

SHIVAJI UNIVERSITY, KOLHAPUR.



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**NEW SYLLABUS FOR
B.Sc. Part III
MICROBIOLOGY
SYLLBUS TO BE IMPLEMENTED
FROM JUNE 2015**

Shivaji University, Kolhapur

Revised Syllabus For Bachelor of Science Part - III : Microbiology

1. TITLE : Microbiology

2. YEAR OF IMPLEMENTATION : Revised Syllabus will be implemented from June 2015 onwards.

3. PREAMBLE:

This syllabus is framed to give sound knowledge with understanding of Microbiology to undergraduate students at first year of three years of B.Sc. degree course. Students learn Microbiology as a separate subject from B.Sc. I. The goal of the syllabus is to make the study of Microbiology popular, interesting and encouraging to the students for higher studies including research. The new and updated syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. GENERAL OBJECTIVES OF THE COURSE :

- 1) To make the students knowledgeable with respect to the subject and its practicable applicability.
- 2) To promote understanding of basic and advanced concepts in microbiology.
- 3) To expose the students to various emerging areas of Microbiology.
- 4) To prepare students for further studies, helping in their bright career in the subject.
- 5) To expose the students to different processes used in industries and in research field.
- 6) To develop their ability to apply the knowledge of microbiology in day to day life.
- 7) To prepare the students to accept the challenges in life sciences.
- 8) To develop skills required in various industries, research labs and in the field of human health.

5. DURATION : The course shall be a full time course .

6. PATTERN: Pattern of Examination will be Semester.

7. MEDIUM OF INSTRUCTION : The medium of instruction shall be in English.

8. STRUCTURE OF COURSE -

1) B. Sc. III : Total Number of Papers - 8

Sr.No.	Subjects	Marks
	SEMISTER V	
1.	Paper - IX	40+10
2.	Paper - X	40+10
3.	Paper - XI	40+10
4.	Paper - XII	40+10
	SEMISTER VI	
5.	Paper – XIII	40+10
6.	Paper – XIV	40+10
7.	Paper – XV	40+10
8.	Paper - XVI	40+10
	PRACTICAL	
5.	Practical - I	50
6.	Practical - II	50
7.	Practical - III	50
8.	Practical - IV	50
Total		600

2) Structure and Titles of Papers of B.Sc. III Course :

SEMESTER V

- Paper IX : Virology
 Paper X : Immunology & Serology
 Paper XI : Food and Industrial Microbiology
 Paper XII : Agricultural Microbiology

SEMESTER VI

- Paper XIII : Microbial Genetics
 Paper XIV : Microbial Biochemistry
 Paper XV : Environmental Microbiology
 Paper XVI : Clinical Microbiology

9. SCHEME OF TEACHING AND EXAMINATION:

[The scheme of teaching and examination should be given as applicable to the course/paper concerned.]

Sr. No.	Subject/Paper	Teaching Scheme (Hrs/week)			
		L	T	P	Total
1	Paper – IX and X	3			
2	Paper – XI and XII	3			
3	Paper – XIII and XIV	3			12
4	Paper – XV and XVI	3			
5	Practical I			5	
6	Practical II			5	20
7	Practical III			5	
8	Practical IV			5	
	Total				32

10. SCHEME OF EXAMINATION :

- The examination shall be conducted at the end of each semester of academic year.
- Each theory paper shall carry 40 marks.
- The evaluation of the performance of the students in theory papers shall be on the basis of Semester Examination of 600 marks.
- Question Paper will be set in view of the / in accordance with the entire Syllabus and preferably covering each unit of syllabi.

11. EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAPERS –
(FOR REVISED SYLLABUS)

Sr. NO.	Title of old paper	Title of new paper
1.	Paper V: Virology and Microbial Genetics	-
	Section I: Virology	Paper IX: Virology
	Section II: Microbial Genetics	Paper XIII: Microbial Genetics
2.	Paper VI: : Food, Industrial Microbiology and Microbial Biochemistry	
	Section I: Food and Industrial Microbiology	Paper XI: Food and Industrial Microbiology
	Section II: Microbial Biochemistry	Paper XIV: Microbial Biochemistry
3.	Paper VII: Agricultural Microbiology and Environmental Microbiology	-
	Section I: Agricultural Microbiology	Paper XII: Agricultural Microbiology
	Section II: Environmental Microbiology	Paper XV : : Environmental Microbiology
4.	Paper VIII: Immunology, Serology and Clinical Microbiology	-
	Section I: Immunology and Serology	Paper X: Immunology and Serology
	Section II: Clinical Microbiology	Paper XVI: Clinical Microbiology
5.	Practical - Old	Practical - New.

12. OTHER FEATURES :

- (A) LIBRARY : Reference and Text Books, Journals and Periodicals, Reference Books for Advanced studies. - List Attached
- (B) SPECIFIC EQUIPMENTS : Necessary to run the Course - OHP, Computer, L.C.D., Projector

(C) LABORATORY SAFETY EQUIPMENTS :

- 1) Fire extinguisher
- 2) First aid kit
- 3) Fumigation chamber
- 4) Stabilized power supply
- 5) Insulated wiring for electric supply.
- 6) Good valves, distribution pipes & regulators for gas supply.
- 7) Operational manuals for instruments.
- 8) Emergency exits.

Nature of Question papers (Theory)

COMMON NATURE OF QUESTION FOR THEORY PAPER MENTIONED SPERATELY:

SHIVAJI UNIVERSITY, KOLHAPUR

B .Sc. III (Microbiology)

(Revised Syllabus from June 2015)

THEORY :

PAPER - IX : VIROLOGY

UNIT – I

Lectures - 10

1) The Structural properties of viruses : Capsids, Nucleic acids and envelope.

Structure of T4 bacteriophage, TMV and HIV, Viroids and prions.

2) Reproduction of Bacteriophages :

a) One step growth experiment.

b) Reproduction of T4 phage.

UNIT – II

Lectures - 10

1) Isolation, cultivation and Purification of viruses

a. Isolation and cultivation of viruses -

i) Animal virus - Tissue culture, chick embryo and live animals.

ii) Plant virus – Protoplasts, Insect tissue culture

iii) Bacteriophages - Plaque method.

b. Purification of viruses using physico-chemical properties

i) Density gradient centrifugation

ii) Precipitation

2) Methods of Enumeration of viruses

i) Latex droplet method (Direct microscopic count)

ii) Plaque and pock method.

UNIT – III

Lectures - 10

1) Lysogeny - Definition of lysogeny and temperate phage, types, lysogeny by lambda

phage - adsorption & penetration, genetic map for lysogenic interaction, expression

of λ genes, establishment of repression, maintenance of repression, integration of λ genome in host chromosome.

2) Reproduction of animal viruses - Adenovirus.

3) Reproduction of plant viruses - TMV

UNIT – IV

Lectures - 10

Oncogenesis :

- a) Definition of oncogenesis
- b) Types of cancer
- c) Characteristics of cancer cells.
- d) Hypothesis about cancer.
 - i) Somatic mutation hypothesis
 - ii) Viral gene hypothesis
 - a) Role of DNA viruses with special emphasis on Papova viruses.
 - b) Role of RNA tumor viruses, Provirus theory, Protovirus theory, Oncogene theory.
 - iii) Defective immunity hypothesis.

Books Recommended :

1. General Microbiology - Stanier
2. Microbiology - Prescott, Klein
3. Microbiology - Davis
4. General Virology - Luria
5. Genetics of Bacteria and their Viruses - William Hayes.
6. General Microbiology Vol. II - Powar and Dagainawala
7. Virology - Biswas and Biswas
8. Virology Vol. 4- Topley and Wilson
9. Principals of virology- S.J. Flint
10. Bacterial and Phage Genetics - Birge

PAPER - X : IMMUNOLOGY AND SEROLOGY

UNIT – I

Lectures - 10

- 1) Membrane receptors for antigen and their role in antigen recognition
 - a. B cell surface receptor for antigen (BCR)
 - b. T cell surface receptor for antigen (TCR)
 - c. NK receptors.
- 2) Immune response
 - A) Molecular mechanism of antibody production.
 - a. Processing and presentation of antigen by Antigen presenting cell.
 - b. Triggering of B cell

c. Clonal proliferation.

d. Differentiation and maturation into antibody forming plasma cell.

B) Cell mediated immune response : Cells involved and their role - T_H, T_c , NK, Killer and Macrophages

UNIT – II

Lectures - 10

1) Cytokines

a. Interleukins as intracellular messengers.

b. Cytokines produced by different T_H cells and Macrophages.

c. Effects of cytokines

2) Immunological tolerance : Tolerance induction in adults and neonates by drug and monoclonal antibody, cellular mechanism of immunological tolerance. Termination of tolerance.

3) Stem cells – Introduction , types and applications

4) Interferon -Nature and types , Induction of Interferon , Mechanism of action.

UNIT – III

Lectures - 10

1) Complement -Nature, Properties, Complement activation by classical and alternate pathway.

Biological consequences of complement activation.

2) Monoclonal antibodies :

a) Basic concepts - Mouse, Human and Humanized antibodies.

b) Production of monoclonal antibodies by hybridoma technology.

c) Production of Humanized Monoclonal antibodies by recombinant DNA technology.

d) Applications of monoclonal antibodies in diagnosis, treatment and research.

3) New diagnostic techniques : a) RIA , b) Dot Blot Technique

UNIT – IV

Lectures - 10

1) Hypersensitivity - Basic concept , Gell and Coombs classification

i) Type I - Anaphylaxis

ii) Type II - Blood transfusion reactions

iii) Type III - Serum sickness.

iv) Type IV- Delayed type hypersensitivity - Allograft rejection.

2) Autoimmune disease : Types, Immunopathological mechanisms - Rheumatoid arthritis, Treatment of autoimmune diseases.

Books Recommended :

1) Immunology - 6th edition - Kubay ,Kindt, Goldsby & Osborne.

2) Essential Immunology - 11th edition - Delves, Martin, Burton and Roitt.

3) Immunology - An Introduction, 4th edition – Tizzard.

4) Basic and Clinical Immunology 5th edition- Stites, Stobo, H. H. Fudenberg.

5) Essentials of Immunology - S. K. Gupta

6) Immunology – M. P. Arora

PAPER XI : FOOD AND INDUSTRIAL MICROBIOLOGY

UNIT – I

Lectures - 10

Food Microbiology

- a) Food as a substrate for microorganisms.
- b) Food poisoning - I) Role of microorganisms in food poisoning
II) Food poisoning - i) Staphylococcal
ii) Fungal (aflatoxin)
- c) Food infections – Salmonellosis.
- d) Probiotics – Concept, production and applications.

UNIT – II

Lectures - 10

Industrial Microbiology

- A) Preservation of industrially important microorganisms - Methods, Culture collection centers.
- B) Industrial production of -
 1. Alcohol - Organisms used, Inoculum preparation, Fermentation media, Fermentation conditions, Extraction and Recovery.
 2. Grape wine - Definition, types, production of table wine (Red and White), microbial defects of wine
 3. Penicillin - Organisms used, Inoculum preparation, Fermentation media, Fermentation conditions, Extraction and Recovery. Concept of semi synthetic penicillin

UNIT – III

Lectures - 10

- A) 1. Strain Improvement
2. Scale up of fermentations
- B) Microbial Production of - 1) Vitamins - Vit. B₁₂
2) Amino acids - Lysine
- C) Microbiological assays

UNIT – IV

Lectures - 10

- 1) Down stream processing & product recovery -
Centrifugation, flocculation, filtration, solvent extraction, distillation, precipitation, crystallization, and chromatography.
- 2) Testing of sterility, pyrogen, carcinogenicity, toxicity and allergens
- 3) Biomethanation - Microbiology and Biochemistry of biomethanation, use of different feed materials, biogas production. Basic models- floating and fixed dome.

Books Recommended:

1. Principles of fermentation technology- Peter F. Stanbury & Allan Whitaker
(Pergamon Press).
2. Principles of Microbial technology - Pepler, Vol. I & II.

3. Industrial Microbiology - Casida
4. Industrial Microbiology - A. H. Patel
5. Industrial Microbiology - Prescott & Dnn
6. Industrial Microbiology - Miller
7. Pharmaceutical Microbiology - Huggo & Russel
8. Modern food Microbiology - Jay & Jay
9. Food Microbiology - Frazier
10. Industrial Microbiology- Cruger.
11. Fermentation Technology- A.H.Modi - Vol. I and II

PAPER XII : AGRICULTURAL MICROBIOLOGY

UNIT – I

Lectures - 10

- 1) Soil Microbiology.
 - a. Physical characters.
 - b. Chemical characters.
 - c. Types of microorganisms in soil and their role in soil fertility.
 - d. Microbiological interactions - Symbiosis, Commensalism, Amensalism, Parasitism, Predation.
- 2) Role of microorganisms in elemental cycle
 - a. Carbon cycle.
 - b. Nitrogen cycle
 - c. Phosphorous cycle

UNIT – II

Lectures - 10

- 1) Role of Microorganisms in reclamation of soil.
 - A) Manure and Compost
 - I) Methods of Production -
 - a) Green manure and farm yard manure
 - b) City compost- Windrow and pit method.
 - c) Vermicompost
 - II) Optimal conditions for composting with reference to - Composition of organic waste, Availability of microorganisms, Aeration, C:N:P ratio, Moisture content, Temperature, pH, Time.
 - III) Standards of City Compost and Vermicompost as per Fertilizer Control Order.

UNIT – III

Lectures - 10

Types, production, methods of application and uses of -

1) Biofertilizers

- i) Nitrogen fixing - Azotobacter, Rhizobium, and Azospirillum.
- ii) Phosphate Solubilizing Microorganisms.

2) Biopesticides

- a) *Bacillus thuringiensis*
- b) *Trichoderma spp.*

UNIT - IV

Lectures - 10

1) Biodegradation of -

- a) Cellulose
- b) Pesticides

2) Plant Pathology

- a) Common symptoms produced by plant pathogens
- b) Modes of transmission of plant diseases.
- c) Plant diseases -
 - i) Citrus Canker
 - ii) Tikka disease of groundnut
 - iii) Bacterial Blight of Pomegranate.

Books Recommended:

1. Soil Microbiology - An exploratory approach - Mark Coyne.
2. Agricultural Microbiology - N. Mukherjee and J. Ghosh.
3. Introduction to Soil Microbiology - Martin Alexander IInd Edition.
4. Agricultural Microbiology - Rangaswamy and Bhagyaraj IInd Edition
5. Plant diseases - R. S. Singh.
6. Plant pathology - R. S. Mehrotra.
7. Diseases of crop plants in India - G. Rangaswamy.
8. Principles of Soil Science - M. M. Rai.
9. Soils and Soils Fertility- 6th edition-Frederick R. Troeh (Blackwell publishing Co.)
10. Soil Microbiology- Singh, Purohit, Parihar. (Agrobios India , 2010)
11. Soil Microbiology and Biochemistry – Ghulam Hassan Dar (New India Publishing Agency, 2010)

PAPER XIII : MICROBIAL GENETICS

UNIT – I

Lectures - 10

- 1) Basic concepts of bacterial genome -
 - a) Structural organization of *E. coli* chromosome - Folded Fiber model.
 - b) One cistron - one polypeptide hypothesis.
 - c) Molecular mechanism of gene expression
 - i) Concept of operon
 - ii) Pribnow box
 - iii) Genetic regulation in tryptophan operon

UNIT – II

Lectures - 10

- 1) Mutations -
 - A) Expression of mutations -
 - a) Time course of phenotypic expression.
 - b) Conditional expression of mutation.
 - B) Suppressor mutations (with examples) - Genetic and non-genetic.
- 2) Methods of isolation and detection of mutants based on -
 - a) Relative survival
 - b) Relative growth
 - c) Visual detection

UNIT – III

Lectures - 10

- 1) Genetic complementation - Cis-trans test
- 2) Extrachromosomal inheritance :
 - a) Kappa particles.
 - b) Transposable elements - general properties and types.
- 3) Techniques in Molecular Biology - DNA sequencing (Sanger's method) , DNA Finger printing , PCR

UNIT – IV

Lectures - 10

- 1) Genetic engineering
 - a) Introduction
 - b) Tools of genetic engineering - Enzymes, Vectors-phage, plasmid and cosmid, DNA probe, linkers and adaptors, Cloning organisms - (Bacteria and Yeasts)
 - c) Techniques -
 - i) Isolation of desired DNA segment.
 - ii) Construction of r-DNA using appropriate vector.
 - iii) Transfer to cloning organisms.
 - iv) Selection of recombinant bacteria and yeasts - Colony hybridization technique.

- d) Application of genetic engineering in - Medicine, Agriculture, Industry, and Environment.

Books Recommended:

1. Genetics - Stickberger.
2. Genes - Benjamin Lewin IX ed.
3. Principles of gene manipulation - Primrose and Old
4. Genetic Engineering - Second Ed. Desmond S. T. Nicholl
5. Recombinant DNA - J. D. Watson
6. Biochemistry - Lehninger
7. Molecular Biology of Gene - J. D. Watson
8. Principles of Genetics - Herskowitz
9. General Microbiology - Stanier

PAPER XIV - MICROBIAL BIOCHEMISTRY

UNIT – I

Lectures - 10

1) Enzymes -

- a) Definition, properties, structure, specificity, mechanism of action (Lock & Key, Induced fit hypothesis)
- b) Allosteric enzymes - Definition, properties, models explaining mechanism of action.
- c) Ribozymes and Isozymes.
- d) Factors affecting catalytic efficiency of enzymes
 - i) Proximity and orientation
 - ii) Strain and distortion.
 - iii) Acid base catalysis
 - iv) Covalent catalysis
- e) Enzyme kinetics - Derivation of Michaelis-Menten equation, Lineweaver Burk Plot, Significance of K_m and V_{max} .
- f) Regulation of enzyme synthesis.
 - i) Positive control - Ara operon
 - ii) Negative control - Lac operon
 - iii) Catabolite repression

UNIT – II

Lectures - 10

1) Extraction & purification of enzymes.

- I) Methods of extraction of intracellular and extracellular enzymes.
 - i) Choice of source and biomass development

ii) Methods of homogenization - cell disruption methods

iii) Purification of enzymes on the basis of -

- a) Molecular size
- b) Solubility differences
- c) Electrical charge
- d) Adsorption characteristic differences
- e) Differences in biological activity

2) Assay of enzymes - Based on substrate and product estimation.

3) Immobilization of enzymes - Methods & applications

UNIT – III

Lectures - 10

1) Basic concepts of -

- a) Glyoxylate bypass
- b) PP pathway, ED pathway, Phosphoketolase pathway
- c) Pyruvate as a key intermediate
- d) Bioluminescence – Occurrence, mechanism & applications.

2) Assimilation of -

- a) Carbon
- b) Nitrogen with respect to N_2 and NH_3 (GOGAT)
- c) Sulphur

UNIT – IV

Lectures - 10

1) Biosynthesis of -

- a) RNA
- b) DNA
- c) Proteins
- d) Peptidoglycan

Books Recommended:

1. Enzymology - Prise & Stevens
2. Enzymes - Biochemistry, Biotechnology, clinical chemistry - Trevor Palmer.
3. Enzymes - Dixon and Webb
4. Nature of Enzymology - R. L. Foster,
5. Lehnigers Principles of Biochemistry by David Nelson & Michale Cox, Fifth edition.
6. General Microbiology - Stanier
7. Principles & techniques of Biochemistry - Wilson & Walker, 6th edition.
8. Biochemistry - Lubert Stryer

PAPER XV: ENVIRONMENTAL MICROBIOLOGY

UNIT – I

Lectures - 10

1. General characteristics of waste-
 - a. Liquid waste - pH, electrical conductivity, COD, BOD, total solids, total dissolved solids, total suspended solids, total volatile solids, chlorides, sulphates, oil & grease.
 - b. Solid waste- pH, electrical conductivity, total volatile solids, ash.
 - c. Standards as per MPCB.
2. Biological safety in laboratory and pharmaceutical industries
3. Eutrophication -
 - a. Classification of lakes
 - b. Sources
 - c. Consequences
 - d. Control
4. Environmental Impact Assessment- Concept.

UNIT – II

Lectures - 10

- 1) Sewage Microbiology
 - a) Physico-chemical and Biological characteristics
 - b) Microflora
 - c) Treatment
 - i) Biological treatment: Trickling filter, Activated sludge process, Oxidation ponds, Anaerobic digestion, Septic tank, Root zone technology
 - ii) Chemical treatment - Chlorination
 - d) Disposal criteria – Recycling, agricultural process.

UNIT – III

Lectures - 10

- 1) Environmental monitoring-
 - A) Cleanroom classification
 - B) Routine EM programme in pharmaceutical industries
 - C) Microbial Control in Cleanrooms
 - D) Bioburden considerations in equipments- biocontamination control.
- 2) Bioremediation - Approaches, types and applications.
- 3) Environmental Impact assessment - Brief introduction.

1) Characteristics and treatment of waste generated by-

- a) Sugar Industry.
- b) Distillery
- c) Dairy Industry
- d) Hospital

2) Bioleaching

- a) Introduction
- b) Microorganisms involved
- c) Chemistry of Microbial leaching
- d) Laboratory scale and pilot scale leaching
- e) In situ leaching - Slope, heap
- f) Leaching of Copper and Uranium

Books Recommended:

1. Environmental Pollution by Chemicals - Walker, Hulchiason.
2. Biochemistry and Microbiology of Pollution - Higgins and Burns.
3. Environmental Pollution - Laurent Hodge, Holt.
4. Waste Water Treatment - Datta and Rao (Oxford and IBH)
5. Sewage and waste treatment - Hammer
6. Pollution - Kudesia, Pragati Prakashan Meerat.
7. Environment Chemical Hazards - Ram Kumar (Swarup and Sons, New Delhi).
8. Environment and Metal Pollution - Khan (ABD Pub. Jaipur).
9. Environment Pollution - Timmy Katyal (Satke Anmol Pub. New Delhi).
10. Ecology of Polluted Water - Vol. II - Anand Kumar (Aph Pub. Co. New Delhi).
11. Environment Pollution and Management of waste waters by Microbial Techniques - Pathade and Goel (ABD Pub. Jaipur).
12. Current Topics in Environmental Sciences - Tripathi and Pandey (ABD Pub. Jaipur).
13. Environmental Impact Assessment - R. K. Trivedy
14. Microbial Limit and Bioburden Tests, 2nd edition - Lucia Clontz (CRC Press)

PAPER XVI : CLINICAL MICROBIOLOGY

UNIT - I

Lectures - 10

- 1) Morphology, cultural and biochemical characteristics, antigenic structure, modes of transmission and pathogenesis, symptoms, laboratory diagnosis, prevention and control of diseases caused by –
i) *Mycobacterium leprae* , ii) *Clostridium perfringens*, iii) *Treponema pallidum*

UNIT – II

Lectures - 10,

- 1) Morphology, cultural and biochemical characteristics, antigenic structure, modes of transmission and pathogenesis, symptoms, laboratory diagnosis, prevention and control of diseases caused by -
i) *Pseudomonas aeruginosa* , ii) *Vibrio cholera*, iii) *Streptococcus pneumoniae* , iv) *Klebsiella pneumoniae*

UNIT – III

Lectures - 10

- 1) Morphology, cultural and biochemical characteristics, antigenic structure, modes of transmission and pathogenesis, symptoms, laboratory diagnosis, prevention and control of diseases caused by -
1) Protozoa : *Plasmodium falciparum* (malaria)
2) Viruses : i) Hepatitis A & B virus , ii) Rabies virus
3) Fungi : *Candida albicans*

UNIT – IV

Lectures - 10

- 1) Chemotherapy
a) General principles of chemotherapy
b) Mode of action of Penicillin, Streptomycin, Tetracycline and Quinolones on microorganisms.
c) Antiviral drug : AZT
d) Antifungal drugs : Ketoconazole.
e) Mechanism of drug resistance
f) Chemoprophylaxis
- 2) Gene therapy – Concept, advantages & disadvantages.
- 3) Immunoprophylaxis – Vaccines and Immune Sera
a) Vaccines - live attenuated , inactive , subunit, conjugate and DNA vaccines
b) Immune Sera – examples with applications

Books Recommended:

- 1) Microbiology - Davis
- 2) Immunology & serology - Ashim Chakravarty
- 3) Medical Microbiology 16th edition by David Greenwood, Richard C B Slack, John Peutherer
- 4) Medical Bacteriology - Dey & Dey
- 5) Medical Bacteriology including Medical Mycology & AIDS - NC Dey & T. K. Dey
- 6) Principals and Practice of Clinical Bacteriology – A.M. Emmerson

PRACTICAL COURSE

Practical - I (Virology and Microbial Genetics)

Major :

1. Isolation of coliphages from sewage.
2. Effect of U.V. light on bacteria and graphical presentation of result.
3. Isolation of auxotrophic mutants by replica plate technique
4. Transfer of genetic material by transformation in *E.coli*
5. Isolation of chromosomal DNA from bacteria (J. Marmurs method)

Minor :

1. Electrophoretic separation of DNA.
2. Isolation of streptomycin - resistant mutants (gradient plate technique)
3. Testing of carcinogenicity of a substance by Ame's test.

Practical - II (Food and Industrial Microbiology)

Major :

1. Assay of amylase by DNSA method (graphical estimation)
2. Bio-assay of Vitamin B12
3. Bio-assay of Penicillin.
4. Microbial testing of Water :
 - a. Presumptive, confirmed and completed test.
 - b. MPN
 - b) SPC of tomato sauce.

Minor:

1. Production of wine and examination for pH, colour and alcohol content.
2. Citric acid fermentation, recovery and estimation by titration.
3. Amylase production by using *Bacillus* species.
4. Isolation of lactic acid bacteria from fermented food.
5. Examination of milk by Direct microscopic count (DMC)

Practical - III (Agricultural and Environmental Microbiology)

Major :

1. Isolation of Azotobacter from soil.
2. Isolation of Xanthomonas from infected citrus fruit.
3. Isolation of Rhizobium from root nodules.
4. Isolation of phosphate solubilising bacteria from soil.
5. Determination of BOD of sewage

Minor :

1. Determination of Nitrogen fixation activity of microorganism.
2. Estimation of Calcium and Magnesium from soil (EDTA method)
3. Determination of organic carbon content of soil (Walkley and Black method)
4. Determination of COD of sewage.

Practical - IV (Immunology and Clinical Microbiology)**Major :**

1. Isolation of following pathogens from clinical samples (wherever possible) and identification of the same by morphological, cultural and biochemical characteristics.
a) *Pseudomonas aeruginosa* b) *Klebsiella pneumoniae* c) *Candida albicans*
2. Determination of MIC of streptomycin against *E.coli* by broth method

Minor :

1. Determination of sensitivity of common pathogens to antibiotics by paper disc method.
2. Serological tests :
 - a) Widal test - Quantitative
 - b) Demonstration of Enzyme Linked Immunosorbent Assay (ELISA)
3. Haematology :
 - a) Estimation of haemoglobin by Sahli's method.
 - b) Determination of ESR of the blood sample (Westergren method)
 - c) Total and differential blood cells count.
4. Urine analysis
 - a) Microscopic examination of urine-crystals, RBCs, pus cells and bacteria.
 - b) Physical and chemical examination of urine.
 - c) Test for protein (Acetic acid test)
 - d) Test for ketone bodies (Rothra's test)
 - e) Test for bile salt and bile pigment.

Books recommended for Practical :

1. Medical Lab Technology - Ramnik and Sood, Jaypee brothers (Medical pub. New Delhi)
2. Practical Biochemistry - Plummer
3. APHA (American Public Health Association) Handbook
4. Soil, Plant and Water Analysis - P. C. Jaiswal
5. Biochemical methods - S. Sadasivam, A. Manickam
6. Practical Biochemistry - J. Jayraman
7. Chemical and Biological Analysis of Water - Dr. R. K. Trivedy and P. K. Goel.

Practical Examination

A) The practical examination will be conducted on three (3) consecutive days for not less than 6 hours on each day of the practical examination.

B) Each candidate must produce a certificate from the Head of the Department in his/her college stating that he/she has completed in a satisfactory manner the practical course on the guidelines laid down from time to time by Academic Council on the recommendation of Board of studies and has been recorded his/her observations in the laboratory journal and written a report on each exercise performed. Every journal is to be checked and signed periodically by a member teaching staff and certified by the Head of the Department at the end of staff and certified by the Head of the Department at the end of the year. Candidates are to produce their journal at the time of practical examination. Candidates have to visit the least Two (2) places of Microbiological interest (Pharmaceutical industry, Dairy, Research institutes etc.) and submit the report of their visit at the time of examination. The report should be duly certified by the Head of the Department.

List of the minimum equipments and related requirements for B. Sc. III

- | | |
|---|------------------------|
| 1) Replica plating units of genetics experiments | : Two |
| 2) Rotary shaker for fermentation experiments | : One |
| 3) Centrifuge (High Speed) | : One |
| 4) Hot plate | : One |
| 5) Hot air oven | : One |
| 6) Bacteriological Incubator | : One |
| 7) Spectrophotometer | : One |
| 8) Research Microscope | : One for each student |
| 9) Haemocytometer | : Two |
| 10) Hamoglobinometer | : Two |
| 11) ESR stands and tubes | : Two |
| 12) Separate room for fine instruments of size 10'x15' feet dimension | |
| 13) A separate culture room of at least 10' x 10' feet dimension | |
| 14) Electrophoresis assembly | : Two |
| 15) Laminar air flow cabinet | : one |
| 16) Distillation assembly | : One (Glass) |
| 17) Reflux assembly | : Four |
| 18) Serological Water bath | : One |
| 19) Colony counter | : One |
| 20) Refrigerator | : One |

Nature of question paper and distribution of marks for B.Sc. Part III Microbiology Practical Examination

Practicals I, II, III & IV

Q.1 Major Experiment	20 Marks
Q. 2 Minor Experiment	15 Marks
Q.3 Journal	05 Marks

SPOTTING **10 Marks**

VIVA-VOCE

(On practicals not attempted in the examination) 10 Marks

TOUR REPORT: 20 MARKS
