



**Shri Govind Guru University, Godhra**  
**Bachelor of Sciences : Microbiology (Major)**  
**Course Learning Outcomes & Contents of the Courses**  
**Semester one**

**BS23MJ1MB1 (Major 1) : Principles of Microbiology**

**Course learning outcomes:** At the conclusion of this course the students -

**Outcome 1.** Have developed a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in this field.

**Outcome 2.** Have developed a very good understanding of the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory.

**Outcome 3.** Are able to explain the useful and harmful activities of the microorganisms.

**Outcome 4.** Are able to perform basic experiments to grow and study microorganisms in the laboratory.

**Unit – 1:**

**15 lectures**

1. The Scope And Relevance Of Microbiology
2. Whittaker's Five Kingdom Classification, Carl Woese's Three Kingdom Classification, Comparison And Difference Of Eucaryotes and Procaryotes
3. The Discovery Of Microorganisms : Antony Van Leeuwenhoek
4. Developments in Germ theory of disease
5. Developments in Pure Culture Techniques
6. Developments in Chemotherapy
7. Developments in Immunology And Prophylaxis
8. Developments in Soil and microbial ecology
9. Developments in virology
10. Contribution of India in the field of microbiology: Kiran Mazumdar-Shaw, Cyrus Poonawala, Ananda Mohan Chakrabarty, Mankombu Sambasivan Swaminathan.

**Unit – 2:**

**15 Lectures**

Introduction to Distribution, morphology, reproduction and importance of:

1. Viruses (acellular microbes)
2. Procaryotic cell
3. Fungi (eukaryotic cell)
4. Protozoa
5. Helminths

**Unit – 3:**

**15 Lectures**

1. Principle Of Light Microscope: Magnification And Resolution Power
2. The Bright-Field Microscope
3. The Dark-Field Microscope
4. The Phase-Contrast Microscope
5. The Fluorescence Microscope
6. The Transmission Electron Microscope
7. The Scanning Electron Microscope

**Unit – 4:**

**15 Lectures**

1. Types Of Stain Used For Light Microscopy(Acidic, Basic, Romanaski, Leuco) And Electron Microscope
2. Staining techniques: Smear preparation, simple staining, Gram staining, negative staining and acid-fast staining.
3. Types Of Mordant, Types Of Fixation: Physical And Chemical, Staining Intensifier.
4. Types Of Stain Used For Electron Microscope
5. Staining techniques for electron microscope: Negative staining, shadowing, freeze etching
6. Difference of light and electron microscope

**Reference Books**



11. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 5th Edition WCB Mc Graw Hill, New York, (2002).
1. Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore, (2004).
2. Alcom, I.E. Fundamentals of Microbiology. VI Edition, Jones and Bartlett Publishers. Sudbury. Massachusetts, (2001).
3. Black J.G. Microbiology-Principles and Explorations. John Wiley & Sons Inc. New York, (2002).
4. Pelczar, MJ Chan ECS and Krieg NR, Microbiology McGraw-Hill.
5. Willey, Sherwood, Woolverton. Prescott, Harley, and Klein's Microbiology McGraw-Hill publication
6. Tortora, Funke, Case. Microbiology. Pearson Benjamin Cummings.
7. JACQUELYN G. BLACK. Microbiology Principles and explorations. JOHN WILEY & SONS, INC.
8. Madigan, Martinko, Bender, Buckley, Stahl. Brock Biology of Microorganisms. Pearson
9. Tom Besty, D.C Jim Koegh. Microbiology Demystified McGRAW-HILL.
10. Online platforms:
  - 1) <https://www.mooc-list.com/tags/immunology>
  - 2) <https://www.mooc-list.com/tags/blood>
  - 3) <https://www.mooc-list.com/tags/vaccines>
  - 4) <https://www.pasteur.fr/en/e-learning-mooc>
  - 5) <https://onlinecourses.swayam2.ac.in>





## BS23MJ1MB1 (Major 2) :Principle techniques of Microbiology

- A. Microbiology Good Laboratory Practices And Biosafety  
B. Introduction To Various Instruments Used In Microbiology Laboratory:Principle, design and Application of:

- a) Balances
- b) Light Microscope – Simple And Compound Microscope,
- c) Sterilizers: Hot Air Oven, Autoclave, Water bath
- d) UV Chamber
- e) Laminar Air Flow
- f) Biological Safety Cabinets,
- g) Bacteriological Filters
- h) Refrigerator for Preservation
- i) Incubator, BOD incubator
- j) pH meter
- k) Centrifuge

- C. Preparation Of nutrient agar slant and nutrient broth  
D. Preservation of culture on nutrient agar slant  
E. Study of pH adjustment of nutrient broth  
F. Study of the presence of microflora in the environment by exposing nutrient agar plates to air.  
G. Permanent Slide Of: *Bacillus*, *Staphylococcus*, *Yeast*, *Rhizopus*, *Gram Negative Short Rods*, *Paramecium*, *Spirogyra*, *Euglena*, *Tape Worm*  
H. Preparation Of Molar Solutions, Normality Solutions, Percent solution, Normal Saline

### I. Wet and dry mounting techniques of light microscope

- a) Simple Staining: Positive Monochrome
- b) Negative Staining
- c) Gram Staining Of Bacteria
- d) Gram Staining Of Yeast
- e) Acid Fast Staining
- f) Spirochete Staining
- g) Mounting Of Mold :*Mucor*, *Rhizopus*, *Aspergillus*

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**Shri Govind Guru University, Godhra**  
**Bachelor of Sciences : Microbiology (Major)**  
**Course Learning Outcomes & Contents of the Courses**

**Semester Two**

**BS23MJ2MB1 (Major 1): Bacteriology**

**Course learning outcomes:** At the completion of this course, the students are able to -

**Outcome 1.** Describe characteristics of bacterial cells, cell organelles, cell wall composition and various appendages like capsules, flagella or pili.

**Outcome 2.** Differentiate a large number of common bacteria by their salient characteristics; classify bacteria into groups.

**Outcome 3.** Describe the nutritional requirements of bacteria for growth; developed knowledge and understanding that besides common bacteria there are several other microbes which grow under extreme environments.

**Outcome 4.** Perform basic laboratory experiments to study microorganisms; methods to preserve bacteria in the laboratory; calculate generation time of growing bacteria.

**Unit – 1:**

**15 Lectures**

**Prokaryotic Cell Structure And Function**

1. An Overview Of Prokaryotic Cell Structure , Shapes, Size Arrangement And Its Diversity
2. Prokaryotic Cell Surface Layers
  - a) Plasma Membranes
  - b) Bacterial Cell Wall: Gram Positive ,Gram Negative Bacteria, Archaea
  - c) Capsules, Glycocalyx, S Layer, Slime Layer
3. The Cytoplasmic Matrix, The Nucleoid, Plasmids, Cytoplasmic Inclusions Structures: Organic And Inorganic Inclusions
4. Components External To The Cell Surface Layers: Flagella: Ultrastructure, Arrangement, Types Of Motility, Mechanism Of Motility., Pili, Fimbriae, Prostheca, Stalk
5. Bacterial exospores and Endospore: Arrangement, Ultrastructure, Sporogenesis, Germination And Exospores

**Unit – 2:**

**15 Lectures**

**Microbial Nutrition And Growth**

1. Requirement Of Bioelements, Growth Factors
2. Nutritional Types Of Microbes
3. Modes Of Nutritional Uptake: Passive, Active, Group Translocation
4. Types Of Cultural Media
5. Modes Of Microbial Reproduction
6. Growth Curves- Normal, Diauxic, Continuous, Synchronous
7. The Mathematics Of Growth, Growth Rate , Generation Time
8. Effect Of Environment Factors On Microbial Growth : Solutes, Water Activity, Temperature, pH, Osmotic Pressure, Gases

**Unit – 3:**

**15 Lectures**

**Control Of Microbes: Physical Methods**

- a) Principles Of Controlling Microbial Population
- b) Conditions Influencing The Effectiveness Of Antimicrobial Agents
- c) Physical Methods Of Microbial Control:
  1. Heat And Temperature
  2. Radiation
  3. Ultrasonication
  4. Filtration



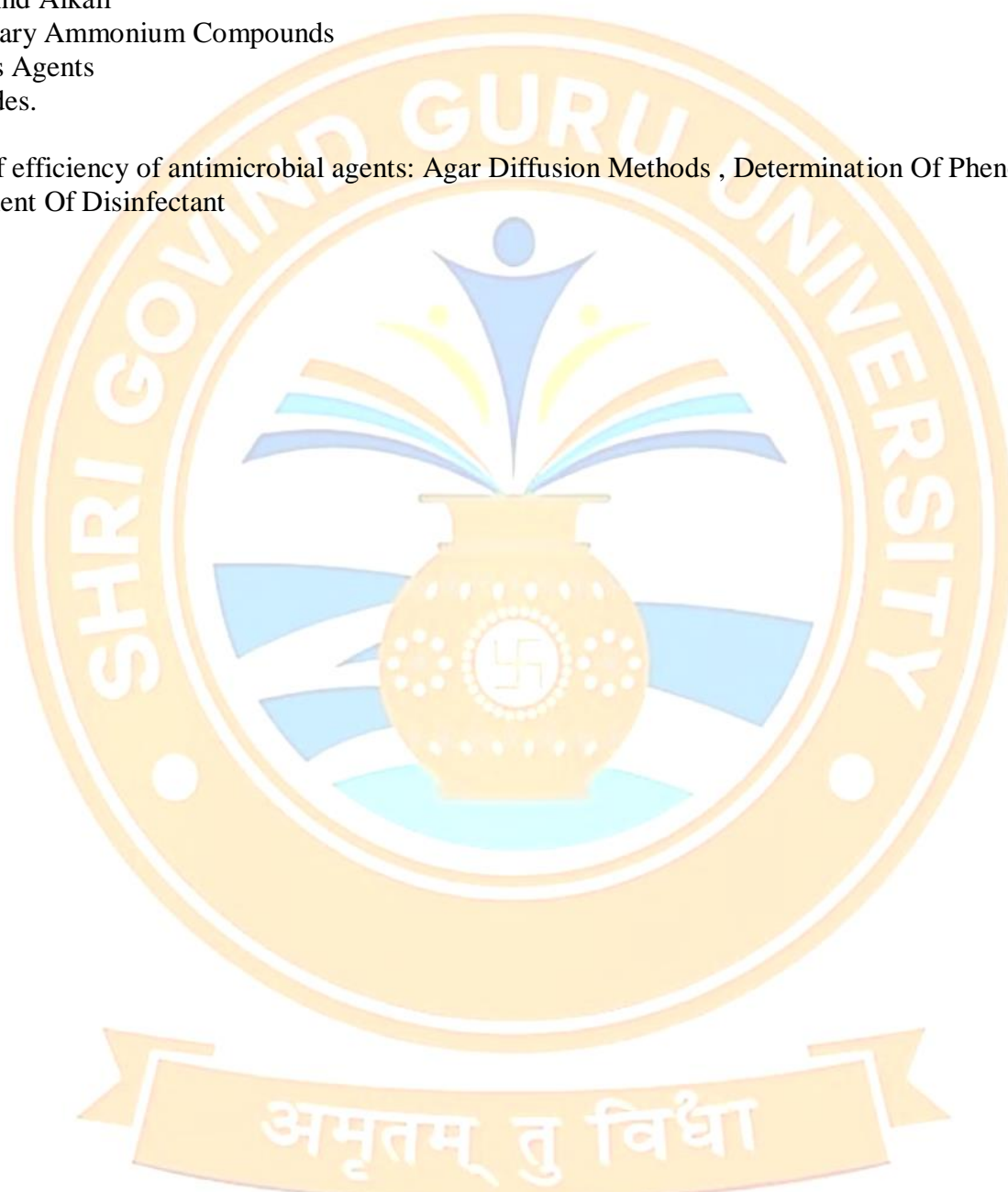
5. Osmotic Pressure, Surface Tension, Water Activity

**Unit – 4:**

**15 Lectures**

**Control Of Microbes: Chemical Methods**

1. Criteria Of Ideal Chemical Agent to Control Microbes
2. Groups of antimicrobial chemical agents
  - a) Phenol
  - b) Alcohols
  - c) Halogens
  - d) Heavy Metals
  - e) Acids And Alkali
  - f) Quaternary Ammonium Compounds
  - g) Gaseous Agents
  - h) Aldehydes.
  - i) Dyes
3. Study of efficiency of antimicrobial agents: Agar Diffusion Methods , Determination Of Phenol Coefficient Of Disinfectant





## BS23MJ2MB2 (Major 2) : Special staining and culture techniques

1. Cell Wall Staining
2. Capsule Staining
3. Endospore Staining
4. Granule Staining
5. Wet Mount: Hanging Drop Technique to study motility of bacteria
6. Preparation and principle Of
  - a. General purpose media: Nutrient Agar, Nutrient Broth
  - b. Dual purpose media: Mac Conkey Agar, EMB Agar
7. Isolation of pure culture of fungi By Spread Plate Method
8. Isolation of pure culture of yeast On GYE Agar Plate from curd sample
9. Isolation of pure culture of bacteria On Nutrient Agar Plate By Four Flame Method
10. Isolation Of Bacteria By Pour Plate Method
11. Study of Effect Of Chemical On Microbial Growth-Bacteria By Cup Borer Method
12. Study of Effect Of Temperature On Bacterial Growth
13. Study of Oligodynamic Effect
14. Preservation of bacterial cultures by various techniques.
15. Chromogenesis in bacteria and fungi

### Reference Books

1. Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 5th Edition WCB Mc Graw Hill, New York, (2002).
2. Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology : An Introduction. Pearson Education, Singapore, (2004).
3. Alcom, I.E. Fundamentals of Microbiology. VI Edition, Jones and Bartlett Publishers. Sudbury, Massachusetts, (2001).
4. Black J.G. Microbiology-Principles and Explorations. John Wiley & Sons Inc. New York, (2002).
5. Tom Besty, D.C Jim Koegh. Microbiology Demystified McGRAW-HILL.
6. Online platforms:
  - 6) <https://www.mooc-list.com/tags/immunology>
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  - 8) <https://www.mooc-list.com/tags/vaccines>
  - 9) <https://www.pasteur.fr/en/e-learning-mooc>
  - 10) <https://onlinecourses.swayam2.ac.in>

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# SHRI GOVIND GURU UNIVERESITY, GODHRA

## B.Sc. Biotechnology Semester-1

### Multidisciplinary paper-1

#### Cell Biology

#### **UNIT 1: FUNDAMENTALS OF CELL**

- 1.1 Discovery of cell
- 1.2 Basic properties of cell
- 1.3 Fundamental classes of cell: (Ultra structure and functions)
  - 1.3.1 Prokaryotic cell
  - 1.3.2 Eukaryotic cell (Plant and Animal)
- 1.4 Cellular membranes: Structure
  - 1.4.1 Brief history of studies on plasma membrane structure
  - 1.4.2 Chemical composition of membranes
  - 1.4.3 Structure and functions of membrane protein
  - 1.4.4 Membrane lipids & membrane fluidity
- 1.5 Cellular membranes: Functions
  - 1.5.1 An overview of membrane functions
  - 1.5.2 Dynamic nature of plasma membrane
  - 1.5.3 Movement of substances across cell membrane

#### **UNIT 2: CELLULAR ORGANELLES**

- 2.1 Endoplasmic reticulum: Structure, function including role in protein segregation.
- 2.2 Golgi complex: Structure, biogenesis and functions including role in protein
- 2.3 Mitochondria: Structure and function, Genomes, biogenesis.
- 2.4 Chloroplasts: Structure and function, genomes, biogenesis
- 2.5 Nucleus: Structure and function, chromosomes and their structure.
- 2.6 Ribosome: Structure and function

# SHRI GOVIND GURU UNIVERESITY, GODHRA

## B.Sc. Biotechnology Semester-1

### **UNIT 3: CELL CYCLE, MITOSIS AND MEIOSIS:**

3.1 Intoduction of the Cell Cycle

3.2M Phase: Mitosis & Cytokinesis:

3.2.1 Prophase

3.2.2 Pro-metaphase

3.2.3 Metaphase

3.2.4 Anaphase

3.2.5 Telophase

3.2.6 Forces required for mitoticmovements

3.2.7 Cytokinesis

3.3Meiosis:

3.3.1 The stages of meiosis



# SHRI GOVIND GURU UNIVERESITY, GODHRA

## B.Sc. Biotechnology Semester-1

### Multidisciplinary paper-2

#### Lab Practicals:

1. Principle, working and uses of laboratory instruments: [Microscope, Incubator, pH meter, Centrifuge, Colony counter]
2. Principle, working and uses of various types of sterilizers:[Hot air oven, Steam sterilizer, Inspissator, Bacteriological filters]
3. General laboratory safety and instructions
4. Preparation and sterilization of glassware's and media, disposals of media and cultures
5. DNA staining by Schiff's reagent using onion peel
6. Study of various stages of meiosis using permanent slides
7. Study of various stages of mitotic cell division using onion root tips

SHRI GOVIND GURU UNIVERESITY, GODHRA

B.Sc. Biotechnology Semester-1

**SHRI GOVIND GURU UNIVERESITY, GODHRA**  
**B.Sc. Biotechnology Semester-2**

**Multidiplinary Paper 3**

**Genetics**

**UNIT-1: CONCEPT OF GENOME AND ITS ORGANIZATION:**

- Mendel's discoveries
- Mendel's first law of independence
- Mendel's Second law of segregation
- Euchromatin and Heterochromatin
- Nucleosome-subunit of all chromatin
- Lampbrush & Polytene chromosomes

**UNIT-2: PATTERNS OF INHERITANCE IN HUMANS:**

- Pedigree analysis of autosomal recessive disorders
- Pedigree analysis of autosomal dominant disorders
- Pedigree analysis of X-linked dominant and recessive disorders
- Y-linked inheritance

**Unit 3 : Population and Evolutionary Genetics**

- Macro- and Micro - evolution in Mendelian population,
- Hardy-Weinberg equilibrium and conditions for its maintenance, Elemental forces of evolution - Mutation, Selection (Types of selection, selection coefficient, selection in natural populations), Genetic drift, Migration
- Species and speciation\_Sympatric and Allopatric

**REFERENCES:**

1. Griffiths, A. F., Wessler, S. R., Lewontin, R. C. and Carroll, S. B. (2008) *Introduction to Genetic Analysis*, 9<sup>th</sup> Edition, W. H. Freeman and Company, New York.
2. Klug, W. S. and Cummings, M. R. (2007) *Concepts of Genetics*, 7<sup>th</sup> Edition, Pearson Education.

SHRI GOVIND GURU UNIVERESITY, GODHRA  
B.Sc. Biotechnology Semester-2

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**Multidisplinary Paper 4**

Lab Practical

1. Preparation of mitotic chromosomes from onion root tip
2. Contribution of scientists in the field of genetics
3. Problems related to Mendelian genetics
4. Study of microbiocidal effect of UV rays
5. Effect of physical and chemical agents on growth of bacteria
  - pH
  - Temperature
  - Heavy metal ions (Oligodynamic Action)
  - U.V. Rays
  - Antibiotics



## First year B.Sc Minor Microbiology (Credit 2)

**Objective:** The students would understand the relevance of microbiology and microorganisms. They would know the basic types of microbes, their cultivation and control the growth of microbes

**Outcome:**

The students will gain the knowledge of the scope of microbiology, how many types of microorganisms are there, what is the importance of microbes.

### Unit 1

10 lectures

1. The Scope And Relevance Of Microbiology
2. Whittaker's Five Kingdom Classification, Carl Woese's Three Kingdom Classification, Comparison And Difference Of Eucaryotes and Procaryotes
3. Prokaryotic Microbes: Bacteria And Archaea
  - a. General Characters
  - b. Outline Of Cell Structural Components (Only Labelled Diagram)
  - c. Distribution And Types Of Habitats
  - d. Medical, Environmental And Agricultural Significance
4. **Eucaryotes**
  - a) Fungi: General Characters, Structure Of Yeast And Mold (Only Labelled Diagram), Habitat, Significance
  - b) Algae: General Characters, Habitat
  - c) Protozoa: General Characters, Significance
5. **Acellular Microbes**
  - a) Virus: General Characters, Medical And Nonmedical Significance Of Virus
  - b) General Characters And Significance Of Subviral Particles:: Viroids, Virusoids, Prions

### Unit 2

10 lectures

- a) Principle Of Light Microscope: Magnification And Resolution Power
- b) The Bright-Field Microscope
- c) The Transmission Electron Microscope
- d) The Scanning Electron Microscope
- e) Types Of Stain Used For Light Microscopy(Acidic, Basic, Romanaski, Leuco) And Electron Microscope
- f) Positive And Negative Staining In Light And Electron Microscope
- g) Smear, Types Of Mordant, Types Of Fixation: Physical And Chemical, Staining Intensifier.

### Unit 3

10 lectures

- A. Requirement Of Bioelements, Growth Factors
- B. Nutritional Types Of Microbes
- C. Modes Of Nutritional Uptake: Passive, Active, Group Translocation
- D. Types Of Cultural Media
- E. Modes Of Microbial Reproduction
- F. Normal Growth Curves
- G. Physical Methods Of Microbial Control:
  1. Heat And Temperature



2. Radiation
- H.Groups of antimicrobial chemical agents
- a) Phenol
- b) Alcohols

### **Lab Course (Credit 2)**

- A. Design And Application Of Instruments Used In Microbiology Laboratory:
  - Analytical Instrument: Balances, Centrifuge, spectrophotometer/Colorimeter, pH Meter
  - Light Microscope – Simple And Compound Microscope
  - Sterilizers: Hot Air Oven, Autoclave, Water bath, UV Chamber, Laminar Air Flow (Biological Safety Cabinets), Bacteriological Filters
    - Refrigerator For Preservation
    - Incubator For Growth
- B. Staining Techniques For Light Microscope:
  - a) Simple Staining: Positive Monochrome
  - b) Negative Staining
  - c) Gram Staining Of Bacteria
  - d) Gram Staining Of Yeast
  - e) Acid Fast Staining
- .C. Isolation And Identification Of Fungi By Spread Plate Method By Using Rose Bengal Agar Plate
- D. Isolation Of Bacteria On Nutrient Agar Plate By Four Flame Method
- E. Isolation Of Bacteria By Pour Plate Method

### **List Of Microbiology Books Authored By:**

- 1) Principles Of Microbiology , Atlas R.M.
- 2) Microbiology Marjorie Kelly Cowan
- 3) Microbiology Gerard J. Tortora
- 4) Microbe Hunters: The Classic Book On The Major Discoveries Of The Microscopic World Paul De Kruif
- 5) Foundations In Microbiology Kathleen Park Talaro
- 6) General Microbiology Roger Y. Stanier Macmillan, 1987
- 7) Michael J. Pelczar Jr. Chan Ecs And Krieg Nr (2004) Microbiology , 5<sup>th</sup> Edition. Tata Mcgraw Hill.
- 8) Instructor's Manual To Accompany Elements Of Microbiology By Michael J. Pelczar



## B.Sc Semester Two [Minor] Microbiology (Credit 2)

### Unit 1

10 lectures

- A. Growth, Requirement Of Bioelements, Growth Factors
- B. Nutritional Types Of Microbes
- C. Modes Of Nutritional Uptake: Passive, Active, Group Translocation
- D. Types Of Cultural Media
- E. Modes Of Microbial Reproduction
- F. Normal Growth Curves, generation time
- G. Batch and continuous cultivation
- H. Measurement of growth
- I. Preservation of cultures

### Unit 2 A

10 lectures

Physical Methods Of Microbial Control:

- A. Principles Of Controlling Microbial Population
- B. Conditions Influencing The Effectiveness Of Antimicrobial Agents
- C. Physical Methods Of Microbial Control:
  1. Heat And Temperature
  2. Radiation
  3. Ultrasonication
  4. Filtration
  5. Osmotic Pressure, Surface Tension, Water Activity

### Unit 2 B

Chemical Methods Of Microbial Control

1. Criteria Of Ideal Chemical Agent to Control Microbes
2. Groups of antimicrobial chemical agents
  - a) Phenol
  - b) Alcohols
  - c) Halogens
  - d) Heavy Metals
  - e) Gaseous Agents
  - f) Aldehydes.

### LAB. COURSE (Credit 2)

1. Cell Wall Staining
2. Capsule Staining
3. Endospore Staining
4. Granule Staining
5. Wet Mount: Hanging Drop Technique to study motility of bacteria
6. Isolation of pure culture of bacteria By Spread Plate Method
7. Isolation of pure culture of bacteria On Nutrient Agar Plate By Four Flame Method
8. Isolation Of Bacteria By Pour Plate Method
9. Study of Effect Of Chemical On Microbial Growth-Bacteria By Cup Borer Method
10. Study of Effect Of Temperature On Bacterial Growth

11. Study of Oligodynamic Effect
12. Study of Effect Of pH On Bacterial Growth
13. Study of growth of bacteria by turbidometric method

**List Of Microbiology Books Authored By:**

- 1) Principles Of Microbiology , Atlas R.M.
  - 2) Microbiology Marjorie Kelly Cowan
  - 3) Microbiology Gerard J. Tortora
  - 4) Microbe Hunters: The Classic Book On The Major Discoveries Of The Microscopic World Paul De Kruif
  - 5) Foundations In Microbiology Kathleen Park Talaro
  - 6) General Microbiology Roger Y. Stanier Macmillan, 1987
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- 7) Michael J. Pelczar Jr. Chan Ecs And Krieg Nr (2004) Microbiology , 5<sup>th</sup> Edition. Tata Mcgraw Hill.
  - 8) Instructor's Manual To Accompany Elements Of Microbiology By Michael J. Pelczar

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SGGU Semester Two Minor Microbiology syllabus July 2023