

**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 50 % 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.



**Bhakta Kavi Narsinh Mehta University**  
**Department of Life Sciences**  
**Semester wise Paper Style of Master of Science (M.Sc.)**  
**For C.B.C.S. Examination for all Semesters**

**Q 1. Answer the following : 14**  
(Any Seven out of Ten questions from whole syllabus – 02 marks each)

**Q 2. Answer the following : 14**  
(Any Two out of Three questions – 07 marks each for two questions)

**Q 3. Answer the following : 14**  
a) Write a note on ( 5 marks )  
b) Write a note on ( 5 marks )  
c) Answer specifically ( 4 marks )

**OR**

**Q 3. Answer the following :**  
(a,b compulsory questions – 07 marks each for two questions)

**Q 4. Answer the following : 14**  
d) Any two out of three questions ( 5 marks each )  
e) Any one out of two questions ( 4 marks )

**Q 5. Answer the following : 14**  
(Any Two out of four – 07 marks each for two questions)

**Note :**

**Q.1 From all units**

**Q.2/Q.3/Q.4/Q.5 From Unit 1, 2, 3 and 4 in any order but a single question must cover a single unit.**

## M. Sc. Microbiology

### Semester - I

Course code	Paper title	Hours / week	Credits
MICR 101	Cell Biology (Core)	04	04
MICR 102	Molecular Biology, Genetics & Evolution (Core)	04	04
MICR 103	Biodiversity & Biosystematics (Core)	04	04
MICR 104	Biostatistics and Bioinformatics** (Multidisciplinary / Interdisciplinary)	04	04
MICR 105	Combined Practical Course	14	08
MICR 106	Seminar Course - 1	02	00
	<b>Total</b>		<b>24</b>

# **M.Sc. Microbiology**

## **DETAILED SYLLABUS**

### **Semester - I**

#### **MICR 101: CELL BIOLOGY**

##### **Unit-1 : Cell Structure & Cell Cycle**

- 1.1 Cell Concept, Ultrastructure of Plasma Membrane, microbial and Plant Cell Wall
- 1.2 Ultrastructure of Nucleus and Nucleolus. Pore Complex of Nuclear envelop
- 1.3 Ultrastructure of Chromosome, Chromosomal Models, Special types of chromosomes
- 1.4 Cell Cycle, G<sub>1</sub>/S Transition, Cyclines and cyclin dependent kinases. Regulation of CDK- cycline activity

##### **Unit-2 : Cellular Organization**

- 2.1 Mitochondria: Membrane Organization, Biogenesis and role in cellular energetics
- 2.2 Chloroplasts: Ultrastructure, biogenesis, Photosynthetic units and reaction centres
- 2.3 Ultrastructure and functions of Lysosome, Peroxisomes & Glyoxisomes
- 2.4 GERL System and its functions. Vacuoles and their role in cell structure and function

##### **Unit-3 : Cytoskeleton, Cellular Transport & Sorting**

- 3.1 Cytoskeleton: Ultrastructure and functions of Microtubules, microfillaments and associated proteins
- 3.2 Cytoskeleton: Ultrastructure and functions of Actin, Myosin, IF and associated proteins
- 3.3 Intracellular Junctions and their functions. Ca<sup>++</sup> dependent homophillic and non-homophillic cell-cell adhesion
- 3.4 Transport across cell membrane: diffusion, active transport and pumps, uniports, symports and antiports

##### **Unit-4 : Cellular Communication, Apoptosis and Cancer**

- 4.1 Cell surface receptors and their mode of action. Phenomenon of exocytosis and endocytosis
- 4.2 Second messenger system, MDP kinase pathways
- 4.3 Apoptosis: Mechanism and significance
- 4.4 Cell biological approach of cancer, AIDS

## **MICR 102: MOLECULAR BIOLOGY, GENETICS & EVOLUTION**

### **Unit-1. Population Genetics**

- 1.1 Principles of Mendelian genetics
- 1.2 Hardy-Weinberg genetic equilibrium, Natural selection
- 1.3 Genetics of Speciation
- 1.4 Origin of life: Coacervates, Miller's experiment, theories of organic evolution

### **Unit-2. DNA as a hereditary material**

- 2.1 Structure of Nucleic acids, Structural differences in prokaryotic and eukaryotic DNA
- 2.2 DNA constancy and C-value paradox,
- 2.3 DNA replication and DNA methylation
- 2.4 Linkage and genetic mapping

### **Unit-3. Gene structure and expression**

- 3.1 The Concept of Gene
- 3.2 Genetic code, Transcription and RNA processing
- 3.3 Translation and post translational modifications
- 3.4 Regulation of gene expression and Operon model

### **Unit-4. Structural Changes in DNA material and Extra Chromosomal inheritance**

- 4.1 Molecular basis of spontaneous and induced mutations
- 4.2 Chromosomal aberrations
- 4.3 DNA damages and repair
- 4.4 Extra-chromosomal inheritance

## **MICR 103: BIODIVERSITY & BIOSYSTEMATICS**

### **Unit – 1: Biodiversity**

- 1.1 Basic Concepts of Biodiversity: Genetic, species and ecological diversity.
- 1.2 Terrestrial, Marine Biodiversity, Eco-tourism and Biodiversity. Conservation and Sustainable use of Biodiversity. Ecosystem monitoring and Rehabilitation.
- 1.3 Threats to Biological Diversity: Habitat Destruction, Invasive species, Disease, Over-exploitation, Pollution, Climate change and Biodiversity.
- 1.4 Structure and functions of the Convention on Biological Diversity (CBD), CBD mechanisms and working bodies.

## **Unit – 2: Microbial Taxonomy**

- 2.1 Principles of systematics and classification of microbes.
- 2.2 Introduction to akaryotes, virus, archea& bacteria, cyanobacteria and prokaryotes
- 2.3 Fungus like protists: Cellular slime moulds, plasmodial slime moulds. General features of Fungus
- 2.4 Organisms of health importance: Common parasites and pathogens of humans and domestic animals

## **Unit – 3: Plant Taxonomy**

- 3.1 Principles of systematics and classification of Plants
- 3.2 General features and Classification of green protists like diatom, dinoflagellates, lichens and algae
- 3.3 Non-tracheophytes (Mosses) and Non-Seed Tracheophytes (Ferns and Fern allies).
- 3.4 Seed plants: Gymnosperm and Angiosperms

## **Unit – 4: Animal Taxonomy**

- 4.1 Principles of systematics and classification of Animals. Organisms of conservation concern: Rare, endangered species. Conservation strategies.
- 4.2 Classification of Protista (Flagellates, Amoebas, Ciliates and Apicomplexans).
- 4.3 Major invertebrate phyla, Lower chordates
- 4.4 Vertebrates: Fish, Amphibia, Reptiles, Birds and Mammal

## **MICR 104: BIOSTATISTICS AND BIOINFORMATICS**

### **Unit – 1: Basics and concepts of Biostatistics**

- 1.1 Data, Tabulation, Classification, Frequency distribution and Graphics
- 1.2 Measure of Central Tendency – Mean, Mode & Median: Definition, Objectives, Merits, Demerits & Uses
- 1.3 Measure of Dispersion – Range, Variance, Standard deviation, Coefficient of Variation
- 1.4 Confidence limit and confidence interval

### **Unit – 2: Statistical tests in Biology**

- 2.1 Student's t-test: Paired and Unpaired
- 2.2 Analysis of Variance
- 2.3 Regression and Correlation analysis
- 2.4 Chi-square test



### **Unit – 3: Basics of Bioinformatics and Biological Database**

- 3.1 Introduction of Bioinformatics, Basic terminology
- 3.2 Application of bioinformatics in various fields: Medicine, Agriculture, Industries etc.
- 3.3 File formats and Structure of database
- 3.4 Types of biological databases

### **Unit – 4: Sequence alignment, Gene prediction and Basic concepts of Omics**

- 4.1 Sequence alignment: Nucleotide and Protein sequences, Pairwise and multiple sequence alignment, BLAST
- 4.2 Gene prediction: Gene structure in prokaryotic and eukaryotic systems, Prediction tools for the gene
- 4.3 Phylogenetic analysis
- 4.4 Drug discovery

### **MICR 105: COMBINED PRACTICAL COURSE**

#### **SUGGESTED PRACTICALS BASED ON PAPERS 101, 102, 103 AND 104**

##### **101. Cell Biology : Suggested practical work**

1. Preparation of paraffin blocks of animal tissue – Understanding the cytological and histological techniques
2. Section cutting, spreading and staining methods, Microscopy
3. Supra – vital Cytological staining of cellular organelles
4. Cellular metabolites: Permanent Cytological Staining
5. Nucleic Acids: Permanent Cytological Staining
6. Cytogenetics: Onion root tip squash preparation for mitosis
7. Dipteran salivary gland squash preparation for giant chromosome
8. Cytological Staining of Barr body
9. Cytogenetics: Stages of meiosis
10. Histological and Cytological Staining of Drumstick
11. Enzyme histochemistry & Cytochemistry
12. Observations on permanent cytological slides

##### **102. Molecular Biology, Genetics & Evolution : Suggested practical work**

1. To confirm thalassemia by NESTROFT (Necked Eye Single Tube RBCs Osmotic Fragility Test)
2. To induce polyploidy in root of *Allium cepa* and observe cytological changes in cell
3. To study karyotype of human chromosome
4. Identification of normal male and female karyotype
5. Identification of Turner syndrome using Karyotype
6. Identification of Klinefelter syndrome using the karyotype
7. Identification of Down syndrome using the karyotype
8. Identification of Edwards syndrome using the karyotype
9. To perform linkage analysis and Map construction with example
10. To perform Pedigree analysis and Probabilities with example

11. Staining of Microbial Cells: Monochrome, Negative & Gram Staining
12. Bacterial Motility (Hanging Drop Method)
13. Bacteriological Media Composition & Preparation and Bacterial Cultivation Methods

### **103. Biodiversity & Biosystematics : Suggested practical work**

1. General features & classification of Invertebrates up to class or order
2. General features & classification of vertebrates up to class or order
3. General features and classification of diatoms, dinoflagellates, lichens and algae
4. General features and classification of non-tracheophytes and non-seed tracheophytes
5. General features and classification of Gymnosperms
6. General features and classification of angiosperms
7. Negative staining, Differential staining (Gram's staining)
8. Specialized staining: Capsule staining, Spirocheck staining, Metachromatic granule staining, Cell wall staining
9. Hanging drop techniques for motility

### **104. Biostatistics & Bioinformatics Biostatistics : Suggested practical work**

1. Frequency Distribution
2. Standard Deviation and Coefficient of Variation
3. Confidence limits for the population mean
4. Students 't' test
5. Analysis of Variance
6. Regression and Correlation
7. Chi Square Test

### **105. Bioinformatics : Suggested practical work**

1. Basic Terminologies in Bioinformatics
2. Biological databases
3. NCBI Search for Gene Sequences
4. UniProt Knowledgebase (UniProt KB) Search for Protein Sequences
5. RCSB PDB search for Protein 3D Structures
6. Pair wise Sequence Alignment using NCBI BLAST
7. Pair wise Sequence Alignment using Bio edit
8. Multiple Sequence alignment using CLC Protein Workbench
9. Multiple Sequence alignment using Clustal X
10. Analysis of 3 D structure of protein by Rasmol