Solapur University, Solapur

B.Sc. II Microbiology (Semester V and VI)

CREDIT AND GRADING SYSTEM

Syllabus w.e.f. 2015

SOLAPUR UNIVERSITY, SOLAPUR
B.Sc. II Microbiology Syllabus W.E.F. June- 2015

Semester III

Paper No	Paper Title	Paper periods	Marks
Paper III	**Cytology and Physiology of Microorganisms**	45	100
Paper-IV	**Bacterial Genetics**	45	100
			200

Semester IV

Paper No	Paper Title	Paper periods	Marks
Paper-V	**Immunology & Medical Microbiology**	45	100
Paper-VI	**Applied Microbiology – II**	45	100
			200

Practical course

	Practicals		200

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

Semester III

Paper III- Cytology and Physiology of Microorganisms

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 and functions
2. **Cell Membrane**: Chemical Composition, structure and functions. Transport across cell membrane – simple diffusion, facilitated diffusion, active transport & group translocation.
3. **Flagella**: Structure and functions ,Mechanism of movement, Tactic behavior
4. **Pili**: Structure and functions
5. **Cytoplasmic inclusions**: Chlorobium vesicles. Gas vacuoles, Magnetosomes and carboxysomes and their functions
6. **Reserve Food Materials**: Nitrogenous and Non nitrogenous and their role
7. **Bacterial Endospore**: Ultrastructure and functions, 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 and Continuous growth, Synchronous 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 (13)

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 (6)

1) Structural properties of viruses- T4, TMV and HIV
2) Lytic cycle of T4 phage
3) Introduction to lysogeny

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-IV
Bacterial Genetics

45 L

Unit – I: Structure of nucleic acids & Replication of Bacterial DNA (10)

1. Chemical nature, Structure & forms of bacterial DNA
2. DNA replication: semiconservative mode, rolling circle model
3. Structure ,functions and types of RNA

Unit – II: Gene & Genetic code (07)

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, Replica plate technique
4. Induced Mutations – Mechanism of Mutagenesis by 5- Bromouracil, 2-aminopurine, Hydroxylamine, Nitrous acid, Alkylating agents, Acridine dyes and U.V. rays
5. DNA repair – i) Photo reactivation ii) Dark Repair Mechanism

Unit – IV Plasmids: Properties, Types and Applications **(04)**

Unit – V Bacterial Recombination (12)

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

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 – Semester IV

Paper-V
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 **(04)**

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

Unit IV Pathogenecity **(06)**

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

Unit V – Microbial Diseases **(12)**

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 VI

Applied Microbiology – II

45 L

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 **(06)**

Diffusion, turbidometric, metabolic response, enzymatic assay

Unit IV: Specific fermentations **(12)**

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

Unit – V Biostatistics **(05)**

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 [Bailey'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. Hugh and Leifson's Medium
    f. Amino Acid Deamination medium
    g. Christensen's urea agar
4. Preparation of Reagents and Solutions
    a.1N NaOH
    b.1N HCl
    c.10%Ferric chloride
    d.Nitrate reduction test reagents (α naphthylamine & Sulphanilic acid)
    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. Hugh 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. Isolation & 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 for University Practical Examination
Total Marks: 140

Q.1 Identification of Pathogen	25
Q.2 Biochemical Tests	20
Q.3 Staining / Micrometry / Screening	25
Q.4 Effects/ Growth Curve [lag phase]	20
Q.5 Biostatistics/ Glucose /Protein / Widal test/ Blood Groups	10
Q.6 Spotting	20
Q.7 Journal	10
Q.8 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.

Internal Practical examination:
Total Marks: 60
The internal practical examination shall be as per scheme given by Faculty of Science.

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