

M. SC. SYLLABUS
MICROBIOLOGY
CHOICE BASED CREDIT SYSTEM
(CBCS)

(Revised, w.e.f. June 2018)



DEPARTMENT OF LIFE SCIENCES

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Junagadh – 362 640

Department of Life Sciences

1. The Course

- The course is full time course comprising of four semesters. There will be four theory papers (three core papers and one interdisciplinary / multidisciplinary paper) and one combined practicals in first two semesters. The last two semesters offer choice of courses to the students where two core courses and one elective (to be chosen from three available) courses will be taught. Any elective course will be taught only when prerequisite number of the student enrolls for that course. Students shall be required to submit at the time of practical examination at the end of each semester.
 - The laboratory Journal and diary of field work (Tour report) duly signed by the teachers concerned from time to time.
 - A set of assignments, submissions, preparations or materials illustrating the subject - matter as per syllabus for each semester.

2. Eligibility

- The candidate with B.Sc. degree in Microbiology with minimum 45% is eligible for admission to M.Sc. Botany course.
- Students, who have cleared B.Sc. with microbiology as the second subject in S.Y. B.Sc. will also be considered for admission, provided the seats are available. A total of 20 seats are available in the Microbiology.
- Students will be admitted as per the reservation policy in effect from time to time, as directed by the University.

3. Educational tour

- The study/ educational tour is compulsory and part of Curriculum to study different ecosystems, botanical, zoological and microbiological places of interest anywhere in the country. Since the tour or tours are part of the curriculum, these can be conducted during any or all of the four semesters. However, in special cases, alternative of the educational tour will be decided and assigned to the student concerned, by the Staff Council of the Department.

4. Seminars / Assignments / Submission

- Regular seminars will be organised on I and II Semesters and it is compulsory. Presentation on relevant topics, mostly from syllabus (oral and / or poster), is mandatory for the enrolled student. For each seminar, a student will be given marks, which will be added in the III Semester marksheet.

5. Attendance

- Admitted students have to attend all the Lectures, Practicals and Seminars. A minimum prescribed attendance as per University rules is required to sanction a term grant. Students whose term is not granted will not be allowed to appear in the examination, and will have to join the same semester in the following year.

6. Semester wise distribution of marks

- SEMESTER-I: 4 Papers (100 Marks each*) : 400
 1 Combined Practical : 200
 Total **: 600**
- SEMESTER-II:
 4 Papers (100 Marks each*) : 400
 1 Combined Practical : 200
 Total **: 600**

*** 70 external + 30 internal**

7. The M.Sc. courses run by this Department are full time studies and as such, a student admitted to the Department is not allowed to join any other courses or study, or take up any paid service.
8. The candidate should bring all original mark sheets, certificates etc. At the time of the interview.

M. Sc. Microbiology

Semester - II

Course code	Paper title	Hours / week	Credits
MICR 207	Biochemistry (Core)	04	04
MICR 208	Biotechnology & Immunology (Core)	04	04
MICR 209	Environmental Science (Core)	04	04
MICR 210	Analytical Techniques** (Multidisciplinary / Interdisciplinary)	04	04
MICR 211	Combined Practical Course	14	08
MICR 212	Seminar Course - 2	02	00
	Total		24

M.Sc. Microbiology

DETAILED SYLLABUS

Semester - II

MICR207: BIOCHEMISTRY

Unit – 1 : Carbohydrates, Lipids and Fatty Acid metabolism

- 1.1 Monosaccharides and disaccharides: Types and properties
- 1.2 Polysaccharides: Homopolysaccharides and heteropolysaccharides
- 1.3 Classification and properties of simple and compound lipids
- 1.4 Function of lipids, Metabolism of fatty acids: Beta oxidation

Unit – 2 : Protein Structure and Function

- 2.1 Physical and chemical properties of amino acid, Classification of amino acids
- 2.2 Primary and Secondary structure of protein
- 2.3 Tertiary and Quaternary structure of protein, Ramchandran Plots
- 2.4 Titration curves and function of proteins

Unit – 3 : Enzymes: Basic Concepts and Kinetics

- 3.1 An introduction to enzymes: Nomenclature and classification
- 3.2 Principles and mechanism of enzymes catalysis: single and multisubstrate, Coenzymes and cofactors
- 3.3 Kinetic properties of enzymes, Michaelis-Menten Model, Double reciprocal plot
- 3.4 Enzyme Inhibition: Competitive, Non- competitive, Uncompetitive and Mixed type

Unit – 4 : Metabolism: Basic Concepts and Regulation

- 4.1 Concept of Bioenergetics: laws of thermodynamic, Entropy and Enthalpy, Energy rich compounds and electron carriers
- 4.2 Glycolysis and Citric Acid Cycle
- 4.3 Other pathways of carbohydrate metabolism ED, Pentose Phosphate, Glyoxylate,
- 4.4 Gluconeogenesis Allosteric proteins, Feedback inhibition

MICR208: BIOTECHNOLOGY & IMMUNOLOGY

Unit – 1 : Biotechnology -1.

- 1.1 Biotechnology : Definition, History and Career scopes
- 1.2 Techniques of immobilization of enzymes & cells
- 1.3 Applications of Immobilized Enzymes & Cells
- 1.4 Bioremediation

Unit – 2 : Biotechnology -2

2.1 Basics of genetic engineering

2.2 DNA isolation techniques

2.3 Restriction enzymes, Gene targeting

2.4 Vectors : plasmids, cosmids and phages, Host vector system, Screening of the recombinant clones

Unit – 3 : Animal and Plant Tissue culture

3.1 Principles and Techniques of Plant Tissue Culture

3.2 Basic Steps of Plant Tissue Culture

3.3 Types of Plant Tissue Culture

3.4 Principles and techniques of animal tissue culture

Unit – 4 : Immunology

5.1 Antigen Antibody: Factors Influencing Immunogenicity, Structure of Ig, Ig Classes & Biological Activities, Monoclonal Antibodies

5.2 Innate and Adaptive Immune System

5.3 Antigen-Antibody Interactions: ELISA Test, Agglutination, Precipitation, Immunofluorescence

5.4 Hypersensitivity and Autoimmunity

MICR209: ENVIRONMENTAL SCIENCES

Unit-1 Ecological Principles

1.1 Habitat and Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

1.2 Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection)

1.3 Concept of metapopulation – demes and dispersal, interdemec extinctions, age structured populations.

1.4 Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

Unit-2 Community Ecology

2.1 Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.

2.2 Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

2.3 Ecosystem Ecology: Ecosystem structure; ecosystem function; energy flow and mineral cycling (C,N,P); primary production and decomposition;

2.4 Structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).

Unit-3 Environment Science

- 3.1 Definition and Scope of Environmental science. The Environment: Physical environment; biotic environment; biotic and abiotic interactions.
- 3.2 Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere.
- 3.3 Biomes of the world, Parasitism, prey-predator relationships
- 3.4 Overview of Sanctuaries, National park and Botanical garden

Unit-4 Pollution and Environmental Impact Assessment

- 4.1 Air: Natural and anthropogenic sources of pollution, primary and secondary pollutants, Methods of monitoring and control of air pollution, Effects of pollutants on human beings, plants, animals, materials and on climate, Acid rain, Air Quality Standards
- 4.2 Water: Types and Sources of water pollution, Standards, sewage and waste water treatment. Water quality standard, Soil pollution and Soil pollution control
- 4.3 Global Environmental problems: Ozone depletion, global warming and climatic change, clean development mechanism.
- 4.4 Introduction to environment impact analysis, Environmental Impact Assessment methodologies, Procedure for reviewing environmental impact analysis, Principles of Remote sensing and its applications of environmental sciences, Application of GIS in Environmental management.

MICR210: ANALYTICAL TECHNIQUES

Unit – 1 : Microscopy and Autoradiography

- 1.1 Theories of Tissue fixation and staining techniques
- 1.2 Principles of Transmission and Scanning Electron microscopy
- 1.3 Principles of Phase Contrast and Fluorescence Microscopy
- 1.4 Principle and applications of Autoradiography

Unit – 2 : Spectroscopy

- 2.1 Basic principles of Spectroscopy, UV, IR, Raman, ESR, ORD
- 2.2 CD and structure of proteins using NMR and ESR
- 2.3 Neutron and X-Ray diffraction for elucidation of 3D structure
- 2.4 Molecular modelling, Mass Spectrometry

Unit – 3 : Chromatographic techniques

- 3.1 Basic Principle and types of Chromatography
- 3.2 Gas Chromatography & GC-MS
- 3.3 Ion Exchange Chromatography, gel permeation, Affinity chromatography
- 3.4 High Performance Liquid Chromatography and FPLC

Unit – 4 : Centrifugation and Electrophoretic Techniques

- 1.1 Principle and applications of Centrifugation techniques
- 1.2 Basic principles of Electrophoresis, Agarose gel, native and SDS-PAGE
- 1.3 Isoelectric focusing, 2D-PAGE and their uses in protein research
- 1.4 Fractionation and Blotting Techniqu

MICR211 : COMBINED PRACTICAL COURSE

SUGGESTED LABORATORY WORK

1. To prepare a titration curve of a weak acid with a strong base
2. To prepare a titration curve and determine the pK and pI value of an amino acid
3. To prepare a calibration curve of reducing sugars by DNSA
4. To prepare a calibration curve of protein by Folin-Lowry method
5. Extraction and estimation of protein by Folin-Lowry method
6. To prepare a calibration curve of amino acid using Ninhydrin reaction method
7. Extraction and estimation of free amino acid content in germinating seeds by ninhydrin reaction method
8. To determine saponification value of fats and oils
9. Isolation & Identification of Bacteria, Yeasts & Fungi
10. Biochemical Tests: Metabolic Activities of Enteric Bacteria: Sugar Fermentation, IMViC, H₂S production, Phenylalanine Deaminase Urea Hydrolysis, Nitrate Reduction, Amylase, Protease
11. Direct ELISA Technique
12. Indirect ELISA Technique
13. Preparation of plant tissue culture media
14. To perform the Ouchterlony double diffusion.
15. To learn the technique of radial immunodiffusion.
16. To learn the technique of agglutination.
17. To determine colour of soil by physical observation and to determine water holding capacity
18. To determine field capacity of soil
19. To determine temperature soil by thermometer.
20. To determine soil-moisture by oven drying
21. To determine soil texture
22. To estimate the amount of organic carbon by Walkley and Black titration method
23. To estimate the amount of Ca from given soil sample
24. To estimate the amount of Mg from given soil sample
25. To determine the amount of carbonate in the soil by rapid test
26. To determine Calcium Carbonate in the Soil.
27. To determine phosphate content in the soil
28. To determine the alkalinity of given water sample.
29. To determine acidity of given water sample.
30. Dissolved oxygen (DO)
31. Biological oxygen demand (BOD)
32. Bacteriological analysis by MPN
33. Colour, turbidity, odour and pH, TS, TDS and TSS
34. Chloride estimation
35. Sulfate estimation

36. Ca-Mg Hardness/ Estimation of total hardness of water by EDTA method.
37. Demonstration of a state-of-the-art compound microscope with Brightfield, Phase-Contrast, Fluorescence and Darkfield operational details.
38. Demonstration of computer controlled brightfield microscopy
39. Demonstration of Image capturing and Image analysis by Image Analysis software
40. Determination of molecular mass of Protein by size exclusion chromatography (Theoretical)
41. PCR amplification of gene
42. DNA sequencing of the amplified gene
43. To perform sandwich DOT ELISA test for antigen.
44. To perform Western Blot Technique
45. To isolate genomic DNA from bacterial isolate
46. To separate amino acids by ascending paper chromatography
47. To separation of amino acids by TLC method
48. Demonstrate the colorimetric method using Beer's & Lamberts law
49. To perform the separation technique by using centrifugation method
