



St. PETER'S UNIVERSITY

St. Peter's Institute of Higher Education and Research

(Declared Under Section 3 of the UGC Act, 1956)

AVADI, CHENNAI – 600 054

TAMIL NADU

B.Sc. (MICROBIOLOGY)

Code No. - 314

(Effective From 2009 – 2010)

(Distance Education)

Regulations and Syllabi

(I & II & III Year)

St. PETER'S INSTITUTE OF DISTANCE EDUCATION

Recognized by Distance Education Council and

Joint Committee of UGC – AICTE - DEC, New Delhi

(Ref. F. No. DEC/SPU/CHN/TN/Recog/09/14 dated 02.04.2009 and

Ref.F.No.DEC/Recog/2009/3169 dated 09.09.2009)

St. PETER'S UNIVERSITY
St. PETER'S INSTITUTE OF DISTANCE EDUCATION
Chennai – 600 054.

Code No. – 314
B.Sc. (MICROBIOLOGY)
(Distance Education)

Regulations and Syllabi
(Effective from 2009 – 2010)

- 1. Eligibility:** Candidates who have passed the Higher Secondary Examination conducted by the Government of Tamilnadu with Biological Sciences as one of the subjects, or any other examination recognized as equivalent thereto are eligible for admission to Three Year B.Sc. Programme in Microbiology.
- 2. Duration:** Three Years.
- 3. Medium:** English is the medium of instruction and examination.
- 4. Methodology:** The methodology of distance education includes supply of self-instructional study materials in print format and in CD, face-to-face instruction for theory and practicals for a limited period during week ends and on holidays, provision of virtual class in phased manner, dissemination of information over e-mail, Student - Support Service at various Centres of the University, Continuous Assessment and End Assessment conducted by the University at various parts of India.
- 5. Weightage for Continuous and End Assessment:** There is no weightage for Continuous Assessment unless the ratio is specifically mentioned in the scheme of Examinations. The End Assessment (EA) has 100% weightage.

6. Credit System: Credit system be followed with 36 credits for each Year and each credit is equivalent to 25 hours of effective study provided in the Time Table of the formal system.

7. Scheme of Examinations

First Year

| Code No. | Course Title | Credit | Marks | |
|------------------------|------------------------------------|-----------|------------|------------|
| | | | EA | Total |
| Theory | | | | |
| 109UTMT01 109UHIT01 | Tamil - I Hindi - I | 6 | 100 | 100 |
| 109UEHT02 | English - I | 6 | 100 | 100 |
| 109UMBT03 | Fundamentals of Microbiology | 6 | 100 | 100 |
| 109UMBT04 | Allied – I: Biochemistry | 6 | 100 | 100 |
| 109UMBP01 | Practical – (Main – I) Record | 6 | 90 10 | 100 |
| 109UMBP02 | Practical – (Allied – I) Record | 6 | 90 10 | 100 |
| Total | | 36 | 600 | 600 |

Second Year

| Code No. | Course Title | Credit | Marks | |
|------------------------|---|-----------|------------|------------|
| | | | EA | Total |
| Theory | | | | |
| 209UTMT01 209UHIT01 | Tamil - II Hindi - II | 6 | 100 | 100 |
| 209UEHT02 | English - II | 6 | 100 | 100 |
| 209UMBT03 | Microbial Genetics & Immunology | 6 | 100 | 100 |
| 209UMBT04 | Allied – Biostatistics and Computer in Biology | 6 | 100 | 100 |
| 209UMBP01 | Practical – (Main – II) Record | 6 | 90 10 | 100 |
| 209UMBP02 | Practical – (Allied – II) Record | 6 | 90 10 | 100 |
| Total | | 36 | 600 | 600 |

Third Year

| Code No. | Course Title | Credit | Marks | |
|---------------|---|-----------|------------|------------|
| | | | EA | Total |
| Theory | | | | |
| 309UMBT01 | Medical Microbiology | 6 | 100 | 100 |
| 309UMBT02 | Food and Industrial Microbiology | 6 | 100 | 100 |
| 309UMBT03 | Soil and Environmental Microbiology | 6 | 100 | 100 |
| 309UMBT04 | Application Oriented subject: Microbial Biotechnology | 6 | 100 | 100 |
| 309UMBP01 | Practical – (Main III) Record | 6 | 90 10 | 100 |
| 309UMBP02 | Practical – IV (Application Oriented subject) Record | 6 | 90 10 | 100 |
| Total | | 36 | 600 | 600 |

8. Passing Requirements: The minimum pass mark (raw score) be 40% in End Assessment.

9. Grading System: Grading System on a 10 Point Scale be followed with 1 mark = 0.1 and the conversion of the Grade point as given below.

$$\begin{aligned} \text{Overall Grade Point Average (OGPA)} &= \frac{\text{Sum of Weighted Grade Points}}{\text{Total Credits}} \\ &= \frac{\sum (EA)C}{\sum C} \end{aligned}$$

The Overall Grade: The Overall Grade and Classification of all successful candidates be arrived at from the Overall Grade Point Average as stipulated in the following conversion Table.

| Grade | Over all Grade Point Average(OGPA) | Over all weighted Average marks | Classification |
|----------|------------------------------------|---------------------------------|---------------------|
| 0 | 9.0 to 10.0 | 90 to 100 | First Class |
| A | 8.0 to 8.9 | 80 to 89 | First Class |
| B | 7.0 to 7.9 | 70 to 79 | First Class |
| C | 6.0 to 6.9 | 60 to 69 | First Class |
| D | 5.0 to 5.9 | 50 to 59 | Second Class |
| E | 4.0 to 4.9 | 40 to 49 | Third Class |
| F | 0.0 to 3.9 | 0 to 39 | Reappearance |

The Grade Sheets of successful candidates provide particulars such as (1) Overall weighted Average Marks and (2) Overall Grade.

10. Pattern of the Question Paper: The question paper for the End Assessment will be set for three hours and for a maximum of 100 marks with following divisions and details.

Part A: 10 questions (with equal distribution to all units in the syllabus). Each question carries 2 marks.

Part B: 5 questions with either or type (with equal distribution to all the units in the syllabus). Each question carries 16 marks.

The total marks scored by the candidates will be reduced to the maximum prescribed in the Regulations.

11. Syllabus

109UMBT03: FUNDAMENTALS OF MICROBIOLOGY

Unit – I – Definition and scope of Microbiology – History of Microbiology – Spontaneous generation, Germ theory of fermentation – Antiseptic surgery and surgical infection – Germ theory of disease. Diversity of microbial world – Principles of classification – Three Kingdom and Five Kingdom approach – Classification of bacteria, fungi and viruses.

Unit – II – Microscopic Techniques Light microscopes – Simple and compound microscopes – Dark field Microscopes – Phase contrast microscope – Electron microscopes – Transmission and Scanning electron Microscope. Stains and Staining techniques – Simple, Gram's, Acid fast, Capsular, Endospore and Granular staining.

Unit – III – Cultivation techniques – Nutritional requirements – components and preparation of media – Inoculation and transfer techniques – Pure culture techniques – Preservation of cultures, Bacterial growth curve – Determination of bacterial growth – Factors affecting growth.

Unit –IV – Metabolism – ATP and its production – Carbohydrates – metals – Biosynthetic (Anabolic) Pathway – Photosynthesis – light reaction and dark reaction – gluconeogenesis – Catabolic pathways – glycolysis – pathway – TCA cycle and electron transport systems – Fermentation.

Unit – V – Control of microorganisms – Physical methods – Sterilization – Radiation – Filtration – Chemical Methods of sterilization. Antimicrobial chemotherapy – principles of chemotherapy – Antimicrobial drugs – Mode of action – Antimicrobial resistance – Antibiotic sensitivity test.

Text Books

1. Dubey RC & Maheswari DK (2005). A text book of Microbiology, Revised Multicolour Edition, Published by S. Chand & Company Limited, New Delhi.
2. Purohit SS (2005). Microbiology – Fundamentals and Applications. Reprinted & Published by Student Edition, Behind Nasrani Cinema, Chopasani Road, Jodhpur.
3. Pelczar TR, Chan ECS & Kreig NR (2006) Microbiology. 5th Edition, Tata McGraw – Hill, New Delhi.
4. Powar CB & Daginawala HF (2005). General Microbiology – Volume I & II. 8th Edition, Himalaya Publishing House, Mumbai.
5. Hans G Schlegel (2003). General Microbiology. Low Price 7th Edition, Cambridge University Press.
6. Meenakumari S (2006) Microbiology Physiology. 1st Edition, MJP Publishers, A unit of Tamil Nadu Book House, Chennai.

Reference Book

1. Prescott M (2005) Microbiology. 6th Edition, Tata McGraw – Hill, New Delhi.
2. Albert G Moat & John W Foster (2004). Microbial Physiology. 4th Edition, John Wiley & Sons, New York.
3. Robert F Boyd (1984). General Microbiology. Times Mirror / Mosby College Publishers.

109UMBT04: BIOCHEMISTRY

Unit - I - Carbohydrates - definition classification. Monosaccharides structure, properties and biological significance, disaccharides, Polysaccharides - types and biological importance carbohydrate Metabolism - Glycolysis, TCA cycle, HMP shunt, Glycogenesis and Glycogenolysis.

Unit - II - Amino acids classification, essential and non - essential amino acids, structure and properties. Proteins - definition, classification and functions - structural levels of organization denaturation and renaturation. Protein metabolism - Deamination, transamination and decarboxylation of aminoacids. Urea cycle.

Unit - III - Enzymes - definition, classification with example active site, lock and key model, induced fit hypothesis, enzyme units - kinetics - factors affecting enzymes activity, MM equation, LB Plot - Enzyme inhibition. Hormones - Definition, Classification of hormones.

Unit - IV - Lipids classifications of lipids physical and chemical properties, saturated and unsaturated fatty acids. Structure of cell membrane and transpore. Lipid metabolism. β -oxidation, biosynthesis of saturated fatty acid.

Unit - V - Vitamins, classification, occurrence, deficiency symptoms, biochemical functions of fat soluble and water soluble vitamins. pH - definition and determination. Buffers - definition important buffers in blood.

Text Books

1. Practical Biochemistry by Keith Wilson and Jon Walker, Cambridge University Press.
2. Murray RK, DK Granner, PA Mayes and VW Rodwell (1999). Harper's Biochemistry. 24th Edition, Large Medical Publication.
3. Jain JL (2003). Fundamentals of Biochemistry. S. Chand and Company Ltd., New Delhi.
4. Deb AC (2004) Concepts of Biochemistry, (Theory and Practical) Books and Allied (P) Ltd., Kolkata.
5. Satyanarayana U (2005). Essentials of Biochemistry, Books and Allied (P) Ltd., Kolkata.
6. Veerakumari L (2004). Biochemistry. MJP Pubilshers, A Unit of Tamil Nadu Book House, Chennai.

109UMBPO1: MAIN PRACTICAL I

1. Handling and maintenance of compound microscope
2. Cleaning of glasswares
3. Staining techniques – Simple, Gram's, Ziehl – Neelsen, Spore and Capsular staining methods.
4. Microscopic Examinations of
Algae – Oscillatoria
Fungi – Mucor spp., Aspergillus spp., Alternaria spp.
Protozoa – Entamoeba spp., Ascaris spp.
Bacteria – Staphylococcus spp. Escherichia coli
5. Motility determination – Hanging drop method
6. Media Preparation
Liquid Media - Peptone water, Nutrient broth
Solid Media – Nutrient agar (Agar slant, Agar plate)
Differential medium – Mac Conkey agar
7. Demonstration of pigment production on Nutrient agar medium
(Staphylococcus aureus, Pseudomonas aeruginosa & Serratia spp.)
8. Pure culture techniques – Pour plate, Streak plate
9. Antibiotic sensitivity test – Kirby – bauer disc diffusion method

109UMBPO2: ALLIED PRACTICAL – I BIOCHEMISTRY

1. Qualitative analysis

- i) Analysis of carbohydrates – Glucose, Fructose, Ribose, Sucrose, Lactose and Starch
- ii) Analysis of Amino acids – Tyrosine, Tryptophan, Arginine, Methionine, Cystine & Phenylalanine.

2. Estimation

- i) Estimation of Glycine by formal titration method.
- ii) Estimation of Ascorbic acid by 2,6 dichlorophenol indophenol dye
- iii) Determination of acid number
- iv) Determination of saponification value
- v) Estimation of urea by DAM colorimetric method.
- vi) Estimation of glucose by Ortho – Toluidine method.

3. Techniques

- i) Separation of amino acid and sugars by Ascending Paper chromatography.
- ii) Separation of Lipid by TLC.

REFERENCES

1. An introduction to practical biochemistry by David T Plummer.
2. Laboratory Manual in Biochemistry by Pattabiraman and Acharya.
3. Practical Biochemistry by Jayaraman.

209UMBT03: MICROBIAL GENETICS AND IMMUNOLOGY

Unit – I – Nucleic acids (DNA & RNA) – structure, chemical composition and types – Evidence to prove DNA & RNA as genetic materials. Replication of DNA – mechanism – Enzymology of DNA replication – Types and models of replication.

Unit – II – Genetic code – Gene expression – Transcription – Translation. Gene regulation in bacteria – lac and trp operons. Gene transfer mechanism – Transformation, conjugation and transduction. Mutation – types – mutagens – detection of mutation. DNA repair – mechanism and types.

Unit – III – History of immunology – Immunity – Innate immunity and acquired immunity – Active and passive immunity – Humoral and cell mediated immunity. Organs and cells of the immune system. Antigens – types and properties. Immunoglobulin – structure, function and classes of Immunoglobulins. Monoclonal antibodies – production and applications.

Unit - IV – Antigen and antibody reactions – Agglutination, precipitation, complement fixation, Immunofluorescence, ELISA, and RIA. Complement activation – classical and alternative pathways. Hypersensitivity reactions – Type I, II, III and IV, Vaccines – types – Immunization schedule.

Unit V – Transplantation immunology – Mechanism of graft rejection, Clinical manifestation, HLA tissue typing and immunosuppressive therapy. Auto immune diseases – Organ specific and systemic autoimmune diseases – proposed mechanism – treatment. Introduction to tumor immunology – tumor antigens, tumor evasion of the immune system Immunohaematology – Major and minor blood groups – ABO & Rh incompatibility.

Text Books

1. David Frifielder (2005). Molecular Biology. 2nd Edition. Narosa Publishers, New Delhi.
2. Robert H Tamarin (2004). Principles of Genetics. 7th Edition. Tata McGraw – Hill Publishing House, New Delhi.
3. Benjamin Lewin (2004). Genes VIII. Pearson Prentice Hall, USA. Rs. 1494/-
4. Peter J Russel (2002). Genetics. Benjamin Cummings.
5. Richard A Goldsby, Thomas J. Kindt, Barbara A Osborne & Janis Kuby (2004). Immunology. 5th Edition, W.H. Freeman and Company, New York.
6. Ivan Roitt, Jonathan Brostolf & David Male (2004). Immunology, 6th Edition, reprinted, Mosby Publications, Edinburgh.
7. Tizard K (1983). Immunology – An introduction. Published by Saunders College, Philadelphia.

209UMBT04: BIOSTATISTICS & COMPUTER IN BIOLOGY

Unit – I – Biostatistics definition – types of data sources of data in life science – Limitations and uses of statistics – collection of data – Primary data – Secondary data – classification of data – Tabulation and presentation of data.

Unit – II – Measures of central tendency – Mean, median. Mode – measures of dispersion – standard deviation – correlation – Regression, Sampling methods – standard error – chi – square test.

Unit – III – Introduction to computers – classification – generations Low, medium and high level languages – software and hardware – Input / output and storage devices. Fortran programming – basics – representation of integer and real constants – variable – expression – assignment – statement – 1/0 statements. Control statements – loops, subscripted variables and files.

Unit – IV – Introduction to data processing – records, fields, data collection preparation, verification, editing and checking – backup and file recovery procedure – Sorting – searching and merging – Microsoft excel – data entry graphs – aggregate functions, formulas and functions. Different number systems and conversion.

Unit – V – Foxpro fundamental and programming. Introduction to Foxpro environment – data base creation and use of data insertion, deletion and modification – Sorting and indexing – Managing multiple data base display of data – Foxpro programming. Memory variables data time, math functions – report generation.

REFERENCE

Biostatistics

1. Gurumani N (2005) An introduction to Biostatistics 2nd Revised Edition, MJP Publishers, Chennai.
2. Daniel WW (1987) Biostatistics, John Wiley and Sons New York
3. Sundar Rao PSS, Richard J. An introduction of Biostatistics – 3rd Edition Christian Medical College, Vellore.

COMPUTER APPLICATION IN BIOLOGY

1. Alexis Leon & Mathews Leon – Fundamentals of Computer Science and Communication Engineering, Vikas Publishing house Pvt. Ltd.
2. Rajaraman V. Computer Programming in Fortran 77. PHI Pvt. New Delhi.
3. Robert Granillo, Illustrated Foxpro 2.0, BPB Publications, New Delhi.

209UMBPO1: MAIN PRACTICAL II

1. Isolation of Genomic DNA (Crude method)
2. Isolation of Auxotrophic mutant by replica plate method
3. Isolation of drug resistant mutants by gradient plate method
4. Blood grouping
5. RPR card test / VDRL test
6. Ouchterlony's double immunodiffusion test
7. Widal test
8. ASO test
9. RA test
10. CRP test
11. ELISA – HBs Ag / HIV & 2 test (Demonstration Only)

209UMBPO2: ALLIED PRACTICAL – II

BIOSTATISTICS & COMPUTER IN BIOLOGY (FORTRAN AND FOXPRO)

1. Finding, Mean, Standard deviation and mean deviation for a given problem.
2. Calculating the correlation co-efficient
3. finding regression co-efficients and regression lines.
4. Calculating chi-square test for a given problem
5. Sorting
6. Indexing
7. Multiple database
8. Reports generation

309UMBT01: MEDICAL MICROBIOLOGY

Unit – I – Collection and transport of clinical specimens for microbiological examinations. Virulence factors of bacteria causing human infections - Normal flora of human body.

Unit – II – Bacteriology – Morphology, Culture, biochemical, pathogenicity, Lab diagnosis and prevention of bacterial diseases – *Staphylococcus aureus*, *Streptococcus pyogenes*, *Neisseriae*, *Mycobacterium tuberculosis*, *Corynebacterium diphtheriae* - *Salmonella typhi*, *Vibrio cholerae*, *Escherichia coli* – Spirocheates.

Unit – III – Mycology – Superficial Mycosis – Pityriasis versicolor, cutaneous mycosis – dermatophytosis, subcutaneous mycosis – sporotrichosis, systemic mycosis – Histoplasmosis, opportunistic mycosis. Candidosis, Cryptococcosis.

Unit – IV - Parasitology – *Entamoeba histolytica*, *Giardia intestinalis*, *Trichomonas vaginalis*, *Leishmania donovani*, *Plasmodium vivax*, *Toxoplasma gondii*, *Taenia solium*, *Ancylostoma duodenale*, *Ascaris lumbricoides* and *Wuchereria bancrofti*.

Unit - V – Medical virology – DNA viruses – Pox, Herpes, Hepatitis Viruses – RNA viruses – Picorna, Arbo viruses – Rhabdo, HIV and oncogenic viruses.

Text Books

1. Satish Gupte (2006). The Short Text books of Medical Microbiology. 9th Edition, Jaype Brothers, Medical Publishers (P) Ltd., New Delhi.
2. Ananthanarayan R & CK Jayaram Paniker (2005). Text Book of Microbiology. 7th Edition, Orient Longman Private Limited.
3. Rajesh Bhatia & Rattan Lal Ichhpujani (2004) Essentials of Medical Microbiology. 3rd Edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.
4. Subhash Chandra Parija (2004). Text book of Medical Parasitology – Protozoology and Helminthology. 2nd Edition, Published by All India Publishers & Distributors, Medical Books Publishers, New Delhi.

Reference Book

1. Baron EJ, Peterson LR and Finegold SM (1994). Bailey and Scott's – Diagnostic Microbiology. 9th Edition, Mosby Publications.
2. Topley & Wilsons (1995). Principles of Bacteriology, Virology and Immunology, Edward Arnold, London.
3. Morag C & MC Timbury (1994). Medical virology. 10th Edition, Churchill Livingstone, London.
4. Patric R Murray (1990). Medical Microbiology. Mosby Publications.

309UMBT02: FOOD & INDUSTRIAL MICROBIOLOGY

Unit – I – Microorganisms in food – bacteria, yeast & mold. Factors affecting microbial growth – extrinsic & intrinsic. Food preservation – Principles, Asepsis (anaerobic condition, high temperature, low temperature & drying), Food additives, Canning.

Unit – II – Contamination & spoilage – cereals, vegetables & fruits, Meat & meat products, milk & milk products, fish & sea foods, Egg & Poultry products. Spoilage of canned foods. Detection of spoilage & Characterization.

Unit – III – Food borne disease – Bacterial (*Brucella*, *Bacillus*, *Clostridium*, *Escherichia*, *Salmonella*, *Staphylococcus*, *Vibrio*) and Non bacterial (fungi). Fermented foods – Dairy products (Cheese, Bread, butter) Vegetable (Sauerkraut) Oriental fermented foods (Soy Sauce) Bioconversion – Vinegar, mushroom cultivation, single cell protein.

Unit – IV – Isolation, screening and preservation of industrially important microorganisms – strain development, development of inoculums and media for industrial fermentation and sterilization. Fermentation types and cultures – Down stream processing, Fermentation systems and control.

Unit – V – Microbial production of wine, organic acids – citric acid, Antibiotics – penicillin, vitamin – B12, Enzyme - α amylase, Amino acids – Glutamic acid, Biotransformations – Steroids and Non steroid compounds.

Text Books

1. Adams MR & MO Moss (2005). Food Microbiology. 1st Edition. Reprinted, Published by New Age International (P) Limited. Publishers, New Delhi.
2. James M Jay (2004). Modern Food Microbiology. 4th Edition, CBS Publishers & Distributors, New Delhi.
3. Agarwal AK & Pradeep Parihar (2006). Industrial Microbiology. Published by Student Edition, Behind Nasrani Cinema, Chopasani Road, Jodhpur.
4. Patel AH (2005). Industrial Microbiology. Published by Macmillan India Ltd., New Delhi.
5. Purohit SS, AK Saluja, HN Kakrani (2004). Pharmaceutical Biotechnology. 1st Edition, Agrobios (India).

309UMBT03: SOIL AND ENVIRONMENTAL MICROBIOLOGY

Unit – I – Introduction to soil microbiology – Types and significance of soil microbes – Bacteria, fungi, actinomycetes, algae, protozoa, nematodes and viruses. Factors affecting microbial population.

Unit – II – Biochemical cycle – carbon, phosphorus, nitrogen – Biological nitrogen fixation. Biofertilizer – *Rhizobium* and *Azotobacter*, Cyanobacteria – Mass multiplication.

Unit – III – Microbial interaction between microbes – neutralism, comensalism, synergism, mutualism, ammensalism, competition, parasitism and predation. Interaction of microbes with plants – Rhizosphere.

Unit – IV – Conventional and molecular methods of studying microbial diversity Microbiology of air and water – Aeromicrobial pathways – Enumeration of bacteria from air – Air sampling devices – Air sanitation. Potability of water quality – Indicator organisms – Water purification – Waterborne and their control measures. Positive and negative roles of microbes in environment.

Unit – V – Microbiology of sewage – chemical and biochemical characters of sewage – BOD, COD- Sewage treatment – physical, chemical and biological treatment.

Text Books

1. Subba Rao NS (2004). Soil Microbiology. 4th Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Subba Rao NS (1995). Biofertilizers in Agriculture and Forestry. 3rd Edition, Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.
3. Robert L Tate (1995). Soil Microbiology. 1st Edition, John Wiley & Sons, Inc. New York.
4. Singh DP & SK Dwivedi (2005). Environmental Microbiology and Biotechnology. 1st Edition, New Age International (P) Ltd., Publishers, New Delhi.
5. Vijaya Ramesh K (2004). Environmental Microbiology. 1st Edition, MJP Publishers (A Unit of Tamil Nadu Book House) Chennai,
6. Joseph C Daniel (1999) Environment Aspects of Microbiology. 1st Edition, Bright sun Publications, Chennai.

309UMBT04: MICROBIAL BIOTECHNOLOGY

Unit – I – Biotechnology – Definition – concepts – history and achievements – Introduction to gene manipulation – plasmids – types of plasmids, episomes – plasmid banks – Phasmids, phagemids – cosmids – transposons – Yeast vectors – Properties and general characterization.

Unit – II – Enzymes – restriction endo nucleases – nomenclature, classification and application – nucleases, methylases, ligases – Definition of a gene, structures, cloning techniques – genomic library – cDNA expression systems.

Unit – III – Nucleic acid and protein hybridization techniques – Southern – northern and Western blottings – PCR – DNA sequencing.

Unit – IV – Principles and application of genetic recombinant technology and strain improvement (Mutational, rDNA). Production of biotechnological products – SCP (algae, yeast, mushroom). Biofertilizer (BGA, VAM) Biopesticides – *Bacillus thuringiensis* – Fuel – ethanol – Microbial algal technology.

Unit – V – Microbial synthesis of commercial production – pharmaceutical products – Interferon – Growth hormone and antibodies – Gene therapy methods.

References

1. Mitra (2005) Genetic Engineering, Published by Macmillan India Ltd. Chennai.
2. Jogdand SN (2005) Gene Biotechnology, Himalaya Publishing House. Mumbai.
3. Satyanarayana U (2005) Biotechnology 1st Edition Books and Allied Publication Pvt. Ltd. Kolkata.
4. Singh BD (2005) Biotechnology 2nd revised and enlarged Edition Kalyane Publishers, Chennai.
5. Kumarasan V (2001) Biotechnology, Published by Saras Publication, Nagercoil, Tamil Nadu.
6. Dubey RC (2005) A Text book of biotechnology. Multicolor illustrative edition. S. Chand Company Ltd.
7. S.S. Purohit (2005) Biotechnology. Fundamental and applications 3rd Edition, Published by student edition. Behind Nasrani Cinema, Chopasani Road, Jodhpur.

309UMBPO1: MAIN PRACTICAL III

1. Staining techniques – Gram's, Ziehl – Neelsen, Capsular, Spore staining.

2. Biochemical identification of bacterial pathogens.

Following tests to be performed : Carbohydrate fermentation, TSI, Indole, MR, VP, Citrate, Urease, Catalase & Oxidase test for

i) *Staphylococcus aureus* iv) *Salmonella typhi*

ii) *Escherichia coli* v) *Proteus vulgaris*

iii) *Klebsiella pneumoniae* vi) *Pseudomonas aeruginosa*

3. Normal saline / Lugol's iodine preparation for parasitic Ova / cyst examination.

4. Stool examination by Zinc – sulphate floatation method.

5. Examination of fungi by KOH and Lactophenol cotton blue stain – Dermatophytes and other fungi.

6. Examination of *Candida albicans* by gram's stain, Germ tube and Sugar assimilation test.

7. Examination of *Cryptococcus neoformans* by Negative staining.

8. Isolation of *Lactobacilli* and *Streptococci* from curd.

9. Methylene blue reductase test.

10. AST – Kirby – Bauer disc diffusion method.

309UMBPO2: MAIN PRACTICAL IV

1. Examination of Plant Disease
 - Blast disease in paddy
 - Blight of rice
 - Citrus canker
 - Tikka leaf spot
2. Isolation of Nitrogen fixing bacteria from root nodules of legumes
3. Isolation and enumeration of micro – organisms from soil by the serial dilution agar plating method.
4. Determination of total bacterial population by standard plate count technique
5. Bacteriological examination of water by multiple tube fermentation test.
 - Presumptive coliforms test
 - Confirmed test
 - Completed test
6. Enumeration of microbes from air by settle plate method.
7. Isolation of bacteriophage from Sewage
8. Paper and thin layer chromatography
9. Cultivation of oyster mushroom (*Pleurotus* spp.) (Demonstration)
10. Batch Fermentation using Erlenmeyer flask (Demonstration)

PRACTICAL REFERENCES
(For Main Practical I, II, III & IV)

1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.
2. James G Cappuccino & Natalie Sherman (2004) Microbiology: A Laboratory manual. 6th Edition, Published by Pearson Education.
3. Dubey RC and Maheswari DK (2004). Practical Microbiology 1st Edition, S. Chand & Company Ltd., New Delhi.
4. Myer's and Koshi's Manual of Diagnostic Procedures in Medical Microbiology and Immunology / Serology (2001). Published by Department of Clinical Microbiology, CMC and Hospital, Vellore, Tamil Nadu.
5. Sundararaj T. Microbiology – Laboratory Manual. Revised and Published by Aswathy Sundararaj, No.5. 1st Cross Street, Thirumalai Nagar, Perundgudi, Chennai.
6. Kannan N (1996) Laboratory Manual in General Microbiology. 1st Edition, Palani Paramount Publications, Palani, Tamilnadu.
7. The HiMedia Manual (2003). For Microbiology and Cell Culture Laboratory Practice. Published by HiMedia Laboratories Pvt. Ltd., Mumbai.