# Solapur University, Solapur

## B.Sc. II Microbiology (Semester III&IV)

**Syllabus w.e.f. 2014**

# SOLAPUR UNIVERSITY, SOLAPUR
# B.Sc. II Microbiology Syllabus W.E.F. June- 2014

## Semester III

| Paper No | Paper Title | Paper periods | Marks |
|---|---|---|---|
| **Paper V** | **Cytology, Physiology of Bacteria and Virology** | 45 | 50 |
| **Paper-VI** | **Bacterial Genetics** | 45 | 50 |
| | | | 100 |

### Semester IV

| Paper No | Paper Title | Paper periods | Marks |
|---|---|---|---|
| **Paper-VII** | **Immunology & Medical Microbiology** | 45 | 50 |
| **Paper-VIII** | **Applied Microbiology – II** | 45 | 50 |
| | | | 100 |

**Practical course**

| | | | |
|---|---|---|---|
| | Practicals | | 100 |

* Practical examination will be conducted at the end of semester IV.

**Sem III**

**Paper V- Cytology, Physiology of Bacteria and Virology**

**45L**

**Unit I: Ultra structure and Functions (14)**

1. **Bacterial Cell wall**: chemical composition, structure of cell wall of Gram Positive and Gram Negative bacteria
2. **Cell Membrane**: Chemical Composition, structure and functions. Transport across cell membrane – simple diffusion, facilitated diffusion, active transport & group translocation.
3. **Flagella**: Structure, Mechanism of movement, Tactic behaviour
4. **Pili**: Structure and functions
5. **Cytoplasmic inclusions**: Chlorobium vesicles. Gas vacuoles, Magnetosomes and carboxysomes
6. **Reserve Food Materials**: Nitrogenous and Non nitrogenous
7. **Bacterial Endospore**: Ultrastructure, sporulation as an example of cell differentiation, Germination of endospore

**Unit II: Bacterial Growth (6)**

Growth phases, generation time and growth rate, Measurement of growth, Batch culture, Continuous culture, Synchronous culture and Diauxic growth.

**Unit III: Effect of Environmental factors on Bacterial growth (6)**

Temperature, pH, Oxygen, Osmotic pressure, Hydrostatic Pressure, Surface Tension, Heavy metals, UV light & Antibiotics [Penicillin, Streptomycin]

**Unit IV: Enzymes and Metabolism (14)**

1. **Enzymes** -Classification of Enzymes, Mechanism of enzyme action –Lock &Key,
Induced –Fit Hypothesis
2. **Modes of ATP generation**

a. Substrate Level Phosphorylation, Fermentation - Homolactic and Heterolactic.

b. Oxidative Phosphorylation: Respiratory electron transport chain, components of ETC, aerobic and anaerobic respiration.

c. Photophosphorylation: photosynthetic ETC [cyclic &noncyclic]

**Unit V Virology (5)**

1) Structural properties of viruses- T4, TMV, HIV and Hepatitis B
2) Lytic cycle of T4 phage

**Reference Books:**

1] Pawar, C.B. and Daginawala, H.F. (1986). General Microbiology Vol. I & II (2nd Edition), Himalaya Publishing House, Mumbai.
2] Stanier, Roger et.al; General Microbiology
3] Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993) Microbiology. 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi
4] Dubey, R.C; Maheswari, D.K. (2000) General Microbiology S. Chand, New Delhi.

**Semester – III**
**Paper-VI**
**Bacterial Genetics**

**45L**

**Unit – I: Structure & Replication of Bacterial DNA** (**8)**

1. Chemical nature, Structure & forms of bacterial DNA
2. DNA replication: semiconservative mode, rolling circle model

**Unit – II: Gene & Genetic code** **(8)**

1. Gene-Basic concept of Genome, genotype, phenotype, Recon, Muton, Cistron & interrupted genes.
2. Genetic code – Basic concept & properties of genetic code.

**Unit III-Bacterial Mutation** **(12)**

1. Basic concepts
2. Types of mutations-Base pair substitutions [missense, nonsense, silent, neutral] and Frame shift.
3. Spontaneous mutations - Fluctuation Test
4. Induced Mutations – Mechanism of Mutagenesis by 5- Bromouracil, 2-aminopurine, Hydroxylamine, Nitrous acid, Alkylation agents, Acridine dyes and U.V. rays
5. DNA repair – i) Photo reactivation ii) Dark Repair Mechanism

**Unit – IV Bacterial Recombination** **(12)**

1. Fate of Exogenote
2. Transformation and Transfection
3. Conjugation
4. Transduction

**Unit – V Plasmids:** Properties, Types and Applications **(5)**

**REFERENCE BOOKS**


1] Salle: Fundamentals of Bacteriology
2] Stainer, Roger et.al: General Microbiology
3] Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). Microbiology 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi

**Semester – IV**
**Paper-VII**
**Immunology & Medical Microbiology**

**45L**

**Unit I: Immunity** **(12)**

**1. Immunity** – Definition & concept
a. Innate immunity – Definition, Levels of innate immunity
b. Acquired immunity – Active & passive

**2. Defense Mechanism of body**
a. First Line of defense: Physico-chemical Barriers
b. Second Line of defense: Significance of fever, inflammation & role phagocytic cells
c. Third Line of defense: Components of immune system
i] Cells – Types & functions
ii] Organs – primary & secondary & their functions
d. Primary & Secondary immune response

**Unit II: Antigen & Antibody** **(11)**

1. Antigen – Types & factors affecting antigenicity
2. Antibody – Basic structure, types, biological properties and functions of Immunoglobulins.
3. Antigen antibody reactions: general features and mechanism.
4. Types of antigen – antibody reactions: Agglutination test, Precipitation test [ring, tube, immunodiffusion], Flocculation test, Complement fixation test

**Unit III: Clinical Microbiology** **(4)**

1. Basic concept
2.Collection, handling & transportation of specimen
3. Methods of diagnosis of diseases: Microscopic, Cultural, Biochemical & Serological

**Unit IV Pathogenecity** **(8)**

**1.** Definition & Concept
2. Basic principles of Microbial adhesion
3. Mechanism Bacterial invasion
4. Bacterial toxins – Types & mechanism of action

**Unit V – Microbial Diseases** **(10)**

1. Bacterial Infections - Enteric fever, Staphylococcal Wound infections, urinary tract infections (*Proteus species*)
2. Fungal infections: Candidiasis
3. Viral infection: Dengue fever

**Reference Books:**


1. Ananthanarayana, R. and Panicker, C.K.S. (2000). Text Book of Microbiology, 6th Edition, Oriental Longman Publications, USA.
2. Riott, I.M. (1998). Essentials of Immunology, ELBS and Black Well Scientific Publishers, England.
3. Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). Microbiology. 5th Edition, WCB McGrawHill, New York.
4. Dugid,J.p.,Medical microbiology

**Semester – IV**
**Paper VIII**
**Applied Microbiology – II**

**45L**

**Unit I: Industrial Microbiology** **(10)**

1. Definition and scope of Industrial microbiology
2. Fermentations: Basic concept, Types- Surface culture, submerged culture, Batch, Continuous, Dual and Multiple
3. Design of typical Fermentor : Parts & their functions

**Unit II: Industrially important Microorganisms** **(12)**

1. Industrially important microorganisms& their products (List)
2. Screening: Primary and Secondary
3. Strain improvement
4. Preservation of industrially important microorganisms

**Unit III: Microbiological assays** **(7)**

Diffusion, turbidometric, metabolic response, enzymatic assay

**Unit IV: Specific fermentations** **(10)**

1. Penicillin (*P.chrysogenium*)
2. Alcohol (*S.cerevisiae*)
3. SCP (*S. cerevisiae*)
4. Concept of probiotics

**Unit – V Biostatistics** **(6)**

1. Introduction
2. Central Tendency – Mean, Median, Mode
3. Applications of Biostatistics in Biology

**Reference Books:**

1. Patel, A.H. (1984). Industrial Microbiology, Mac Milan India Ltd., Hyderabad.
2. Cassida, L.E. (1968). Industrial Microbiology, Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
3. Robert F. Boyl, General Microbiology
4. Crueger. W., Biotechnology &Industrial Microbiology
5. Prescott & Dunn, Industrial Microbiology
6. Purohit, Microbiology- Fundamentals and Applications, sixth edition

**B.Sc.II Microbiology**
**Practical Course**

1. Micrometry
2. Stains and Staining Procedures
    i. Spore Staining [Dorner's method]
    ii. Flagella Staining [Leifson's Method]
    iii. Nuclear material Staining [Giemsa's method]
    iv. Lipid Staining[Burdon's method]
3. Preparation of culture media
    a. Wilson and Blair's medium
    b. Gelatin Agar
    c. Amino Acid Decarboxylation Medium
    d. Peptone Nitrate Broth
    e. Huge and Leifson's Medium
    f. Amino Acid Deamination medium
    g. Christensen's agar
4. Preparation of Reagents and Solutions
    a.1N NaOH
    b.1N HCl
    c.10%Ferric chloride
    d.Nitrate reduction test reagents
    e.1%Tannic acid
    F.Phosphate buffer solution of pH 7.0
    g.Benedict's reagent
    h.Biuret reagent
5. Biochemical Tests
    a. Gelatin Hydrolysis
    b. Amino Acid Decarboxylation
    c. Amino Acid Deamination
    d. Urea Hydrolysis
    e. Nitrate Reduction
    f. Oxidase
    g. Huge and Leifson's
6. Effect of environmental factors on growth of microorganisms
    a. UV light
    b. Heavy Metals
    c. Salt Concentration (NaCl)
    d. pH
    e. Temperature
    f. Antibiotics [Penicillin & Streptomycin]
7. Primary Screening:
    a. Antibiotic Producers – Crowded Plate Technique
    b. Amylase Producers – Replica Plate Technique
    c. Protease Producers[gelatinase] – Replica Plate Technique

8. Identification of Pathogenic Microorganisms from Clinical Samples
    a. *Salmonella* spp.
    *b.Candida spp.*
    *c. Proteus spp.*
9. Determination of Blood Groups – ABO & Rh
10. Widal test (slide test):Qualitative
11. Glucose Estimation (Benedict's Method).
12. Protein Estimation (Biuret Method).
13. Study of Growth phases of *E.coli* by optical density method.
14. Practical on Biostatistics –Mean, Mode and Median

**Practical Question Paper**

| | |
|---|---|
| Q.1 Identification of Pathogen | 20 |
| Q.2 Staining / Micrometry / Screening | 20 |
| Q.3 Effects/ / Growth Curve [lag phase] | 15 |
| Q.4 Biostatistics/ Glucose /Protein / Widal test/ Blood Groups | 15 |
| Q.5 Spotting | 10 |
| Q.6 Journal | 10 |
| Q.7 Tour Report | 10 |

The practical Examination will be conducted for two (2) successive days for 6 hours each day. There will be one batch of maximum 20 students each day.

**References for Practical course**


1]Cappuccino, J.G. and Sherman, N. (2005). Microbiology – A Laboratory Manual. 7th Edition. Pearson Education. Published by Dorling Kindersley (India) Pvt. Ltd.

2] Mukherjee, K.L. (1996). Medical Laboratory Technology. Vol II. Tata Mc GrawHill Publishing Co. Ltd., New Delhi

3] Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi

4] Naik Sandesh, Handbook of Practical microbiology

6] Frobisher, H., Hinsdil, R.D., Crabtree, K.T. and Goodhert, D.R. (2005) Fundamentals of Microbiology, Saunders and Company, London.

7] K.R.Aneja, Pranay Jain, Raman Aneja (2008). A Textbook of Basic and Applied Microbiology, New Age International Publishers