KADI SARVA VISHWAVIDYALAYA, GANDHINAGAR

B.Sc. Curriculum as Per NEP

Microbiology Courses for Semester 1

W.E.F. June 2023

KADI SARVA VISHWAVIDYALAYA

Microbiology Major Course -1

MBM201-1C - FUNDAMENTALS OF MICROBIOLOGY

LEARNING OUTCOMES:

- Thorough knowledge and understanding of concepts of microbiology.
- Learning about types of microbes.
- Learning information on microscopy and staining materials that helps to observe microorganism.
- Detailed knowledge on isolation, cultivation and enumeration of microorganisms.
- Learning in depth knowledge about classification and taxonomy of microorganisms.
- Understand the concept of origin of life, bacterial classification.
- Gain knowledge about the structure, function and applications of the bacterial cell.

TEACHING AND EVALUATION SCHEME:

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
				Hrs.	Max Marks		
		Theory Per Week			CCE	SEE	
MBM201-1C	Fundamentals of Microbiology	4	4	2.5	50	50	100

Unit 1: The Microbial World **Teaching Hours: 15 (Weightage 25%)**

➢ Introduction: Microbes in our lives

➢ Classification of Microorganisms:

- Binomial system of nomenclature
- Difference between prokaryotic and eukaryotic microorganisms
- Whittaker's five kingdom concept of classification
- Carl Woese's three kingdom classification system
- Introduction to Bergey's Manual of Determinative and Systematic Bacteriology

➢ Major Groups of Microorganism (Introduction and General Characteristics)

- Prokaryotic microbes: Eubacteria and Archaebacteria
- Eukaryotic microbes: Fungi (Yeasts & Moulds), Protozoa, Algae
- Acellular microbes: Viruses

➢ Distribution of Microorganisms in Nature

➢ An overview of Scope of Microbiology

Unit 2: The History of Microbiology **Teaching Hours: 15 (Weightage 25%)**

➢ The Discovery of Microorganisms

- Microbiology and the origin of life
- Contribution of A. V. Leeuwenhoek in the Discovery of Microscope
- Spontaneous generation vs. Biogenesis

➢ The Golden Age of Microbiology

- Germ theory of fermentation
- Germ theory of disease
- Pure culture technique and Koch's Postulates
- Contribution of Joseph Lister in Antisepsis
- Contribution of Edward Jenner & Louis Pasteur
- The Birth of Modern Chemotherapy: Contribution of Paul Ehrlich, Alexander Fleming and Selman A. Waksman

Unit-3 Microscopy **Teaching Hours: 15 (Weightage 25%)**

➢ Light Microscopy
- Principle of bright-field microscopy: resolving power, numerical aperture, limit of resolution and magnification
- Component parts of the compound light microscope
- Principle and applications of dark-field, fluorescence, and phase-contrast microscopy

➢ Preparation of Specimens for Light Microscopy
- The wet-mount and hanging-drop techniques
- Microbiological stains: acidic, basic, and neutral dyes
- Smear preparation, fixation, use of Mordants, Intensifiers, Decolorizers
- Simple staining of the smear: positive [and negative staining), Differential Staining and Structural Staining

➢ Electron Microscopy: Principle and applications of Transmission & Scanning Electron Microscopy

Unit-4 Morphology of Bacteria **Teaching Hours: 15 (Weightage 25%)**

- Size, shape and arrangement of bacterial cells.
- Structures external to cell wall- Flagella, pili, capsule, sheath and prosthecae.
- Structures internal to cell wall- Cell membrane, nuclear material, cell wall (Protoplast and Spheroplast), spores, cytoplasmic inclusions, magnetosomes and plasmids.

- *Continuous Evaluation: It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests

- Reference Books:

1. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
2. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan
3. Brock Biology of Microorganisms. 14th edition. Pearson International Edition
4. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
5. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
6. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.

KADI SARVA VISHWAVIDYALAYA

Microbiology Major Course -2

MBM202-1C - FUNDAMENTALS OF MICROBIOLOGY LABORATORY

LEARNING OUTCOMES:

- Understand basic instruementaiton in Microbiology Laboratory
- Learning about basic tools and techniques of Microbiology
- Develop understanding about concept of sterilization.
- Microscopic examination of Bacteria by various staining techniques

TEACHING AND EVALUATION SCHEME:

Subject Code	Subject Title	Teaching Scheme	Credits	Examination Scheme			Total Marks
				Hrs.	Max Marks		
		Practical Per Week			CCE	SEE	
MBM202-1C	Fundamentals of Microbiology Laboratory	8	4	5	50	50	100

Unit-1 : Basics of Instrumentations and Preparation for Microbiology laboratory **(Weightage :50%)**

1. To study the principle and applications of important instruments used in microbiology laboratory
    - Biological Safety Cabinets
    - Autoclave,
    - Incubator
    - BOD Incubator
    - Hot Air Oven
    - Light Microscope
    - pH Meter
    - Colony counter
    - Rotary Shaker
    - Centrifuge
2. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader)
3. Preparation of Standard Solutions (Moral Solution, Molal Solution, Normal Solution)
4. Preparation and Cleaning of Glass-wares in Microbiology Laboratory
5. Sterilization in Microbiology Laboratory- Sterilization of medium using Autoclave, Sterilization of glassware using Hot Air Oven

6. Preparation of different media: synthetic media BG-11, Complex media-nutrient agar, McConkey agar, EMB agar

Unit-2 Study of Microorganisms **(Weightage :50%)**

1. Study of different shapes of bacteria using permanent slides
2. Study of *Rhizopus*, *Penicillium*, *Aspergillus* using temporary mounts
3. Study of *Spirogyra* , *Nostoc and Anabena* using temporary Mounts
4. Motility by hanging drop method and stab agar method.
5. Use of counting chamber for yeast Cell Counting
6. Measurement of microbial size by Micrometry.
7. Staining techniques- Monochrome staining, Negative staining
8. Differential Staining – Gram Staining
9. Cell wall Staining,
10. Capsule Staining,
11. Spore Staining,
12. Granules Staining,
13. Spirochete staining
14. Flagella Staining

References:

- Experimental Microbiology by Rakesh Patel
- Stanier. Ingraham et al., General Microbiology 4th & 5th Ed. 1987, Macmillan Education Ltd .
- Tortora G. J. Funke B. R. & Case C. L. (2004). Microbiology: an introduction (Eighth). Pearson Benjamin Cummings
- A.J.Salle, Fundamental Principles of Bacteriology.

KADI SARVA VISHWAVIDYALAYA

Microbiology Minor Course – Semester 1

MBE201-1C - BASICS OF MICROBIOLOGY

LEARNING OUTCOMES:

- Thorough knowledge and understanding of concepts of microbiology.
- Learning about types of microbes.
- Gain knowledge about the structure, function and applications of the bacterial cell.

TEACHING AND EVALUATION SCHEME:

Subject Code	Subject Title	Teaching Scheme		Credits	Examination Scheme			Total Marks
					Hrs.	Max Marks		
		Theory Per Week	Practical Per week			CCE	SEE	
MBE201-1C	Basics of Microbiology	2	4	4	2.5	50	50	100

Unit 1: The Microbial World **Teaching Hours: 15**

➢ Introduction: Microbes in our lives

➢ Major Groups of Microorganism (Introduction and General Characteristics)

- Prokaryotic microbes: Eubacteria and Archaebacteria
- Eukaryotic microbes: Fungi (Yeasts & Moulds), Protozoa, Algae
- Acellular microbes: Viruses

➢ Distribution of Microorganisms in Nature

➢An overview of Scope of Microbiology

Unit-2 : Morphology of Bacteria **Teaching Hours: 15**

Morphology of Bacteria

• Size, shape and arrangement of bacterial cells.

• Structures external to cell wall- Flagella, pili, capsule, sheath and prosthecae.

• Structures internal to cell wall- Cell membrane, nuclear material, cell wall (Protoplast and Spheroplast), spores, cytoplasmic inclusions, magnetosomes and plasmids.

Microscopy: Bright field, Dark field, Phase contrast, Fluorescent and Electron microscopy.

Practical's: **Teaching Hours: 30**

To study the principle and applications of important instruments used in microbiology laboratory

- Biological Safety Cabinets
- Autoclave,
- Incubator
- BOD Incubator
- Hot Air Oven
- Light Microscope
- pH Meter
- Colony counter
- Rotary Shaker
- Centrifuge

Preparation of Standard Solutions (Moral Solution, Molal Solution, Normal Solution)
Preparation and Cleaning of Glass-wares in Microbiology Laboratory
Sterilization in Microbiology Laboratory
Study of different shapes of bacteria using permanent slides
Staining techniques- Monochrome staining, Negative staining
Differential Staining – Gram Staining

• *Continuous Evaluation: It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests

• Reference Books:

1. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
2. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan
3. Brock Biology of Microorganisms. 14th edition. Pearson International Edition
4. Experimental Microbiology by Rakesh Patel

KADI SARVA VISHWAVIDYALAYA

Microbiology Multidisciplinary Course – Semester 1

MDC211-1C - Introduction to Microbial World

LEARNING OUTCOMES:

- Thorough knowledge and understanding of concepts of microbiology.
- Learning about types of microbes.
- Gain knowledge about the structure, function and applications of the bacterial cell.

TEACHING AND EVALUATION SCHEME:

Subject Code	Subject Title	Teaching Scheme		Credits	Examination Scheme			Total Marks
					Hrs.	Max Marks		
		Theory Per Week	Practical Per week			CCE	SEE	
MDC211-1C	Introduction to Microbial World	2	4	4	2.5	50	50	100

Unit 1: The Microbial World **Teaching Hours: 15**

➢ Introduction: Microbes in our lives
- Introduction to major groups of microorganisms: Bacteria, Fungi, Algae, Protozoa,Viruses
- Applied areas of Microbiology.

➢ Distribution of Microorganisms in Nature

➢An overview of Scope of Microbiology

Classification
- Bacterial nomenclature.
- Whittaker's classification system of prokaryotes.
- Introduction to Bergey's manual of determinative and systematic classification.

Unit-2 : Morphology of Bacteria **Teaching Hours: 15**

Morphology of Bacteria

• Size, shape and arrangement of bacterial cells.

• Structures external to cell wall- Flagella, pili, capsule, sheath and prosthecae.

• Structures internal to cell wall- Cell membrane, nuclear material, cell wall (Protoplast and Spheroplast), spores, cytoplasmic inclusions, magnetosomes and plasmids.

Microscopy: Bright field, Dark field, Phase contrast, Fluorescent and Electron microscopy.

Practical's: **Teaching Hours: 30**

➢ To study the principle and applications of important instruments used in microbiology laboratory

- Biological Safety Cabinets
- Autoclave,
- Incubator
- BOD Incubator
- Hot Air Oven
- Light Microscope
- pH Meter
- Colony counter
- Rotary Shaker
- Centrifuge

➢ Preparation of Standard Solutions (Moral Solution, Molal Solution, Normal Solution)
➢ Preparation and Cleaning of Glass-wares in Microbiology Laboratory
➢ Sterilization in Microbiology Laboratory
➢ Study of different shapes of bacteria using permanent slides
➢ Staining techniques- Monochrome staining, Negative staining
➢ Differential Staining – Gram Staining

• *Continuous Evaluation: It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests

• Reference Books:

1. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
2. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan
3. Brock Biology of Microorganisms. 14th edition. Pearson International Edition
4. Experimental Microbiology by Rakesh Patel

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Microbiology SEC (Skill Enhancement Couse) – Semester 1

SEC211-1C - Basic Microbiological Skills

LEARNING OUTCOMES:

- Principles which underlies sterilization of culture media to be used for microbiological work.
- Understanding about techniques used for isolation, cultivation of microorganism in laboratory
- Learning techniques of pure culture and culture preservation
- Learning and practicing professional skills in handling microbes.

Subject Code	Subject Title	Teaching Scheme		Credits	Examination Scheme			Total Marks
					Hrs.	Max Marks		
		Theory Per Week	Practical Per week			CCE	SEE	
SEC211-1C	Basic Microbiological Skills	2	0	2	2	25	25	50

Unit-1: Media and Pure Culture Techniques (Weightage :50%)

- Culture media: basic composition, Solid and liquid media, Synthetic and complex media,Enriched and enrichment media, Selective and differential media;
- Isolation and culture of microbes**,** inoculation and incubation and maintenance of cultures and related instruments.
- Pure culture techniques (Pour plate, Spreading, Streaking and serial dilution)
- Maintenance and preservation of pure culture
- Cultivation of anaerobic bacteria.

Unit-2: Basic Characterization of microorganisms. (Weightage :50%)

- Collection of samples, processing of samples, serial dilution, technique, inoculation of samples, incubation and observations of microbial colonies.
- Morphological characterization of microorganisms
- Colony characteristics
- Microscopic characters
- biochemical/physiological tests or properties and identification