

Swami Ramanand Teerth Marathwada University, Nanded.

Faculty of Science

B. Sc. First Year Syllabus

Semester Pattern effective from June 2013

Subject: Microbiology

Sr. No.	Semester	Paper No.	Title of paper	Total periods/week	Total period	Total Marks
1	I	I	Introductory Microbiology	03	45	50
		II	Microbiological Techniques	03	45	50
2	II	III	Basic Microbiology & Biomolecules	03	45	50
		IV	Microbial Physiology	03	45	50
3	Practical (Annual pattern)	V	Practical's based on theory paper I,II, III,IV	08	20 practicals	100

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

Marks distribution:

- 1) Theory exam: 40 marks (for each MCQ paper)
- 2) Internal evaluation: 10 marks (Mid term Exam)

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.

Swami Ramanand Teerth Marathwada University, Nanded.

B. Sc. First year (Semester - I)

Semester Pattern effective from -2013

MICROBIOLOGY

Maximum Marks: 50

Periods: 45

PAPER I - INTRODUCTORY MICROBIOLOGY

UNIT I: Scope of Microbiology

Periods: 08

- 1.1 Definition and concept
- 1.2 General characters of Microorganisms and Distribution of Microorganisms in nature.
- 1.3 Role of microorganisms in Agriculture, Human and Animal Health, Industries, Genetic Engineering.
- 1.4 Beneficial & Harmful role of Micro-organisms with suitable examples.

UNIT II: Historical Developments In Microbiology

Periods: 15

- 2.1 Early observation of microorganisms
- 2.2 Controversy over spontaneous generation - Contribution of different scientists
- 2.3 Recognition of microbial role in diseases - Koch's postulates and contribution of Louis Pasteur, Edward Jenner.
- 2.4 Recognition of microbial role in fermentation.
- 2.5 Discovery of microbial effect on organic and inorganic matter.
- 2.6 Discovery of pure culture concept
- 2.7 Aseptic surgery.

UNIT III: General characters of microorganisms

Periods: 12

- 3.1 The eukaryotic cell (Eucyte): Microalgae, Fungi and Lichens.
- 3.2 Prokaryotic cell (Procyte) and Actinomycetes.
- 3.3 Difference between Eukaryotic and Prokaryotic cell
- 3.4 Archae: Cell structure, metabolic character, functions and reproduction of Methanogens, Halophiles, Thermoacidophiles. Economic importance of Archae.
- 3.5 Protozoa: (Giardia, Entamoeba and Plasmodium)

UNIT IV: Taxonomy of Microbes

Periods: 10

- 4.1 Microbial Classification and Nomenclature
 - a) Taxonomic Groups
 - b) Goals of classification
- 4.2 General Methods of classifying Bacteria: Intuitive Method, Numerical Taxonomy, Genetic Relatedness and Nomenclature.
- 4.3 Introduction to Bergey's Manual of Bacteriology (9th edition).

Swami Ramanand Teerth Marathwada University Nanded

B. Sc. First year (Semester- I)

Semester Pattern effective from -2013

Microbiology

Maximum Marks: 50

Periods: 45

PAPER II- MICROBIOLOGICAL TECHNIQUES

UNIT I: Bioinstrumentation

Periods: 12

- 1.1 i) Microscopy
 - a) Definition: Magnification, Resolving power, Depth of focus, Focal length. Angular aperture, Numerical aperture
 - b) Objectives (Low, High, Oil immersion) and Oculars Function
 - c) Condensers: Abbes, Cardioids, Parabolic and their functions
- ii) Principle, Construction using ray diagram and applications of Compound Microscope: Dark field, Phase Contrast and Fluorescent.
- iii) Electron Microscope (SEM and TEM).
- 1.2 Principle and working of Instruments: Laminar Air flow, Colorimeter, Spectrophotometer, Centrifuge, pH Meter, Paper chromatography and electrophoresis.
- 1.3 Radioactive labeling & counting, Autoradiography

UNIT II: Microbial Staining Techniques

Periods: 10

- 2.1 Definition: Stain, Dye, Acidic stain, Basic stain, Auxochrome, Chromophore, Mordant, Chromogen, Leuco compound, Natural stain, Fluorochrome, Decolouring agent and Counter stain.
- 2.2 Theories of Staining, 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, PHB and Metachromatic granule Staining.

UNIT III - Sterilization Techniques

Periods: 13

- 3.1 Definition of Sterilization, Disinfection, Antiseptic, Germicide, Sanitizer, Fungicide, Vermicide, Bacteriostatic and Bactericidal agent.
- 3.2 Chemical Disinfectants
 - a) Characterization of ideal disinfectant
 - b) Chemical Agents: Phenol and Phenolic compounds, Alcohols, Gaseous sterilizing Agents: Formaldehyde, Ethylene Oxide, β - Propiolactone.
- 3.3 Evaluation of Disinfectant (Phenol Coefficient).
- 3.4 Sterilization by Physical Agent
 - a) Heat: Moist Heat, Dry heat, Boiling, Tyndallization, Pasteurization, Steam under pressure (Autoclave), Incineration, Hot air Oven.
 - b) Radiation:- Ionising and Non-ionising radiations.
 - c) Filtration and Types of filters (Bacteriological)

UNIT IV: BACTERIAL CULTIVATION AND MAINTENANCES

Periods: 10

- 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) Media used, Properties of good culture media.
 - b) Definition, Concept, Use and Types of different culture media.
 - c) Synthetic, Non-synthetic, Natural, Selective, Differential, Enriched, Enrichment, Assay, Minimal, Maintenance and Transport Medium. Buffers in culture medium
- 4.3 Cultivation of anaerobes.

Swami Ramanand Teerth Marathwada University Nanded

B. Sc. First year (Semester – II)

Semester Pattern effective from -2013

Microbiology

Maximum Marks: 50

Periods: 45

PAPER III: BASIC MICROBIOLOGY & BIOMOLECULES

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.

UNIT II: The viruses: Distribution and structure

Periods: 10

2.1 Viruses

2.2 Bacterial viruses (Bacteriophages)

2.3 Multiplication of Virulent phage: The lytic cycle

2.4 The development of temperate phages: Lysogeny

2.5 Relation of viruses and plasmids to tumor formation.

2.6 Important human viral pathogens

UNIT III: Biomolecules

Periods: 10

3.1 Carbohydrates

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)

f) Biological Significance of carbohydrates

3.2 Lipids

a) Definition and Classification

b) Types of lipids

a) Simple Lipids:- Triglycerides

b) Conjugated Lipids:- Phosphatidic Acid, Phospholipids and Cholesterol

c) Biological importance of Lipids,

UNIT IV: Informational & Functional Biomolecules

Periods: 10

4.1 Nucleic Acids

a) Nucleosides and Nucleotides, Ribose, Deoxyribose sugars.

b) DNA:- Properties, Structure and Functions

c) RNA:- Properties, Structure and Functions

4.2 Proteins

a) Definition and classification

b) Peptide bonds

c) Enzymes

d) Biological Significance of proteins

Swami Ramanand Teerth Marathwada University Nanded

B. Sc. First year (Semester – II) Semester Pattern effective from -2013 MICROBIOLOGY

Maximum Marks: 50

Periods: 45

PAPER IV: MICROBIAL PHYSIOLOGY

UNIT I: Microbial Nutrition

Periods: 10

1.1 Microbial nutrition

- a) Concept
- b) Common nutritional requirements
- c) Energy sources
- d) C, H, N, O, P, S, Micronutrients, Growth factors, Water etc.
- e) Nutritional categories of microorganisms on the basis of carbon and energy source.

UNIT II: Permeation (in brief)

Periods: 12

- 2.1 Passive diffusion
- 2.2 Facilitated diffusion
- 2.3 Active transport mechanism
- 2.4 Group translocation
- 2.5 Uptake of amino acids and sugars (as examples)

UNIT III: Reproduction and Growth

Periods: 15

- 3.1 Basic concepts of Microbes: General characteristics and functions of Microbes, Physical and Chemical Structures of different Microbes, Importance of Cell shape, cell size in rods and cocci.
- 3.2 Microbial Reproduction: Types/modes of reproduction in microbes: Binary fission, budding.
- 3.3 Bacterial growth: Different types of bacterial culture (Batch, Synchronous, Arithmetic) – Definition and brief description. Growth Phases, Growth Kinetics, Calculation of duration of Phases and generation time, Growth yields, Methods of growth determination. Factors affecting growth - temperature, pH, osmotic pressure and nutrient concentration per cell.

UNIT IV Bacterial Sporulation

Periods- 08

- 3.1 Bacterial Sporulation- Structure of endospore, Endospore formation (Stages) in *Bacillus*, Spore germination, Significance of Ca-dipicolinate (DPA) and soluble Proteins (SASP),

Swami Ramanand Teerth Marathwada University Nanded

B. Sc. First year

Semester Pattern effective from June -2013

MICROBIOLOGY

Practical Paper V (Annual Theory Based practicals)

(Practical syllabus requires **four periods per batch per week for 2 consecutive days** B. Sc. First year practical includes studies of growth of microorganisms and life activities of microorganisms. These studies need two consecutive days for completion of practical.)

Maximum Marks: 100

- 1) Microscopy- Different parts of compound microscope. Use and care of compound microscope
- 2) Construction, Operation and utility of laboratory equipments.
 - a) Autoclave
 - b) Hot air oven
 - c) Incubator
 - d) pH meter
 - e) High speed centrifuge
 - f) Colorimeter/Spectrophotometer
 - g) Anaerobic jar
 - h) Bacterial filters
 - i) Laminar air flow
- 3) Staining
 - a) Simple staining: Monochrome, Negative
 - b) Differential : Gram's staining
 - c) Structural staining:
 - I. Capsule staining (Manvel's Method)
 - II. Cell wall staining (Chance's method)
 - III. Endospore staining (Schaefer and Fulton's Method)
 - IV. PHB staining (Burdon's method.)
- 4) Hanging drop technique.
- 5) Micrometry
- 6) Preparation of culture media
 - a) Nutrient broth and Agar
 - b) MacConkey's Broth and Agar
 - c) Sugar Media
- 7) Isolation of bacteria from mixed culture
 - a) Streak plate method
 - b) Spread plate method
 - c) Pour plate method
- 8) Effect of physical and chemical agents on growth of bacteria
 - a) pH
 - b) Temperature
 - c) Heavy metal ions (Oligodynamic Action)
 - d) U.V. rays
 - e) Antibiotics
- 9) Qualitative tests for
 - a) Carbohydrates: Benedict's test
 - b) Protein: Biuret test
 - c) Nucleic acid: Diphenylamine test (DPA) for DNA and Orcinol test for RNA.
- 10) Demonstration of Yeast, Fungi, Actinomycetes, Algae and Protozoa.
- 11) Study of Bacterial Growth curve.
- 12) Isolation and enumeration of coliphages.

Books Recommended

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