# SURENDRANAGAR UNIVERSITY

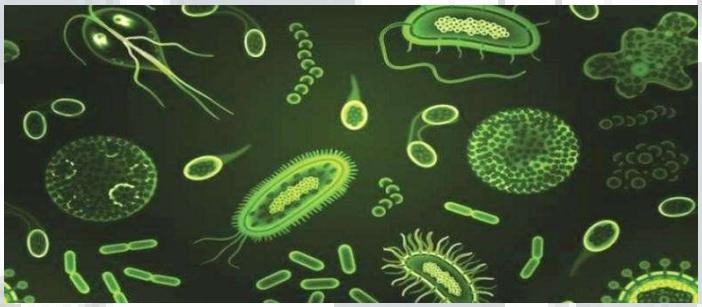
## COURSE STRUCTURE & SYLLABUS

## FOR

## UNDERGRADUATE PROGRAMME

## IN

# MICROBIOLOGY



## (CORE COURSE FOR SEMESTER I & II)

**(As per Choice Based Credit System as recommended by UGC)**

## Effective from June – 2021

SURENDRANAGAR UNIVERSITY
विद्या परमं बलम्

**SURENDRANAGAR UNIVERSITY**

**SCHOOL OF SCIENCE**

**CBCS BASED COURSE STRUCTURE FOR SEMESTER 1 TO 6 & SYLLABUS FOR SEMESTER 1 & 2 FOR UNDERGRADUATE PROGRAMME IN MICROBIOLOGY TO BE EFFECTIVE FROM JUNE 2021**

| No. | Diploma/ Graduate/ Post Graduate | Semester | Title Of Paper | Paper No. | Credits | Internal Marks | External Marks | Practical & Viva Marks | Total Marks | Unique Code No. of Paper | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Year | Faculty | Subject | Course Group | Level | Semester | Paper No. | Option |
| 1 | Graduate | 01 | Fundamentals of Microbiology | MB 101 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 01 | 01 | - |
| 2 | Graduate | 02 | Basics of Biochemistry & Microbial Control | MB 201 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 02 | 02 | - |
| 3 | Graduate | 03 | Microbial Diversity | MB 301 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 03 | 03 | - |
| 4 | Graduate | 04 | Applied & Environmental Microbiology | MB 401 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 04 | 04 | - |
| 5 | Graduate | 05 | Immunology | MB 501 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 05 | 05 | - |
| 6 | Graduate | 05 | Bacterial Metabolism | MB 502 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 05 | 06 | - |
| 7 | Graduate | 05 | Molecular Biology and Genetic Engineering | MB 503 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 05 | 07 | |
| 8 | Graduate | 06 | Fermentation Technology | MB 601 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 06 | 08 | - |
| 9 | Graduate | 06 | Bio - Analytical Techniques | MB 602 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 06 | 09 | - |
| 10 | Graduate | 06 | Clinical and Diagnostic Microbiology | MB 603 | 4 | 30 | 70 | 50 | 150 | 19 | 03 | 05 | - | 01 | 06 | 10 | - |

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# COURSE STRUCTURE FOR UG PROGRAM AND CREDIT SYSTEM

## SKELETON OF COMPLETE COURSE CONTENT OF UNDER GRADUATE MICROBIOLOGY (SEMESTER I TO VI)

| SEMESTER | PAPER NO. & CODE | TITLE OF THE PAPER | CREDIT |
|---|---|---|---|
| I | MB-101 (Theory) | **Fundamentals of Microbiology** | 4 |
| | MB-101 (Practical) | **-do-** | 3 |
| II | MB-201 (Theory) | **Basics of Biochemistry and Microbial Control** | 4 |
| | MB-201 (Practical) | **-do-** | 3 |
| III | MB-301 (Theory) | **Microbial Diversity** | 4 |
| | MB-301 (Practical) | **-do-** | 3 |
| IV | MB-401 (Theory) | **Applied and Environmental Microbiology** | 4 |
| | MB-401 (Practical) | **-do-** | 3 |
| V | MB-501 (Theory) | **Immunology** | 4 |
| | MB-501 (Practical) | **-do-** | 3 |
| | MB-502 (Theory) | **Bacterial Metabolism** | 4 |
| | MB-502 (Practical) | **-do-** | 3 |
| | MB-503 (Theory) | **Molecular Biology and Genetic Engineering** | 4 |
| | MB-503 (Practical) | **-do-** | 3 |
| VI | MB-601 (Theory) | **Fermentation Technology** | 4 |
| | MB-601 (Practical) | **-do-** | 3 |
| | MB-602 (Theory) | **Bio-Analytical Techniques** | 4 |
| | MB-602 (Practical) | **-do-** | 3 |
| | MB-603 (Theory) | **Clinical and Diagnostic Microbiology** | 4 |
| | MB-603 (Practical) | **-do-** | 3 |

# SYLLABUS FORMAT OF SEMESTER 1 AND 2

| Stream | Paper | Unit | Title of Unit | Credit | Lectures | Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | External | | Internal |
| B.Sc. Sem-1 (UG) Paper-101 | MB-101-FUNDAMENTALS OF MICROBIOLOGY THEORY CREDIT (04) | 1 | SCOPE AND HISTORY OF MICROBIOLOGY | 0.8 | 12 | 70 | 14 | 30 |
| | | 2 | MICROSCOPY AND STAINING | 0.8 | 12 | | 14 | |
| | | 3 | MORPHOLOGY OF BACTERIA | 0.8 | 12 | | 14 | |
| | | 4 | CULTIVATION OF BACTERIA | 0.8 | 12 | | 14 | |
| | | 5 | REPRODUCTION AND GROWTH OF BACTERIA | 0.8 | 12 | | 14 | |
| | **Total** | | | **04** | **60** | **100** | | |
| | MB101 PRACTICAL CREDIT (03) | | INSTRUMENTATION, STAINING, ISOLATION, ENUMERATION AND GROWTH CURVE OF BACTERIA | 03 | 30 | 35 | | 15 |
| | **Total** | | | **03** | **30** | **50** | | |
| B.Sc. Sem-1 (UG) Paper-201 | MB- 201 BASICS OF BIOCHEMISTRY AND MICROBIAL CONTROL THEORY CREDIT (04) | 1 | REVIEW OF BASIC CHEMISTRY | 0.8 | 12 | 70 | 14 | 30 |
| | | 2 | INTRODUCTION TO BIOMOLECULES | 0.8 | 12 | | 14 | |
| | | 3 | ENZYMES | 0.8 | 12 | | 14 | |
| | | 4 | CONTROL OF MICROORGANISMS BY PHYSICAL AND CHEMICAL AGENTS | 0.8 | 12 | | 14 | |
| | | 5 | ANTIBIOTICS AND THEIR MODE OF ACTION | 0.8 | 12 | | 14 | |
| | **Total** | | | **04** | **60** | **100** | | |
| | MB201 PRACTICAL CREDIT (03) | | QUALITATIVE AND QUANTITATIVE ANALYSIS OF BIOMOLECULES, ENZYME ASSAY, ANTIMICROBIAL ACTIVITY , TOTAL YEAST COUNT | 03 | 30 | 35 | | 15 |
| | **Total** | | | **03** | **30** | **50** | | |

## GENERAL INSTRUCTIONS

**1)** The Medium of Instruction will be English for Theory and practical course

**2)** There will be 6 Lectures / Week / Theory Paper / Semester.

**3)** Each Lecture (Period) will be of 55 Mins. (1 Period = 55 Mins).

**4)** There will be 2 Practical / Week / Paper / Batch. Each Practical will be of 3 Periods (1 Period 55 Mins.).

**5)** Each Semester Theory Paper will be of FIVE Units. There will be 60 Hrs. of Theory teaching / Paper / Semester.

**6)** Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks. So, Total Marks of Theory and Practical for each Paper will be 150. (100+50 = 150)

## Instructions to the Candidates for Practical Examination:

**1)** The practical examination will be conducted for TWO (2) days.

**2)** The Time duration of practical examination will be of FOUR (4) hrs on both the days.

**3)** All the students have to remain present at the examination centre 15 minutes before the scheduled time for examination.

**4)** Students have to carry with them Certified journal, I-card or examination receipt, Slide box, Apron and all other necessary requirements for examination.

**5)** Candidate should not leave the laboratory without the permission of examiner.

**6)** Use of calculator is allowed but the use of Mobile phones is strictly prohibited.

**7)** The candidate has to leave the laboratory only after the submission of all the answer sheets of the exercises performed.

# SKELETON OF THEORY EXAMINATION (EXTERNAL)

| | | |
|---|---|---|
| **QUESTION 1 – UNIT 1** | | |
| **Q 1 A** | **Objective type questions** | **4 Marks** |
| **Q 1 B** | **Answer in brief (Any 1 out of 2)** | **2 Marks** |
| **Q 1 C** | **Answer in detail (Any 1 out of 2)** | **3 Marks** |
| **Q 1 D** | **Write a note on (Any 1 out of 2)** | **5 Marks** |
| **QUESTION 2 – UNIT 2** | | |
| **Q 2 A** | **Answer in brief (Any 1 out of 2)** | **4 Marks** |
| **Q 2 B** | **Answer in brief (Any 1 out of 2)** | **2 Marks** |
| **Q 2 C** | **Answer in detail (Any 1 out of 2)** | **3 Marks** |
| **Q 2 D** | **Write a note on (Any 1 out of 2)** | **5 Marks** |
| **QUESTION 3– UNIT 3** | | |
| **Q 3 A** | **Objective type questions** | **4 Marks** |
| **Q 3 B** | **Answer in brief (Any 1 out of 2)** | **2 Marks** |
| **Q 3 C** | **Answer in detail (Any 1 out of 2)** | **3 Marks** |
| **Q 3 D** | **Write a note on (Any 1 out of 2)** | **5 Marks** |
| **QUESTION 4 – UNIT 4** | | |
| **Q 4 A** | **Objective type questions** | **4 Marks** |
| **Q 4 B** | **Answer in brief(Any 1 out of 2)** | **2 Marks** |
| **Q 4 C** | **Answer in detail (Any 1 out of 2)** | **3 Marks** |
| **Q 4 D** | **Write a note on (Any 1 out of 2)** | **5 Marks** |
| **QUESTION 5 – UNIT 5** | | |
| **Q 5 A** | **Objective type questions** | **4 Marks** |
| **Q 5 B** | **Answer in brief (Any 1 out of 2)** | **2 Marks** |
| **Q 5 C** | **Answer in detail (Any 1 out of 2)** | **3 Marks** |
| **Q 5 D** | **Write a note on (Any 1 out of 2)** | **5 Marks** |
| **TOTAL MARKS : 70 TOTAL TIME : 2½ HOURS** | | |

# SKELETON OF PRACTICAL EXAMINATION (EXTERNAL)

## SEMESTER – I and II: MB 101 and MB 201

### SECTION- I: EXAMINER –I
### (EXTERNAL)

| Ex. No. | Detail of Exercise | Marks | Day to begin the exercise |
|---|---|---|---|
| 1 | Perform any one from the given list of exercises as per the instruction of the examiner exercise | 10 | 1st Day |
| 5 | Viva-voce | 04 | 1st / 2nd Day |
| 6 | Certified Journal | 03 | 1st / 2nd Day |
| | Total Marks | | 17 |

### SECTION- II: EXAMINER –II
### (INTERNAL)

| Ex. No. | Detail of Exercise | Marks | Day to begin the exercise |
|---|---|---|---|
| 2 | Perform any one from the given list of exercises as per the instruction of the examiner exercise | 10 | 1st / 2nd Day |
| 3 | Spotting | 04 | 1st / 2nd Day |
| 4 | Viva-voce | 04 | 1st / 2nd Day |
| | Total Marks | | 18 |

## INTERNAL EVALUATION FOR MB 101 AND MB 201 (THEORY)

| No. | Pattern of Internal Evaluation | Marks |
|---|---|---|
| 1 | Assignment | 10 |
| | MCQ Test | 10 |
| | Seminar/Presentation | 10 |
| OR | | |
| 2 | MCQ Test | 30 |
| OR | | |
| 3 | Assignment | 10 |
| | MCQ Test | 20 |
| OR | | |
| 4 | Seminar/Presentation | 10 |
| | MCQ Test | 20 |

## INTERNAL EVALUATION FOR MB 101 AND MB 201 (PRACTICAL)

| No. | Pattern of Internal Evaluation | Marks |
|---|---|---|
| 1 | Reagent Preparation/Calculation | 05 |
| 2 | Practical Performance/Test | 05 |
| 3 | Viva | 05 |

## LIST OF INSTRUMENTS FOR MICROBIOLOGY SEMESTER 1 AND 2

| No. | Name of Instrument |
|---|---|
| 1 | Compound Microscopes |
| 2 | Autoclave |
| 3 | Incubator |
| 4 | Hot air oven |
| 5 | Vortex mixer |
| 6 | Water bath |
| 7 | Heating mantle |
| 8 | Magnetic stirrer |
| 9 | UV chamber |
| 10 | Inoculation chamber |
| 11 | pH meter |
| 12 | Colony counter |
| 13 | Refrigerator |
| 14 | Bunsen burner |
| 15 | Micrometer (stage and ocular) |
| 16 | Colorimeter |
| 17 | Membrane filter set |
| 18 | Centrifuge |
| 19 | Electronic shaker Incubator |
| 20 | Electronic Analytical Balance |
| 21 | Double-pan Analytical Balance |
| 22 | Spectrophotometer |
| 23 | Computers |
| 24 | Water distillation system |
| 25 | Haemocytometers |
| 26 | Inspissator |

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - I
# (With effect from June 2021)
# MB-101- FUNDAMENTALS OF MICROBIOLOGY (THEORY)

## UNIT 1: SCOPE AND HISTORY OF MICROBIOLOGY

**(Credit-0.8, Teaching Hours-12, Marks-14)**

1.1 Microbiology as a field of Biology
1.2 Historical developments in Microbiology
1.3 The Place of Microorganisms in the living world: Groups of Microorganisms and their distribution in Nature
1.4 Spontaneous generation versus Biogenesis: germ Theory of diseases
1.5 Applied areas of Microbiology

### REFERENCE BOOKS (SEMESTER 1 UNIT 1)


1. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
2. Modi, H.A. Elementary Microbiology - Vol –I & II, Akta Prakashan, Nadiyad.
3. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.
4. Stanier, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London.
5. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.


## UNIT 2: MICROSCOPY AND STAINING

**(Credit-0.8, Teaching Hours-12, Marks-14)**

2.1 Microscopy: Introduction and Types
2.2 Principle, Construction and working of : Bright field Microscopy, Dark field Microscopy, Fluorescent Microscopy, Phase Contrast Microscopy
2.3 Introduction to Advanced Microscopic techniques: Confocal Microscopy, Electron Microscopy, Preparation of sample for Electron Microscopy
2.4 Introduction to Stains: Natural, Acidic & Basic Stains, Chromophore & Auxochrome groups, Leuco compounds
2.5 Theories and types of Staining

**REFERENCE BOOKS (SEMESTER 1 UNIT 2)**


1. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
2. Salle, S.J. (1974).Fundamental Principals of Bacteriology, Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.


## UNIT 3: MORPHOLOGY OF BACTERIA

**(Credit-0.8, Teaching Hours-12, Marks-14)**

3.1 Size, Shape and Arrangement of Bacteria
3.2 Bacterial Structures – External to Cell Wall : Capsule, Flagella, Pili, Prostheca, Sheath & Stalk
3.3 The cell wall of Bacteria – Structure and chemical composition of Gram negative and Gram positive Bacterial cell wall
3.4 Bacterial Structures – Internal to Cell Wall : Cell Membrane, Protoplast, Spheroplast, Membranous intrusions and intracellular membrane system, Cytoplasm, Cytoplasmic inclusions and Vacuoles, Nuclear Material
3.5 Bacterial Spores and Cyst – Types of spore, Structure and formation of Endospores (Sporogenesis).

**REFERENCE BOOKS (SEMESTER 1 UNIT 3)**


1. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
2. Modi, H.A. Elementary Microbiology - Vol –I & II, Akta Prakashan, Nadiyad.
3. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.
4. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.


## UNIT 4: CULTIVATION OF BACTERIA

**(Credit-0.8, Teaching Hours-12, Marks-14)**

4.1 Nutritional requirements and types of Bacteria,
4.2 Chemical and Physical requirement of Growth – Bacteriological Media & their Types, Air, pH & Temperature, Cultivation of Anaerobes
4.3 Natural Microbial Population ( Mixed Cultures), Selective methods to obtain Pure Cultures
4.4 Isolation and Preservation of pure cultures
4.5 Cultural Characteristics

**REFERENCE BOOKS (SEMESTER 1 UNIT 4)**


1 Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
2 Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.

3 Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.
4 Stanier, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London.
5 Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.

## UNIT 5: REPRODUCTION AND GROWTH OF BACTERIA

**(Credit-0.8, Teaching Hours-12, Marks-14)**

5.1 Introduction and Definition of Growth, Modes of Cell division in prokaryotes
5.2 Septum Formation
5.3 Bacterial Growth Curve
5.4 Synchronous culture & Continuous Growth of Bacteria
5.5 Measurement of Bacterial Growth

### REFERENCE BOOKS (SEMESTER 1 UNIT 5)

1. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5th Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
2. Frobisher M., Hinsdill, Crabtree and Goodherat Fundamentals of Microbiology, 9th Edition. W.B Saunders Co. USA.
3. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
4. Mani, A., Selwaraj, A.M., Narayanan L.M., and Arumngam, N., Microbiology, Saras Publication, Delhi

## MB-101- FUNDAMENTALS OF MICROBIOLOGY (PRACTICAL)

**Practical Hours – 3hrs/day for 2 days/Week  Total Credit – 3  Total 6 hours/Week**

1) Principles, working and uses of the following laboratory instruments :
   a) Microscope  b) Incubator
   c) pH meter  d) Refrigerator
   e) Colorimeter  f) Colony counter
2) Principles, working and uses of the following sterilizers:
   a) Autoclave  b)Hot air oven
   c) Steam sterilizer  d) Inspissator
   e) Bacteriological filters.
3) Preparation of glassware for sterilization and disposal of laboratory media and cultures.
4) Preparation of Stains and Staining Reagents.
5) Study of Permanent Slides of Bacteria, Fungi, Algae and Protozoa.
6) Study of bacterial motility by hanging drop method.
7) Monochrome Staining:
   a) Negative Staining
   b) Positive Staining
8) Differential Staining : Gram's Staining
9) Special staining of bacteria:
   a) Capsule staining – Hiss's method
   b) Cell wall staining – Webb's method
   c) Spore staining – Schaeffer's method
   d) Metachromatic granule staining – Albert's method
   e) Spirochete staining – Harrie's method
10) Isolation of bacteria by streak plate/pour plate and spread plate technique
11) Study of liquid/solidified culture media
12) Enumeration of bacterial number by viable count technique.
13) Total count of yeast by microscopic method using Haemocytometer
14) Measurement of size of microorganisms by Micrometry (Demonstration)
15) Growth curve of Bacteria by colorimetric method and determination of Generation time and Growth rate of *E. coli* by colorimetric method.

### REFERENCE BOOKS (SEMESTER 1 PRACTICALS)


1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma, Manual of Microbiology – Tools and Techniques , Ane books, Delhi

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - II
# (With effect from June 2021)
# MB-201 BASICS OF BIOCHEMISTRY AND MICROBIAL CONTROL (THEORY)

## UNIT 1: REVIEW OF BASIC BIOCHEMISTRY

**(Credit-0.8, Teaching Hours-12, Marks-14)**

1.1 Introduction to Atoms, Elements & Molecules
1.2 Major Chemical bonds in biological system: Ionic Bonds, Covalent Bonds, Hydrogen Bonds, Van der Waals interactions, Hydrophobic interactions
1.3 Introduction and importance of to pH
1.4 Major Chemical reactions: Acid Base, Redox, Condensation-Hydrolysis Reactions
1.5 Water and its important properties

### REFERENCE BOOKS (SEMESTER 2 UNIT 1)


1. Atlas. R.M., Microbiology, 2nd Edition. Wm. C. Brown Publishers
2. Satyanarayana. U., Biochemistry, Books and allied Pvt. Ltd.
3. Mathew, Van Holde & Ahern, Biochemistry, 3 rd Edition. Pearson Education (Singapore) Pte. Ltd. India Branch, New Delhi


## UNIT 2: INTRODUCTION TO BIOMOLECULES

**(Credit-0.8, Teaching Hours-12, Marks-14)**

2.1 Introduction and types of Biomolecules
2.2 Classification, Structures and Biological function of Carbohydrates
2.3 Classification, Structures and Biological function of Lipids
2.4 Classification, Structures and Biological function of Proteins
2.5 Classification, Structures and Biological function of Nucleic acids

### REFERENCE BOOKS (SEMESTER 2 UNIT 2)


1. Atlas. R.M., Microbiology, 2nd Edition. Wm. C. Brown Publishers
2. Satyanarayana. U., Biochemistry, Books and allied Pvt. Ltd.
3. Mathew, Van Holde & Ahern, Biochemistry, 3 rd Edition. Pearson Education (Singapore) Pte. Ltd. India Branch, New Delhi

## UNIT 3: ENZYMES

**(Credit-0.8, Teaching Hours-12, Marks-14)**

3.1 Definition and Chemical & Physical Properties of Enzymes
3.2 Classification and Nomenclature of Enzymes
3.3 Enzyme activity: Nature & Mechanism of enzyme activity, Inhibition of enzymes action
3.4 Mechanism and Regulation of Enzymes Activity and Enzymes Synthesis
3.5 Differences between Prokaryotic & Eukaryotic Enzyme Regulation

**REFERENCE BOOKS (SEMESTER 2 UNIT 3)**


1. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5th Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
2. Powar and Daginawala, General Microbiology Vol-I. Himalaya Publishing House, Mumbai.
3. Satyanarayana. U., Biochemistry, Books and allied Pvt. Ltd.


## UNIT 4: CONTROL OF MICROORGANISMS BY PHYSICAL AND CHEMICAL AGENTS

**(Credit-0.8, Teaching Hours-12, Marks-14)**

4.1 Fundamentals of Microbial Control
Principle, Types and Definition of Sterilization, Disinfectant, Antiseptic, Sanitizer, Germicide, Bactericide and Bacteriostasis.
4.2 Characteristics, Evaluation and Selection of Ideal antimicrobial agent
4.3 Physical Agents of Microbial Control –
High Temperature, Low temperature, Desiccation, Osmotic Pressure, Radiation, Ultraviolet lights, X- rays, Gamma rays, Cathode rays, surface tension and interfacial tension, filtration.
4.4 Chemical Agents of Microbial Control –
Phenol and phenolic compound, Alcohol, Halogen, Heavy metals and their compounds, Dyes, Detergents, Quaternary ammonium compounds, Aldehydes, Gaseous sterilization
4.5 Phenol Coefficient Method for the evaluation of chemical antimicrobial agents

**REFERENCE BOOKS (SEMESTER 2 UNIT 4)**


1. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5th Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
2. Powar and Daginawala, General Microbiology Vol-I. Himalaya Publishing House, Mumbai.
3. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.

## UNIT 5: ANTIBIOTICS AND THEIR MODE OF ACTION

**(Credit-0.8, Teaching Hours-12, Marks-14)**

5.1 Chemotherapeutic agents and Chemotherapy

5.2 Characteristics of ideal chemotherapeutic agent

5.3 Antibiotics and their mode of action: Inhibition of cell wall synthesis, Damage to cytoplasmic membrane, Inhibition of nucleic acid and protein synthesis, Inhibition of specific enzyme system

5.4 Antifungal, antiviral and antitumor chemotherapeutic agents

5.5 Nonmedical uses of antibiotics

**REFERENCE BOOKS (SEMESTER 2 UNIT 5)**


1. Atlas. R.M., Microbiology, 2nd Edition. Wm. C. Brown Publishers
2. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5th Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Powar and Daginawala, General Microbiology Vol-I. Himalaya Publishing House, Mumbai.
4. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi
5. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.

## MB-201 MB-201 BASICS OF BIOCHEMISTRY AND MICROBIAL CONTROL (PRACTICAL)

**Practical Hours – 3hrs/day for 2 days/Week** **Total Credit – 3** **Total 6 hours/Week**

1) Qualitative analysis of Amino acids and Proteins
2) Qualitative analysis of Carbohydrates
3) Colorimetric estimation of Protein by Folin and Lowry's method
4) Titrimetric estimation of reducing Sugars by Cole's method
5) Colorimetric estimation of reducing sugar by DNSA method
6) Effect of Chemicals on growth of bacteria by disc method
7) Effect of Alcohols on growth of bacteria by Disc method
8) Effect of Heavy metal on growth of bacteria – oligo dynamic action
9) Effect of Antibiotics on growth of bacteria: Agar ditch method and Agar cup Method.
10) Assay of Alpha – Amylase by iodometric method
11) Study of effect of Temperature on Enzyme activity
12) Study of effect of pH on Enzyme activity

### REFERENCE BOOKS (SEMESTER 2 PRACTICAL)


1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma., manual of Microbiology – Tools & Techniques, Ane Books, Delhi.

# SURENDRANAGAR UNIVERSITY

## COURSE STRUCTURE & SYLLABUS

## FOR

## UNDERGRADUATE PROGRAMME

## IN

# MICROBIOLOGY

## (CORE COURSE FOR SEMESTER III & IV)

**(As per Choice Based Credit System as recommended by UGC)**

## Effective from June – 2022

SURENDRANAGAR UNIVERSITY
विद्या परमं बलम्

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# SURENDRANAGAR UNIVERSITY
## SCHOOL OF SCIENCE
### CBCS BASED COURSE STRUCTURE FOR SEMESTER 1 TO 6 & SYLLABUS FOR SEMESTER 3 & 4 FOR UNDERGRADUATE PROGRAMME IN MICROBIOLOGY TO BE EFFECTIVE FROM JUNE 2022

| No. | Diploma/ Graduate/ Post Graduate | Semester | Title Of Paper | Paper No. | Credits | Internal Marks | External Marks | Practical & Viva Marks | Total Marks | Unique Code No. of Paper | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Year | Faculty | Subject | Course Group | Level | Semester | Paper No. | Option |
| 1 | Graduate | 01 | Fundamentals of Microbiology | MB 101 | 4 | 30 | 70 | 50 | 150 | 2019 | 03 | 05 | - | 01 | 01 | 01 | - |
| 2 | Graduate | 02 | Basics of Biochemistry & Microbial Control | MB 201 | 4 | 30 | 70 | 50 | 150 | 2019 | 03 | 05 | - | 01 | 02 | 02 | - |
| 3 | Graduate | 03 | Microbial Diversity | MB 301 | 4 | 30 | 70 | 50 | 150 | 2020 | 03 | 05 | - | 01 | 03 | 03 | - |
| 4 | Graduate | 04 | Applied & Environmental Microbiology | MB 401 | 4 | 30 | 70 | 50 | 150 | 2020 | 03 | 05 | - | 01 | 04 | 04 | - |
| 5 | Graduate | 05 | Immunology | MB 501 | 4 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 05 | 05 | - |
| 6 | Graduate | 05 | Bacterial Metabolism | MB 502 | 4 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 05 | 06 | - |
| 7 | Graduate | 05 | Molecular Biology and Genetic Engineering | MB 503 | 4 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 05 | 07 | |
| 8 | Graduate | 06 | Fermentation Technology | MB 601 | 4 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 06 | 08 | - |
| 9 | Graduate | 06 | Bio - Analytical Techniques | MB 602 | 4 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 06 | 09 | - |
| 10 | Graduate | 06 | Clinical and Diagnostic Microbiology | MB 603 | 4 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 06 | 10 | - |

# COURSE STRUCTURE FOR UG PROGRAM AND CREDIT SYSTEM

## SKELETON OF COMPLETE COURSE CONTENT OF UNDER GRADUATE MICROBIOLOGY (SEMESTER I TO VI)

| SEMESTER | PAPER NO. & CODE | TITLE OF THE PAPER | CREDIT |
|---|---|---|---|
| I | MB-101 (Theory) | **Fundamentals of Microbiology** | 4 |
| | MB-101 (Practical) | **-do-** | 3 |
| II | MB-201 (Theory) | **Basics of Biochemistry and Microbial Control** | 4 |
| | MB-201 (Practical) | **-do-** | 3 |
| III | MB-301 (Theory) | **Microbial Diversity** | 4 |
| | MB-301 (Practical) | **-do-** | 3 |
| IV | MB-401 (Theory) | **Applied and Environmental Microbiology** | 4 |
| | MB-401 (Practical) | **-do-** | 3 |
| V | MB-501 (Theory) | **Immunology** | 4 |
| | MB-501 (Practical) | **-do-** | 3 |
| | MB-502 (Theory) | **Bacterial Metabolism** | 4 |
| | MB-502 (Practical) | **-do-** | 3 |
| | MB-503 (Theory) | **Molecular Biology and Genetic Engineering** | 4 |
| | MB-503 (Practical) | **-do-** | 3 |
| VI | MB-601 (Theory) | **Fermentation Technology** | 4 |
| | MB-601 (Practical) | **-do-** | 3 |
| | MB-602 (Theory) | **Bio-Analytical Techniques** | 4 |
| | MB-602 (Practical) | **-do-** | 3 |
| | MB-603 (Theory) | **Clinical and Diagnostic Microbiology** | 4 |

# SYLLABUS FORMAT OF SEMESTER 3 AND 4

| Stream | Paper | Unit | Title of Unit | Credit | Lectures | Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | External | | Internal |
| B.Sc. Sem-3 (UG) Paper-301 | MB- 301 - MICROBIAL DIVERSITY THEORY CREDIT (06) | 1 | INTRODUCTION TO MICROBIAL DIVERSITY | 0.8 | 12 | 70 | 14 | 30 |
| | | 2 | PROKARYOTIC DIVERSITY | 0.8 | 12 | | 14 | |
| | | 3 | DIVERSITY OF SOME UNUSVAL PROKARYOTES | 0.8 | 12 | | 14 | |
| | | 4 | EUKARYOTIC DIVERSITY | 0.8 | 12 | | 14 | |
| | | 5 | AKARYOTIC DIVERSITY (VIRUS) | 0.8 | 12 | | 14 | |
| | **Total** | | | **4** | **60** | **100** | | |
| | MB 301 PRACTICAL CREDIT (03) | | ISOLATION, CHARACTERIZATION AND MICROSCOPIC OBSERVATIONS | 03 | 30 | 35 | | 15 |
| | **Total** | | | **03** | **30** | **50** | | |
| B.Sc. Sem-4 (UG) Paper-401 | MB- 401 APPLIED AND ENVIRONMENTAL MICROBIOLOGY THEORY CREDIT (06) | 1 | SOIL MICROBIOLOGY | 0.8 | 12 | 70 | 14 | 30 |
| | | 2 | FOOD MICROBIOLOGY | 0.8 | 12 | | 14 | |
| | | 3 | MILK MICROBIOLOGY | 0.8 | 12 | | 14 | |
| | | 4 | MICROBIOLOGY OF DRINKING WATER AND WASTE WATER | 0.8 | 12 | | 14 | |
| | | 5 | ENVIRONMENTAL MICROBIOLOGY | 0.8 | 12 | | 14 | |
| | **Total** | | | **4** | **60** | **100** | | |
| | MB 401 PRACTICAL CREDIT (03) | | QUALITATIVE AND QUANTITATIVE ANALYSIS OF SOIL, FOOD, MILK, WATER AND AIR | 03 | 30 | 35 | | 15 |
| | **Total** | | | **03** | **30** | **50** | | |

## GENERAL INSTRUCTIONS

**1)** The Medium of Instruction will be English for Theory and practical course

**2)** There will be 6 Lectures / Week / Theory Paper / Semester.

**3)** Each Lecture (Period) will be of 55 Mins. (1 Period = 55 Mins).

**4)** There will be 2 Practical / Week / Paper / Batch. Each Practical will be of 3 Periods (1 Period 55 Mins.).

**5)** Each Semester Theory Paper will be of FIVE Units. There will be 60 Hrs. of Theory teaching / Paper / Semester.

**6)** Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks. So, Total Marks of Theory and Practical for each Paper will be 150. (100+50 = 150)

## Instructions to the Candidates for Practical Examination:

**1)** The practical examination will be conducted for TWO (2) days.

**2)** The Time duration of practical examination will be of FOUR (4) hrs on both the days.

**3)** All the students have to remain present at the examination centre 15 minutes before the scheduled time for examination.

**4)** Students have to carry with them Certified journal, I-card or examination receipt, Slide box, Apron and all other necessary requirements for examination.

**5)** Candidate should not leave the laboratory without the permission of examiner.

**6)** Use of calculator is allowed but the use of Mobile phones is strictly prohibited.

**7)** The candidate has to leave the laboratory only after the submission of all the answer sheets of the exercises performed.

# SKELETON OF THEORY EXAMINATION (EXTERNAL)

| QUESTION 1 – UNIT 1 | | |
|---|---|---|
| Q 1 A | Objective type questions | 4 Marks |
| Q 1 B | Answer in brief (Any 1 out of 2) | 2 Marks |
| Q 1 C | Answer in detail (Any 1 out of 2) | 3 Marks |
| Q 1 D | Write a note on (Any 1 out of 2) | 5 Marks |
| **QUESTION 2 – UNIT 2** | | |
| Q 2 A | Answer in brief (Any 1 out of 2) | 4 Marks |
| Q 2 B | Answer in brief (Any 1 out of 2) | 2 Marks |
| Q 2 C | Answer in detail (Any 1 out of 2) | 3 Marks |
| Q 2 D | Write a note on (Any 1 out of 2) | 5 Marks |
| **QUESTION 3– UNIT 3** | | |
| Q 3 A | Objective type questions | 4 Marks |
| Q 3 B | Answer in brief (Any 1 out of 2) | 2 Marks |
| Q 3 C | Answer in detail (Any 1 out of 2) | 3 Marks |
| Q 3 D | Write a note on (Any 1 out of 2) | 5 Marks |
| **QUESTION 4 – UNIT 4** | | |
| Q 4 A | Objective type questions | 4 Marks |
| Q 4 B | Answer in brief(Any 1 out of 2) | 2 Marks |
| Q 4 C | Answer in detail (Any 1 out of 2) | 3 Marks |
| Q 4 D | Write a note on (Any 1 out of 2) | 5 Marks |
| **QUESTION 5 – UNIT 5** | | |
| Q 5 A | Objective type questions | 4 Marks |
| Q 5 B | Answer in brief (Any 1 out of 2) | 2 Marks |
| Q 5 C | Answer in detail (Any 1 out of 2) | 3 Marks |
| Q 5 D | Write a note on (Any 1 out of 2) | 5 Marks |
| **TOTAL MARKS : 70 TOTAL TIME : 2½ HOURS** | | |

# SKELETON OF PRACTICAL EXAMINATION (EXTERNAL)

## SEMESTER – III and IV: MB 301 and MB 401

### SECTION- I: EXAMINER –I (EXTERNAL)

| Ex. No. | Detail of Exercise | Marks | Day to begin the exercise |
|---|---|---|---|
| 1 | Perform any one from the given list of exercises as per the instruction of the examiner exercise | 10 | 1st Day |
| 5 | Viva-voce | 04 | 1st / 2nd Day |
| 6 | Certified Journal | 03 | 1st / 2nd Day |
| | Total Marks | | 17 |

### SECTION- II: EXAMINER –II (INTERNAL)

| Ex. No. | Detail of Exercise | Marks | Day to begin the exercise |
|---|---|---|---|
| 2 | Perform any one from the given list of exercises as per the instruction of the examiner exercise | 10 | 1st / 2nd Day |
| 3 | Spotting | 04 | 1st / 2nd Day |
| 4 | Viva-voce | 04 | 1st / 2nd Day |
| | Total Marks | | 18 |

## INTERNAL EVALUATION FOR MB: 301 AND MB: 401 (THEORY)

| No. | Pattern of Internal Evaluation | Marks |
|---|---|---|
| 1 | Assignment | 10 |
| | MCQ Test | 10 |
| | Seminar/Presentation | 10 |
| OR | | |
| 2 | MCQ Test | 30 |
| OR | | |
| 3 | Assignment | 10 |
| | MCQ Test | 20 |
| OR | | |
| 4 | Seminar/Presentation | 10 |
| | MCQ Test | 20 |

## INTERNAL EVALUATION FOR MB 301 AND MB 401 (PRACTICAL)

| No. | Pattern of Internal Evaluation | Marks |
|---|---|---|
| 1 | Reagent Preparation/Calculation | 05 |
| 2 | Practical Performance/Test | 05 |

## LIST OF INSTRUMENTS FOR MICROBIOLOGY SEMESTER 3 AND 4

| No. | Name of Instrument |
|---|---|
| 1 | Compound Microscopes |
| 2 | Autoclave |
| 3 | Incubator |
| 4 | Hot air oven |
| 5 | Vortex mixer |
| 6 | Water bath |
| 7 | Heating mantle |
| 8 | Magnetic stirrer |
| 9 | UV chamber |
| 10 | Inoculation chamber |
| 11 | pH meter |
| 12 | Colony counter |
| 13 | Refrigerator |
| 14 | Bunsen burner |
| 15 | Micrometer (stage and ocular) |
| 16 | Colorimeter |
| 17 | Membrane filter set |
| 18 | Centrifuge |
| 19 | Electronic shaker Incubator |
| 20 | Electronic Analytical Balance |
| 21 | Double-pan Analytical Balance |
| 22 | Spectrophotometer |
| 23 | Computers |
| 24 | Water distillation system |
| 25 | Haemocytometers |
| 26 | Inspissator |

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - III
# (With effect from June 2022)
# MB-301- MICROBIAL DIVERSITY
# (THEORY)

## UNIT 1: INTRODUCTION TO MICROBIAL DIVERSITY

**(Credit-0.8, Teaching Hours-12, Marks-14)**

1.1 Biodiversity- Microbial evolution and types of diversity
1.2 Introduction and overview of microbial taxonomy, taxonomic ranks of microorganisms and classification systems (Phenetic, phylogenetic and polyphasic classification)
1.3 Major characteristics used in taxonomy: classical and molecular characteristics
1.4 Major divisions of life and groups of microorganisms: study of different classifications and place of microbes
1.5 Introduction and overview of Metagenomics and its applications

**REFERENCE BOOKS (SEMESTER 3 UNIT 1)**


1. Frazier, W.C., Westhoff, D.C. (1978). Food Microbiology. Tata McGraw-Hill Publishing Company.
2. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Salle, S.J. (1974).Fundamental Principals of Bacteriology, Tata McGraw Hill Publication Co. Ltd. New Delhi.
4. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.


## UNIT 2: PROKARYOTIC DIVERSITY

**(Credit- 0.8, Teaching Hours-12, Marks-14)**

2.1 Introduction and overview of Bergey's Manual and Habitat and distinguishing features of Gram negative & positive bacteria
2.2 Aerobic/ Microaerophilic Gram negative bacteria:
- 2.2.1 Motile, helical & vibrioid
- 2.2.2 Non-motile curved bacteria
- 2.2.3 Rods and cocci

2.3 Facultative anaerobic Gram negative bacteria:
- 2.3.1 Rods, curved and helical bacteria
- 2.3.2 Dissimilatory Sulfate reducers

2.4 Anaerobic Gram negative bacteria:
- 2.4.1 Anaerobic cocci
- 2.4.2 Phototrophic bacteria (Anoxygenic and oxygenic phototrophs)

2. 5 Gram positive bacteria – General features of:
- 2.5.1 Endospore forming rods and cocci
- 2.5.2 Asporogenous rods and cocci
- 2.5.3 Mycobacteria and Actinomycetes

**REFERENCE BOOKS (SEMESTER 3 UNIT 2)**


1. Presscott, M.J., Harley, J.P., Klein, D.A. (2002). Microbiology, 5th Edition. New York: WCB Mc GrawHill publication.
2. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Salle, S.J. (1974).Fundamental Principals of Bacteriology, Tata McGraw Hill Publication Co. Ltd. New Delhi.
4. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
5. Stainer, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London.


## UNIT 3: DIVERSITY OF SOME UNUSVAL PROKATYOTES

**(Credit-0.8, Teaching Hours-12, Marks-14)**

3.1 Bacteria with unusual morphology
- 3.1.1 Budding and appendaged bacteria
- 3.1.2 Sheathed Bacteria
- 3.1.3 Mycoplasma

3.2 Bacteria with gliding motility

3.3 Rickettsia and Chlamydia

3.4 Archaeabacteria
- 3.4.1 Introduction and general features of archaea
- 3.4.2 Types of Extremophilic Microorganisms: over view of Thermophiles, Halophiles, Acidophiles, Alkalophiles, Barophiles and Methanogens

3.5 Importance of prokaryotic microorganisms

**REFERENCE BOOKS (SEMESTER 3 UNIT 3)**


1. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
2. Modi, H.A. Elementary Microbiology - Vol –I & II, Akta Prakashan, Nadiyad.
3. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.
4. Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.
5. Stainer, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. **General Microbiology, 5th Edition**. MacMillan Press Ltd., London.
6. Salle, S.J. Fundamental Principals of Bacteriology, Tata McGraw Hill Publication Co. Ltd. New Delhi

## UNIT 4: EUKARYOTIC DIVERSITY

**(Credit-0.8, Teaching Hours-12, Marks-14)**

A: FUNGI

4.1 General characteristics, occurrence, Structure, Reproduction (Mucor and Aspergillus)

4.2 Economic importance of fungi

B: ALGAE

4.3 General Characteristics, Occurrence & Ultra- Structure

4.4 Economic importance of Algae

C: PROTOZOA

4.5 General Characteristics, Occurrence, Ultra- Structure & Economic importance of Protozoa

### REFERENCE BOOKS (SEMESTER 3 UNIT 4)


1 Dubey, R.C.and Maheshwari, D.K., **A Text Book of Microbiology**, S. Chand Publications, New Delhi.

2 Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.

3 Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi.

4 Powar and Daginawala, General Microbiology Vol-II. Himalaya Publishing House, Mumbai.

5 Stanier, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London.

6 Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.


## UNIT 5: AKARYOTIC DIVERSITY

**(Credit-0.8, Teaching Hours-12, Marks-14)**

5.1 Introduction, General Characteristics and Classification (overview of different classifications)

5.2 Cultivation of Viruses

5.3 Bacterial Viruses: general structure (T4 phage), Lytic life cycle (T4 phage), lysogenic life cycle with genetics (Lambda phage)

5.4 Introduction to Animal Viruses: Structure (HIV), Cytocidal effects, Viruses and Cancer, Prions

5.5 Introduction to Plant Viruses: Structure of TMV, Economic importance, Viroids

### REFERENCE BOOKS (SEMESTER 3 UNIT 5)


1. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5th Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
2. Frobisher M., Hinsdill, Crabtree and Goodherat Fundamentals of Microbiology, 9th Edition. W.B Saunders Co. USA.
3. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.

4. Mani, A., Selwaraj, A.M., Narayanan L.M., and Arumngam, N., Microbiology, Saras Publication, Delhi
5. Prescott, Healey and Klein., Microbiology-5th International Edition, Tata-McGraw Hill publications, Delhi
6. Atlas. R.M., Principles of Microbiology- 2nd Edition

## MB-301- MICROBIAL DIVERSITY (PRACTICAL)

**Practical Hours – 3hrs/day for 2 days/Week** **Total Credit – 3** **Total 6 hours/Week**

1) Isolation of Gram negative 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 of Gram positive bacteria from the given sample.
4) Identification of Gram positive bacteria from the given pure culture using biochemical media (*Bacillus megaterium, Bacillus subtilis, staphylococcus aureus, Streptococcus*)
5) Identification of Fungi on the basis of Morphological Characteristics.
6) Cultivation of yeast from different natural samples and its morphological characterization using microscopic observation.
7) Microscopic observation of different algae from the given samples.
8) Microscopic observation of different protozoa from the given sample.
9) Isolation and cultivation of bacteriophage of *E.coli* from the given sewage sample.
10) Cultivation of Extremophile (Halophile/thermophile/acidophile/alkalophile/psychophile)

### REFERENCE BOOKS (SEMESTER 3 PRACTICALS)


1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma, Manual of Microbiology – Tools and Techniques , Ane books, Delhi

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - IV
# (With effect from June 2022)
# MB-401- APPLIED AND ENVIRONMENTAL MICROBIOLOGY (THEORY)

## UNIT 1: SOIL MICROBIOLOGY

**(Credit-0.8, Teaching Hours-12, Marks-14)**

1.1 Physical & Chemical Characteristics of Soil (formation and horizon of soil)
1.2 Rhizosphere & Microbial flora of Soil and their Interactions among soil microorganisms: (Neutral, Beneficial & Harmful interactions)
1.3 Biogeochemical cycle - Nitrogen cycle and biochemistry of nitrogen fixation
1.4 Biogeochemical cycle – Sulphur cycle and winogradsky's column
1.5 Biogeochemical cycle – Carbon cycle & humus

### REFERENCE BOOKS (SEMESTER 4 UNIT 1)


1. Presscott, M.J., Harley, J.P., Klein, D.A. (2002). Microbiology, 5th Edition. New York: WCB Mc GrawHill publication.
2. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Salle, S.J. (1974).Fundamental Principals of Bacteriology, Tata McGraw Hill Publication Co. Ltd. New Delhi.
4. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
5. Stainer, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London.


## UNIT 2: FOOD MICROBIOLOGY

**(Credit-0.8, Teaching Hours-12, Marks-14)**

2.1 Microbial flora of fresh food & Microbial spoilage of Fresh foods & Canned Foods
2.2 Food Borne infection & intoxication: Role of *S.aureus*, *C.botulinum* & *Salmonella* Spp.in food poisoning
2.3 Preservation of foods: General principles & methods of food preservation
2.4 Microbiological examination of food; Introduction to AGMark
2.5 Brief introduction about fermented foods: Pickles, Sauerkraut, Silage, Sausages & Bread and Microorganisms as food: Single Cell Protein, Mushrooms and Functional foods

**REFERENCE BOOKS (SEMESTER 4 UNIT 2)**


1. Frazier, W.C., Westhoff, D.C. (1978). Food Microbiology. Tata McGraw-Hill Publishing Company.
2. Presscott, M.J., Harley, J.P., Klein, D.A. (2002). Microbiology, 5th Edition. New York: WCB Mc GrawHill publication.
3. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
4. Salle, S.J. (1974).Fundamental Principals of Bacteriology, Tata McGraw Hill Publication Co. Ltd. New Delhi.
5. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
6. Stainer, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London.


## UNIT 3: MILK MICROBIOLOGY

**(Credit-0.8, Teaching Hours-12, Marks-14)**

3.1 Types of microbes in milk

3.2 Fermented milk Beverages & Manufactured Dairy Products: Starter Culture, Cheese, Yogurt, Buttermilk, Acidophilus milk, Kefir

3.3 Spoilage of milk & milk products

3.4 Microbial analysis of milk: SPC, Direct count, MBRT, Resazurin test and Grading of milk

3.5 Preservation of milk: Principles & methods of preservation

**REFERENCE BOOKS (SEMESTER 2 UNIT 3)**


1. Prajapati, J.B. (1995). Fundamentals of Dairy Microbiology: Ekta Publication, India
2. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5th Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Powar and Daginawala, General Microbiology Vol-I. Himalaya Publishing House, Mumbai.
4. Presscott, M.J., Harley, J.P., Klein, D.A. (2002). Microbiology, 5th Edition. New York: WCB Mc GrawHill publication.


## UNIT 4: MICROBIOLOGY OF DRINKING WATER AND WASTE WATER

**(Credit-0.8, Teaching Hours-12, Marks-14)**

4.1 Microbiology of drinking water: Sanitary survey, Bacteriological evidence of pollution, Bacteriological analysis & Sampling techniques of water & Microorganisms other than Coliforms as nuisance organisms

4.2 4.2 Water purification: Sedimentation, Filtration use of Sand filters, Disinfection C Waste water

4.3 Chemical and Microbial Characteristics of waste water, B.O.D., C.O.D. as indicator of quality of waste water

4.4 Waste water treatment & Disposal - Single Dwelling Process & Treatment - Primary Treatment, Secondary Treatment, Advanced & final treatment

4.5 Solid waste processing: Anaerobic Sludge digestion & Composting

**REFERENCE BOOKS (SEMESTER 4 UNIT 4)**


1. Frazier, W.C., Westhoff, D.C. (1978). Food Microbiology. Tata McGraw-Hill Publishing Company.
2. Presscott, M.J., Harley, J.P., Klein, D.A. (2002). Microbiology, 5th Edition. New York: WCB Mc GrawHill publication.
3. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5 Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
4. Salle, S.J. (1974).Fundamental Principals of Bacteriology, Tata McGraw Hill Publication Co. Ltd. New Delhi.
5. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.
6. Stainer, R.Y., Iingraham, J.L., Wheelis, M.L., Painter, R.K. General Microbiology, 5th Edition. MacMillan Press Ltd., London.


## UNIT 5: ENVIRONMENTAL MICROBIOLOGY

**(Credit-0.8, Teaching Hours-12, Marks-14)**

5.1 Pollution – types, pollutants, sources, effects on ecology

5.2 Biomagnification of pesticides

5.3 Biodeterioration of paper, metal and paint.

5.4 Bioleaching and bioenhanced oil recovery

5.5 Microbial technology for sustainable environment: Biofuel, Bioplastic, Biofertilizer

**REFERENCE BOOKS (SEMESTER 4 UNIT 5)**


1. Atlas. R.M., Microbiology, 2nd Edition. Wm. C. Brown Publishers
2. Pelczar, M.J., Chan E.C.S., Krieg, N.R., Microbiology, 5th Edition. Tata McGraw Hill Publication Co. Ltd. New Delhi.
3. Powar and Daginawala, General Microbiology Vol-I. Himalaya Publishing House, Mumbai.
4. Tortora, Funke & Case. Microbiology-An Introduction, 8 Edition, Pearson Education, Delhi
5. Purohit, S.S., Microbiology-Fundamentals and Applications-6th Edition, Agrobios Publications, Delhi.

## MB-401 APPLIED AND ENVIRONMENTAL MICROBILOGY (PRACTICAL)

**Practical Hours – 3hrs/day for 2 days/Week  Total Credit – 3  Total 6 hours/Week**

1) Isolation of nitrogen fixing bacteria
2) Cultivation of nitrifying and denitrifying bacteria (Demo)
3) Cultivation of cellulose decomposing microorganisms from soil (Demo)
4) Demonstration of oozing , and isolation of pathogen from diseased specimen of lemon leaf showing citrus canker and isolation of Xanthomonas spp.
5) Standard qualitative analysis of milk
6) Methylene Blue Reduction Time test for milk
7) Isolation and identification of coli forms from Water by Presumptive, Confirmed & Completed test
8) Chemical analysis of water: Chloride, Hardness, Nitrite Nitrogen, Alkalinity, Acidity, TDS, TSS, TS
9) Chemical analysis of water: BOD (demo), DO (to perform)
10) Determination of air flora and air density from indoor & outdoor sources

### REFERENCE BOOKS (SEMESTER 4 PRACTICAL)


1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India.
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India.
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand & Company Ltd., New Delhi
4. Konika Sharma., manual of Microbiology – Tools & Techniques, Ane Books, Delhi.

# SURENRANAGAR UNIVERSITY

विद्या परमं बलम्

## COURSE STRUCTURE & SYLLABUS

## FOR

## UNDERGRADUATE PROGRAMME

## IN

# MICROBIOLOGY

## (CORE COURSE FOR SEMESTER V&VI)

**(As per Choice Based Credit System as recommended by UGC)**

## Effective from June – 2022

# TABLE OF CONTENTS

## SURENDRANAGAR UNIVERSITY - SCHOOL OF SCIENCE

### CBCS BASED COURSE STRUCTURE FOR SEMESTER 1 TO 6 & SYLLABUS FOR SEMESTER 5&6 FOR UNDERGRADUATE PROGRAMME IN MICROBIOLOGY TO BE EFFECTIVE FROM JUNE 2022

| No. | Diploma/ Graduate/ Post Graduate | Semester | Title Of Paper | Paper No. | Credits | Internal Marks | External Marks | Practical & Viva Marks | Total Marks | Unique Code No. of Paper | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Year | Faculty | Subject | Course Group | Level | Semester | Paper No. | Option |
| 1 | Graduate | 01 | Fundamentals of Microbiology | MB 101 | 6 | 30 | 70 | 50 | 150 | 2019 | 03 | 05 | - | 01 | 01 | 01 | - |
| 2 | Graduate | 02 | Basics of Biochemistry & Microbial Control | MB 201 | 6 | 30 | 70 | 50 | 150 | 2019 | 03 | 05 | - | 01 | 02 | 02 | - |
| 3 | Graduate | 03 | Microbial Diversity | MB 301 | 6 | 30 | 70 | 50 | 150 | 2020 | 03 | 05 | - | 01 | 03 | 03 | - |
| 4 | Graduate | 04 | Applied & Environmental Microbiology | MB 401 | 6 | 30 | 70 | 50 | 150 | 2020 | 03 | 05 | - | 01 | 04 | 04 | - |
| 5 | Graduate | 05 | Immunology | MB 501 | 6 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 05 | 05 | - |
| 6 | Graduate | 05 | Bacterial Metabolism | MB 502 | 6 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 05 | 06 | - |
| 7 | Graduate | 05 | Molecular Biology and Genetic Engineering | MB 503 | 6 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 05 | 07 | |
| 8 | Graduate | 06 | Fermentation Technology | MB 601 | 6 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 06 | 08 | - |
| 9 | Graduate | 06 | Bio - Analytical Techniques | MB 602 | 6 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 06 | 09 | - |
| 10 | Graduate | 06 | Clinical and Diagnostic Microbiology | MB 603 | 6 | 30 | 70 | 50 | 150 | 2021 | 03 | 05 | - | 01 | 06 | 10 | - |
| 11 | Graduate | 06 | Research /Review/Survey Project | ----- | 4 | ------- | -------- | 100 | 100 | 2021 | 03 | 05 | - | 01 | 06 | 11 | |

COURSE STRUCTURE FOR UG PROGRAM AND CREDIT SYSTEM

**SKELETON OF COMPLETE COURSE CONTENT OF UNDER GRADUATE MICROBIOLOGY (SEMESTER I TO VI)**

| SEMESTER | PAPER NO. & CODE | TITLE OF THE PAPER | CREDIT |
|---|---|---|---|
| I | MB-101 (Theory) | **Fundamentals of Microbiology** | 6 |
| | MB-101 (Practical) | **-do-** | 3 |
| II | MB-201 (Theory) | **Basics of Biochemistry and Microbial Control** | 6 |
| | MB-201 (Practical) | **-do-** | 3 |
| III | MB-301 (Theory) | **Microbial Diversity** | 6 |
| | MB-301 (Practical) | **-do-** | 3 |
| IV | MB-401 (Theory) | **Applied and Environmental Microbiology** | 6 |
| | MB-401 (Practical) | **-do-** | 3 |
| V | MB-501 (Theory) | **Immunology** | 6 |
| | MB-501 (Practical) | **-do-** | 3 |
| | MB-502 (Theory) | **Bacterial Metabolism** | 6 |
| | MB-502 (Practical) | **-do-** | 3 |
| | MB-503 (Theory) | **Molecular Biology and Genetic Engineering** | 6 |
| | MB-503 (Practical) | **-do-** | 3 |
| VI | MB-601 (Theory) | **Fermentation Technology** | 6 |
| | MB-601 (Practical) | **-do-** | 3 |
| | MB-602 (Theory) | **Bio-Analytical Techniques** | 6 |
| | MB-602 (Practical) | **-do-** | 3 |
| | MB-603 (Theory) | **Clinical and Diagnostic Microbiology** | 6 |
| | MB-603 (Practical) | **-do-** | 3 |

# SYLLABUS FORMAT OF SEMESTER 5 AND 6

| Stream | Paper | Unit | Title of Unit | Credit | Lectures | Marks | |
|---|---|---|---|---|---|---|---|
| | | | | | | External | Internal |
| B.Sc. Sem-5 (UG) Paper-501 | MB- 501 IMMUNOLOGY THEORY CREDIT (06) | 1 | IMMUNITY AND IMMUNE SYSTEM | 1.2 | 12 | 70 | 14 30 |
| | | 2 | ANTIGEN AND ANTIBODY | 1.2 | 12 | | 14 |
| | | 3 | IMMUNE RESPONSE | 1.2 | 12 | | 14 |
| | | 4 | DYSFUNCTIONAL IMMUNITY | 1.2 | 12 | | 14 |
| | | 5 | NORMAL FLORA AND INFECTION | 1.2 | 12 | | 14 |
| | **Total** | | | **06** | **60** | **100** | |
| | MB 501 IMMUNOLOGY PRACTICAL CREDIT (03) | | HAEMATOLOGY AND SEROLOGY | 03 | 30 | 35 | 15 |
| | **Total** | | | **03** | **30** | **50** | |
| B.Sc. Sem-5 (UG) Paper-502 | MB- 502 BACTERIAL METABOLISM THEORY CREDIT (06) | 1 | INTRODUCTION TO METABOLISM, BIOENERGATICS AND ENZYME KINETICS | 1.2 | 12 | 70 | 14 30 |
| | | 2 | HETEROTROPHIC MODE OF METABOLISM | 1.2 | 12 | | 14 |
| | | 3 | ENERGY GENERATION AND ANABOLISM | 1.2 | 12 | | 14 |
| | | 4 | SELECTED ASPECTS OF METABOLISM IN SPECIFIC MICROBIOAL SYSTEMS | 1.2 | 12 | | 14 |
| | | 5 | MEMBRANE BIOLOGY | 1.2 | 12 | | 14 |
| | **Total** | | | **06** | **60** | **100** | |
| | MB 502 BACTERIAL METABOLISM PRACTICAL CREDIT (03) | | ENZYME KINETICS | 03 | 30 | 35 | 15 |
| | **Total** | | | **03** | **30** | **50** | |

| Stream | Paper | Unit | Title of Unit | Credit | Lectures | Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | External | | Internal |
| B.Sc. Sem-5 (UG) Paper-503 | MB-503 MOLECULAR BIOLOGY AND GENETIC ENGINEERING THEORY CREDIT (06) | 1 | FUNDAMENTALS OF GENETICS | 1.2 | 12 | 70 | 14 | 30 |
| | | 2 | GENE EXPRESSION AND REGULATION | 1.2 | 12 | | 14 | |
| | | 3 | GENETRANSFER AND RECOMBINATION | 1.2 | 12 | | 14 | |
| | | 4 | MUTATION AND DNA REPAIR | 1.2 | 12 | | 14 | |
| | | 5 | GENETIC ENGINEERING AND PROTEIN ENGINEERING | 1.2 | 12 | | 14 | |
| | **Total** | | | **06** | **60** | **100** | | |
| | MB 503 MOLECULAR BIOLOGY AND GENETIC ENGINEERING PRACTICAL CREDIT (03) | | BASIC MOLECULAR BIOLOGY AND GENETIC ENGINEERING | 03 | 30 | 35 | | 15 |
| | **Total** | | | **03** | **30** | **50** | | |
| B.Sc. Sem-6 (UG) Paper-601 | MB- 601 FERMENTATION TECHNOLOGY THEORY CREDIT (06) | 1 | FERMENTATION TECHNOLOGY AND INDUSTRIALLY IMPORTANT MICROORGANISMS | 1.2 | 12 | 70 | 14 | 30 |
| | | 2 | FERMENTATION MEDIA FORMULATION | 1.2 | 12 | | 14 | |
| | | 3 | FERMENTOR DESIGN AND ASEPTIC OPERATION | 1.2 | 12 | | 14 | |
| | | 4 | OVERVIEW OF DOWN STREAM PROCESS | 1.2 | 12 | | 14 | |
| | | 5 | STUDY OF SELECTED FERMENTATION PROCESSES | 1.2 | 12 | | 14 | |
| | **Total** | | | **06** | **60** | **100** | | |
| | MB 601 FERMENTATION TECHNOLOGY PRACTICAL CREDIT (03) | | FERMENTATION PROCESS AND ANALYSIS | 03 | 30 | 35 | | 15 |
| | **Total** | | | **03** | **30** | **50** | | |

| Stream | Paper | Unit | Title of Unit | Credit | Lectures | Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | External | | Internal |
| B.Sc. Sem-6 (UG) Paper-602 | MB- 602 BIO-ANALYTICAL TECHNIQUES CREDIT (06) | 1 | BASIC BIOANALYTICAL TECHNIQUES IN BIOSCIENCES | 1.2 | 12 | 70 | 14 | 30 |
| | | 2 | PRINCIPLES AND THEORIES OF CHROMATOGRAPHY | 1.2 | 12 | | 14 | |
| | | 3 | MOLECULAR TECHNIQUES AND BIOSENSOR TECHNOLOGY | 1.2 | 12 | | 14 | |
| | | 4 | MODERN ANALYTICAL TECHNIQUES | 1.2 | 12 | | 14 | |
| | | 5 | BIOINFORMATICS | 1.2 | 12 | | 14 | |
| | Total | | | 06 | 60 | 100 | | |
| | MB-602 BIO- ANALYTICAL TECHNIQUES PRACTICAL CREDIT (03) | | ANALYSIS OF BIOMOLECULES | 03 | 30 | 35 | | 15 |
| | Total | | | 03 | 30 | 50 | | |
| B.Sc. Sem-6 (UG) Paper-603 | MB- 603 CLINICAL NAD DIAGNOSTIC MICROBIOLOGY THEORY CREDIT (06) | 1 | HAEMATOLOGY | 1.2 | 12 | 70 | 14 | 30 |
| | | 2 | SEROLOGY | 1.2 | 12 | | 14 | |
| | | 3 | CONVENTIONAL AND ADVANSED DIAGNOSTIC TECHNIQUES | 1.2 | 12 | | 14 | |
| | | 4 | EPIDEMIOLOGY AND MICROBIAL AGENTS OF DISEASES (BACTERIA AND FUNGI) | 1.2 | 12 | | 14 | |
| | | 5 | MICROBIAL AGENT OF DISEASES (VIRUS) AND PROPHYLAXIX | 1.2 | 12 | | 14 | |
| | Total | | | 06 | 60 | 100 | | |
| | MB-603 CLINICAL NAD DIAGNOSTIC MICROBIOLOGY PRACTICAL CREDIT (03) | | VARIOUS DIAGNOSTIC TECHNIQUES | 03 | 30 | 35 | | 15 |
| | | | Total | 03 | 30 | 50 | | |

## GENERAL INSTRUCTIONS

**1)** The Medium of Instruction will be English for Theory and practical course

**2)** There will be 6 Lectures / Week / Theory Paper / Semester.

**3)** Each Lecture (Period) will be of 55 Mins. (1 Period = 55 Mins).

**4)** There will be 3 Practical / Week / Paper / Batch. Each Practical will be of 3 Periods (1 Period 55 Mins.).

**5)** Each Semester Theory Paper will be of FIVE Units. There will be 60 Hrs. of Theory teaching / Paper / Semester.

**6)** Each Theory Paper / Semester will be of 100 Marks. There will be 30 marks for internal evaluation and 70 marks for external evaluation. Each Practical Paper / Semester will be of 50 Marks. So, Total Marks of Theory and Practical for each Paper will be 150. (100+50 = 150)

**7)** A Research / Review / Survey project is a compulsory part of the curriculum which carries 4 credit and 100 marks. The work will be evaluated at the end of the semester along with Practical examination in the form of Viva voce and the submission of the thesis / project report.

## Instructions to the Candidates for Practical Examination:

**1)** The practical examination will be conducted for THREE (3) days.

**2)** The Time duration of practical examination will be of SIX 96)hrs on all the three days

**3)** All the students have to remain present at the examination centre 15 minutes before the scheduled time for examination.

**4)** Students have to carry with them Certified journal, I-card or examination receipt, Slide box, Apron and all other necessary requirements for examination.

**5)** Candidate should not leave the laboratory without the permission of examiner.

**6)** Use of calculator is allowed but the use of Mobile phones is strictly prohibited.

**7)** The candidate has to leave the laboratory only after the submission of all the answer sheets of the exercises performed.

# SKELETON OF THEORY EXAMINATION (EXTERNAL)

| QUESTION 1 – UNIT 1 | | |
|---|---|---|
| Q 1 A | Objective type questions | 4 Marks |
| Q 1 B | Answer in brief(Any 1 out of 2) | 2 Marks |
| Q 1 C | Answer in detail(Any 1 out of 2) | 3 Marks |
| Q 1 D | Write a note on(Any 1 out of 2) | 5 Marks |
| **QUESTION 2 – UNIT 2** | | |
| Q 2 A | Answer in brief(Any 1 out of 2) | 4 Marks |
| Q 2 B | Answer in brief(Any 1 out of 2) | 2 Marks |
| Q 2 C | Answer in detail(Any 1 out of 2) | 3 Marks |
| Q 2 D | Write a note on(Any 1 out of 2) | 5 Marks |
| **QUESTION 3– UNIT 3** | | |
| Q 3 A | Objective type questions | 4 Marks |
| Q 3 B | Answer in brief(Any 1 out of 2) | 2 Marks |
| Q 3 C | Answer in detail(Any 1 out of 2) | 3 Marks |
| Q 3 D | Write a note on(Any 1 out of 2) | 5 Marks |
| **QUESTION 4 – UNIT 4** | | |
| Q 4 A | Objective type questions | 4 Marks |
| Q 4 B | Answer in brief(Any 1 out of 2) | 2 Marks |
| Q 4 C | Answer in detail(Any 1 out of 2) | 3 Marks |
| Q 4 D | Write a note on(Any 1 out of 2) | 5 Marks |
| **QUESTION 5 – UNIT 5** | | |
| Q 5 A | Objective type questions | 4 Marks |
| Q 5 B | Answer in brief(Any 1 out of 2) | 2 Marks |
| Q 5 C | Answer in detail(Any 1 out of 2) | 3 Marks |
| Q 5 D | Write a note on(Any 1 out of 2) | 5 Marks |
| **TOTAL MARKS : 70 TOTAL TIME : 2½ HOURS** | | |

# SKELETON OF PRACTICAL EXAMINATION (EXTERNAL)

## SEMESTER – V and VI:

### SECTION- I: EXAMINER –I (EXTERNAL)

| Ex. No. | Detail of Exercise | Marks | Day to begin the exercise |
|---|---|---|---|
| 1 | Perform any one from the given list of exercises as per the instruction of the examiner exercise | 20 | 1st Day |
| 5 | Viva-voce | 10 | 1st / 2nd Day |
| 6 | Certified Journal | 10 | 1st / 2nd Day |
| | Total Marks | 40 | |

### SECTION- II: EXAMINER –II (INTERNAL)

| Ex. No. | Detail of Exercise | Marks | Day to begin the exercise |
|---|---|---|---|
| 2 | Perform any one from the given list of exercises as per the instruction of the examiner exercise | 25 | 1st /2nd Day |
| 3 | Perform any one from the given list of exercises as per the instruction of the examiner exercise | 25 | 1st /2nd Day |
| 3 | Spotting | 10 | 1st /2nd Day |
| 4 | Viva-voce | 05 | 1st / 2nd Day |
| | Total Marks | 65 | |

## INTERNAL EVALUATION FOR SEMESTER V & VI (THEORY)

| No. | Pattern of Internal Evaluation | Marks |
|---|---|---|
| 1 | Assignment | 10 |
| | MCQ Test | 10 |
| | Seminar/Presentation | 10 |
| OR | | |
| 2 | MCQ Test | 30 |
| OR | | |
| 3 | Assignment | 10 |
| | MCQ Test | 20 |
| OR | | |
| 4 | Seminar/Presentation | 10 |
| | MCQ Test | 20 |

## INTERNAL EVALUATION FOR SEMESTER V & VI (PRACTICAL)

| No. | Pattern of Internal Evaluation | Marks |
|---|---|---|
| 1 | Reagent Preparation/Calculation | 15 |
| 2 | Practical Performance/Test | 15 |
| 3 | Viva | 15 |

## LIST OF INSTRUMENTS FOR MICROBIOLOGY SEMESTER 5 AND 6

| No. | Name of Instrument |
|---|---|
| 1 | Compound Microscopes |
| 2 | Autoclave |
| 3 | Incubator |
| 4 | Hot air oven |
| 5 | Vortex mixer |
| 6 | Water bath |
| 7 | Heating mantle |
| 8 | Magnetic stirrer |
| 9 | UV chamber |
| 10 | Inoculation chamber |
| 11 | pH meter |
| 12 | Colony counter |
| 13 | Refrigerator |
| 14 | Bunsen burner |
| 15 | Micrometer (stage and ocular) |
| 16 | Colorimeter |
| 17 | Membrane filter set |
| 18 | Centrifuge |
| 19 | Electronic shaker Incubator |
| 20 | Electronic Analytical Balance |
| 21 | Double-pan Analytical Balance |
| 22 | Spectrophotometer |
| 23 | Computers |
| 24 | Water distillation system |
| 25 | Haemocytometers |
| 26 | Inspissator |

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - V
# (With effect from June 2022)
# MB-501:IMMUNOLOGY
# (THEORY)

**Unit 1: IMMUNITY AND IMMUNE SYSTEM**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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1.1 Types of immunity: Natural, Acquired, herd, Innate, specific.
1.2 Structure, functions and properties of Immune Cells: – Stem cell, T cell, B cell, NKcell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cells.
1.3 Structure, functions and properties of Immune Organs: – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT.
1.4 Properties of immune system: Discrimination, Specificity, Memory, Transferability & Diversity.
1.5 Introduction to Immune response.

**REFERENCE BOOKS**


1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition.Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition.Hoboken: Taylor and Francis.
5. S. C.Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited


**Unit 2: ANTIGEN AND ANTIBODY**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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**A. Antigen**

2.1 Definition & types of microbial antigens.
2.2 Factors influencing Immunogenicity& Adjuvant, Epitopes and Haptens.

**B. Antibody**

2.3 Basic structure of Antibody& Immunoglobulin classes and their Biological functions.
2.4 Antibody Diversity and Clonal Selection Theory.
2.5 Overview of Monoclonal Antibody and polyclonal antibody.

**REFERENCE BOOKS**


1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.

2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

**Unit 3: IMMUNE RESPONSE**

**(Credit-1.2, Teaching Hours-12, Marks-14)**

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3.1 Structure and properties of class I and II MHC.

3.2 Antigen processing and presentation. (Endogenous and Exogenous pathways)

3.3 Generation of Humoral Immune Response (Plasma and Memory cells).

3.4 Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co-stimulatory signals)

3.5 Cytokines, Phagocytosis, Inflammation, Opsonisationand Complement system: overview.

**REFERENCE BOOKS**

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

**Unit 4: DYSFUNCTIONAL IMMUNITY**

**(Credit-1.2, Teaching Hours-12, Marks-14)**

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4.1 Immunodeficiency Diseases

4.2 Hypersensitivity

4.3 Autoimmune diseases

4.4Overview of Tumor immunity

4.5 Overview of Transplantation immunity

**REFERENCE BOOKS**

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's

microbiology.7th -12thedition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2ndedition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

**Unit 5: NORMAL FLORA AND INFECTION**

**(Credit-1.2, Teaching Hours-12, Marks-14)**

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5.1 Normal flora of healthy human host: Introduction & types.

5.2 Host –microbe interactions: Process of Infection, Pathogenicity and Virulence.

5.3 Microbial adherence: Penetration of epithelial cell layers and events in infection following penetration.

5.4 Microbial virulence factors.

5.5 Vaccines: Conventional and Modern approaches.

**REFERENCE BOOKS**

1. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
2. Atlas, R. M. (1997). Principles of microbiology. 2ndedition. Dubuque, IA: Wm. C. Brown Publishers.
3. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12thedition. New York: McGraw-Hill Higher Education.
4. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2ndedition. Hoboken: Taylor and Francis.
5. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

# SURENRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - V
# (With effect from June 2022)
## MB-501:IMMUNOLOGY
## (PRACTICAL)

1. Microscopic observation and Identification of blood cells
2. Total count of RBC
3. Total count of WBC
4. Differential count of WBC
5. Isolation of normal flora of skin
6. Isolation of normal flora of mouth
7. Understanding of the medical problems (**Case Study)**

**REFERENCE BOOKS**


1. Talwar, G. P., & Gupta, S. K. (1992). A Handbook of Practical and Clinical Immunology. New Delhi: CBS Publishers & Distributors.
2. Medical Laboratory Technology – Vol – I, II, III – MukherjiK.L.2nd edition.Tata McGraw-Hill Education.
3. Godkar, P. B., &Godkar, P. D. (2005). Text Book of Medical Laboratory Technology: Basic Histopathologic Techniques and the Laboratory Requirements.Bhalani Publishing House.
4. Cappuccino, J. G., & Welsh, C. Microbiology: A laboratory manual.5th -12th edition.Benjamin Cummings Black & White & Pearson.
5. Experimental Microbiology (volume 1 &2) by Rakesh Patel. 3rd Edition. AdityaPublishers.
6. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand& Company Ltd., New Delhi

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - V
# (With effect from June 2022)
# MB-502:BACTERIAL METABOLISM
# (THEORY)

**UNIT 1: INTRODUCTION TO METABOLISM, BIOENERGETICS AND ENZYME KINETICS**
**(Credit- 1.2, Teaching Hours-12, Marks-14)**

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1.1 General Overview of metabolism: Primary & Secondary metabolites & their significance
1.2 Bioenergetics : The concept of free energy, Determination of ΔG & Energy rich compounds
1.3 Energy metabolism: Role of ATP in metabolism, Role of reducing power in metabolism, Role of precursor metabolites in metabolism
1.4 Non Regulatory Enzymes : Derivation of the Michaelis - Menten Equation
1.5 Regulatory Enzymes : Allosteric Enzymes - Conformational changes in Regulatory Enzymes

**REFERENCE BOOKS**


1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition.OUP USA.
2. Outlines of biochemistry byConn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition.McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.


**UNIT 2:HETEROTROPHIC MODE OF METABOLISM**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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2.1 Glycolysis and its regulation
2.2The Pentose phosphate pathway &The Entner - Doudroff pathway
2.3The Citric acid cycle and its regulation &The Glyoxylate cycle
2.4Protein Catabolism: General reactions of amino acids catabolism, Stickland Reaction, Lipid Catabolism: Oxidation of Fatty Acids, Beta- Oxidation of Fatty Acids

**REFERENCE BOOKS**


1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA.
2. Outlines of biochemistry byConn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.

**UNIT 3: ENERGY GENERATION AND ANABOLISM**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

3.1 Different modes of ATP generation
3.2 Electron transport chain: Introduction, Components of ETC and energy yield
3.3 Anaerobic Respiration
3.4 Peptidoglycan Biosynthesis
3.5 Bacterial photosynthesis

**REFERENCE BOOKS**


1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA.
2. Outlines of biochemistry byConn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
5. Biochemistry by Jeremy M. Berg, LubertStryer, John Tymoczko, Gregory Gatto. 5th - 9th Edition. W.H. Freeman and Company, New York.
6. Biochemistry by Donald Voet & Judith G. Voet. 4th edition. John Wiley & Sons.


**UNIT 4: SELECTED ASPECTS OF METABOLISM IN SPECIFIC MICROBIOAL SYSTEMS**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

4.1 Chemo - autotrophs : Nitrifying Bacteria and Iron bacteria
4.2 Chemo - autotrophs : Sulfur Oxidizers and Hydrogen Bacteria
4.3 The lactic acid bacteria: Patterns of carbohydrate fermentation in lactic acid bacteria
4.4 The Enteric group and related Eubacteria : Fermentative patterns of Gram negative Eubacteria
4.5 Archaebacteria: Energy metabolism and Carbon- Assimilation in Methanogens, photophosphorylation in Halobacterium

**REFERENCE BOOKS**


1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA
2. General microbiology by Stanier R.Y. 5th edition. McMillan.
3. Bacterial Physiology and Metabolism by B. H. Kim & G. M. Gadd. 1st edition .Cambridge University Press.
4. Brock Biology of Microorganisms by Michael T. Madigan, John M. Martinko.11th – 15th edition. Pearson.
5. Microbial physiology by A. G. Moat, J. W. Foster & M. P. Spector. 4th edition. John Wiley & Sons.

**UNIT 5: MEMBRANE BIOLOGY**

**(Credit-1.2, Teaching Hours-12, Marks-14)**

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5.1 Structure of cell membrane: Fluid Mosaic Model

5.2 Passive transport: Simple & Facilitated Diffusion

5.3 Active transport

5.4 Specific Transport Systems: Mechanosensitive channels, Chemiosmotic-driven transport, Iron transport, thephosphotransferase system

5.5 Overview of Quorum sensing & Signal Transduction

**REFERENCE BOOKS**


1. The physiology and Biochemistry of Prokaryotes by David white. 2nd edition. OUP USA
2. Outlines of biochemistry byConn E.E. and Stumpt P.K. 5th edition. John Wiley and Sons, New York.
3. General microbiology by Stanier R.Y. 5th edition. McMillan.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
5. Bacterial Physiology and Metabolism by B. H. Kim & G. M. Gadd. 1st edition.Cambridge University Press.

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - V
# (With effect from June 2022)
## MB-502:BACTERIAL METABOLISM
## (PRACTICAL)

1. Study effect of temperature on amylase activity
2. Study effect on amylase activity
3. Study effect of enzyme concentration on amylase activity
4. Determination of Vmax and Km for amylase enzyme by performing substrate concentration curve with M-M and line weaver Burk plot
5. Isolation and characterization of lactic acid bacteria from suitable sources.
6. Study of Diauxic growth curve in *E. coli*
7. Preparation of Winogradsky column (Demonstration)

**REFERENCE BOOKS**

1 Experimental Microbiology (volume 1 &2) by Rakesh Patel. 3rd Edition. AdityaPublishers.

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - V
# (With effect from June 2022)
# MB-503:MOLECULAR BIOLOGY AND GENETIC ENGINEERING (THEORY)

**UNIT 1: FUNDAMENTALS OF GENETICS**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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1.1 History of genetics and central dogma of life
1.2 Mendelian Laws of inheritance
1.3 DNA is the universal genetic material & experimental evidences
1.4 Gene structure and architecture in Prokaryotes and Eukaryotes
1.5 Prokaryotic DNA Replication: experiment, machineries, Mechanism & models

**REFERENCE BOOKS**


1. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor &Fransis Group. UK.
2. Krebs, J. E.,Goldstein, E. S. et al., Lewin's Genes XII (any recent Edition), Jones and Bartlett Publishers, Inc., USA.
3. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
4. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
5. Synder L., Champness, et al. Molecular Genetics of Bacteria –4th Edition. ASM Press, USA.
6. Verma P.S.&Agarwal V.K., Cell Biology, Genetics, Molecular Biology, Evolution & Ecology - Reprint Edn. 2006 edition. S Chand publications


**UNIT 2: GENE EXPRESSION AND REGULATION**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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2.1 ProkaryoticTranscription: machineries and mechanism
2.2 Post transcriptional modifications of RNA: overview of splicing, capping, polyadenylation& editing
2.3 Genetic code, prokaryotic Translation (machineries and mechanism) and post translational modifications
2.4 An overview of Levels and modes of regulation of gene expression.
2.5 The Operon Models: Regulation of lactose utilization – The lac operon &Regulation of tryptophan biosynthesis – The trp operon

**REFERENCE BOOKS**


1. Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston : Jones and Bartlett Publishers, c1998.
2. Twyman R. M., Advanced Molecular Biology – 1stEdition. Taylor &Fransis Group. UK.
3. Synder L., Champness, et al. Molecular Genetics of Bacteria –4th Edition. ASM Press, USA.
4. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
5. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
6. Prescott, Healey and Klein.,Microbiology - 5th - 10thEdition, Tata-McGraw Hill publications, Delhi.
7. Verma P.S.&Agarwal V.K., Cell Biology, Genetics, Molecular Biology, Evolution & Ecology - Reprint Edn. 2006 edition. S Chand publications


**UNIT 3: GENE TRANSFER AND RECOMBINATION**

**(Credit-1.2, Teaching Hours-12, Marks-14)**

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3.1 Types of Recombination: Homologous recombination, Site specific recombination, illegitimate recombination

3.2 Transformation: 1. Natural transformation - competence, DNA uptake, role of natural transformation, 2. artificial induced competence& electroporation

3.3 Transduction: Generalized transduction, specialized transduction and Abortive transduction

3.4 Conjugation: Mechanism of DNA transfer in Gram positive and Gram negative bacteria

3.5 Transposable genetic elements

**REFERENCE BOOKS**


1 Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston : Jones and Bartlett Publishers, c1998.
2 Twyman R. M., Advanced Molecular Biology – 1stEdition. Taylor &Fransis Group. UK.
3 Synder L., Champness, et al. Molecular Genetics of Bacteria –4th Edition. ASM Press, USA.
4 Gardner, M. J. Simmons, D. P. Snustad, PRINCIPLES OF GENETICS- 8th Edition. John Wiley & Sons.
5 Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
6 Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
7 Prescott, Healey and Klein.,Microbiology - 5th - 10thEdition, Tata-McGraw Hill publications, Delhi.


**UNIT 4: MUTATION AND DNA REPAIR**

**(Credit-1.2, Teaching Hours-12, Marks-14)**

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4.1 Types of mutation- Spontaneous mutations and Induced mutations

4.2 Biochemical basis of mutation and mutation Reversion

4.3 Physical, Chemical and Biological Mutagenesis; Ames test

4.4 Experimental evidence of mutation: fluctuation analysis, mutation rate, Phenotypic and Phenomiclag

4.5 DNA repair mechanisms - Mismatch repair, Excision repair, Photo reactivation,

Recombinationalrepair and SOS repair

**REFERENCE BOOKS**


1. Malacinski G. M. & David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston : Jones and Bartlett Publishers, c1998.
2. Twyman R. M., Advanced Molecular Biology – 1stEdition. Taylor &Fransis Group. UK.
3. Synder L., Champness, et al. Molecular Genetics of Bacteria –4th Edition. ASM Press, USA.
4. Gardner, M. J. Simmons, D. P. Snustad, PRINCIPLES OF GENETICS- 8th Edition. John Wiley & Sons publication.
5. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
6. Lehninger principles of biochemistry by Nelson, D., and Cox, M. 4th - 8th edition. W.H. Freeman and Company, New York.
7. Prescott, Healey and Klein.,Microbiology - 5th - 10thEdition, Tata-McGraw Hill publications, Delhi.


**UNIT 5: GENETIC ENGINEERING AND PROTEIN ENGINEERING**

**(Credit-1.2, Teaching Hours-12, Marks-14)**

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5.1 Genetic engineering: aims and applications

5.2 Genetic manipulations of prokaryotes:

a. Isolation of DNA

b. Vectors of rDNA Technology – plasmid (pBR322 &pUC), Bacteriophage (lambda phage & M13), Cosmid, Phagmid, BACs, YACs

c. Insertion of DNA molecules into a vector

d. Transformation methods and Growth

e. Detection of Recombinant- Colony Hybridization

5.3 Genetic manipulations of eukaryotes: Genetic manipulation of plant cells (*Agrobacterium* mediated) and animal cells

5.4 Site directed mutagenesis

5.5 Molecular Chaperon

**REFERENCE BOOKS**


1 Trevan, M.D., et al., Biotechnology -The BiologiclPrinciples . Tata Mcgraw Hill Publishing Co Ltd.

2 Twyman R. M., Advanced Molecular Biology – 1stEdition. Taylor &Fransis Group. UK.

3 John Cronan, et al., Microbial Genetics - 2nd Edition. Narosa publications.

4 Malacinski G. M. &David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston: Jones and Bartlett Publishers, c1998.

5 T. A. Brown, Gene Cloning and DNA Analysis: An Introduction -7th Edition. Wiley-Blackwell publications.

6 S. B. Primrose, R.Twyman&B. Old, Principles of Gene Manipulation .6th Edition.Wiley-Blackwell publications

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - V
# (With effect from June 2022)
## MB-503:MOLECULAR BIOLOGY AND GENETIC ENGINEERING (PRACTICAL)

1. Isolation of genomic DNAfrom bacteria (only demonstration experiment)
2. Estimation of DNA by DPA method
3. Conjugation in *E. coli* by plate method
4. Isolation of plasmid (Only demonstration experiment)
5. Transformation of plasmid in bacteria
6. Isolation of RNA (only demonstration experiment)
7. Estimation of RNA by Orcinol method
8. Isolation of Lactose non fermenter mutant of *E. coli* by physical mutagenesis
9. Isolation of antibiotic resistant bacteriaby gradient-plate method.
10. Isolation of streptomycin resistant mutants by Replica plating technique.
11. The Ames test: For detecting potential carcinogen (only demonstration experiment)

**REFERENCE BOOKS**


1. Trevan, M.D., et al., Biotechnology -The Biological Principles . Tata Mcgraw Hill Publishing Co Ltd.
2. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor &Fransis Group. UK.
3. Prescott, Healey and Klein., Microbiology-9 or 10th Edition, Tata-McGraw Hill publications, Delhi
4. Atlas. R.M., Principles of Microbiology- 2nd Edition. Wm. C. Brown Publishers.
5. John Cronan, et al., Microbial Genetics - 2nd Edition. Narosa publications.
6. Malacinski G. M. &David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston: Jones and Bartlett Publishers, c1998.
7. T. A. Brown, Gene Cloning and DNA Analysis: An Introduction -7th Edition. Wiley-Blackwell publications.
8. Sandy B. Primrose, Richard Twyman&Bob Old, Principles of Gene Manipulation – 6th Edition.Wiley-Blackwell publications

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - VI
# (With effect from June 2022)
# MB-601: FERMENTATION TECHNOLOGY
# (THEORY)

**UNIT 1 BASICS OF FERMENTATION TECHNOLOGY & INDUSTRIALLY IMPORTANT MICROORGANISMS**
**(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)**

1.1 Basic Concept of fermentation technology & historical development of industrial microbiology
1.2 Range of Fermentation Processes & its Component parts
1.3 Primary & Secondary Screening of industrial important microbes & culture collection centre
1.4 Isolation & improvements of industrial important microbes
1.5 Fermentation economics

**REFERENCE BOOKS**


1. Principles of Fermentation Technology by Stanbury& Whittaker. 2nd edition. Butterworth-Heinemann, Elsevier Ltd.
2. Industrial Microbiology by L. E. Casida. 2nd edition. New Age International Private Limited
3. A text book of Industrial Microbiology by WulfCrueger&AnnelieseCrueger. 2nd edition.Sinauer Associates Inc.,U.S.
4. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications
5. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology vol. 1 & 2 by V.K. Joshi & Ashok Pandey. Asiatech Publishers Inc.


**UNIT 2 FORMULATION OF FERMENTATION MEDIA**
**(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)**

2.1 Introduction to Media and its Types
2.2 Media formulation
2.3 Raw materials: Crude Carbon and Nitrogen sources, Minerals, Precursors, Growth Regulators, Buffers, Antifoam agents
2.4 Inoculum and Production medium
2.5 Media Optimization

**REFERENCE BOOKS**


1. Principles of Fermentation Technology by Stanbury& Whittaker. 2nd edition. Butterworth-Heinemann, Elsevier Ltd.
2. Industrial Microbiology by L. E. Casida. 2nd edition. New Age International Private Limited

3. A text book of Industrial Microbiology by WulfCrueger&AnnelieseCrueger. 2nd edition. Sinauer Associates Inc.,U.S.
4. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications
5. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology vol. 1 & 2 by V.K. Joshi & Ashok Pandey. Asiatech Publishers Inc.

**UNIT 3 DESIGN AND ASEPTIC OPERATION**
**(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)**

3.1 Introduction and basic functions of fermenter: criteria and design

3.2 Types of bioreactors

3.3 Aeration and Agitation – Types and importance of agitators & aerators

3.4 Sterilization process in fermentation industries: Introduction of Del factor, an overview of Fermentor sterilization & Medium sterilization

3.5 Fermentation process: Batch Fermentation, Continuous fermentation and their comparative advantages and disadvantages

**REFERENCE BOOKS**

1. Principles of Fermentation Technology by Stanbury& Whittaker. 2nd edition. Butterworth-Heinemann, Elsevier Ltd.
2. A text book of Industrial Microbiology by WulfCrueger&AnnelieseCrueger. 2nd edition. Sinauer Associates Inc.,U.S.
3. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications

**UNIT 4 OVERVIEW: DOWNSTREAM PROCESSES**
**(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)**

4.1 Methods of Cell separation: Broth conditioning, Precipitation, Sedimentation, Centrifugation, Filtration

4.2 Centrifugation and filteration

4.3 Techniques of Cell Disruption: Mechanical and Non mechanical methods

4.4 Product Recovery: Liquid liquid extraction, Solvent recovery, Two Phase aqueous extraction, Super critical fluid extraction

4.5 Physical, Chemical and Biological assay of fermentation products

**REFERENCE BOOKS**

1. Principles of Fermentation Technology by Stanbury& Whittaker. 2nd edition. Butterworth-Heinemann, Elsevier Ltd.
2. Industrial Microbiology by L. E. Casida. 2nd edition. New Age International Private Limited

3. A text book of Industrial Microbiology by WulfCrueger&AnnelieseCrueger. 2nd edition. Sinauer Associates Inc.,U.S.
4. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications

**UNIT 5 STUDIES OF SELECTIVE FERMENTATION PROCESSES**
**(CREDIT-1.2, TEACHING HOURS-12, MARKS-14)**

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5.1 Production of organic solvents: Ethyl alcohol
5.2 Production of enzymes & vitamins: Amylases and Riboflavin
5.3 Production of antibiotics: Penicillin
5.4 Production of amino acids & organic acids: Lysine and Citric acid
5.5 Introduction to methods of immobilizations – Whole cell and/or enzyme: Applications of immobilization

**REFERENCE BOOKS**

1. Industrial Microbiology by L. E. Casida. 2nd edition. New Age International Private Limited
2. A text book of Industrial Microbiology by WulfCrueger&AnnelieseCrueger. 2nd edition. Sinauer Associates Inc.,U.S.
3. Industrial Microbiology by A.H. Patel. 2nd edition. Laxmi Publications
4. Biotechnology: Food Fermentation Microbiology, Biochemistry & Technology vol. 1 & 2 by V.K. Joshi & Ashok Pandey. Asiatech Publishers Inc.
5. Trevan, M.D., et al., Biotechnology -The Biologicl Principles. Tata Mcgraw Hill Publishing Co Ltd.

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - VI
## (With effect from June 2022)
## MB-601: FERMENTATION TECHNOLOGY
## (PRACTICAL)

1 Primary screening of industrially important microorganisms capable of producing: Antibiotics, Organic acids, amylases

*2* Bioassay of streptomycin using *E.coli.*

*3* Laboratory fermentation & estimation of Ethyl Alcohol by *Saccharomyces*

4 Laboratory fermentation & estimation of amylase by *Bacillus spp*.

5 Sterility testing of fermentation products (Demo)

6 Immobilization of yeast cells by Ca- alginate entrapment method & Determination of viability of immobilized cells by invertase activity

**REFERENCE BOOKS**


1. Microbiology- A laboratory Manual by James G. Chappuccino& Natalie Sherman. 4th edition. Pearson Benjamin Cummings
2 Handbook Bacteriological Techniques by F.J. Baker. 2nd edition. Butterworth & Co Publishers Ltd.
3 Introduction to Microbial Techniques By Gunasekaran
4 Experimental Microbiology (volume 1 &2) by Rakesh Patel. 3rd Edition. AdityaPublishers.

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - VI
## (With effect from June 2022)
## MB 602: BIO-ANALYTICAL TECHNIQUES
## (THEORY)

**UNIT 1:Basic Analytical Techniques in Biosciences**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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1.1 Concept Of Good Laboratory Practices and Quality Management
1.2 Applications of Radioisotopes in Biosciences

**Principle, Instrumentation and applications of following spectroscopy techniques:**

1.3 Colorimetry and UV- Visible Spectrophotometry
1.4 Mass spectroscopy, IR spectroscopy and NMR spectroscopy
1.5 Atomic Spectroscopy: Atomic Absorption/Emission Spectrometer

**REFERENCE BOOKS**


1. Purohit, S. S. (2012). Microbiology: Fundamentals and applications. Jodhpur: Agrobios (India).
2. Wilson, K., Walker, J. M., Hofmann, A., &Clokie, S. (2018). Wilson and Walker's principles and techniques of biochemistry and molecular biology.
3. Srivastava, M. (2008). Bioanalytical techniques. Oxford: Alpha Science International.
4. Ramesh, V. (2019). Biomolecular and Bioanalytical Techniques: Theory, Methodology and Applications.
5. Upadhyay, A., Upadhyay, K., &Nath, N. (2009). Biophysical chemistry: (principles and techniques). Himalaya Pub. House Mumbai,India.


**Unit 2: Principles and Theories of Chromatography**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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2.1 Introduction to Chromatography – Partition & adsorption; planner & column

**Principle, working and applications of following chromatography techniques**

2.2 Paper and Thin Layer Chromatography
2.2 Affinity and Ion Exchange Chromatography
2.3 Size Exclusion Chromatography and Gas Chromatography
2.4 High Performance Liquid Chromatography (HPLC) and FPLC
2.5 Concept and applications of GC-MS and LC-MS

**REFERENCE BOOKS**


1. Purohit, S. S. (2012). Microbiology: Fundamentals and applications. Jodhpur: Agrobios (India).
2. Wilson, K., Walker, J. M., Hofmann, A., &Clokie, S. (2018). Wilson and Walker's principles and techniques of biochemistry and molecular biology.

3. Srivastava, M. (2008). Bioanalytical techniques. Oxford: Alpha Science International.
4. Ramesh, V. (2019). Biomolecular and Bioanalytical Techniques: Theory, Methodology and Applications.
5. Upadhyay, A., Upadhyay, K., &Nath, N. (2009). Biophysical chemistry: (principles and techniques). Himalaya Pub. House Mumbai, India.

**Unit 3: MolecularTechniques and Biosensor Technology**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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3.1 Electrophoresis: Basic principle, components and applications of Paper electrophoresis&Agarose gel electrophoresis
3.2 PFGE: Principle, working and applications of Native gel electrophoresis &SDS-PAGE
3.3 An overview of 2D-PAGEs (concept of isoelectric focusing) & Capillary electrophoresis
3.4 Introduction to Autoradiography& Flow cytometry
3.5 Overview of Biosensor Technology

**REFERENCE BOOKS**

1. Purohit, S. S. (2012). Microbiology: Fundamentals and applications. Jodhpur: Agrobios (India).
2. Wilson, K., Walker, J. M., Hofmann, A., &Clokie, S. (2018). Wilson and Walker's principles and techniques of biochemistry and molecular biology.
3. Srivastava, M. (2008). Bioanalytical techniques. Oxford: Alpha Science International.
4. Ramesh, V. (2019). Biomolecular and Bioanalytical Techniques: Theory, Methodology and Applications.
5. Upadhyay, A., Upadhyay, K., &Nath, N. (2009). Biophysical chemistry: (principles and techniques). Himalaya Pub. House Mumbai, India.

**Unit 4.Modern Bioanalytical Techniques**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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4.1 DNA sequencing: Principles and Methods, Automated DNA sequence Analyzer
4.2 Blotting techniques and FISH
4.3 RFLP, RAPD, VNTR, STR and SNP analysis
4.4 Chemical synthesis of DNA
4.5 PCR Technology: Principle, Methods, Primer design(overview and Features) and Applications.

**REFERENCE BOOKS**

1. Purohit, S. S. (2012). Microbiology: Fundamentals and applications. Jodhpur: Agrobios (India).
2. Wilson, K., Walker, J. M., Hofmann, A., &Clokie, S. (2018). Wilson and Walker's principles and techniques of biochemistry and molecular biology.
3. Srivastava, M. (2008). Bioanalytical techniques. Oxford: Alpha Science International.
4. Ramesh, V. (2019). Biomolecular and Bioanalytical Techniques: Theory, Methodology and

Applications.
5. Upadhyay, A., Upadhyay, K., &Nath, N. (2009). Biophysical chemistry: (principles and techniques). Himalaya Pub. House Mumbai, India.
6. Trevan, M.D., et al., Biotechnology -The Biological Principles. Tata Mcgraw Hill Publishing Co Ltd.
7. Twyman R. M., Advanced Molecular Biology – 1st Edition. Taylor &Fransis Group. UK.
8. Malacinski G. M. &David Freifelder, Essential of Molecular Biology – 3rd Edition. Boston: Jones and Bartlett Publishers, c1998.
9. T. A. Brown, Gene Cloning and DNA Analysis: An Introduction -7th Edition. Wiley-Blackwell publications.
10. Sandy B. Primrose, Richard Twyman&Bob Old, Principles of Gene Manipulation – 6th Edition.Wiley-Blackwell publications

**Unit 5: Bioinformatics**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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5.1 Introduction and Importance of Bioinformatics
5.2 Database and DBMS: Primary and Secondary Biological Databases, Structure Databases, Miscellaneous Database
5.3 Information Retrial from Biological Database: ENTREZ, SRS and DBGET
5.4 Sequence Alignment tools: BLAST and FASTA
5.5 Construction of Phylogenetic tree using computer

**REFERENCE BOOKS**

1. Hodgman, T. C., French, A., &Westhead, D. R. (2010). Bioinformatics. Abingdon: Taylor & Francis.
2. Attwood, T. K., & Parry-Smith, D. J. (1998). Introduction to bioinformatics. Harlow. Pearson.
3. Baxevanis, A. D., & Ouellette, B. F. F. (2001). Bioinformatics: A practical guide to the analysis of genes and proteins. Wiley Intersciences,New York.

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - VI
## (With effect from June 2022)
## MB-602: Bio-Analytical Techniques
## (PRACTICAL)

1. Determination of absorbance maxima of $KMnO_4$
2. Separation of carbohydrates / amino acids by ascending paper chromatography.
3. Separation of amino acids by circular paper chromatography.
4. Separation of amino acids by Thin layer chromatography.
5. Separation of nucleic acid by agarose gel electrophoresis.
6. Separation of proteins by SDS PAGE (Demonstration).
7. Retrieval of DNA/gene sequence of bacterial species from NCBI.
8. Demonstration of BLAST analysis.

**REFERENCE BOOKS**


1. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India
2. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India
3. Dubey. R.C., Maheshwari. D.K., Practical Microbiology, S.Chand& Company Ltd., New Delhi
4. Konika Sharma, Manual of Microbiology – Tools and Techniques ,Ane Books, Delhi

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - VI
# (With effect from June 2022)
# MB-603: CLINICAL DIAGNOSTIC MICROBIOLOGY
# (THEORY)

**Unit1: Hematology**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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1.1. Hematopoiesis
1.2. Discovery of human blood group system, ABO and Rh system
1.3. Hemostasis
1.4. Introduction to blood banking& Separation and storage of blood components
1.5. Principle, significance and procedure of blood transfusion

**REFERENCE BOOKS**


1. Michael, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.
5. Ananthanarayan, R. (2013). Textbook of microbiology. Hyderabad: University Press (India).
6. Mukherjee, K. L., &Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.


**Unit 2: Serology**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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2.1 In vitro antigen: antibody reaction: Precipitin test (in fluid and gel) and Complement fixation test.
2.2Agglutination test (Hemagglutination, Bacterial Agglutination, Passive Agglutination and agglutination inhibition)
2.3 Special Serological tests: Fluorescent antibody technique, NuefeldQuellung reaction, Detection of heterophile antibody and Virus neutralizing antibody.
2.4 Evaluation of Virulence: Antifibrinolysin&Antistreptolysin.
2.5 Overview of Intracutaneous diagnostic test

**REFERENCE BOOKS**


1. Michael, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.

4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12thedition. New York: McGraw-Hill Higher Education.
5. Ananthanarayan, R. (2013). Textbook of microbiology. Hyderabad: University Press (India).
6. Mukherjee, K. L., &Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.

**Unit 3: Conventional and Advanced Diagnostic Techniques**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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**A. Conventional techniques.**

3.1 Methods of specimen collection.

3.2 Identification of microbes from specimen: Microscopy, Rapid methods of identification and Molecular methods.

**B. Advanced techniques.**

3.3 Immunoelectrophoresis and Immunofluoroscence.

3.4 Radioimmunoassay, ELISA, Western Blot.

3.5 Detection of pathogen by PCR, Immunohistochemistry and Immunotherapy.

**REFERENCE BOOKS**

1. MICHAEL, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2ndedition. Dubuque, IA: Wm. C. Brown Publishers.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12thedition. New York: McGraw-Hill Higher Education.
5. Ananthanarayan, R. (2013). Textbook of microbiology. Hyderabad: University Press (India).
6. Mukherjee, K. L., &Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.
7. Dey NC, Dey TK, Sinha D. Medical Bacteriology Including Medical Mycology and AIDS; New Central Book Agency, Kolkata.
8. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2ndedition. Hoboken: Taylor and Francis.
9. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

**Unit 4: Epidemiology and Microbial Agents of Disease (Bacteria & Fungi)**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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4.1 Epidemiology of infectious disease: Markers, concepts and tools

**Bacteria – Pathogenicity, diagnosis, treatment and prevention**

*4.2* Gram negative Bacteria– *Treponema and Salmonella*

*4.3* Gram positive Bacteria – *Streptococci* and *Mycobacterium*

**Fungi - Pathogenicity, diagnosis, treatment and prevention**

*4.4 Malassezia furfur, Tineapedis* and *Sporoctrichumschencii*

*4.5 Cryptococcus neoformans*and *Candida albicans*

**REFERENCE BOOKS**


1. MICHAEL, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2ndedition. Dubuque, IA: Wm. C. Brown Publishers.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12thedition. New York: McGraw-Hill Higher Education.
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6. Mukherjee, K. L., &Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.
7. Dey NC, Dey TK, Sinha D. Medical Bacteriology Including Medical Mycology and AIDS; New Central Book Agency, Kolkata.
8. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2ndedition. Hoboken: Taylor and Francis.
9. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited


**Unit 5:. Microbial Agents of Disease (Protozoa and Virus), and Prophylaxis**
**(Credit-1.2, Teaching Hours-12, Marks-14)**

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*5.1* Protozoa: Pathogenicity, diagnosis, treatment and prevention of*Plasmodium spp. &Entamoebahistolytica*

**Viruses – - Pathogenicity, diagnosis, treatment and prevention.**

5.2 Air borne infections: Influenza & Mumps.

5.3Food-Water borne infection: Hepatitis virus & Rota virus.

5.4 Viral Zoonosis: Rabies virus & Swine Flu.

5.5 Direct contact: HIV & Herpes virus.

**REFERENCE BOOKS**


1. MICHAEL, J. P. (2009). Microbiology: An Application Based Approach. Tata McGraw Hill Education Private Limited.
2. Goldsby, R. A., Kindt, T. J., Osborne, B. A., &Kuby, J. (2003). Immunology. 7th -12th edition. W. H.
3. Atlas, R. M. (1997). Principles of microbiology. 2nd edition. Dubuque, IA: Wm. C. Brown Publishers.
4. Willey, J. M., Sherwood, L., Woolverton, C. J., & Prescott, L. M. (2008). Prescott, Harley, and Klein's microbiology.7th -12th edition. New York: McGraw-Hill Higher Education.
5. Ananthanarayan, R. (2013). Textbook of microbiology. Hyderabad: University Press (India).
6. Mukherjee, K. L., &Ghosh, S. (2010). Medical laboratory technology: Procedure manual for routine diagnostic tests (vol 1 to 3). New Delhi: Tata McGraw Hill.
7. Dey NC, Dey TK, Sinha D. Medical Bacteriology Including Medical Mycology and AIDS; New Central Book Agency, Kolkata.
8. Lydyard, P., Whelan, A., &Fanger, M. (2011). BIOS Instant Notes in Immunology. 2nd edition. Hoboken: Taylor and Francis.
9. S. C. Parija.(2012). Textbook of Microbiology and Immunology. 2nd edition. Reed Elsevier India Private Limited

# SURENDRANAGAR UNIVERSITY, SURENDRANAGAR
# SYLLABUS FOR MICROBIOLOGY SEMESTER - VI
## (With effect from June 2022)
## MB-603: CLINICAL DIAGNOSTIC MICROBIOLOGY
## (PRACTICAL)

1. Antibiotic susceptibility of the pathogens isolated from the clinical specimen
2. Study of Agglutination by
    a. Blood grouping
    b. Serodiagnosis of enteric fever by Widal test
    c. Serodiagnosis of syphilis by RPR Test
3. Haemoglobin estimation by Sahli's method
4. Bleeding time by filter paper technique and clotting time by capillary method
5. Erythrocyte Sedimentation Rate (ESR-demonstration)
6. Blood sugar estimation by GOD / POD method
7. Determination of Serum bilirubin
8. Determination of Serum Cholesterol
9. Physical, chemical and microscopic analysis of urine
10. Screening of Thalassemia by NESTROFT
11. Total count of platelets

**REFERENCE BOOKS**


1. Talwar, G. P., & Gupta, S. K. (1992). A Handbook of Practical and Clinical Immunology. New Delhi: CBS Publishers & Distributors.
2. Medical Laboratory Technology – Vol – I, II, III – MukherjiK.L.2nd edition.Tata McGraw-Hill Education.
3. Godkar, P. B., &Godkar, P. D. (2005). Text Book of Medical Laboratory Technology: Basic Histopathologic Techniques and the Laboratory Requirements.Bhalani Publishing House.
4. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-I, Aditya Publications, Ahmedabad, India
5. Patel. R.J., Patel. K.R., Experimental Microbiology, Vol-II, Aditya Publications, Ahmedabad, India