proteins
- c) Functional proteins
- d) Biological significance of proteins

4.2 Nucleic Acids

- a) Nucleosides and Nucleotides.
- b) DNA: - Properties, Structure and Functions
- c) RNA: - Properties, Structure and Functions

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CBCS Syllabus for B. Sc. First year (Semester- II)

Effective progressively from June 2017

Core Course: Microbiology

Credits: 04(Four)

THEORY PAPER-IV

Periods: 45

Microbial Nutrition and Growth

(Course Code: U-MIB-253)

Course Objectives :

Gain knowledge about microbial nutrition

Understand mechanism of uptake of nutrients in microbial cells.

Study the microbial growth and kinetics of growth.

Understand influence of environmental factors on microbial growth.

Course Outcomes: Students will be able to explain the nutritional requirements and mechanisms of their transportation in the cell, bacterial growth and its count, Response of bacterial growth to different environmental factors and survival mechanisms under unfavourable conditions.

UNIT I: Microbial Nutrition

10L

1.1 Major bio-elements, minor bio-elements and growth factors

1.2 Sources of energy

1.3 Nutritional categories of microorganisms on the basis of carbon and energy source.

UNIT II: Nutrient Transport

12L

2.1 Modes of nutrition: osmotrophic, phagotrophic

2.2 Nutrient transport and membrane function: primary and secondary transport, porins, OMP, carrier proteins

2.3 Passive diffusion

2.4 Facilitated diffusion

2.5 Active transport mechanism

2.6 Group translocation

UNIT III Bacterial Reproduction and Growth

11L

3.1 Microbial Reproduction – Binary fission, Budding, fragmentation and formation of conidiophores

3.2 New cell formation (Macromolecular synthesis, septum formation)

3.3 Definition of growth and growth phases

3.4 The mathematical nature and expression of growth, generation time

3.5 Measurement of growth: cell number, cell mass, cell activity

3.6 Different types of bacterial cultures –Batch culture, continuous culture, synchronous culture

UNIT IV Effect of environmental factors on microbial growth and survival

12L

4.1 Environmental factors affecting growth - temperature, pH, osmotic pressure, oxygen, hydrostatic pressure, heavy metals

4.2 Survival of bacteria-Bacterial sporulation and cyst formation

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CBCS Syllabus for B. Sc. First year (Semester- II)

Effective progressively from June 2017

Microbiology

Credits: 01(50 marks)

Periods: 45

Lab Course-02

(Course Code: U-MIB-254)

Course Objectives:

Learn microbial technique and related skill

Gain knowledge related to cultivation of Microbes and analysis of bio-molecules

Course Outcomes:A student successfully completing **Lab course MB02** will exhibit ability to
Perform isolation and maintenance of bacterial cultures; design experiments to test effect of physicochemical factors on bacterial growth; perform qualitative and quantitative analysis of macromolecules

Experiments

- 1) Isolation of bacteria from mixed culture
 - a) Streak plate method
- 2) Isolation and Enumeration of bacteria
 - b) Spread plate method
 - c) Pour plate method
- 3) Preservation of bacterial cultures by refrigeration, subculturing on agar slant, oil overlay and soil stocks.
- 4) Isolation of fungi,
- 5) Isolation and enumeration of coliphages
- 6) Effect of physical agents on growth of bacteria
 - a) pH
 - b) Temperature
 - c) U.V. rays
- 7) Effect of chemical agents on growth of bacteria
 - a) Heavy metal ions (Oligodynamic Action)
 - b) Antibiotics
- 8) Qualitative and quantitative analysis of Carbohydrates
- 9) Qualitative and quantitative analysis of Protein: Biuret test
- 10). Qualitative and quantitative analysis of DNA.
- 11) Qualitative and quantitative analysis of RNA
- 12) Demonstration of Yeast, Fungi, Actinomycetes, Algae and Protozoa.

Reference Books

- 1) Bisen P.S., Varma K.: Handbook of Microbiology CBS Publishers and Distributors, Delhi.
Introduction to viruses: Vikas Publishing House Pvt. Ltd., New Delhi.
- 2) Dubey H.C.: A textbook of fungi and Viruses, Vikas Publishing House Pvt. Ltd. Delhi.
- 3) Dubey R.C. and D.K., Maheshwary, A textbook of Microbiology S Chand and Co. New Delhi.
- 4) Frobisher, Hinsdill, Crabtree, Goodheart: Fundamentals of microbiology: W.B. Saunders Company, U.S.A. Toppan Company Ltd., Japan.
- 5) Luria: General Virology
- 6) Modi H.A.: Elementary Microbiology (Fundamentals of Microbiology) Vol. II Ekta Prakashan, Nadiad, Gujrat
- 7) Parasher Y.K.: Modern Microbiology : Campas Books International: New Delhi
- 8) Pelczar Michael J., Jr./E.C.S Chan, Elements of Microbiology: McGraw, Hill International Book Company, New Delhi.
- 9) Pelczar Michael J., Jr. E.C.S Chan, Noel R. Krieg: Microbiology: Concepts and applications- McGraw Hill Inc.
- 10) Pelczar Michael J., Reid R.D. and Chan E.C.s.: Microbiology, Tata McGraw hill publishing Co. Ltd., New Delhi.
- 11) Powar C. B. and Dagainawala H.I.: General microbiology Vol I and II Himalaya publishing house, Bombay.
- 12) Prescott L.M. Harley J.P.. and Klein Donald A.: Microbiology , W.M.C.. Brown publishers
- 13) Purohit S.S.: Microbiology: Fundamentals and Applications: Agro-Botanical publishers Bikaner, India.
- 14) R.A. Atlas: Microbiology- Fundamentals and applications Mcmilan.
- 15) Singh R.P., Microbiology Kalyani Publication
- 16) Stanier Roger Y., Adelberg Edward A.. Ingraham Johan L., General microbiology, Prentice- Hall, Englewood Cliffs, New Jersey, Publishing Co. Ltd., New Delhi.
- 17) Tauro P, Kapoor K.K., yadav K.S.: introduction to Microbiology: Wiley Eastern Ltd., New Delhi.
- 18) Dubey, Maheshwari: Practical Microbiology.
- 19) Yadav Manju, Microbiology Discovery Publishing House, New Delhi Microbiology, Times Mirror/mosby College Publication.
- 20) Gunasekarn: Introduction to Microbial Techniques.