

Solapur University, Solapur

B.Sc. I Microbiology

(Semester Pattern)

Syllabus- 2010-2011

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

UNIT –I (History and Scope of Microbiology)

A) History – Major Contributions of

- | | |
|-----------------------------|-------------------|
| 1) Antony Van Leeuwenhoek. | 2) Louis Pasture. |
| 2) Robert Koch | 4) A. Fleming. |
| 5) Robert Hook | 6) J.Tyndall. |
| 7) J.D.Watson & F.H.C.Crick | 8) J.Liester |
| 9) D.Ivanowsky | 10) 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.
3. Introduction to Applied branches in Microbiology.
 - Environmental, (Air, Sewage, Water, Soil)
 - Food, Dairy, Medical, Industrial, Biotechnology, Geomicrobiology, Gnotobiology.

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

A)Bacterial Taxonomy:-

1. General principles of Bacterial nomenclature.
2. Criteria of bacterial classification – Morphological & Cultural.

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 materials, Mesosomes, Ribosomes.

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. Actinomycetes.
3. Rickettsia
4. mycoplasma
5. Chlamydia.

SEMISTER 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: - Chances Method
- b) Capsule: - Manvel'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 & γ 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-Propiolactene

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, Pour.

C) i) Anaerobic Culture methods.

- a) Rosenthal b) Gas Pack c) Use of Reducing agents.

D) Maintenance of pure culture Freezing, Lyophilization, Soil stock, Paraffin method.

SEMISTER II

PAPER III

Microbial Physiology

UNIT – I (Basic Biochemistry of Microbes.)

Structure & Functions of Macromolecules.

- a) Carbohydrates.
- b) Proteins.
- c) Nucleic Acids.

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 extract, NaCl, Vitamins, Sugar, Na tartrate, 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, 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 –

Beneficial and harmful associations.

Beneficial – Neutralism, Mutualism, Ammensalism, Symbiosis, Proto.co-operation, Commensalism.

Harmful – Competition, Parasitism, Predation.

B) Association of microorganisms with plant – root nodulation.

Association of microorganisms with animal – ruminant symbiosis.

Association of microorganisms with human – normal flora of human body & their significance.

SEMISTER II

PAPER - IV

Applied Microbiology I

UNIT – I (Air & Soil Microbiology)

A) Air Microbiology

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

B) Soil Microbiology

- i) Soil as an environment
 - Components of soil
 - a) Physical – Gases
 - b) Chemical – H₂O, Organic & Inorganic substances.
 - c) Microbial – Different Microorganisms.

UNIT – II (Water & Sewage Microbiology)

A) Water Microbiology

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

B) Sewage Microbiology

- a) Types & Composition of sewage
- b) Definition of BOD, COD, DO.
- c) Sewage treatment –
 - 1) Physical / Primary
 - 2) Biological / Secondary
 - 3) Chemical / tertiary.

UNIT – III (Food & Milk Microbiology)

A) Food Microbiology

- a) Food as substrate for microorganisms
- b) Microbial spoilage of food – bread, pickles.
- 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) Composition of Milk.
- b) Sources of contamination.
- c) Microbiological examination of milk
DMC, SPC, Dye reduction tests(MBRT)
- d) Pasteurization of milk – i) Definition, methods (LTH, HTST, UHT)
ii) Efficiency of pasteurization (Phosphatase 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 disease – 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 disease –

- 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) Precaution to work in microbiology laboratory.

2) Use & care of Compound microscope.

3) Demonstration of –

- a) Cleaning of Glassware's
- b) Sterilization of glassware's (Hot air oven)
- c) Sterilization of fruit juice (Seitz filter)
- d) Separation of biomass (Centrifugation)
- e) Use of incubator.

4) Preparation & Sterilization of media.

- a) Nutrient broth (Liquid)
- b) Nutrient Stab (Solid)
- c) Preparation of slants & plates of (Solid)
 - Nutrient agar, Milk agar, Sabouraud's agar
 - (Basal) (Enriched) (Selective)
 - MacConkey's agar (Differential & Selective)

5) Evaluating the efficiency of hot air oven & autoclave.

6) Demonstration of various inoculation techniques.

- a) Broth inoculation.
- b) Butt inoculation.
- c) Slant inoculation.
- d) Plate inoculation. – Spot, cross, zigzag, four quadrant, spread, pour.

7) Maintenance of pure culture.

8) Study of cultural characters.

- a) Study of growth pattern of bacteria in liquid media.
 - [Turbidity, Pellicle, Deposit]
- b) Study of colony characters of bacteria
- c) Pigment study.

9) Study of morphology of microorganisms.

- a) Bacteria: - Preparation of suspension, smear, heat fixation.
 - Monochrome Staining.

Negative Staining.

- b) Fungi: - Maintaining in LCB
- c) Actinomycets: - Coverslip culture.
- d) Protozoa: - (from Ponds)
- e) Hanging drop motility test
- f) Special staining:- Cell Wall (chances)

Capsule (Manvals)

Volutin granules (Albert)

10) Preparation of pure culture from mixed culture.

11) Study of physiological character of bacteria.

- a) IMViC
- b) H₂S Production.
- c) Oxidase.
- d) Catalase.
- e) Caesinase.
- d) CHO fermentation

12) Enumeration of bacteria from air –

13) Determination of quality of milk – MBRT.

14) SPC of Soil/ Sewage/ Water/ Milk.



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)

Practical Question Paper

Q.1) Staining.	10
Cell wall/ Capsule/ Volutin granules.	
Q.2) SPC of soil/ water/ sewage/ milk.	10
Q.3) Physiology.	05
Indol/ Methyl Red/ Voges prosker/ Citrate Utilization/ Catalase	
H ₂ S/ Caseinase/ Glucose/ MBRT.	
Q.4) Demonstration .	05
Centrifugation/ Sterilization/ pH adjustment of media/ Colony characters	
From mixed population	
Q.5) Sterility testing/ effectiveness of antiseptics/ obtaining culture/	05
Q.6) Spotting.	10
Q.7) 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.