



**Solapur University, Solapur**

**B.Sc. Part-I (Microbiology)**

**Revised Semester Pattern  
Syllabus**

**w.e.f. June 2013**

**SOLAPUR UNIVERSITY, SOLAPUR**  
**SYLLABUS FOR B.Sc – I (MICROBIOLOGY)**  
**(SEMESTER PATTERN)**  
**SEMESTER I**  
**PAPER -I**  
**Fundamentals of Microbiology**

**UNIT –I (History and Scope of Microbiology)**

**A) History:** - (a) Controversy over abiogenesis/Spontaneous generation conflict

(b) Major Contributions of

- |                           |                             |
|---------------------------|-----------------------------|
| 1) Antony Van Leeuwenhoek | 2) Louis Pasteur            |
| 3) Edward Jenner          | 4) Robert Koch              |
| 5) Alexander Fleming      | 6) Robert Hook              |
| 7) John Tyndall           | 8) J.D.Watson & F.H.C.Crick |
| 9) Joseph Lister          | 10) D.Ivanowsky             |
| 11) Winogradsky           |                             |

**B) Scope:-**

1. Introduction to types of microorganisms: - Bacteria, Viruses, Algae, Fungi, Protozoa
2. Distribution of microorganisms in nature and their beneficial and harmful activities

**UNIT – II (Taxonomy, Morphology & Cytology of Bacteria)**

**A) Bacterial Taxonomy:-**

1. General principles of Bacterial nomenclature
2. Criteria for bacterial classification – Morphological, Cultural and Biochemical Characters

**B) Difference between Prokaryotic & Eukaryotic cell.**

**C) Morphology and Cytology of Bacteria.**

1. Size, Shape, arrangement of bacteria
2. Structure of typical Bacterial cell
3. Structure and function of Cell Wall, Cell Membrane, Capsule & Slime layer, Flagella, Pili, Nuclear material, Mesosomes, Ribosomes, Endospore

**UNIT – III (Virology & Mycology)**

**A) Virology:-**

1. Virology – Structure of viruses, Classification based on host & type of nucleic acid, and morphological types
2. General characteristics of viruses

**B) Mycology:-**

General characteristics, classification and cultivation of Fungi

**UNIT – IV (General Characteristics of various Microorganisms)**

1. Archaeobacteria.
2. Actinomycets.
3. Rickettsia
4. Mycoplasma
5. Chlamydia

**SEMESTER I  
PAPER –II  
Microbial Techniques**

**UNIT – I (Microscopy & Safety in Microbiology)**

**A) Microscopy:-**

1. General principles of light microscopy. Magnification, Numerical Aperture, Resolving power, working distance of light microscope.
2. Ray diagram, special features, applications & comparative studies of compound & Electron Microscope.

**UNIT – II (Staining Techniques)**

1. Definition of Dyes & Stains
2. Classification of stains – Acidic, Basic & Neutral with examples
3. Principle, procedure, mechanism and applications of following staining procedures
  - a) Simple
  - b) Negative
  - c) Differential: - Gram and acid fast
4. Special staining methods
  - a) Cell wall: - Chance's Method
  - b) Capsule: - Maneval's method.
  - c) Volutin Granules: - Albert's Method.

**UNIT – III (Sterilization Techniques)**

1. Definitions: - Sterilization, Disinfection, Antiseptic, Germicide, Microbiostasis, Sanitization
2. Sterilization by Physical agents
  - a) Temperature – Dry heat, moist heat, Desiccation
  - b) Osmotic pressure.
  - c) Radiation – U.V.Rays &  $\gamma$  ray
  - d) Filtration – Asbestos membrane filtration
3. Sterilization by chemical agents
  - a) Phenol & Phenolic compounds
  - b) Ethyl alcohol
  - c) Halogens – Cl & I
  - d) Heavy metals – Copper & Mercury, Formaldehyde
  - e) Gaseous agents – Ethylene oxide, B-Propiolactone

**UNIT – IV (Cultivation technique of microorganisms)**

**A) Culture Media: -**

1. In vivo Living – Embryonated Egg, Animal Tissue Culture
2. In vitro – Non living media Natural, Synthetic, Semi synthetic, Differential, Enriched, Selective

**B) Methods of Pure culture techniques: -**

1. Streak Plate
2. Serial dilution: - Spread Plate and Pour Plate

**C) Anaerobic Culture Methods.**

- a) Rosenthal b) Gas Pack c) Use of Reducing agents.
- d) Maintenance of pure culture: Freezing, Lyophilization, Soil stock, Paraffin method

**SEMESTER II**  
**PAPER III**  
**Microbial Physiology**

**UNIT: - I (Basic Biochemistry of Microbes)**

Structure & Functions of Macromolecules

- a) Carbohydrates
- b) Proteins
- c) Nucleic Acids
- d) Lipids

**UNIT: - II (Microbial Growth & Nutrition)**

**A) Microbial Growth.**

- a) Introduction and Definition
- b) Growth phases of Bacteria

**B) Microbial Nutrition**

- a) Nutritional requirements of microorganisms
- b) Common components of media & their functions:-  
Peptone, Meat extracts, NaCl, Vitamins, Sugar, Na taurocholate, Milk, Starch,  
Blood,  
Agar agar
- c) Common indicators & their functions:-  
Andrade's, Neutral Red, Bromothymol Blue
- d) Nutritional types of Microorganisms based on Carbon & Energy Source

**UNIT: - III (Microbial Enzymes & Metabolism)**

**A) Microbial Enzymes:-**

- a) Definition, basic structure, cofactors & prosthetic groups & active site
- b) Types of Enzymes – Extra & Intracellular, Constitutive & Induced Enzymes –  
with  
example.

**B) Microbial Metabolism:-**

- a) Definition – Anabolism, Catabolism, Metabolism, and High energy compounds.
- b) Structure & energy content of ATP
- c) Catabolism of Glucose – EMP, TCA Cycle

**UNIT: - IV (Microbial Associations)**

**A) Definition & types of associations with examples:-**

- a) Beneficial – Neutralism, Mutualism, Symbiosis, Proto.co-operation,  
Commensalism.
- b) Harmful – Competition, Ammensalism, Antagonism, Parasitism, Predation.

**B) Association of microorganisms with plant:-**

e.g. - Root nodulation

**C) Association of microorganisms with animal:-**

e.g. - Ruminant symbiosis

**D) Association of microorganisms with human:-**

e.g. - Normal flora of human body & their significance

**SEMESTER II**  
**PAPER - IV**  
**Applied Microbiology I**

**UNIT – I (Air & Soil Microbiology)**

**A) Air Microbiology**

- a) Sources of microorganisms in air
- b) Definition of infectious dust, droplets and droplet nuclei
- c) Microbial examination of air
  - i) Impaction – Solid (Sieve device)
  - ii) Impingement – Liquid (Bead bubbler device)

**B) Soil Microbiology**

- a) Soil as an environment
- b) Components of soil
  - i) Physical – Gases
  - ii) Chemical – H<sub>2</sub>O, Organic & Inorganic substances
  - iii) Microbial – Different Microorganisms

**UNIT – II (Water Microbiology)**

**A) Water Microbiology**

- i) Sources of microorganisms in water
- ii) Fecal pollution of water & its indicator
- iii) Routine bacteriological analysis of water
  - Tests for coliforms – Qualitative (Presumptive, Confirmed & Completed)
  - Differentiation of coliforms – IMViC & Eijkman test
  - Quantitative – MPN
- iv) Municipal Water purification –  
Sedimentation, Filtration, Disinfection

**UNIT – III (Food & Milk Microbiology)**

**A) Food Microbiology**

- a) Food as substrate for Microorganisms
- b) Food infection and Food poisoning: - Definition and example
- c) General principles & methods of food preservation:-  
Asepsis, removal of Microorganisms, anaerobiosis, dehydration, Use of high & low Temperature, irradiation, Use of preservatives (Use of NaCl, Na benzoate, Vinegar, Sugar).

**B) Milk Microbiology**

- a) Definition and Composition of Milk
- b) Sources of contamination
- c) Microbiological examination of Milk: - MBRT test

**UNIT – IV (Medical Microbiology)**

**A) Definitions:-**

Infections, etiology, etiological agents, disease, pathogen, incubation period, fomite pathogenicity, virulence, morbidity rate, mortality rate, opportunistic pathogen, epidemiology, prophylaxis, carriers, host

**B) Types of diseases:-**

Epidemic, endemic, pandemic & sporadic

**C) Types of infections:-**

Primary, Secondary, acute, chronic, reinfection, cross infection,  
Mixed infection, congenital, local, and generalized

**D) Methods of transmission of diseases –**

1. Inoculation
2. Ingestion
3. Contact
4. Inhalation

**E) Prophylactic measures for microbial diseases**

- a) Chemoprophylaxis
- b) Immunoprophylaxis (Active & Passive)

**B.Sc. – I (Practical Course)**

1. Precautions and care in Microbiology laboratory
2. Use and Care of compound Microscope
3. Demonstration of principle, working and application of:  
Incubator, Hot air oven, Autoclave, Centrifuge, Colorimeter, Colony counter,  
Refrigerator, Anaerobic jar and Seitz Filter
4. Staining Procedures
  - (a) Monochrome Staining
  - (b) Negative Staining
  - (c) Gram Staining
5. Special Staining Procedures
  - (a) Cell Wall Staining (Chance's Method)
  - (b) Capsule Staining (Maneval's Method)
  - (c) Volutin granule Staining (Albert's Method)
6. Preparation of Culture Media  
Saline, Peptone Water, Nutrient Broth, Nutrient agar, MacConkey's agar, Starch  
Agar, Milk agar, Sabouraud's agar
7. Demonstration of Inoculation techniques
  - (a) Broth Inoculation
  - (b) Butt Inoculation
  - (c) Slant Inoculation
  - (d) Plate Inoculation
    - (I) Streak Plate: - Spot, Zigzag and Four Quadrant Method
    - (II) Spread Plate
    - (III) Pour Plate
8. Isolation, Colony Characters, Gram Staining and Motility of
  - (a) *Bacillus Spp.*
  - (b) *Escherichia coli*
  - (c) *Staphylococcus aureus*
9. Enumeration of Microorganisms from air by solid impaction method
10. Cultivation and Mounting of Fungi
  - (a) *Aspergillus*
  - (b) *Rhizopus*
  - (c) *Penicillium*
  - (d) *Mucor*

11. Study of biochemical and enzymatic activity of microorganisms by
  - (a) IMViC Test.
  - (b) H<sub>2</sub>S.
  - (c) Glucose fermentation.
  - (d) Amylase activity
  - (e) Caseinase activity
  - (f) MBRT Test
12. Observation Microorganisms from human Skin and root nodules by Monochrome staining.

**Solapur University, Solapur**  
Nature of Question Paper For Semester Pattern  
• Faculty of Science  
(w.e.f. June 2010)  
Time :- 2 hrs. Total Marks-50

**Q. No.1) Multiple choice questions.** (10)

- 1) -----  
a)        b)        c)        d)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)
- 10)

**Q.No.2) Answer any Five of the following** (10)

- i)
- ii)
- iii)
- iv)
- v)
- vi)

**Q.No.3) A) Answer any Two of the following** (06)

- i)
- ii)
- iii)

**B) Write the Answer/Solve/Problem/Note** (04)

**Q.No.4) Answer any Two of the following** (10)

- i)
- ii)
- iii)

**Q.No.5) Answer any Two of the following** (10)

- i)
- ii)
- iii)

**B.Sc.Part I Microbiology**

**Practical Question Paper**

	Marks
Q.1 Staining Cell wall/ Capsule/ Volutin granules Or Observation of Microorganisms from Skin/Root Nodules	10
Q.2) Isolation, Colony Characters, Gram Staining and Motility of <i>Bacillus spp/E.coli/S.aureus</i>	15
Q.3) Biochemical Test/ Enzymatic activity Indol/ Methyl Red/ Voges proskauer/ Citrate Utilization/ H <sub>2</sub> S/ Amylase/ Caseinase/ Glucose fermentation/MBRT	05
Q.4) Demonstration of Principle, Working and Applications of Centrifuge/Incubator/ Hot air oven/Autoclave/Seitz Filter	05
Q.5) Spotting (A) Identify and give its Use (Microscope Part) (B) Identify and give Significance of Mounted Fungus (C) In which Staining Method it is used and give its significance (Stain) (D) In which Medium it is used and give its significance (Media Component) (E) In which Test it is used and give its significance (Indicator/Reagent)	10
Q.6) Journal	05

**1. Structure of the courses:-**

- A) Each paper of every subject for Arts, Social Sciences & Commerce Faculty shall be of 50 marks as resolved by the respective faculties and Academic Council.
- B) For Science Faculty subjects each paper shall be of 50 marks and practical for every Subject shall be of 50 Marks as resolved in the faculty and Academic Council.
- C) For B. Pharmacy also the paper shall be of 50 marks for University examination. Internal marks will be given in the form of grades.
- D) For courses which were in semester pattern will have their original distribution already of marks for each paper.
- E) For the faculties of Education, Law, Engineering the course structure shall be as per the resolutions of the respective faculties and Academic Council.

**2. Nature of question paper:**

- A) Nature of questions.
  - “20% Marks - objectives question” (One mark each and multiple choice questions)
  - “40% Marks - Short notes / Short answer type questions / Short Mathematical type questions/ Problems. (2 to 5 Marks each)
  - “40% Marks - Descriptive type questions / Long Mathematical type questions / Problems. (6 to 10 Marks each)
- B) Objective type question will be of multiple choice (MCQ) with four alternatives. This answer book will be collected in first 15 minutes for 10 marks and in first 30 minutes for 20 marks. Each objective question will carry one mark each.
- C) Questions on any topic may be set in any type of question. All questions should be set in such a way that there should be permutation and combination of questions on all topics from the syllabus. As far as possible it should cover entire syllabus.
- D) There will be only five questions in the question paper. All questions will be compulsory. There will be internal option (30%) and not overall option. for questions 2 to 5.

**3.** Practical Examination for B. Sc. I. will be conducted at the end of second semester.

**4.** Examination fees for semester Examination will be decided in the Board of Examinations.

The structures of all courses in all Faculties were approved and placed before the Academic Council. After considered deliberations and discussion it was decided not to convene a meeting of the Academic Council for the same matter as there is no deviation from any decision taken by Faculties and Academic Council. Nature of Question Paper approved by Hon. Vice Chancellor on behalf of the Academic Council.