

SHRI SHIVAJI SCIENCE AND ARTS COLLEGE, CHIKHLI (DIST. BULDANA)
DEPARTMENT OF MICROBIOLOGY
SYLLABUS B. Sc. I (Semester – I)

The examination shall comprise of two theory papers, one in each semester and one practical in each Semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks. The following syllabi are prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-I (08 marks).

1S-Microbiology

Paper - Fundamentals of Microbiology and Microbial Physiology

UNIT I: A. History of Microbiology:

- a. Discovery of Microscope- Leeuwenhoek, Robert Hook.
- b. Controversy over Spontaneous, generation, Contributions of Aristotle, Redi, Needham, Schulze and Schwann, Schroder & Vandusich, Louis Pasteur, John Tyndall
- c. Germ theory of diseases- Joseph Lister, Koch postulates, River postulates.
- d. Pure culture concept- Joseph Lister, Koch, DeBarry.

B. Scope of Microbiology as a modern Science.

- Industrial Microbiology, Environmental Microbiology, Medical microbiology, Food and Dairy Microbiology, Genetic engineering and Biotechnology.
- b. Different types of Microorganisms (outline)
- c. Distribution of Microorganisms in nature, and their beneficial and harmful activities.

UNIT II : A. Microscopy:

- i) Definitions- Magnification, Resolving power, numerical aperture, focal length, Working Distance Aberrations,
- ii) Objectives- Functions, low and high power objectives, Oil Immersion objectives,
- iii) Ocular- Functions, Huygenian, Ramsceden, Hyperplane and compensating.
- iv) Condensor- Functions, Abbe, parabolic
- v) Iris diaphragm

B. Principles, construction, ray diagram and applications

- i) Compound Microscope,
- ii) Darkfield Microscope,
- iii) Phase Contrast microscope

- iv) Fluorescent Microscope,
- v) Electron Microscope.

C. Staining:

Dyes and Staining - Definitions, auxochromes, Chromophore, mordents, chromogens, Leucostains, Principles and Methods of the following techniques:

- Simple staining
- Differential- Gram, Acid fast,.
- Structural-Endospore, flagella.

UNIT III : Classification of Microorganisms:

A. Bacterial Classification:

- i. Definition- Taxonomy, Classification, Taxonomic rank, Identification, Nomenclature,
- ii. Bergy's manual of systematic Bacteriology, General characteristics enlisting all parts with major characters and examples(Vol. I to IV)
- iii. Methods of Classification: Intuitive, Numerical taxonomy, Genetic relatedness,

B. General characteristics of:

- i. Viruses,
- ii. Fungi (Including yeasts)
- iii. Actinomycetes,
- iv. Mycoplasma and Rickettsia
- v. Algae

UNIT IV: Structural Organization of Bacteria:

- a) Concept of prokaryotes and Eukaryotes; Comparison and Differences.
- b) Typical Bacterial cell
- c) Shape, Size and Arrangement of Bacteria
- d) Structure and functions of following:
 - i. Capsule and slime layer
 - ii. Cell wall- Gram positive and Gram negative bacteria.
 - iii. Cytoplasmic membrane- fluid mosaic model
 - iv. Flagella- Arrangement, Mechanism of flagellar movement.
 - v. Pili-Arrangement and function
 - vi. Ribosome's- Prokaryotic and Eukaryotic
 - vii. Plasmid- Definition, General characters, classes
 - viii. Bacterial chromosome
 - ix. Endospores- Structure and arrangements.

UNIT V: A. Microbial Nutrition:

- i. Basic Nutritional Requirements: Sources of C, N, O, P, S, Energy, Macronutrients, Growth factors, water etc.
 - ii. Media; Synthetic, Non-synthetic, Liquid and Solid, Semisolid, Differential, Enriched, Selective media. Role of beef extract, yeast extract, peptone, agar and gelatine.
- Determination of nutritional requirements: Auxanographic technique, Replica plating technique.
 - Nutritional classification; on the basis of source of carbon and energy

B. Pure Culture Techniques:

- i. Definition- Pure and Mixed culture:
 - ii. Methods of Isolation of Pure culture, Serial dilution, Streak plate, pour plate, spread plate, Enrichment culture, and Single cell isolation method.
- Methods of preservation of pure culture- Agar slants, Saline suspension, overlaying with oil, Freeze drying.

UNIT VI: Reproduction and Growth of Bacteria:

- a) Reproduction: Binary fission, Budding, Fragmentation, Sporulation,
 - b) Growth rate and generation time- Definition, mathematical expression.
 - c) Bacterial growth curve
 - d) Synchronous culture: Definition, methods of isolation (Helmstetter-Cummings Technique) and application.
 - e) Continuous culture: Definition, method (chemostat, and Turbidostat Techniques) and Application.
 - f) Measurement of Growth:
 - i. Cell number measurement- Breed method, Colony count
 - ii Cell mass measurement- Dry weight and Turbidity measurement.
 - iii. Cell activity measurement- Biochemical activity
- Factors influencing bacterial Growth- Temperature, pH, Gaseous.

Microbiology Practical's

1S-Microbiology

1. Microscopy:

- i. Different parts of compound microscope
- ii. Use and Care of compound microscope

2. Construction, operation and utility of Laboratory equipments;

- i. Autoclave 75 76
- ii. Hot air oven
- iii. Bacteriological Incubator
- iv. pH meter
- v. Centrifuge
- vi. Colorimeter/ spectrophotometer
- vii. Anaerobic Jar
- viii. Bacteriological filters
- ix. Laminar air flow
- x. Air sampler

xi. BOD incubator

3. Preparation of Nutrient media:

- i. Nutrient broth
- ii. Nutrient agar
- iii. PDA

4. Demonstration of bacteria from; Soil, Water, Air, Milk, Skin

5. Microscopic Examination of bacteria

- i. Monochrome staining
- ii. Gram's staining
- iii. Acid fast staining
- iv. Negative staining
- V Endospore staining

6. Hanging drop technique to demonstrate Bacterial motility

7. Measurement of size of bacteria.

8. Cultivation and Demonstration of

- i. Yeast- *Saccharomyces cereviceae*, *Candida albicans*.
- ii. Molds- *Mucor*, *Rhizopus*, *Penicillium*, *Aspergillus*

9. Demonstration of

- a) Protozoa-*E.histolytica*,*Paramoecium*
- b) Algae – *Anabena* , *Nostoc*, *Spirogyra*

10. Isolation of Pure culture by

- i) Streak plate ii) Pour plate iii) Spread plate.

11. Enumeration of bacteria in the given sample by standard plate count.

12. Demonstration of Replica plate technique / auxanographic technique.

1st Semester Microbiology Practical's Mark Distribution

- | | |
|-------------------------|----------|
| 1. Major Experiment - | 15 Marks |
| 2. Minor Experiment - | 10 Marks |
| 3. Viva –Voce - | 10 Marks |
| 4. Spotting - | 10 Marks |
| 5. Laboratory Journal - | 05 Marks |

Total

50 Marks