

Solapur University, Solapur

**B.Sc.-III Microbiology
Syllabus 2009- 2010**

SOLAPUR UNIVERSITY, SOLAPUR

B.Sc.III MICROBIOLOGY SYLLABUS

(Paper -V)

Microbial Taxonomy and Genetics

Section I: Microbial Taxonomy and Bioinformatics

- | | | |
|-----------------|---|------|
| Unit I | Bacterial nomenclature and classification | (08) |
| | <ul style="list-style-type: none"> A) Comparative study of Bacteria, Archaea and Eucarya. . B) Classification of prokaryotic organisms – an overview, Introduction to Bergey’s manual C) Principles of bacterial nomenclature. D) Microbial taxonomy Classical and Genetic approaches: <ul style="list-style-type: none"> i) Classical approach:-Morphological, Physiological, metabolic, Ecological and Serological. ii) Genetic approach :-(G+C) content and rRNA sequencing in identification of microorganisms. | |
| Unit II | Classification of viruses | (6) |
| | <ul style="list-style-type: none"> A) Viral classification, LHT system and as per international committee B) Isolation, cultivation, purification and enumeration of viruses | |
| Unit III | Reproduction of bacteriophages | (8) |
| | <ul style="list-style-type: none"> A) One step growth experiment B) Reproduction of ds DNA/ ss DNA / RNA bacteriophages C) Temperate phages and lysogeny of λ phages | |
| Unit IV | Types of extremophiles, General characteristics of and their role in respective extreme environment. | (8) |
| | <p>Acidophiles, Alkalophiles, Thermophiles, Hyperthermophiles, Psychrophiles, Barophiles, Osmophiles, Piezophile, Polyextremophile, Xerophile.</p> | |
| Unit V | Bioinformatics | (10) |
| | <ul style="list-style-type: none"> A) Introduction to Bioinformatics. Use of bioinformatics in major research areas. B) Major Bioinformatics Resources on Internet: National Centre for Biotechnology Information (NCBI). <ul style="list-style-type: none"> i. The knowledge of various databases and bioinformatics tools available at NCBI resource ii. The major content of the NCBI databases. iii. Purpose and applications in life sciences. C) Protein data bank (PDB) and Nucleic acid sequence database (GenBank) D) The Basic Local Alignment Search Tool (BLAST), Nucleotide-nucleotide BLAST (blastn), Protein-protein BLAST (blastp), Specialized BLAST and FASTA | |

Section II: Microbial Genetics

- Unit I Basic concepts of microbial genetics (8)**
- A) Structural organisation of *Escherichia coli* chromosome, folded fibre model
 - B) Replication of DNA: DNA polymerase enzymes, mechanisms of replication and models – rolling circle and theta model
 - C) Transcription, RNA polymerase enzyme, process and post transcriptional modification.
 - D) Operon concept – Lac Operon, Nif gene regulation
- Unit II Bacterial mutations (12)**
- A) Effect of mutation on translation
 - B) Effect of mutation on phenotypes
 - C) Time course of phenotypic expression
 - D) Selection, detection & adaptation of mutants
 - E) Population dynamics: Basic concept
- Unit III Genetic complementation (4)**
- A) Mutation in bacteriophages.
 - B) Cis-trans test
- Unit IV Genetic engineering and Protein engineering (8)**
- A) Introduction, tools and techniques of genetic engineering
 - B) Application of genetic engineering
 - C) Protein engineering – concept and application
- Unit V Techniques in molecular biology (8)**
- A) Electrophoresis of DNA and protein
 - B) DNA sequencing – Maxam and Gilbert's method, Sanger's method
 - C) DNA finger printing – methods and applications

(Paper VI)**Industrial Microbiology and Microbial Biochemistry****Section I: Industrial Microbiology**

- Unit I Food and diary Microbiology (06)**
- A) Food as a substrate for microorganisms
 - B) Food Fermentations – i) Idli ii) Bread
 - C) Fermented dairy products: i) Cheese ii) curd iii) Butter iv) Kefir and v)Yogurt
- Unit II Industrial Microbiology (08)**
- Industrial production of alcoholic beverages
- A) Grape wine – Definition, types, production of dry white table wine, Red table wine, Sparkling wines - champagne, California sherry,

Microbial and non microbial spoilage of wines, Defects in wine.

B) Beer – Definition, types, production of Lager beer and Ales Beer.

Unit III Industrial production of - (10)

- A) Streptomycin
- B) Lysine
- C) Biopolymers:Glucans and Dextrans
- D) Immunoactive products – toxoids, sera, vaccines
- E) rDNA products – Insulin, Interferon

Unit IV Quality control in fermentation industry: (10)

- A) Test for sterility, pyrogenicity, allergy, carcinogenicity, toxicity for pharmaceutical and health care and food products
- B) Downstream processing:
filtration, cross flow filtration, flocculation, , whole broth processing
solvent extraction, , concentration, Centrifugation, crystallization,
distillation, adsorption elution, Precipitation and chromatography,

Unit V Recent trends in fermentation Industry (06)

- A) Good manufacturing practices in fermentation industry
- B) Computer applications in fermentation technology
- C) Fermentation economics

Section II – Microbial Biochemistry

Unit I Enzyme kinetics and regulation (10)

- A) Definition, properties, structure, specificity, mechanism of action
(Lock and key model, induced fit hypothesis)
- B) Allosteric enzymes – Definition, models explaining mechanism of action
- C) Ribosymes and Isozymes
- D) Factors affecting catalysis efficiency of enzymes
 - i) Proximity, orientation
 - ii) Strain and distortion
 - iii) Acid base catalysis
 - iv) Covalent catalysis
- E) Enzyme kinetics – Derivation of Michaelis Menten equation,
Significance of K_m and V_{max}
- F) Regulation of enzyme synthesis
 - i) Positive control – Arabinose operon
 - ii) End product repression – Tryptophan operon
 - iii) Catabolite repression

Unit II Extraction, purification and assay of enzymes (06)

- A) Extraction, homogenisation cell disruption and extraction of
membrane bound enzymes
- B) Purification of enzymes on the basis of
 - i) Molecular size

- ii) Solubility differences
 - iii) Electric charge
 - iv) Adsorption characteristic differences.
 - v) Differences in biological activity
 - C) Immobilization of enzymes – method and applications
 - D) Assay of enzymes
- Unit III Assimilation of :** (06)
- i) Carbon
 - ii) Nitrogen – N_2 and NH_3 (GOGAT)
 - iii) Sulphur
- Unit IV Bioenergetics:-Metabolic Pathways** (8)
- A) Glyoxylate bypass
 - B) PP Pathway
 - C) ED pathway
 - D) Phosphoketolase pathway
 - E) Energy utilization in Bioluminescence.
 - F) Pyruvate as key metabolite
- Unit V Biosynthesis of :** (10)
- A) Nucleotides,
 - B) Protein
 - C) Peptidoglycan

(Paper VII)**Agricultural and Environmental Microbiology****Section I: Agricultural Microbiology**

- Unit I Soil Microbiology** (8)
- A) Introduction - Definition, approaches to soil microbiology, current topic in soil microbiology.
 - B) Soil as an ecosystem
 - C) Soil formation, structures and properties.
 - D) Soil microorganisms, types and their role.
 - E) Qualitative and quantitative methods to study soil fertility.
 - F) Microbial interactions – symbiosis, commensalisms, amensalism, parasitism, predation.
- Unit II Role of microorganisms in** (8)
- A) Carbon cycle
 - B) Nitrogen cycle
 - C) Sulphur cycle
 - D) Phosphorous cycle
 - E) Interaction between micro organisms and metals

Unit III Composting : (12)

- A) Compost production with reference to organic waste, availability of microorganisms, aeration, C:N:P ratio, moisture control, temperature, pH and time
- Green manure
 - Farm yard manure
 - Town compost
 - Vermicompost
- B) Biodegradation of Cellulose, Lignin, Pesticides and Hydrocarbons. (4)

Unit IV Plant pathology (8)

- A) Common symptoms produced by plant pathogens.
- B) Modes of transmission Plant diseases – oily spots on pomegranate – *Xanthomonas oxyoposdis*, white smut of sugarcane, soft rot of potato.
- C) Control measures of plant diseases

Unit IV Applications of Biotechnology in Agriculture (4)**Section II: Environmental Microbiology****Unit I Air microbiology** (7)

- A) Microorganisms in air – Launching, transport and deposition of aerosols, survival of microorganisms in air.
- B) Significance of microorganisms in air (extramural and intramural)
- C) Methods to study air borne microorganisms. Sampling, qualitative and quantitative methods.
- D) Bioaerosal control (ventilation, filtration, biocidal control, UV gaseous (quarantine)
- E) Sources, types, effects, control of air pollution. Depletion of ozone layer (causes, impact and control)
- F) Biological safety.
- G) Gnotobiology (Germ free animal)

Unit II A) Marine microbiology Types of microorganisms in fresh and marine water, estuaries, methods to study aquatic microorganisms. Characteristics of marine environment, types of organisms and their role. (8)**B) Eutrophication:**

- Classification of lakes
- Sources
- Consequences
- Control

Unit III Microbiology of potable water: Definition of potable water, standard for potability, municipal water purification process, microorganisms as bioindicators of faecal pollution, routine bacteriological analysis of (8)

- water.
- Unit IV Environmental impact assessment:** (11)
- A) Waste water assessment and management, types of wastes, chemical assessment, microflora, BOD, COD, treatment and disposal of waste water.
- B) Assessment and management of pollutants – toxic elements, their sources and effects and bioremediation (or is points, mercury, arsenic and radioactive substances)
- i) Environmental standards
 - ii) Environmental legislations.
 - iii) Environmental education and awareness
- Unit V**
- A) Bio-leaching: Introduction, Microorganisms involved, Biochemistry of microbial leaching, Commercial leaching – slope, heap, in situ leaching, Leaching of Copper and Uranium (8)
- B) Oil recovery: Methods – primary, secondary, and microbially enhanced, Biotechnological solution of oil recovery.
- C) Characteristics and treatment of wastes from different industries – paper and pulp, sugar and distillery, textile, dairy and antibiotic producing industries

(Paper VIII)**Immunology and Medical Microbiology****Section I: Immunology**

- Unit I Complement system** (4)
- Components of complement and their properties, Activation of complement – classical and alternate pathway, Biological effects of complement
- Unit II Major Histocompatibility complex** (8)
- A. Organisation of MHC genes in man and mouse, classes of MHC molecules – structure and role,
- B. Adaptive immunology
- a) Humeral (antibody) mediated – mechanisms,
 - b) Cell mediated – cellular components, mechanism, cytokines
- Unit III**
- A) **Monoclonal antibodies** – production (hybridoma technology). In vivo and in vitro production. applications of monoclonal antibodies in diagnosis, research and treatment and research, (6)
- B) Basis of antibody diversity: Basic concept of Immunoglobulin gen, structure and its expression.
- Unit IV**
- A) **Immunological tolerance** (14)
- B) **Autoimmunity** – mechanism, types a) hemocytolytic b) organ specific c) non organ specific
- C) **Hypersensitivity** – types i) based on time required for manifestation-Immediate and delayed. i) Based on pathogenesis-anaphylactic reaction, atopy Catalytic and cytotoxic reaction. Immune

complex reaction-Arthus reaction, serum sickness. Delayed reaction. -
tuberculin reaction- tuberculin test

D)Transplantation Immunology – terminology, classes of
transplants, mechanisms of graft rejection, prevention of graft
rejection, HLA typing

- Unit V Immunohematology:** A) ABO blood group system, Rh blood group system, blood transfusion reaction (8)
- B) National immunization programme: need and significance
- C) Immunoprophylaxis – a. vaccines, Definition, types – conventional (traditional), and new generation – a) DNA vaccines b) recombinant vaccines
- B) Immunotherapy (passive immunization.)

Section II: Medical Microbiology

- Unit I** A) Pathogenicity of viruses, fungi and protozoa (4)
- B) Hospital infection – factors contributing, common types, diagnosis and prophylaxis
- Unit II** Microbial diseases (viral, fungi and bacteria) (8)
- (Morphology, cultural and biochemical characters, antigenic structures, modes of transmission, pathogenesis, symptoms, laboratory diagnosis, prophylaxis and treatment of following diseases)
- | | |
|----------------------------------|-----------------------------------|
| 1. <i>Pseudomonas aeruginosa</i> | 5. <i>Clostridium perfringens</i> |
| 2. <i>Mycobacterium leprae</i> | 6. <i>Mycoplasma pneumoniae</i> |
| 3. <i>Helicobacter pylori</i> | 7. <i>Klebsiella pneumoniae</i> |
| 4. <i>Treponema pallidum</i> | 8. <i>Vibrio</i> |
- Unit III Microbial diseases (viral and protozoan)** (10)
- (Morphology, cultural and biochemical characters, antigenic structures, modes of transmission, pathogenesis, symptoms, laboratory diagnosis, prophylaxis and treatment of following diseases)
- | | |
|----------------------|--|
| 1. Herpes (Complex) | a. Candidiasis |
| 2. Rabies | b. Malaria (all four with comparative account) |
| 3. Hepatitis A and B | |
| 4. AIDS | |
- Unit IV** A) Urinary tract infection – etiology, symptoms, diagnosis, prophylaxis and treatment
- B) Biomedical waste management – objective, contents, quality and types of wastes, waste treatment methods.
- C) Biological warfare – Use of biological agents - bacteria, viruses, or other disease-causing agents as biological weapons.
- Unit V Chemotherapy** (7)
- A) Spectrum of antimicrobial activity

- B) Mode of action of following antimicrobial drugs:
- C) Penicillin, Bacitracin, Vancomycin, Isoniazid, Streptomycin, Chloramphenicol, Tetracycline, neomycin, erythromycin, rifampicin, quinolones (cipro), Sulphonamide, Trimethoprim, Azidothymidine, Amphotericin,.
- D) Tests to guide chemotherapy a) diffusion tests b) broth dilution tests
- E) Mechanisms of drug resistance
- Unit VI** A) **Reproduction of animal viruses** – Adeno and Influenza. (5)
- B) **Determination of number of viral population.**
- C) **Oncogenesis** – types of cancer, characteristics of cancerous cells, oncogenic viruses – DNA and RNA,
- D) **Hypothesis of cancer:-** Somatic mutation, viral gene, defective immunity

References:

Paper V:

1. Breed and Buchanan. Bergey's Manual of Determinative Bacteriology, 9th Edition, 1974.
2. General microbiology – Stanier
3. General microbiology – Pawar and Daginawala Vol I and II
4. Biochemistry – Lehninger
5. Molecular Biology of Gene – J.D. Watson
6. Recombinant DNA – J.D. Watson
7. Microbiology - Davis
8. Biochemistry - Purohit
9. Genetics of bacteria and their viruses – William Hays
10. Virology – Biswas
11. Introduction of Bioinformatics – Affwood, T.K.
12. Bioinformatics by Shalini Suri
13. Principles and techniques of Practical Biochemistry – K. Wilsons J.Walkar.
14. Analytical Chemistry – Robert B. Dilts
15. Chromatographic methods by Brathwaite and White
16. Physiology and Biochemistry of Extremophiles by Charles Gerday and Nicolas Glansdorff (2007)
17. <http://www.ncbi.nlm.nih.gov/>
18. Prescott, Harley and Klein's Microbiology, Willey Sherwood Woolverton, McGraw – Hill International Edition, (2008)

Paper VI:

1. Outline of Biochemistry – Cohn and Stump
2. Biochemistry – West and Todd Russel
3. Biochemistry – Lehninger
4. Enzymes – Dixon and Web
5. Biological chemistry – Mahler and Cordes
6. Nature of Enzymology – R.L. Foster
7. Enzyme structure and Mechanism – Alen fereht
8. Principles of fermentation technology – Stanbury and Whitekar
9. Dairy Technology – Sukumar De
10. Pharmaceutical Microbiology – Huggo and
11. Biochemistry – Fox and Nelson
12. Industrial Microbiology – Prescott and Dunn
13. Microbial technology – Peppler
14. Food Microbiology – R.C. Dubey, D.K. Mahashwari
15. Biochemistry – A problem approach by Wood, Hood and Weison

Paper VII:

1. Environmental Microbiology – Maier
2. Microbial ecology – Fundamentals and applications - Atlas and Bartha
3. Microbiology – Prescott and Harley, 5th edition
4. Advances in Biotechnology – S.W. Jogdand.
5. Textbook of Biotechnology – R.C. Dubey,
6. Biotechnology – B.D. Singh
7. Microbial dynamics and diversity – Desy Staley
8. Biology of Microorganisms – Brock, Parker, Madigen, 9th edition
9. Soil Microbiology – Subbarao, N.S.
10. Genetics – Glick
11. Genes VIII by Benjamin Lewin (2003)

Paper VIII:

1. Text book of Medical Microbiology – Ananthnarayan
2. Review of Medical Microbioloyg – Jawetz et al
3. Microbiology – Zinsar
4. Prescott, Harley and Klein's Microbiology, Willey Sherwood Woolverton, McGraw – Hill International Edition, (2008)
5. Roitt M., (1984) Essentials of Immunology, P.G.Publishers Pvt. Ltd. New Delhi

6. Roitt Evan, Brostoff J. Male D. (1993) Immunology 6th Edition, Mosby and Co., London.
7. Kuby J. (1996) Immunology Ed., 3 W.H. Freeman and Co.
8. Immunology – Fudengerg
9. Medical Microbiology – Cruickshank
10. Davis and Dulbacco Medical Microbiology.
11. Parasitology – Chattergii
12. Biochemistry of antibiotics – Franklin and Snow
13. Medical laboratory technology – Ramnaik Sood
14. Diagnostic Microbiology – Bailey's and Scotts
15. Immunology – a problem approach by Wood, Hood and Weison
16. Medical Bacteriology – Dey and Dey
17. G.P. Talwar (1983) Handbook of Immunology, Vikas Publishing Pvt. Ltd, New Delhi.

PRACTICAL COURSE

Practical I:

1. Isolation of DNA from bacteria by J. Mamar's method
2. Electrophoretic separation of DNA.
3. Electrophoretic separation of protein (serum)
4. Isolation of coliphages from sewage & determination of phage cross infectivity.
5. One step growth curve
6. Determination of Optimum dose of U.V. by UV survival curve (comparative study of *Escherichia coli* and *Staphylococcus aureus*.)
7. Isolation of Lac negative mutants of *E.coli* by visual detection method.
8. Isolation of Streptomycin resistant mutant by gradient plate technique.
9. Isolation of Vitamin B12 requiring (auxotrophic) mutants by replica plate technique.
10. Diauxic growth curve of *Escherichia coli* (glucose and lactose).
11. Browsing of National Centre for Biotechnology Information (NCBI) website.
12. Exploring protein sequence database (PDB) and GenBank and BLAST.

Practical II:

1. Examination of milk **i)** DMC **ii)** Quantitative analysis of milk by SPC (using nutrient agar)
2. Phosphates Test
3. Bioassay of Vitamin B12

4. Bioassay of Penicillin
5. Production of wine by using Jaggery medium by *S. cerevisiae*, examination of pH, colour, taste.
6. Estimation of alcohol by using $K_2Cr_2O_7$.
7. Sterility testing of dry powder by direct inoculation on Soyabean casein digest medium.
8. Sterility testing of media.
9. Immobilisation of enzyme by using Sodium alginate.
10. Thin layer chromatography
11. Demonstration of crude recovery of amylase enzyme & Amylase assay.
12. Isolation of Lactic acid Bacteria.
14. Estimation of Citric acid by titration method

Practical III:

1. Isolation of microorganisms from soil. (Identification up to genus level)
2. Isolation of *Rhizobium* from root nodules.
3. Isolation of **Phosphate solubilising** bacteria from soil.
4. Isolation of *Xantomonas* from infected plant material
5. SPC of market **Biofertilizers**.
6. Vermicomposting of vegetable waste
7. Estimation of available nitrogen from soil.
8. Estimation of available phosphorous from soil (Stannous chloride method)
9. Estimation of Calcium and Magnesium from soil (EDTA method)
10. Determination of organic carbon contents of soil (Walkley and Black method)
11. Setting up Winogradsky's column and study of various types and groups.
12. Study of Eutrophication by Winogradsky's column
13. Study & analysis of fresh water flora.
14. Microbiological analysis Drinking water: TPC, presumptive confirm and completed test.
15. Determination of potability of water by MPN.
16. Waste water analysis : physical (total solids), chemical (COD), biological (BOD)
17. Qualitative & Quantitative Analysis of Air Flora. & Determination of sedimentation rate.

Practical IV:

1. Preparation of Tri sugar iron agar (TSI) medium slants and study of biochemical

reactions on (TSI) slant.

2. Determination of minimum inhibitory concentration (MIC).of penicillin On *Staph aureus*.
3. Antibiotic sensitivity test (by disc diffusion method)
4. Study of determination of effectiveness of antiseptic agents against selected organisms (*Escherichia coli*, *Staphylococcus aureus*, *Bacillus*), (antiseptic agents – tincture iodine, 3% H₂O₂, 70% alcohol, 5% chlorine bleach) disc diffusion method
5. A.Isolation of pathogen from clinical sample
 - a) *Pseudomonas aeruginosa*
 - b) *Klebsiella pneumoniae*
 - c) *Corynebacterium diphtheria*
 B.Isolation and identification of member of Enterobacteriaceae (Maximum Two) up to species level from biomedical waste (Gram staining, colony characterization, motility and biochemical tests – IMViC, H₂S, oxidase, catalase, urea hydrolysis, gelatine hydrolysis, phenylalanine deaminase test, lysine decarboxylase test, sugar fermentation)
6. Widal test (quantitative test)
7. Haematology – RBC count, WBC count, differential WBC count, Erythrocyte sedimentation rate (ESR) and demonstration of malarial parasite.
8. Urine analysis
 - a) Microscopic examination – pus cells, RBC, bacteria, crystals.
 - b) Chemical examination – glucose (benedict's method, protein (acetic acid), bile salt (sulphur method) ketone bodies (Rothera's test)
9. Immunodiffusion test.
10. Study of synergistic action of antibiotics

Practical Examination

- A) The practical examination will be conducted on four (4) 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 in his/her observation 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 the year. Candidate are to produce their journal at the time of practical examination Candidate have to visit (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.

Distribution of Marks for practical examination

For practical I, II, III, IV each.

- 1) One major experiment: 20 marks
- 2) Two minor experiment: 10 marks each
- 3) Journal : 5 marks.

Total marks:

Practical I : 45 Marks
 Practical II : 45 Marks
 Practical III : 45 Marks
 Practical IV : 45 Marks
 Tour Report : 20 Marks

Total Marks : 200

Practical wise distribution of marks

Practical – I

A) Major Experiments: (20)

- i) Isolation of coli phages/ Mutants. **OR**
- ii) Transformation of competent *E.coli* cells. **OR**
- iii) Electrophoresis separation of DNA/Proteins.

B) Minor experiments: (20)

- i) Diauxic growth / One step growth curve / Optimum dose of U.V by survival curve. &
- ii) Isolation of chromosomal DNA/ Phage cross infertility /Browsing/ PDB/ BLAST

Practical II

A) Major Experiments: (20)

- i) Bioassay of Penicillin / Vitamin B₁₂ OR
- ii) Amylase assay/OR
- iii) TLC of sugars / amino acidsOR
- iv) SPC of milk.OR Isolation of Lactic acid bacteria

B) Minor experiments: (20)

- i) Direct microscopic count of milk / Phosphatase test of milk. &
- ii) Immobilization of enzymes.OR
- iii) Estimation of citric acid by titration/ alcohol by $K_2Cr_2O_7$

Practical III

A) Major Experiments: (20)

- i) Isolation of *Azotobacter/Rhizobium/Xanthomonas* OR
- ii)BOD of sewage sample .OR
- iii).Estimation of nitrogen from soil.

B) Minor experiments: (20)

- i) COD of sewage sample
- ii) Estimation of calcium/ Magnesium/ Organic carbon of soil.

Practical – IV

A) Major Experiments: (20)

- i) Isolation and identification of:

Pseudomonas aeruginosa/ Klebsiella pneumoniae/ Corynebacterium diphtheriae **OR**

ii) Isolation and identification of Enterobacteriaceae up to species level from biomedical waste (Gram staining, colony characterization, motility and biochemical tests – IMViC, H₂S, oxidase, catalase, urea hydrolysis, gelatine hydrolysis, phenylalanine deaminase test, lysine decarboxylase test, sugar fermentation test)

B) Minor experiments: (20)

- i) Determination of Antibiotic sensitivity to common pathogens.
- ii) Serological tests.
- iii) Hematological tests.
- iv) Examination of urine sample.

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

- 1) Replica plating units for 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) Haemoglobinometer : Two.
- 11) ESR stands and tubes : Two.
- 12) Separate room for fine instruments of size 10'×15' feet dimension
- 13) A separate culture room of atleast 10'×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
- 21) TLC UNIT : One
- 22) Winogradsky colomm : One