Swami Ramanand Teerth Marathwada University, Nanded

Choice Based Credit System (CBCS) Course Structure

Distribution of credits for B.Sc. Agricultural Microbiology (optional)

Under Faculty of Science

B. Sc. Syllabus structure

Semester Pattern effective from June 2016

Subject: Agricultural Microbiology

Semester	Paper No.	Name of the Course	Instruction Hrs/ week	Total period	Internal Evaluation	Marks of Semester	Total Marks	Credits
I	CCAMB I (Section A)	Agricultural Introductory Microbiology (PI))	03	45	10	40	50	2
	CCAMB I (Section B)	Bio instrumentation and Microbial technique (PII)	03	45	10	40	50	2
II	CCAMB II (Section A)	Cell Biology and Microbial growth (PIII)	03	45	10	40	50	2
	CCAMB II (Section B)	Basic Microbiology & Bio-molecules (PIV)	03	45	10	40	50	2
	CCAMBP I [CCMB I & II (Section A & B)]	Practical's based on Section A & Section B of CCAMB I & CCAMB II (PV)	04	20 Practical	20	80	100	4

Total credits semester I and II: 12

Semester	Paper No.	Name of the Course	Instruction Hrs/ week	Total period	Internal Evaluation	Marks of Semester	Total Marks	Credits
III	CCAMB III (Section A)	Applied Agricultural Microbiology (P-VI)	03	45	10	40	50	2
	CCMB III (Section B)	Microbes in Agriculture (P-VII)	03	45	10	40	50	2
	CCAMBP II [CCMB III & IV (Section A)]	Practical's based on P-VI & P-VIII (P-X)	04		10	40	50	2
	CCAMBP II [CCMB III & IV (Section B)]	SEC I (1 Skill/ optional)				-	50	2
IV	CCAMB IV (Section A)	Food, Soil Microbiology, and Microbial Ecology (P-VIII)	03	45	10	40	50	2
	CCAMB IV (Section B)	Management of crop plant diseases (P-IX)	03	45	10	40	50	2
	CCAMBP III [CCMB III & IV (Section B)]	Practical's based on P-VII & P-IX (P-XI)	04	10 practical	10	40	50	2
	CCAMBP III [CCMB III & IV (Section B)]	SEC II (1 Skill / optional)				-	50	2

Total credits semester III and IV: 16

Semester	Paper No.	Name of the Course	Instruction Hrs/ week	Total period	Internal Evaluation	Marks of Semester	Total Marks	Credits
V	DSEAMB I (Section A)	Genetics and Molecular Biology (P-XII)	03	45	10	40	50	2
	DSEAMB I [(Section B) Elective]	Industrial Biotechnology (P-XIII)	03	45	10	40	50	2
	DSEAMBP I [DECMB I & II (Section A)]	Practical's based on P- XII & PXIV(P-XIV)	04		10	40	50	2
	DSEAMBP II [DECMB I& IV (Section B)]	SEC III (1 Skill/ optional)				-	50-	2
VI	DSEAMB II (Section A)	Recombinant DNA technology and genetic engineering (P-XIV)	03	45	10	40	50	2
	DSEAMB II [(Section B) Elective]	Agricultural Biotechnology (P-XV)	03	45	10	40	50	2
	DSEAMBP II) [DECMB I & II (Section B)]	Practical's based on P- XIII & P-XV (P-XVII)	04	10 practical	10	40	50	2
	DSEAMBP II(Section B)	SEC IV (Project))				-	50	2

Total credits semester V and VI: 16

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course

B. Sc. First year (Semester - I)

Semester Pattern effective from -2016

AGRICULTURAL MICROBIOLOGY

CCAMB I (Section A)

INTRODUCTORY AGRICULTURAL MICROBIOLOGY (P-I)

Credits: 02 (Marks: 50) **Periods: 45**

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, Winogradasky, 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

3.1General Characters and Structure (In Brief) of
a) Archaebacteria
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^{th} edition)

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Choice Based Credit System (CBCS) Course

B. Sc. First year (Semester - I)

Semester Pattern effective from -2016

AGRICULTURAL MICROBIOLOGY

CCAMB I (Section B)

BIONSTRUMENTATION AND MICROBIAL TECHNIQUES (P-II)

Credits: 02 (Marks: 50) **Periods: 45**

UNIT I: Microscopy Periods: 12

1.1 Introduction

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

1.2 Principle, Construction using ray diagram and applications of

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

UNIT II: Principle and working of Instruments Periods: 07

a) Laminar Air flow
b) Colorimeter
c) Centrifuge
d) pH. Meter
e) Paper chromatography

UNIT III: Microbial staining Techniques Periods: 13

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

3.2 Theories of Staining

3.3 Principles, Mechanism, Procedure and Observation of

a) Simple staining: Monochrome staining, Negative staining
b) Differential staining: Gram's staining and Acid Fast staining
c) 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, Viricide, Bacteriostatic and Bactericidal agent.

4.2 Chemical Disinfectants

a) Characterization of ideal disinfectant
b) Chemical Agents:
i) Phenol and Phenolic compounds
ii) Alcohols
iii) Gaseous sterilizing Agents: Formaldehyde, Ethylene Oxide, β- Propiolactone.

4.3 Evaluation of Disinfectant (Phenol Coefficient).

4.4 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 Nonionising radiations.
c) Filtration and Types of filters (Bacteriological)

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course

B. Sc. First year (Semester - I)

Semester Pattern effective from -2016

AGRICULTURAL MICROBIOLOGY

CCAMB II (Section A)

CELL BIOLOGY AND MICROBIAL GROWTH (P-III)

Credits: 02 (Marks: 50) **Periods: 45**

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

2.1Cytology 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- β 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

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course

B. Sc. First year (Semester - I)

Semester Pattern effective from -2016

AGRICULTURAL MICROBIOLOGY

CCAMB II (Section B)

BASIC MICROBIOLOGY & BIOCHEMISTRY (P-IV)

Credits: 02 (Marks: 50) **Periods: 45**

UNIT I: Biochemistry of Macromolecules –

1.1Carbohydrates 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)

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. First year

Semester Pattern effective from June -2016

AGRICULTURAL MICROBIOLOGY

Practical Paper: CCAMBP-I (P-V)

(Annual practical Based on [CCMB I & II (Section A & B))

(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.)

Credits: 04 **(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.

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, Crabtee, Goodheart:: W.B. Saundrs 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.