B.Sc. Semester III (Microbiology)

Course	Course code	Paper title	Teaching hours per week	CCE	SEE	Total marks	Credit points	Exam duration (Hours)
Major Discipline Specific core course	SC23MJDS CMIC301	Microbial Biochemistry and Physiology	4	50	50	100	4	2.5
Major Discipline Specific core course	SC23MJDS CMIC301A	Microbial Diversity and Taxonomy	4	50	50	100	4	2.5
Multi Disciplinary Course	SC23MDC MIC303	Diversity of Microorganisms	2	25	25	50	2	2
Major Discipline Specific core course Practical Paper	SC23 PMJDSC MIC301	Microbial Biochemistry and Physiology Practical Part A	4	25	25	50 (Part A) + 50 (Part B) = 100	2 (Part A) + 2 (Part B) = 4	More than 3
	SC23 PMJDSC MIC301A	Microbial Diversity and Taxonomy Practical Part B	4	25	25			More than 3
Multi Disciplinary Course Practical Paper	SC23PMDC MIC303	Diversity of Microorganisms practical	4	25	25	50	2	More than 3
Ability Enhancement Course		AEC Basket	2	25	25	50	2	2
Skill Enhancement Course		SEC Basket	2	25	25	50	2	2
Indian Knowledge System II Course		IKS course Basket	2	25	25	50	2	2
Total			**30**	**275**	**275**	**550**	**22**	

Sem-3 / Micro. Biology
Syllabus - Jun-2024

B.Sc. Semester III (Microbiology)

Course	Course code	Paper title	Teaching hours per week	CCE	SEE	Total marks	Credit points	Exam duration (Hours)
Major Discipline Specific core course	SC23MJDS CMIC301	Microbial Biochemistry and Physiology	4	50	50	100	4	2.5
Major Discipline Specific core course	SC23MJDS CMIC301A	Microbial Diversity and Taxonomy	4	50	50	100	4	2.5
Multi Disciplinary Course	SC23MDC MIC303	Diversity of Microorganisms	2	25	25	50	2	2
Major Discipline Specific core course Practical Paper	SC23 PMJDSC MIC301	Microbial Biochemistry and Physiology Practical Part A	4	25	25	50 (Part A) + 50 (Part B) = 100	2 (Part A) + 2 (Part B) = 4	More than 3
	SC23 PMJDSC MIC301A	Microbial Diversity and Taxonomy Practical Part B	4	25	25			More than 3
Multi Disciplinary Course Practical Paper	SC23PMDC MIC303	Diversity of Microorganisms practical	4	25	25	50	2	More than 3
Ability Enhancement Course		AEC Basket	2	25	25	50	2	2
Skill Enhancement Course		SEC Basket	2	25	25	50	2	2
Indian Knowledge System II Course		IKS course Basket	2	25	25	50	2	2
Total			**30**	**275**	**275**	**550**	**22**	

Sem-3 / Micro. Biology
Syllabus. Jun-2024

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

COURSE NAME B. SC. MICROBIOLOGY SEMESTER III
PROGRAM CODE: SCIUG105
MAJOR DISCPLINE SPECIFIC COURSE CODE: SC23MJDSCMIC301

MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY

Total Credits- 04 (04 Period/Week)		**Theory**	**External-50 Marks**
			Internal- 50 Marks

Course objective

To make student familiar with microbiology as important subject, History and development of subject, Scope of microbiology in various sectors and basic introduction to microbial metabolism and physiology

UNIT 1: Basic bioenergetics

- Chemical bonds and Stabilizing interactions: Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction
- Structure and properties of water
- pH and buffer: pH and buffer and Buffering against pH changes in biological systems.
- Energy flow: Basic introduction to laws of thermodynamics, Gibb's free energy and chemical potential, Enthalpy& Entropy and relation between them.

UNIT 2: Introduction to Metabolism

- An overview of metabolism, Anabolism, Catabolism, Primary and Secondary metabolism
- Energy rich compounds in cell metabolism, Basic concept of respiration, aerobic respiration, anaerobic respiration and fermentation.
- Carbohydrate metabolism: Glycolysis, TCA cycle, Electron transportsystem, components of respiratory system, Oxidative phosphorylation and photophosphorylation.
- Lipid metabolism: Biosynthesis of fatty acids and Phospholipids, Catabolism of fattyacids and β- Oxidation of fatty acids.

UNIT 3: Microbial growth and nutrient uptake

- Definitions of Growth.Microbial Growth, Mathematical Expression of microbial growthand Methods for the measurement of microbial growth(Direct microscopic count,

Electronicenumeration of cell numbers, plate count method, Membrane filter method, Turbidimetric methods, Biomass based methods).

- Batch culture, continuous culture, synchronous growth, diauxic growth
- Nutrient uptake and transport: Passive and facilitated diffusion, types of transport (primary, secondary, active), concept of uniport, symport and antiport, group translocation, iron uptake.

UNIT 4: Impact of environment on microbial growth

- Microbial growth in response to environment: temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs); pH (acidophiles, alkaliphiles); solute and water activity (halophiles, xerophiles, osmophiles); Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe)
- Microbial growth in response to nutrient and energy: nutritional requirement of bacteria, autotrophshererotrophs, phototrophs, chemotrophs, obligate parasites with suitable examples.
- Introduction to aerobic and anaerobic chemolithotrophwith suitable example each. Hydrogen oxidation and methanogenesis (definition and basic reaction).
- Groups of phototrophic microorganisms, anoxygenic vs. oxygenic photosynthesis with reference to photosynthesis in green bacteria, purple bacteria and cyanobacteria.

Outcomes:

- ✓ Students will know about fundamental aspects of basic biochemistry and metabolism
- ✓ Students will learn the basics of microbial growth, impact of environmental factors, and nutrient uptake approaches.

Reference books

1. Harper H. A. 1993 Review of Physiological Chemistry (Lange Publications).
2. Lehninger A. l., Nelson D. L. and Cox M.M. 1993. Principles of Biochemistry (CBC Publishers).
3. Rastogi S. C. 2003 Biochemistry (Tata Mc GrawHill Publishing Co. Ltd.).
4. MT, and Martinko JM (2014). Brock Biology of Microorganisms. 14th edition. Prentice Hall International Inc.
5. Moat AG and Foster JW. (2002). Microbial Physiology. 4th edition. John Wiley & Sons
6. Reddy SR and Reddy SM. (2005). Microbial Physiology. Scientific Publishers India
7. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. (1987). General Microbiology. 5th edition, McMillan Press.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY, PATAN

COURSE NAME B. SC. MICROBIOLOGY SEMESTER III
PROGRAM CODE: SCIUG105
MAJOR DISCPLINE SPECIFIC COURSE CODE: SC23MJDSCMIC301A

MICROBIAL DIVERSITY AND TAXONOMY

Total Credits- 04 (04 Period/Week)	**Theory**	**External-50 Marks**
		Internal- 50 Marks

Learning objectives

- To acquaint students with basic concepts of microbial diversity and how the microbe concept emerged

UNIT-1 Introduction to microbial diversity

- Overview of Biodiversity: Evolution and Diversity of Microbes
- Microbial Taxonomy: Overview and Introduction Taxonomic ranks of microorganisms in classification systems
- Binomial nomenclature; Carl Woese's three domain classification; Whitteker's five kingdom classification.
- Phylogeny: Overview of Prokaryotic Phylogeny and Eukaryotic Phylogenetic Groups

UNIT-2 Introduction to characteristics of prokaryotic diversity

- Overview of Eubacteria and Archaea
- Gram-negative bacteria: general characteristics of helical vibroids, Aerobic / microaerophilic motile Curves in non-motile bacteria Microaerophilic / aerobic rods and cocci Bacteria with helices, curves, and rods are facultative anaerobes. Reducers of dissimilatory sulfur Anaerobic bacteria Bacteria that feed on light
- General characteristics of Gram-positive bacteria: Rods and cocci that generate endospores, Actinomycetes and Mycobacteria
- Microorganisms with Extremophile

UNIT-3 Eukaryotic diversity

A: Fungi: General features of Fungi: Define, Occurrence, Structure, and Reproduction (sexual & Asexual) Fungi classification and an overview of their main divisions Fungi's economic

significance

B: Algae: General features of Algae: Define Occurrence, Ultra-Structure, and Reproduction (Asexual & sexual). Algae's economic significance:

C: Protozoa: General Features of protozoa: Define Occurrence, Ultra-Structure, and Reproduction. Protozoa's Economic Importance.

UNIT-4 Viruses or Akaryotic diversity

- Overview and General Features of viruses: Definition, Organization, and classification.
- Cultivation of virus.
- Overview of Bacterial Viruses: Classification, Lytic Life Cycle (T4 Phage), and Lysogenic Life Cycle (Lambda Phage).
- Overview of Viruses in Animals: Classification, Replication, Cytocidal Impact, Viruses and Cancer, Prions.
- Overview of Plant Viruses: Taxonomy, Structure, and Replication of TMV, Viroids.

Learning outcomes:

- Student will be able to describe the fundamental concepts and terminology of taxonomic organization and parameters used in classifying bacteria, and the molecular analytic approaches used to classify diverse bacteria.
- Student will be able to discuss about the use of rRNA analysis as a means of developing phylogenetic relationships.
- Student will be able to describe the major groups of archaea, their stand-out physiological and structural features, as well as their ecological niches and economic significance.
- Student will be able to discuss the major groups of eubacteria, including archea with special features.

Reference Books:

1. Prescott, Healey and Klein., Microbiology-5 th International Edition, Tata-McGraw Hill publications, Delhi
2. Atlas. R.M., Principles of Microbiology- 2 nd Edition
3. Modi, H.A. Elementary Microbiology - Vol -I, Akta Prakashan, Nadiyad
4. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology,5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
5. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.

6. Stainer, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London.
7. Salle, S.J. Fundamental Principals of Bacteriology, Tata McGraw Hill Publication Co. Ltd. New Delhi.
8. Frobisher M., Hinsdill, Crabtree and Goodherat, Fundamentals of Microbiology, 9 th Edition. W.B Saunders Co. USA .
9. Dubey, R.C.and Maheshwari, D.K., A Text Book of Microbiology, S. Chand Publications, New Delhi.
10. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY,PATAN

COURSE NAME B. SC. MICROBIOLOGY SEMESTER III
PROGRAM CODE: SCIUG105
PRACTICAL MAJOR DISCPLINE SPECIFIC COURSE CODE:SC23PMJDSCMIC301 & SC23PMJDSCMIC301A
MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY PRACTICAL PART A
MICROBIAL DIVERSITY AND TAXONOMY
PRACTICAL PART B

Total Credits-04	**Part A: 2 credit**	**(04 Period/Week)**	**Internal- 25 Marks**	**External-25 Marks**	**Total marks: 100**
	Part B: 2 credit	**(04 Period/Week)**	**Internal- 25 Marks**	**External-25 Marks**	

SC23PMJDSCMIC301: MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY PRACTICAL PART A

List of Practical

1. Concept of pH and buffers, preparation of buffer solutions
2. Cole` method for estimation of reducing sugars
3. Estimation of total lipid content from given samples
4. Study of growth curve of *E.coli* by turbidometric and standard plate count methods.
5. Calculation of generation time and specific growth rate of bacteria from graph plotted with experimental data
6. Effect of pH on growth of bacteria
7. Effect of temperature on growth of bacteria
8. Effect of carbon sources on growth of bacteria
10. Effect of nitrogen sources on growth of bacteria
11. Effect of salt concentration on growth of bacteria

SC23PMJDSCMIC301A MICROBIAL DIVERSITY AND TAXONOMY PRACTICAL PART B

List of Practicals

1. Isolation of Gram negative & Gram positive bacteria from the given sample.
2. Identification of Gram negative bacteria from the given pure culture using biochemical media (*E.coli*, *Entrobacter aerogens*, Proteus, Salmonella).
3. Isolation and Identification of Gram positive bacteria from natural sources (*Bacillus megaterium*, *Bacillus subtilis*, *Staphylococcus aureus*, *Streptococcus*)
4. Cultivation and Identification of Fungi on the basis of Morphological Characteristics.
5. Cultivation of yeast from different natural samples and its morphological characterization using microscopic observation.
6. Study of premenant slide observation of Algae (Volvox, Spyrogyra, and Chlamydomonas).
7. Study of premenant slide observation of Protozoa (Amoeba, Paramecium, and Plasmodium).