

Madurai Kamaraj University

B.Sc. Microbiology (Non–Semester)

REGULATIONS AND SYLLABUS

(This will come into effect from the academic year 2013– 2014 onwards)

1. ELIGIBILITY FOR ADMISSION

Candidates should have passed the **Higher Secondary Examination** conducted by the board of Higher Secondary Education, Government of Tamil Nadu or equivalent examination conducted by other states of India with **Biology/Botany /Zoology** as one of the subjects in Higher Secondary Education.

2. DURATION OF THE COURSE

The students shall undergo the prescribed course of study for a period of **three academic years**.

3. MEDIUM OF INSTRUCTION

English

4. SUBJECTS OF STUDY

Part 1: TAMIL

Part 2: ENGLISH

2 Ancillary subjects; (4 Papers in total)

CHEMISTRY- 2 papers (1st year -1; 2nd year – 1)

ZOOLOGY/BOTANY- 2 papers (1st year -1-; 2nd year – 1)

Part 3: Major- MICROBIOLOGY: (8 Papers and 4 practicals)

Core papers- Max Marks-100 Time: 3 hrs

Practicals - Max Marks – 100

Record note book = 10 marks

Practical exam = 90 marks, Time: 3 hrs

(The record note book should be submitted by the candidate on the day of practical examination for evaluation without fail)

Structure of the Question Paper (Theory)

Section – A

Time: 3 hrs

Max Marks: 100

Answer ALL questions

(10 x 3 marks = 30)

Write Short answers

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

N.B: Two questions from each Unit (5x2- 10 questions)

Section – B

Answer ALL questions

(5 x 8 marks = 40)

Answer the following not exceeding 3 pages each

11. (a) or (b)
12. (a) or (b)
13. (a) or (b)
14. (a) or (b)
15. (a) or (b)

N.B: One question from each Unit with internal choice from the same unit (i.e.), 5x1 = 5 Questions

Section – C

Answer any THREE questions not exceeding 5 pages each

(3 x 10 marks = 30)

- 16.
- 17.
- 18.
- 19.
- 20.

Structure of the Question Paper (Practical)

Time: 3 hrs

Max Marks: 100

Section – A

Identify and write short notes on the given Spotters/ Specimen (6 x 5 marks = 30 marks)

- 1
- 2
- 3
- 4
- 5
- 6

Section – B

Minor Practicals

Write a short account on the principle and procedure on any THREE of the following

(3 x 10 marks = 30 marks)

- 6
- 7
- 8
- 9

Section – C

Major Practicals

Write detailed account on the principle and procedure any TWO of the following

(2 x 15 marks = 30 marks)

- 10
- 11
- 12

Section D

Record Note book

10 marks

B.Sc., Microbiology Non Semester (DDE, MKU) - Overall Scheme

Year	Subjects	Max Marks	Min Marks
I Year	Paper 1- General Microbiology	100	35
	Paper 2- Microbial Physiology & Taxonomy	100	35
	MAJOR PRACTICAL– 1 (Microbiology)	100	35
II Year	Paper 3- Biochemistry	100	35
	Paper 4- Microbial Genetics & Molecular Biology		
	MAJOR PRACTICAL– 2 (Biochemistry & Molecular Biology)	100	35
III Year	Paper 5- Soil, Agricultural & Environmental Microbiology	100	35
	Paper 6- Medical Microbiology & Immunology	100	35
	MAJOR PRACTICAL– 3 (Soil, Agric. & Environ. Microbiology, Medical Microbiology & Immunology)	100	35
	Paper 7- Industrial Microbiology	100	35

	Paper 8- Biotechnology	100	35
	MAJOR PRACTICAL-4 (Industrial Microbiology & Biotechnology)	1200	420

SYLLABUS FOR B.Sc., MICROBIOLOGY (MAJOR) , NON-SEMESTER

DE I-MB T1 GENERAL MICROBIOLOGY

Unit I

Introduction – Definition, scope and history of Microbiology. Classification of microorganisms - General principles and nomenclature – Haeckel’s three kingdom concept, Whittaker’s five kingdom concept. Microbiology and Human Health - Contributions of Leeuwenhoek, Jenner, Spallanzani, Louis Pasteur, John Needham and Robert Koch.

Unit II

Microscopy – simple, compound microscope, light & dark field microscope, electron and phase contrast microscopes – parts, functions and applications- Resolving power, Numerical aperture.

Unit III

Prokaryotes – bacteria, archea, actinomycetes, structure and functions of cell and cellular components, slime, capsule, pili, flagella, cell wall, cytoplasmic membrane, mesosomes, ribosome, nucleoid and other cytoplasmic inclusions. Differences between prokaryotic and eukaryotic cells.

Unit IV

Salient features of Algae, structure and reproduction of Chlamydomonas, Chlorella, Euglena, Diatoms, Dinoflagellates. Salient features of fungal morphology, structures and reproduction; *Rhizopus*, *Aspergillus*, *Penicillium*, *Saccharomyces*, *Neurospora* & *Candida*

Unit V

Salient features of Bacteria: *Bacillus*, *Clostridium*, *E. coli*, *Salmonella*, Blue green algae, *Streptomyces* and *Mycoplasma*. Viruses: T4, Lambda, TMV, Polio, HIV. Protozoa: *Plasmodium*.

References

1. Prescott L.M., Harley J.P & Klein D.A., Microbiology, 6/e, McGraw Hill Publishers, 2006.
2. Pelczar M.J., Chan E.C.S. & Kreig N.R. Microbiology. Tata McGraw Hill Publishing Co., Ltd., New Delhi, 1993.
3. Schlegel H.G. General Microbiology. Cambridge University Press, Cambridge, 1993.
4. Stainer R.Y, Ingraham, Wheelis M.G. & Paintor, P.R. The Microbial World. Prentice Hall, New Jersey, 1986.
5. Tauro P., Kapoor K.K. & Yadav K.S. An Introduction to Microbiology. Wiley Publications, New Delhi, 1989.
6. Cappuccino J.G. & Sherman N. Microbiology: A laboratory manual, Addison-Wesley, 2002.
7. Holt J.G. & Krieg N. R. Bergey's manual of determinative bacteriology, Lippincott Williams & Wilkin publishers, 2000.

DE I MB T2 MICROBIAL PHYSIOLOGY & TAXONOMY

Unit I

Generation of Energy: Entropy, generation of ATP – substrate level phosphorylation, oxidative phosphorylation, proton motif force, Fermentation vs respiration pathways, anaerobic respiration, acid fermentations.

Unit II

Photosynthesis and inorganic metabolism: Photosynthesis in bacteria. Assimilation of inorganic phosphorus, sulphur and nitrogen in bacteria – sulphate reduction pathway, ammonia assimilation pathway, nitrogenase and nitrogen fixation. Transport of sugars and metabolites – active, passive and facilitated transport systems, chemiosmosis, ion gradients.

Unit III

Bacterial cell division and differentiation – Cell wall synthesis and cell division in *E. coli*, life cycle of *Bacillus*, stages of endospore formation, germination and outgrowth. Gliding bacteria and gliding motility, life cycle of fruiting bacteria – Myxobacteria. Sporulation in fungi.

Unit IV

Taxonomic ranks, hierarchical arrangements in taxonomy. Classification systems like natural, phenetic and phylogenetic. Major characteristics used in taxonomy- Morphological, physiological, biochemical and molecular characteristics. Principles of chemotaxonomy and numerical taxonomy

Unit V

Classification of bacteria as per Bergey's Manual of Systematic Bacteriology – Organisms placed in the five kingdoms – Their salient features with examples.

Classification of Algae by Fritsch, classification of Fungi by Alexopoulos & Mims. Principles of Virus taxonomy, characteristics used in nomenclature & classification of bacterial, plant and animal viruses- their major families with suitable examples.

References

1. Moat A.G., Foster J.W. & Spector M.P, Microbial Physiology, 4/e, Wiley-Liss, 2002.
2. Caldwell D.R. Microbial physiology and metabolism, William C Brown publishers, USA 2002.
3. Cappuccino J.G. & N. Sherman, Microbiology: A laboratory manual, Addison-Wesley, 2002.
4. Prescott L.M., Harley J.P. & Klein D.A., Microbiology, 6/e, McGraw Hill Publishers, 2006.
5. Maigan M.T., Martinko J.M., & Brock P. J. Biology of Microorganisms 9/e Prentice- Hall, 2000.
6. Alexopoulos C.J. & Mims C.W., Introductory Mycology 3/e, Wiley, New York, 1979.
7. Nester E. W., Roberts C.V. & Nester M.T. Microbiology - A Human Perspective, Iowa, USA, 1995.
8. Stainer R.Y., Ingraham J.L., Wheelis M.L., & Painter P.R. General Microbiology, McMillan Educational Ltd, London, 1999.
9. Holt J.G. & Krieg N.R. Bergey's manual of determinative bacteriology, Lippincott Williams & Wilkin publishers, 2000.

DE-I MB-P1 MAJOR PRACTICALS - 1

General Microbiology

1. Parts, working principle and applications of compound microscope
2. Sterilization methods: moist heat, dry heat, filtration, disinfectants
3. Preparation of bacterial and fungal culture media
4. Isolation of bacteria and fungi from environmental samples

5. Enumeration of bacteria from environmental samples
6. Observation of bacterial colony morphology
7. Observation of bacterial cell morphology under microscope
8. Pure culture techniques: streak, spread and pour plate methods
9. Staining methods: Simple staining, Gram-staining

Microbial Taxonomy

Observation of permanent specimen slides & photomicrographs:

Bacteria: *Bacillus*; *E. coli*; *Pseudomonas*, *Staphyococcus*

Algae: *Chlamydomonas*, *Chlorella*, *Euglena*, Diatoms

Fungi: *Aspergillus*; *Penicillium*; *Rhizopus*; Yeast

Viruses: T4; Lambda; Tobacco Mosaic Virus, Pox; Vaccinia (photomicrographs)

Biochemical tests for bacterial identification

1. Carbohydrate fermentation
2. Acid-gas production
3. IMVIC tests
4. MR-VP tests
5. Catalase test
6. Oxidase test

Microbial Physiology

1. Measurement of growth-
 - a) Determination of direct count and viable count
 - b) Plotting growth curve on cm and semi-log graph sheets

References

1. Gunasekaran P. Microbiology: A laboratory manual, New Age international publishers, 1996.
2. Kannan N. Laboratory manual in general microbiology, Panima publishers, 2002.
3. Cappuccino J.G. & Sherman N. Microbiology: A laboratory manual, Addison-Wesley, 2002.
4. Moat A.G, Foster J.W. & Spector M.P. Microbial Physiology 4/e, Wiley-Liss, 2002.

DE II-MB T3 BIOCHEMISTRY

Unit I

Water and Life – pH and Buffers. Law of Thermodynamics-Oxidative and reduction reactions, redox potential, free energy and reaction, ATP energetics.

Unit II

Carbohydrates- Biological significance-Classification, Structure, chemical and physical properties of monosaccharide, disaccharides and polysaccharides. Metabolism of carbohydrates- Embden-Meyerhof-Parnas, Entner-Doudoroff, Pentose Phosphate pathways - TCA cycle.

Unit III

Lipids- fatty acids- simple fats. Physical and Chemical properties- Nomenclature of fatty acids- Phospholipids- Spingolipids- Lipoproteins- Reaction of phospholipids and Eicosanoids, Oxidation of fatty acids (β -Oxidation) - Fatty acid synthesis.

Unit IV

Proteins- Structure- Classification, properties of amino acids and proteins. Primary, secondary, tertiary and quaternary structures of proteins - Enzymes and their classifications - General properties of enzymes (pH, Temperature, Substrate concentrations), Michaelis Menton equation, enzyme inhibition, Isozymes.

Unit V

Nucleic acids – Components, Double helical structure- Nucleic acid denaturation-Classes of nucleic acids- Metabolism of nucleic acids- Synthesis of purines and pyrimidines.

References

1. Lehninger A.L. Principles of Biochemistry 2/e, CSB Publishers, 1993.
2. Conn E.E., Stumpf P.K , Bruening G & Doi. Outlines of Biochemistry 5/e –R.H, John Wiley & Sons, 1987.
3. Voet D & Voet J.G. Biochemistry, John Wiley & Sons, NY,1990.
4. Stryer L. Biochemistry 2/e, W.H. Freeman and Company, NY, 1998
5. Zubay G. Biochemistry 2/e, McMillan Publishers New York, Collier McMillan Company, London 1998.
6. Palanivelu, P. Enzymes, Ribozymes and DNazymes, Twentyfirst Century Publications, Palkalai Nagar, Madurai - 625 021, 2007.

DE-II- MB T4 MICROBIAL GENETICS & MOLECULAR BIOLOGY

Unit I

Structural aspects of DNA – the double helical model- Various forms of DNA-hyperchromicity – Genome organization – Prokaryotes and Eukaryotes.

DNA replication- Semi conservative - Nature of replication- DNA polymerases in prokaryotes- the processes of DNA replication- Replication in eukaryotes- Mitochondrial DNA replication.

Unit II

Genetics- Microbial genetics vs. Mendelian genetics-DNA as genetic material-experimental evidence- concept of gene and mutations- fluctuation test and its significance- complementation.

Mutagens-chemical and physical mutagens- UV, NTG and hydroxylamine- mode of action- isolation of auxotroph and drug resistance mutants- DNA damage and repair.

Unit III

Genetic exchange in bacteria- transformation and transduction (generalized and specialized) and conjugation- co-transduction and its use in genetic mapping-chromosome transfer by Hfr strains- arriving at *E. coli* genetic map.

Unit IV

Genetic code, Codons, Anticodons, Wobble hypothesis, Protein synthesis- the stages of protein synthesis- the process of translation in prokaryotes, factors involved in translation- the triplet nature of genetic code- an over view of comparisons with eukaryotic translation.

Unit V

Transcription – RNA polymerases in prokaryotes and eukaryotes – their function- process of transcription in prokaryotes- initiation, elongation and termination- factors involved. Regulation of gene expression in bacterial system- the operon model- detailed study of *lac* and *trp* operons.

References

1. Benjamin Lewin. Gene VII: Oxford University Press: 2000.
2. Watson, J. D., Hopkins, N. H., Roberts, J. W., Steitz, J. A., & Weiner, A. M. Molecular biology of the Gene 4/e, The Benjamin/Cumming Publishing Company Inc. 1992.
3. Snyder L & Wendy W. Molecular Genetics of Bacteria, 2/e, ASM press, Washington DC, 2003.
4. Friefelder, D. Microbial genetics, Narosa Publishing House, 1987.

DE II-MB P2 MAJOR PRACTICALS – 2

Biochemistry

1. Colorimeter- Beer & Lambert's law
2. Absorption maximum of a compound
3. pH meter- principle and measurements
4. Standardization of a pH meter
5. Estimation of Carbohydrates
6. Estimation of Proteins (Lowry's method)
7. Separation of amino acids by paper chromatography

Microbial genetics & Molecular Biology

1. Isolation of spontaneous mutant: antibiotic resistant mutants
2. Isolation of auxotrophic mutant by chemical and UV mutagenesis
 - i. (Replica plating technique)
3. Induction of *lac* operon
4. Separation of proteins by polyacrylamide gel electrophoresis

References

1. Palanivelu P. Analytical Biochemistry & Separation Techniques 4/e, 21st Century Publication, Palkalai Nagar, Madurai - 625 021 (2004).
2. Maniatis T., Fritsch E.F. & Sambrook J. Cold Spring, Molecular Cloning, A laboratory manual, Cold Spring Harbor laboratory (2002).
3. David R.W, Botstein D & Roth J.R., Advanced bacterial genetics, Cold Spring Harbor laboratory (1980).
4. Jayaraman J. Laboratory manual in biochemistry 5/e, New Age international publishers (1996).
5. Wilson K & Walker J. Principles of practical biochemistry, Cambridge University press (2000).
6. Plummer D.T, An Introduction to practical biochemistry, TATA McGraw Hill (1997).

DE III-MB T5 MEDICAL MICROBIOLOGY & IMMUNOLOGY

Unit I

History of Infectious Diseases: Human – microbe interactions – epidemiology of infectious diseases - Systemic bacteriology: General characters, molecular pathogenesis and laboratory diagnosis of diseases using Southern and western blotting methods, Applications of PCR in Medical Microbiology - Role of virulent factors in bacterial adhesion and colonization - Host-defense mechanisms.

Unit II

Diagnosis and control of microbial diseases – Collection and identification of pathogens from specimen - Biochemical tests for bacteria - Diagnosis of viral infections using immunological tests and phage typing. Principle and significance of antimicrobial chemotherapy and susceptibility testing. Mechanism of action of β -lactams - drugs affecting protein and nucleic acid synthesis – Mode of action of antiviral and antifungal drugs- Development of drug resistance.

Unit III

Bacterial diseases: Transmission, diagnosis, clinical symptoms and treatment for bacterial diseases; diphtheria, plague, tuberculosis, cholera, typhoid, peptic ulcer, Staphylococcal and Streptococcal diseases.

Viral diseases: Etiology, prophylaxis, clinical symptoms and treatment for human viral diseases. Smallpox, Rabies, Viral hepatitis, Poliomyelitis, AIDS and secondary infections.

Fungal and protozoan diseases: Cutaneous mycoses, systemic mycoses, opportunistic mycoses. Life cycle, diagnosis and treatment of following protozoan diseases – moebiasis, Giardiasis, malaria, kala-azar, Trypanosomiasis.

Unit- IV

Elements of Immunity: Overview of the Immune system- Basic concepts in immunology (History), principles of innate and acquired immunity - Cells and organs of the immune system - Classes of antigens and their characteristics.

Unit- V

Antibody structure: Classification and characterization, structure, properties, agglutination, complement system, Hypersensitivity, immune tolerance,

Humoral and cell mediated immune response: B-cell maturation, Activation and differentiation, Major Histocompatibility complex (MHC) - antigen processing and presentation T cell maturation, activation and differentiation.

References

1. Jawetz E., Melnic J.L. & Adelberg E.A. Medical Microbiology 22/e McGraw Hill Companies, 2004.
2. Mims C., Playfair J., Roitt I., Wakelin D. & Williams, R. Medical Microbiology 3/e Mosby publications, 2004.
3. Ananthanarayanan R. & Jayaram Panicker, C.K. Textbook of Microbiology, Orient Longman, 2005.
4. Roitt I.M. Essentials of immunology, ELBS, Blackwell Scientific Publication, 1998.
5. Kuby, J. Immunology 3/e. W.H.Freeman and Company, New York 1997.

6. Travers J. Immunobiology- The immune system in health and disease 3/e - Garland publishers, New York, 1997.
7. Elgert, K. Immunology understanding of immune system, Wiley Liss, New York, 1996.
8. Abbas A.K. & Lichtman, A.H. Cellular and Molecular Immunology 5/e, Saunders, 2000.

DE III MB T6 SOIL, AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY

Unit I

Soil microbes: Bacteria, Fungi and Actinomycetes (distribution) – Microbial interaction: mutualism, amensalism and commensalisms - Soil enzymes – Plant microbial interactions- N₂ fixation, symbiotic and free living- Genetics of N₂ fixation – phosphate solubilization – Rhizosphere effect – Mycorrhizal association; ecto and endomycorrhizae, actinorrhizae

Unit II

Plant microbe interactions - pathogenesis, mechanism of pathogen establishment and symptoms. Plant diseases caused by Bacteria, *Xanthomonas*, *Mycoplasma*, Fungi, *Pyricularia*, *Fusarium* and Viruses, TMV, CMV.

Unit III

Disease control- Fungicides, Pesticides, Biological control mechanisms - Production of bioinsecticides, bacterial and viral.

Unit IV

Biofertilizers: production and methods of application – Biopesticides: bacterial, fungal and viral – Microbial nematicides and microbial herbicides – Biotechnology in Agriculture: Bt. cotton and herbicide tolerant plants. Plant Growth Promoting Rhizobia (PGPR), Mycorrhizae and role of mycorrhizae in agriculture

Unit V

Role of microorganisms in biogeochemical cycles (N, P and C cycles) – Biodegradation of xenobiotics (pesticides) – Microbes in waste treatment: solid and liquid wastes – sewage treatment (Primary, secondary & tertiary treatments) – COD & BOD – pollution indicating microbes.

References

1. Rangasami G & Bagyaraj D.J. Agricultural Microbiology 2/e, Prentice-Hall publications, 1993.
2. Atlas, R. & Richard, B. Microbial ecology 2/e, Benjamin-Cummings publications, 1987.
3. Prescott L.M, Harley J.P. & Klein D.A., Microbiology, 6/e, McGraw Hill Publishers, 2006.

4. Madigan M.T., Martinko J.M. & Brock P.J. Biology of Microorganisms 8/e, Prentice-Hall Inc. 1997.

DE III-MB P3 MAJOR PRACTICALS- 3

Medical Microbiology

1. Collection and processing of medical samples
2. Antibiotic susceptibility test: disc diffusion method
3. Measurement of minimal inhibitory concentration (MIC) and minimal lethal concentration (MLC)
4. Isolation and identification of pathogenic bacteria from clinical specimens using selection plate methods.
5. Urine analysis (Microscopic Examination)

Immunology

6. Separation of serum/plasma
7. Erythrocyte sedimentation rate
8. Blood cell count: RBC count, WBC count – total and differential
9. Blood typing: ABO, Rh

Soil, Agricultural & Environmental Microbiology

10. Isolation and characterization of soil microbes
11. Serial dilution method for enumeration of soil bacteria
12. Identification of microbial pathogen in paddy and vegetable crops (field study).
13. Isolation of symbiotic nitrogen fixing bacteria from root nodules - *Rhizobium*
14. Isolation of phosphate solubilising bacteria – *Pseudomonas*
15. Examination of mycorrhizae – VAM
16. Potability testing of water (MPN test)
17. Microbial assessment of air quality – open plate method

References

1. Rangasami G & Bagyaraj D.J. Agricultural Microbiology 2/e, Prentice-Hall publications 1993.
2. Atlas, R & Richard, B. Microbial ecology 2/e, Benjamin-Cummings publications 1987.
3. Madigan M.T., Martinko J.M. & Brock P.J. Biology of Microorganisms 8/e, Prentice-Hall Inc. 1997.
4. Jawetz E., Melnic, J.L & Adelberg E.A. Medical Microbiology 22/e, McGraw Hill Companies, 2001.
5. Mims C, Playfair J, Roitt I, Wakelin D & Williams R, Medical Microbiology 3/e, Mosby publications, 2004.
6. Ananthanarayanan R & Jayaram Panicker, C.K, Textbook of Microbiology, Orient Longman, 1997.

DE III-MB T7 INDUSTRIAL MICROBIOLOGY

Unit I

Historical development of industrial microbiology, industrially important microorganism, Fermentor design: Basic design, configurations, parts and function. Fermentor types: Air lift and CSTR tower fermentor and packed bed bioreactor. Control and monitoring of variables, temperature, pH, agitation, pressure, online measurement, on/off control, PD control.

Unit II

Fermentation processes: Inoculum preparation, Inoculum build-up, Fermentor preculture, production processes. Parameters – physical, chemical and biological parameters in fermentation process, measurement using electrodes and computers.

Unit III

Fermentation types: aerobic, anaerobic and solid state fermentation. Bioreactor-operations-batch, fed batch, continuous process.

Unit IV

Production processes: Aerobic fermentation (Penicillin, Glutamic acid, Lysine, Vitamin B12), anaerobic fermentation (Ethanol, Acetone - Butanol) and solid state (Gibberellic acid). Detection and assay of fermentation products, physicochemical, biological assays.

Unit V

Product recovery: The recovery and purification of fermentations products (intracellular and extracellular), cell disruption, precipitation, ultrafiltration, centrifugation, solvent extraction, chromatography, drying, Quality assurance and quality control of fermented products.

References

1. Crueger W. & Crueger A. Biotechnology, A Text book of Industrial Microbiology, Panima Publishers, New Delhi (2000).
2. Nandari H. Industrial Biotechnology, Dominant Publications and Distributors, New Delhi (2005).
3. Reed G. Prescott & Dunn's Industrial Microbiology, CBS Publishers and Distributors, New Delhi (1987),
4. Rita Singh & Ghosh S. K., Industrial Biotechnology, Global Vision Publishing House, New Delhi (2004).
5. Stanbury O.F., Whitakar A., & Hall S.J., Principles of Fermentation Technology, Aditya Books (P) Ltd., New Delhi (1997).

DE III-MB T8 BIOTECHNOLOGY

Unit I

History and scope of Biotechnology: Biotechnology as an inter-disciplinary course –Cloning vectors: Plasmids (pBR322, pUC18) - Lambda phage derived vectors, cosmids and their applications. M13 phage and its uses; - Selection of suitable hosts for gene cloning - Cloning in *E. coli*

Unit II

Gene manipulation techniques: DNA isolation, Plasmid isolation- Restriction enzymes: Types and properties- Restriction digestion- DNA ligation. - Methods of gene transfer – Gene gun method, electroporation and microinjection methods - Southern and Northern blotting techniques- DNA sequencing.

Unit III

Animal & Plant Biotechnology: Mammalian cell cloning vectors-Transgenic animals: transgenic mice and sheep. Ti Plasmids, Agrobacterium mediated gene transfer mechanism - Markers and Reporter genes and their applications - Transgenic plants – insecticide resistance, herbicide and drought tolerance.

Unit IV

Microbial production of recombinant proteins: Expression vectors–Constitutive and inducible promoters - Production of recombinant DNA proteins using microbial hosts – Production of Insulin- Growth hormone- Interferons - tissue Plasminogen Activator.

Unit V

Intellectual property rights & Biosafety: GATT and IPR, different forms of IPR, IPR in India, patent co-operation treaty, forms of patents, process of patenting, Indian and international agencies involved in patenting, patenting biological materials. Biosafety aspects, Containment categories.

References

- 1 Ratledge C & Kristiansen B. Basic Biotechnology 3/e, Cambridge University Press (2008)
2. Darnell J. Lodish H. & Baltimore D., Molecular Cell Biology, Scientific American Books Inc., Iowa. 2006
- 3 Glick B.R. & Pasternak, J.J., Molecular Biotechnology- Principles and Applications of Recombinant DNA technology, ASM press, Washington 2006.
4. Mitra S., Genetic Engineering, Macmillan, India Limited, New Delhi 2001.
5. Winnacker E.L. From Genes to Clones: Introduction to Gene Technology, VCH Publications, Germany, 1987.

DE III- MB P4 MAJOR PRACTICALS – 4

Industrial Microbiology

1. Screening for amylase and protease producing bacteria and fungi from soil samples
2. Crowded plate technique for antibiotics producing microbes
3. Immobilization of yeast cells

Biotechnology

1. Isolation of chromosomal DNA from *E. coli*
2. Plasmid DNAs from *E. coli*
3. Separation of DNAs by agarose gel electrophoresis
4. Determination of purity and quantification of DNA
5. Restriction Digestion Analysis
6. Ligation
7. Transformation of *E. coli* using plasmid (pUC18/19)
8. Blue-white Selection of transformants

References

1. Palanivelu, P. Analytical Biochemistry & Separation Techniques, 4/e, 21st Century Publication, Palkalai Nagar, Madurai - 625 021 (2004).
2. Maniatis T, Fritsch E.F. & Sambrook J. Molecular Cloning, A laboratory manual, Cold Spring Harbor laboratory (2002).
