

# Swami Ramanand Teerth Marathwada University Nanded

Faculty of Science

## B.Sc. First year Syllabus

Semester Pattern effective from June 2013

### Subject: Agricultural Microbiology

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Sr. No.	Semester	Paper. No	Title of paper	Total periods/week	Total period	Total Marks
1	I	I	Agricultural Introductory Microbiology	03	45	50
		II	Bio instrumentation and Microbial technique	03	45	50
2	II	III	Cell Biology and Microbial growth	03	45	50
		IV	Basic Microbiology & Biochemistry	03	45	50
3	Practical (Annual)	V	Practical's based on theory paper I,II, III,IV	04	20 practicals	100

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

Marks distribution:

- 1) Theory exam: 40 marks (for each paper)
- 2) Internal evaluation: 10 marks.

Note: 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.

# Swami Ramanand Teerth Marathwada University Nanded

## B.Sc. First year Semester I

Semester Pattern effective from June 2013

### Agricultural Microbiology

Maximum Marks: - 50

Periods:- 45

#### PAPER I - Introductory Agricultural Microbiology

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##### UNIT I: INTRODUCTION

periods:-10

###### 1.1 Scope of Microbiology

- a) Definition and concept
- b) General characters of Microorganisms
- c) Distribution of Microorganisms in nature.

###### 1.2 Role of microorganisms in

- a) Agriculture
- b) Human and animal health
- c) Industries
- d) Genetic Engineering
- e) Beneficial & Harmful role of Micro-organisms with suitable examples.

##### UNIT II: Historical account

periods:-12

###### 2.1 Historical developments in microbiology.

- a) Early observation of microorganisms
- b) Controversy over spontaneous generation – Contribution of different scientists:
- c) Recognition of microbial role in diseases – Koch's postulates and contribution of Louis Pasteur, Edward Jenner, Winogradsky, Alexander Flemming, Beijerinck, Waksman.
- d) Recognition of microbial role in Agro industries.
- e) Discovery of microbial effect on organic and inorganic matter in Soil.

##### UNIT III: General characters of micro organisms

periods:-10

###### 3.1 General Characters and Structure (In Brief) of

- a) Archaeobacteria
- b) Microalgae
- c) Fungi
- d) Actinomycetes
- e) Protozoa

###### 3.2 Ultra structure of Animal virus – HIV, Bacterial Virus, Plant Virus – TMV (Brief account with labeled figures.)

##### .UNIT IV: Taxonomy of Microbes

periods:-13

###### 4.1 Microbial Classification and Nomenclature

- a) Taxonomic Groups
- b) Goals of classification
- 4.2 General Methods of classifying Bacteria

- a) Intuitive Method
- b) Numerical Taxonomy
- c) Genetic Relatedness
- d) Nomenclature

###### 4.3 Introduction to Bergey's Manual of Bacteriology (9<sup>th</sup> edition)

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## B.Sc. First year Semester I

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### Agricultural Microbiology

Maximum Marks:- 50

Periods:- 45

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#### PAPER II

#### BIONSTRUMENTATION AND MICROBIAL TECHNIQUES

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#### UNIT I: Microscopy

periods:-12

##### 1.1 Introduction

- Definition: Magnification, Resolving power, Depth of focus, Focal length. Angular aperture, Numerical aperture
- Objectives: Low, High, Oil immersion.
- Oculars Function
- Condensers: Abbes, Cardioids, Parabolic and their functions

##### 1.2 Principle, Construction using ray diagram and applications of

- Compound Microscope
- Electron Microscope  
(Scanning Electron Microscope and Transmission Electron Microscope)
- Introduction to Phase Contrast Microscope, Dark field Microscope Fluorescent Microscope in brief.

#### UNIT II: Principle and working of Instruments

periods:-07

- Laminar Air flow
- Colorimeter
- Centrifuge
- pH. Meter
- Paper chromatography

periods:-13

#### UNIT III: Microbial staining Techniques

3.1 Definition: Stain, Dye, Acidic stain, Basic stain, Auxochrome, Chromophore, Mordent, Chromogen, Leuco compound, Natural stain, Flurochrome, Decolouring agent and Counter stain.

##### 3.2 Theories of Staining

##### 3.3 Principles, Mechanism, Procedure and Observation of

- Simple staining: Monochrome staining, Negative staining
- Differential staining: Gram's staining and Acid Fast staining
- Structural staining: Cell wall staining, Capsule staining, Spore staining, Flagella staining (PKG Method), Reserve food Material staining (PHB, Metachromatic granule Staining).

#### UNIT IV - Sterilization techniques

periods:-13

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

##### 4.2 Chemical Disinfectants

- Characterization of ideal disinfectant
- Chemical Agents:
  - Phenol and Phenolic compounds
  - Alcohols
  - Gaseous sterilizing Agents: Formaldehyde, Ethylene Oxide,  $\beta$ - Propiolactone.

##### 4.3 Evaluation of Disinfectant (Phenol Coefficient).

##### 4.4 Sterilization by Physical Agent

- Heat: Moist Heat, Dry heat, Boiling, Tyndallization, Pasteurization, Steam under pressure (Autoclave) Incineration, Hot air Oven.
  - Radiation:- Ionising and Nonionising radiations.
  - Filtration and Types of filters (Bacteriological)
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# Swami Ramanand Teerth Marathwada University Nanded

## B.Sc. First year Semester – II Semester Pattern effective from June 2013 Agricultural Microbiology

Maximum Marks 50

Periods:- 45

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### Paper III: Cell Biology and Microbial growth

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#### UNIT I: Eukaryotic and Prokaryotic cell

periods:-07

- a) Morphology- size and arrangement of bacterial cell.
- b) Ultra structure of animal and plant cell
- c) Difference between Eukaryotic and Prokaryotic cell.

#### UNIT II: Ultra structure of bacterial cell

periods 14

##### 2.1 Cytology of typical bacterial cell

- a) Structure, Chemical composition and function of following:-
  - i) Capsule and slime layer
  - ii) Cell wall : Gram positive and gram negative bacteria
  - iii) Unit membrane
  - iv) Flagella: Arrangement, Mechanism of Flagella movement, Chemo taxis, Photo taxis, Magneto taxis
  - v) Pili.
  - vi) Ribosome
  - vii) Nuclear material, Mesosome, Plasmids
  - viii) Endospore -Types, Sporulating bacteria, Architecture of Endospore, Sporulation process, Germination process
  - ix) Reserve Food material- poly-  $\beta$  hydroxy butyrate granules, Glycogen ,Microbial Poly phosphate granules and sulfur granules.

#### UNIT III: Growth

##### 3.1 Bacterial Growth

periods:-12

- a) Definition
- b) Concept of Growth
- c) Bacterial Growth Curve
- d) Phases of Growth
- e) Diauxic Growth
- f) Synchronous Growth
- g) Continuous Culture
- h) Measurement of bacterial Growth

##### 3.2 Bacterial Cell division -Binary fission

#### UNIT IV: Effect of Environmental factors on Bacteria & Fungi.

periods:-12

##### 4.1 Effect of Environmental factors on Microorganisms

- a) Temperature
  - b) pH
  - c) Nutrient concentration
  - d) Oxygen
  - e) Osmotic pressure
  - f) Hydrostatic pressure
  - g) Surface Tension
  - h) Heavy metals
  - i) Radiations
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# Swami Ramanand Teerth Marathwada University Nanded

## B.Sc. First year Semester – II Semester Pattern effective from June 2013 Agricultural Microbiology

Maximum Marks:- 50

Periods:- 45

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### PAPER IV: Basic Microbiology & Biochemistry

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#### UNIT I: Biochemistry of Macromolecules –

##### 1.1 Carbohydrates

periods:13

- 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

##### 1.2 Lipids

- a) Definition and Classification
- b) Types of lipids
  - i) Simple Lipids:- Triglycerides
  - ii) Conjugated Lipids:- Phosphatidic Acid, Phospholipids and Cholesterol
- c) Biological importance of Lipids,

##### 1.3 Nucleic Acids

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

##### 1.4 Proteins

- a) Definition and classification
- b) List of essential amino acids
- c) Peptide bonds
- d) Biological Significance of proteins

periods:10

#### UNIT II: Microbial Nutrition

##### 2.1 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 III: Nutrients (uptakes in brief)

periods:10

- a) Passive diffusion
- b) Facilitated diffusion
- c) Active transport mechanism
- d) Group translocation
- e) Uptake of amino acids and sugars (as examples)

#### UNIT IV: Activation and maintenance of Bacteria:

periods:12

##### 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. (Any two methods)

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# Swami Ramanand Teerth Marathwada University Nanded

## B.Sc. First year

Semester Pattern effective from June 2013

### Agricultural Microbiology

#### Practical Paper V (Theory Based)

(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 needs two consecutive days for completion of practical.)

Maximum Marks: 100

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- 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
    1. Simple staining: Monochrome, Negative
    2. Differential : Grams staining
    3. Structural staining:
      - a) Capsule staining ( Manvel's Method )
      - b) Cell wall staining ( Chance's method )
      - c) Endospore staining (Schaefer and Fulton's Method )
      - d) PHB staining (Burdon's method.)
  - 4) Micrometry
  - 5) Preparation of culture media
    - a) Nutrient broth and Agar
    - b) MacConkey's Broth and Agar
    - c) Sugar Media
  - 6) Isolation of bacteria from mixed culture
    - a) Streak plate method
    - b) Spread plate method
    - c) Pour plate method
  - 7) 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
  - 8) 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.
  - 9) Demonstration of Yeast, Fungi, Actinomycetes, Algae and Protozoa.
  - 10) Study of Bacterial Growth curve.
  - 11) Hanging drop technique.
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## **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.