

COURSES OFFERED IN THE DEPARTMENT OF BIOTECHNOLOGY



**DEPARTMENT OF BIOTECHNOLOGY
SCHOOL OF LIFE SCIENCES
PONDICHERY UNIVERSITY**

M. Sc. COURSES OFFERED IN THE DEPARTMENT OF BIOTECHNOLOGY

Sl. No.	COURSE TITLE	CREDIT	SEMESTER
1.	BIOT 411 CELL BIOLOGY	3	I
2.	BIOT 461 CELL BIOLOGY LAB	1	I
3.	BIOT 412 IMMUNOLOGY	3	I
4.	BIOT 462 IMMUNOLOGY LAB	1	I
5.	BIOT 413 MICROBIOLOGY	3	I
6.	BIOT 463 MICROBIOLOGY LAB	1	I
7.	BIOT 415 TECHNIQUES IN BIOTECHNOLOGY	3	I
8.	BIOT 414 BIOCHEMISTRY	3	I
9.	BIOT 464 BIOCHEMISTRY LAB	1	I
10.	BIOT 466 TECHNIQUES IN BIOTECHNOLOGY LAB	1	I
11.	BIOT 421 MOLECULAR GENETICS	3	II
12.	BIOT 471 MOLECULAR GENETICS LAB	1	II
13.	BIOT 422 MOLECULAR PLANT- MICROBE INTERACTION	3	II
14.	BIOT 472 MOLECULAR PLANT – MICROBE INTERACTION LAB	1	II
15.	BIOT 423 APPLIED MICROBIOLOGY	3	II
16.	BIOT 473 APPLIED MICROBIOLOGY LAB	1	II
17.	BIOT 424 IMMUNOTECHNOLOGY	3	II
18.	BIOT 474 IMMUNOTECHNOLOGY LAB	1	II
19.	BIOT 425 MOLECULAR PLANT BREEDING	3	II
20.	BIOT 475 MOLECULAR PLANT BREEDING LAB	1	II
21.	BIOT 511 RECOMBINANT DNA TECHNOLOGY	3	III
22.	BIOT 561 RECOMBINANT DNA TECHNOLOGY LAB	1	III
23.	BIOT 512 PLANT BIOTECHNOLOGY	3	III
24.	BIOT 562 PLANT BIOTECHNOLOGY LAB	1	III
25.	BIOT 513 BIOPROCESS TECHNOLOGY	3	III
26.	BIOT 514 MARINE BIOTECHNOLOGY	3	III
27.	BIOT 564 MARINE BIOTECHNOLOGY LAB	1	III
28.	BIOT 515 PHARMACOKINETICS	3	III
29.	BIOT 516 MICROBIAL BIOTECHNOLOGY	3	III
30.	BIOT 565 MICROBIAL BIOTECHNOLOGY LAB	1	III
31.	BIOT 591 SEMINAR	1	III
32.	BIOT 592 PROJECT	2	III
33.	BIOT 521 RADIATION BIOLOGY	3	IV
34.	BIOT 575 RADIATION BIOLOGY LAB	1	IV
35.	BIOT 522 ANIMAL BIOTECHNOLOGY	3	IV
36.	BIOT 576 ANIMAL BIOTECHNOLOGY LAB	1	IV
37.	BIOT 523 MEDICAL BIOTECHNOLOGY	3	IV
38.	BIOT 566 MEDICAL BIOTECHNOLOGY LAB.	1	IV
39.	BIOT 524 PROTEOMICS AND GENOMICS	3	IV
40.	BIOT 574 PROTEOMICS AND GENOMICS LAB	1	IV
41.	BIOT 593 PROJECT	4	IV

Internal test I - IIIrd week of August, February

Internal test II - IIIrd week of September, March

Internal test III - IIIrd week of October, April

M.Sc. Biotechnology – SEMESTER I

COURSES	CREDIT
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HARD CORE

BIOT 411 CELL BIOLOGY	3
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BIOT 412 IMMUNOLOGY	3
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BIOT 413 MICROBIOLOGY	3
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BIOT 415 TECHNIQUES IN BIOTECHNOLOGY	3
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BIOT 414 BIOCHEMISTRY	3
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SOFT CORE

BIOT 461 CELL BIOLOGY LAB	1
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BIOT 462 IMMUNOLOGY LAB	1
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BIOT 463 MICROBIOLOGY LAB	1
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BIOT 464 BIOCHEMISTRY LAB	1
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BIOT 465 BIOCHEMICAL METHODOLOGY LAB	1
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M.Sc. Biotechnology – SEMESTER II

COURSES	CREDIT
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HARD CORE

BIOT 421 MOLECULAR GENETICS	3
BIOT 422 MOLECULAR PLANT-MICROBE INTERACTION	3
BIOT 423 APPLIED MICROBIOLOGY	3
BIOT 424 IMMUNOTECHNOLOGY	3
BIOT 425 MOLECULAR PLANT BREEDING	3

SOFT CORE

BIOT 471 MOLECULAR GENETICS LAB	1
BIOT 472 MOLECULAR PLANT-MICROBE INTERACTION LAB	1
BIOT 473 APPLIED MICROBIOLOGY LAB	1
BIOT 474 IMMUNOTECHNOLOGY LAB	1
BIOT 475 MOLECULAR PLANT BREEDING LAB	1

M.Sc. Biotechnology – SEMESTER III

COURSES	CREDIT
HARD CORE	
BIOT 511 RECOMBINANT DNA TECHNOLOGY	3
BIOT 512 PLANT BIOTECHNOLOGY	3
BIOT-513 BIOPROCESS TECHNOLOGY	3
BIOT 514 MARINE BIOTECHNOLOGY	3
BIOT 515 PHARMACOKINETICS	3
BIOT 516 MICROBIAL BIOTECHNOLOGY	3
SOFT CORE	
BIOT 561 RECOMBINANT DNA TECHNOLOGY LAB	1
BIOT 562 PLANT BIOTECHNOLOGY LAB	1
BIOT 564 MARINE BIOTECHNOLOGY LAB	1
BIOT 565 MICROBIAL BIOTECHNOLOGY LAB	1
BIOT 591 SEMINAR	1
BIOT 592 PROJECT	2

M.Sc. Biotechnology – SEMESTER IV

COURSES	CREDIT
HARD CORE	
BIOT 521 RADIATION BIOLOGY	3
BIOT 522 ANIMAL BIOTECHNOLOGY	3
BIOT 523 MEDICAL BIOTECHNOLOGY	3
BIOT 524 PROTEOMICS AND GENOMICS	3
SOFT CORE	
BIOT 574 PROTEOMICS AND GENOMICS LAB	1
BIOT 566 MEDICAL BIOTECHNOLOGY LAB	1
BIOT 593 PROJECT	4

BIOT- 411 CELL BIOLOGY**CREDIT- 3****UNIT I****8h**

Basic properties of cell, Different classes of cell: Prokaryotic, animal and plant cell, their characteristics, cell wall, composition, function of bacterial cell wall. Plasma membrane, structure, function, fluid mosaic model, membranes, lipids and proteins transport across the membranes- passive, active; phagocytosis, endocytosis, role of clatherin coated vesicles.

UNIT II**8h**

Endoplasmic reticulum, golgi complex- exocytosis; Lysosomes: phagocytosis, endocytosis; Plant cell vacuoles; Structure of mitochondria and organization of respiratory chain; Structure of chloroplast and photophosphorylation; Structure of nucleus, nucleolus, nuclear membrane, transport across nuclear membrane.

UNIT III**8h**

Molecular aspects of cell division and cell cycle, Regulation of cell cycle events, apoptosis, necrosis.

UNIT IV**4h**

Water, inorganic, organic constituents of cell, minerals, polysaccharides, proteins lipids, nucleic acids, vitamins, enzymes.

UNIT V**10h**

Extracellular matrix, collagen, proteoglycans, fibronectin, laminins, integrins, selectin, cadherins, role of tight junctions and gap junctions, Role of G- proteins coupled receptors, cAMP, Tyrosine kinase in cell signal transductions.

TEXT BOOKS

Cell and Molecular Biology : Lodish, H. F., 2000, W.H. Freeman & Co Ltd, USA
Cell: a Molecular Approach : Cooper, G. M., 2000, Sinauer Associates, USA

REFERENCE

Biochemistry, Biomolecules by Voet, D., and Voet, J. G. 2004, 3rd ed, John Wiley & Sons
Cell: Cooper
Gene VIII : Lewin, B., 2003, Prentice Hall , USA.

1. Osmofragility of RBC
2. Isolation of plasma membrane from erythrocyte
3. Chloroplast isolation from mung beans leaves
4. Extraction and estimation of chlorophyll
5. Extraction of Acid phosphatase from potato to study the effect of pH, temperature,
6. Effect of substrate concentration and inhibitor on on the efficiency of the enzyme.
7. Extraction of tyrosinase from potato
8. Preparation of Competent cell by calciumchloride method and checking its efficiency
9. Preparation of slides from onion root tip for mitosis

UNIT I Introduction to the study of Immunology: Historic perspective, Overview and Concepts, Mile stones in immunology, Discovery of humoral and cellular immunity, Functions of humoral and Cell- Mediated Immunoresponses.	6 h
UNIT II Components of immunity, Innate and Adaptive immunity, Cells and Tissues of the Immune System: Lymphoid organs, lymphoid cells and other cells involved in immunological responses.	6 h
UNIT III Antigens and Immunogenicity. Nature of Antigens and antibodies. Theories of Antibody formation. Antibody structure, structural basis of Antibody diversity; Immunoglobulins as Antigens, Properties of Immunoglobulins, subtypes.	10 h
UNIT IV Antigen - Antibody Reaction, Strength of Antigen and Antibody reaction, Cross reactivity, Precipitation and Agglutination reactions, Radioimmunoassay and ELISA. B-cell generation, activation and differentiation. Antibody production, Regulation and Diversity.	10 h
UNIT V Complement and its role in Immune Responses. Cellular Immunity, Immune tolerance and suppression, Hypersensitivity Reactions, Types of Hypersensitivity, Autoimmunity, Immunization principles and Immune deficiencies.	4 h

TEXT BOOKS

1. Coleman, Lombard and Sicard. Fundamental Immunology, WCB publishers 1992.
2. Goldsby RA, Kindt TJ, Osborne BA. Kuby Immunology, Fourth Ed, W.H. Freeman and company, New York, 2000.

REFERENCE

1. Hudson, L. and Hay, F.C. Practical Immunology, Black Well publishers 1989.
2. Dixon, F.J. Advances in Immunology, Academic Press 1986.

1. Immunization and generation of Anti-sera in rabbit against antigen
2. Separation of immunoglobulin G fractions using affinity chromatography
3. Single Diffusion methods of Immunelectrophoresis
4. Double diffusion method of Immunelectrophoresis
5. Rocket electrophoresis
6. Titer value determination
7. ELISA for detection of Antigens and Antibodies
8. Sandwich ELISA
9. Blood group mapping

BIOT- 413**MICROBIOLOGY****CREDIT - 3****UNIT I**

8h

Introduction to microbiology: scope, relevance, discovery and origin of microbial world, theories-spontaneous generation, germ theory of diseases. Interaction of light with objects. Microscopy and applications. Types of microscopy, Bright field, Dark field, Fluorescence, Phase-contrast and Electron Microscopy.

UNIT II

8 h

Eukaryotes: Cell structure and function; Cell wall, cell membrane, endoplasmic reticulum, Mitochondria, Golgi complex, Lysosomes, peroxisomes, chloroplast and nucleus. Prokaryotes: Cell structure and function; pili, flagella, capsule, cell wall, plasma membrane, mesosomes, endoplasmic reticulum.

UNIT III

7 h

Microbial diversity: Diversity and distribution of microbes. Classification of bacteria and fungi. General characteristics of virus, life cycle and classification of viruses.

UNIT IV

7 h

Microbial nutrition : Heterotrophs, autotrophs; uptake of nutrients, Enrichment culture technique. Transformation of elements: Carbon, Nitrogen, Phosphorous and Sulphur.

UNIT V

8 h

Microbial growth: Kinetics of growth; Batch culture, continuous culture, synchronous culture. Effect of temperature, pH, osmotic pressure, hydrostatic pressure and radiation on microbial growth.

TEXT BOOKS

1. Tortora G.J., Funke B.R., Case C.L. Microbiology: An introduction 8th Edition. San Francisco: Pearson Publishers, 2004.
2. Microbiology Fundamentals and applications - S. S. Purohit. Oscar Publications, 2003.

REFERENCE

1. Madigan M.T., Martinko, J.M., Parker J. Brock Biology of Microorganisms. 10th Edition. Prentice Hall Publishers, 2003.
2. Alcamo I. E., Fundamentals of Microbiology, 6th Edition. Benjamin Cummings Publishing Company, Inc., 2001.

1. Microbial isolation techniques. Isolation of bacteria and fungi
2. Establishment of pure cultures - streak, pour and spread plating techniques
3. Identification of microbes. Simple, differential, negative, spore staining methods.
4. Establishment of bacterial growth curve
5. In vitro antibiosis tests
6. Screening of microbes for the production of enzymes and hormones- chitinase, protease, lipase, cellulase, amylase, HCN and IAA.
7. Biochemical and genetic fingerprinting of microbes
8. Phylogenetic analysis of microbes
9. Microbial preservation techniques- patch plate, slant, water stock, glycerol stock and lyophilisation.

BIOT-415 TECHNIQUES IN BIOTECHNOLOGY CREDIT-3

UNIT I	8h
Acid, base, buffers: Definition and theories proposed for acids and bases, titration curves of amino acids, Henderson Hasselbalch equation and its application. Determination of pH by hydrogen electrode and glass electrode. Colloidal state and its membrane, definition of colloids, types of colloids, properties of colloids.	
UNIT II	7 h
Calorimetry: Principle, Beer and Lamberts, description of the instrument and techniques. Spectrophotometry: Principle and description of the instrument.	
UNIT III	7 h
Centrifugation: Principle, types of centrifugation, description of the analytical and ultracentrifuge. Determination of molecular weight by sedimentation velocity method, separation of cell organelles.	
UNIT IV	8 h
Electrophoresis: Principle, types of electrophoresis, separation of serum proteins, DNA fragments by (i) moving boundary electrophoresis, (ii) paper electrophoresis, (iii) starch gel electrophoresis, (iv) agar gel electrophoresis, (v) Ag-Ab reaction – Immunoelectrophoresis.	
UNIT V	10 h
Chromatography: Principle, types of chromatography: (i) Paper chromatography – separation of amino acids by ascending chromatography, (ii) Adsorption chromatography: Principle and separation of phospholipids, (iii) Ion-exchange chromatography: Principle, different types of resins and separation of amino acids. Affinity chromatography: Principle and separation of enzymes. (iv) Gel filtration chromatography: Principle, estimation of molecular size and weight of biological macromolecules.	

TEXT BOOKS

1. Morris and Morris Separation methods in Biochemistry. Pitman London 1960.
2. Wilson, K. and Walker, J. Practical Biochemistry – Principles and techniques Cambridge University Press.

REFERENCES

1. Brawer, I M., Perce, A.M., Experimental techniques in Biochemistry. Prentice Hall Foundation, New York 1974.

BIOT-466 TECHNIQUES IN BIOTECHNOLOGY LAB CREDIT- 1

1. Buffers Preparations
2. Spectrophotometry: Visible and UV spectrophotometry
3. Centrifugation: High speed centrifugation, density gradient centrifugation
4. Chromatography Ion – exchange, Adsorption & Gel filtration.
5. Electrophoresis: Agarose and SDS - PAGE
6. FTIR, ESR & NMR
7. Biological applications of radioisotopes: ^3H labeling of liver tissue
8. Polymerase Chain Reaction.

BIOT -414

BIOCHEMISTRY

CREDIT- 3

UNIT I	5h
Introduction: Biochemical basis of life. Significance of macromolecules – Carbohydrates, proteins, lipids and nucleic acids.	
UNIT II	7h
Chemistry and Metabolism of Carbohydrates - Structure and function of monosaccharides, Oligosaccharides and Polysaccharides – Metabolism of carbohydrates – Glycolysis, Citric acid cycle, HMP pathway and Glycogenolysis.	
UNIT III	6h
Classification and chemistry Lipids: Structure and functions of triglycerides, phospholipids, glycolipids, Significance of PUFA, Cholesterol and its derivatives. Metabolism of fatty acids – β oxidation, fatty acid biosynthesis, endogenous synthesis of triacylglycerols, phospholipids cerebrosides, gangliosides, cholesterol.	
UNIT IV	9h
Classification of Proteins and their functions: Essential and nonessential Aminoacids – structure and properties of amino acids, general degradation of amino acids – transamination, oxidative deamination, decarboxylation, disposal of ammonia – Urea cycle, structure of proteins – primary secondary and tertiary structures. Biocatalysts: Enzymes classification, Mechanism of action / allosteric enzymes / Isoenzymes / Coenzymes and cofactors.	
UNIT V	8h
Nucleic acids: Structure and function of DNA and RNA – Purine and Pyrimidine bases – structure, degradation and synthesis, inborn errors of nucleotide metabolism.	

TEXT BOOKS

1. Lehninger AL, Nelson DL and Cox MM (2002), Principles of Biochemistry. Mac Millan Worth Publishers Inc. (CBS Pub. & Distributors, New Delhi)
2. Martin DW, Jr., Mayer, PA and Rodwell, VW (2002). Harper's Review of Biochemistry 25th Edition, Maruzen Asian Ed: Lange Med. Pub.
3. Stryer L (2002). Biochemistry, Freeman & Co.

BIOT-464

BIOCHEMISTRY LAB

CREDIT- 1

1. Laboratory safety guidelines.
2. Isolation and quantitation of total DNA from plant and animal.
3. Isolation and purification of DNA
4. Isolation of chloroplast DNA.
5. Isolation and quantitation of RNA.
6. Isolation and quantitation of protein.
7. Isolation and purification of protein by affinity chromatography
8. Extraction and analysis of fatty acids.
9. Estimation of enzyme activity under various conditions viz., pH, temperature and substrate.

UNIT I

7h

Experimental evidences for DNA as the genetic material. Molecular nature of the gene. Organisation of Prokaryotic and Eukaryotic genome, Non-Mendelian inheritance, Sex linked inheritance.

UNIT II

7h

DNA Replication: conservative, semi conservative, rolling circle, Cairn's model of replication. Mechanism of replication: Okazaki fragments, role of different enzymes and accessory proteins. Specific examples of replication – single stranded phage, double stranded, SV40, ØX174.

UNIT III

9h

Mutation and Mutagenesis: Types of mutations- Induced mutations, Reverse mutations, suppressor mutations, spontaneous mutations. Chemical mutagens – nitrous acid, hydroxylamine, alkylating agents, intercalaters. Physical mutation by radiations. Mechanism of DNA repair process: Photo reactivation, excision repair, recombinational repair, SOS repair.

UNIT IV

9h

Genetics of Bacteria and viruses: Transformation, Conjugation, F+, Hfr, Transduction-generalized and specialized. Gene Expression: DNA transcription in prokaryotic and eukaryotic systems, Types of RNA and their functions, Role of RNA polymerases and other factors involved in transcription machinery, molecular mechanism of translation, post translational modifications.

UNIT V

8h

Regulation of gene expression: operon concept, regulatory gene, operator an promoter regions, lac and trp operons as examples for inducible and repressible operons, effect of glucose, CAP, cAMP.

TEXT BOOKS

1. Freidfelder, D. Molecular Biology. Jones & Bartlett Pub, Second Edition. 1986.
2. Strickberger, MW., Genetics, 3rd edition, Macmillan Publishing Company, 1985

REFERENCE BOOKS

1. Basic Genetics by Daniel L. Hartl, David Freifelder, Leon A. Snyder Jones & Bartlett Pub. 1988.
2. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J.A., and A.M. Weiner. Molecular Biology of the Gene, Volume I & II (4th Edition). Benjamin Cummings Publications, 1987.

1. UV mutagenesis and percent survival
2. Photoreactivation of UV irradiated *E. coli*.
3. Development of auxotrophic mutants employing EMS
4. Screening of multiple antibiotic resistant mutants of *E. coli*
5. Plasmid curing in bacteria
6. Replica plating technique
7. Determination of purity and estimation of DNA
8. Transfection by single burst experiment
9. Blue and white colony selection employing X-gal-IPTG

BIOT- 422 MOLECULAR PLANT-MICROBE INTERACTION CREDIT -3

UNIT I 8 h

Introduction to Molecular Plant Pathology-Concepts and Definitions. An overview of plant-pathogen interaction. Molecular Biology of disease resistance. Plant chemicals involved in resistance. Gene-for-gene interaction-Resistance genes-Avirulence genes. Systemic Acquired Resistance (SAR). SAR-maker proteins. Biosynthesis and mode of action of Salicylic acid.

UNIT II 8 h

Defense related pathways. Octodecanoid pathway. Lipoxygenase pathway, Shikimic Acid pathway, Cyanogenesis, Anthocyanin biosynthetic pathway, Hypersensitive Reaction, Reactive Oxygen species and their role in resistance. Pathogenesis Related (PR) proteins. Resistance gene dependent plant defense. Role of sinapoyl CoA and feruloyl CoA in resistance.

UNIT III 7 h

Pathogen and Diversity: Bacteria, Fungi, Viruses and Nematodes. Bacterial, fungal and viral diseases. Specific symptoms associated with phytopathogens. Virulence mechanisms of bacterial and fungal pathogens.

UNIT IV 7 h

Molecular Diagnosis: Molecular tools for the detection of plant pathogens. Introduction-molecular probes- different molecular methods (immunological assays and nucleic acid hybridization and amplification techniques) for the identification of pathogens. Use of PCR in the detection and characterization of phytopathogens.

UNIT V 8 h

Modern biotechnological strategies for disease management: Plant growth-promoting rhizobacteria (PGPR). Taxonomy and diversity of fluorescent pseudomonads. Mechanisms of plant growth promotion and antagonism.

TEXT BOOKS

1. Molecular Plant Pathology. S. J. Gurr, M. J. McPherson and D. J. Bowles; Oxford University Press (1998)
2. Plants, Genes and Crop Biotechnology, M. J. Chrispeels and D. E. Sadava; Jones and Bartlett Publishers, II Edition (2003)

REFERENCES

1. The Plant Cell (Special Edition: Plant Microbe Interaction) Vol.8, 1996.
2. Molecular methods in Plant Pathology. Rudra P. Singh and Uma S. Singh; Boca Raton, Fla. Lewis Publishers, 1995.
3. Molecular Biology in Crop Protection. G. Marshall and D. Walters; Kluwer Academic Publishers, 1994.

BIOT- 472 MOLECULAR PLANT-MICROBE INTERACTION LAB

CREDIT - 1

1. Isolation of plant pathogens from infected plants
2. identification of pathogens
3. Study the factors involved in fungal and bacterial pathogenesis
4. Genomic DNA extraction from phytopathogenic bacteria and fungi
5. Quantitative and qualitative analyses of genomic DNA
6. Analysis of genome of pathogenic bacteria or fungi by RAPD analysis
7. Identification of microbes for biocontrol of fungal and bacterial pathogens
8. Detection of antibiotic genes in antagonistic bacteria
9. Extraction antimicrobial metabolites from biocontrol bacteria

BIOT -423**APPLIED MICROBIOLOGY****CREDIT-3**

UNIT I. History and development-Growth phase, Isolation, Preservation Screening of microbes used in Industry: Strain improvement by mutation, selection and enrichment. Bioreactors-types. Air lift, cavitator, acetator, fluid Bed reactors.	8 h
UNIT II. Production of beverage and industrial alcohols, wine, beer. Production of organic acids -lactic acid, acetone-butanol, citric acid and acetic acid. Production of microbial biomass –SCP.	10 h
UNIT III Industrial Production of antibiotics- Penicillin, erythromycin and streptomycin; Bacterial production of enzymes-protease,cellulase,amylase. glucose isomerase, etc, Immobilization of enzymes and development of biosensors.	8 h
UNIT IV Role of Microorganisms in cheese production –cheddar cheese, blue cheese, Swiss cheese, camembert cheese, yogurt, buttermilk , sour cream, koumiss,kefir manufacturing. Leather processing.	6 h
UNIT V Production of therapeutic and diagnostic proteins –Interferon, somatotropin cytokines ,insulin, growth factors, steroids. Microbial leaching of ores.	8 h

TEXT BOOKS

1. Industrial Microbiology (1992): 4th edition-Prescott & Dunn.,CBS
2. Perspectives in Biotechnology and applied Microbiology. Elsevier Publication, Alani,D.I., and Murray Moo-Young (1986):
3. Applied Microbiology –(1968)Cassida Jr. Tata McGraw hill. Microbiology- Concepts and applications (1994): Paula A.Ketchun

REFERENCE BOOKS

1. Fermentation Technology - (1998) Staneberry et al.
2. Molecular Biotechnology - Principles & applications of Recombinant DNA - Bernad R.Glick and Jack J.Pasternak.

1. Estimation of Microbial biomass
2. Red and White wine fermentation
3. Alcohol production from molasses using yeast
4. Production of amylase using bacillus under submerged conditions
5. Production of protease using *Protease vulgaris* under submerged conditions
6. Production of protease using rice bran.
7. Cottage cheese production
8. Production of penicillin-G
9. Mass culture of LAB in fermentor.
10. Industrial visit to brewery and distillery.

UNIT I Introduction scope of Immunotechnology, Preparation and purification of Antigens, Extraction of antigens from pathogens, parasites and other biological materials. Antigen fractionation and purification. Preparation of synthetic antigens, Recombinant antigens.	6 h
UNIT II Production, purification and characterization of antibodies. Different kinds of Immunization procedures. Purification of Immunoglobulins, Characterization of Immunoglobulins	6 h
UNIT III Hybridoma and monoclonal antibody (MCAb) techniques, Production of marine hybridoma, Production of MCAs in cultures and animal (Ascites), Purification of MCAs. Characterization of MCAs/ and Labelling of antibodies.	8 h
UNIT IV Cellular immunological methods, Markers of immunocompetant cells, Separation and purification of immunocompetant cells. Functional tests for immunocompetant cells and Histocompatibility testing.	8 h
UNIT V Immunological assays - Agglutination tests, Complement fixation tests, In vivo tests/ Neutralization tests, Immunodiffusion, Immunoelectrophoresis, Radioimmunoassays, Enzyme immunoassays, Immunoblotting, Immunohistochemistry and immunohistopathology and Immunofluorescence techniques.	8 h

TEXT BOOKS

1. Goldsby RA, Kindt TJ, Osborne BA. Kuby Immunology, Fourth Ed, W.H. Freeman and company, New York, 2000.
2. Rose et al., Manual of Clinical laboratory Immunology, 6th Ed ASM Publications, 2002.

REFERENCES

1. Burdon and Khippiberg, Laboratory techniques in Biochemistry and Molecular Biology, Humana Press, 1984.
2. Weir DM, Herzenberg LA, and Blackwell C. Handbook of Experimental Immunology, Black well Science Oxford 1989.
3. Lefkovic and Pernis, Immunological methods. Academic Press, 1978.
4. Boore baeck, Antibody Engineering 2nd Ed Wiley, 1995.

1. Preparation of antigens from pathogens and parasites
2. Slide and Tube agglutination reaction
3. Immunofluorescence technique
4. Culturing of Leucocytes
5. SDS-PAGE and Immunoblotting
6. Rapid detection of HBV and HCV candidate antigens
7. Diagnostic PCR
8. Separation of CD cells using Flow cytometry
9. Isolation and identification of lymphocytes.

UNIT I	7h
Plant breeding- History; Genetic resources- centres of diversity and origin of crop plants, Law of homologous variation, genetics resources	
UNIT II	8h
Mode of reproduction and breeding strategies - Breeding of self and cross pollinated and vegetatively propagated crop plants, Heterosis breeding, Polyploidy and haploids in breeding, Wide hybridization, Mutation breeding, Breeding crops to contain useful and adaptive traits; seed production and variety development and its conservation.	
UNIT III	8h
Plant genome mapping: Types of mapping population; RFLP and AFLP mapping. Marker assisted breeding using RFLP, AFLP, RAPD, SNP and CAPS marker.	
UNIT IV	7h
Plant tissue culture and somatic cell genetics – role of growth regulators, Micropropagation, Germplasm storage <i>in vitro</i> ; Embryo rescue, Haploids and triploids, Secondary products, Protoplast culture and fusion, Cybrids, Somaclonal variation, Mutant selection <i>in vitro</i> and by transposon tagging.	
UNIT V	8h
Plant genetic engineering using recombinant DNA techniques: Genetic engineering for abiotic stress, quality improvement; Strategies for Marker Gene Removal from Transgenic plants; Transgene silencing, Strategies to avoid gene silencing and improve gene expression in transgenic plants, Description and uses of antisense RNA, ribozymes in plants; Ethics and plant genetic engineering.	

TEXT BOOKS

1. Allard R W (1999). Principles of Plant Breeding 2nd ed. John Wiley & sons
2. Lorz H and Wenzel G (2005). Molecular marker systems in Plant Breeding and Crop Improvement (Biotechnology in Agriculture and Forestry), Springer

REFERENCE BOOKS

1. Henry R Y (2001). Plant Genotyping - The DNA Fingerprinting of Plants. CABI Publishing
2. Paterson AH (2002). Genome mapping in Plants, Academic Ptness. Sandiego

BIOT- 475 MOLECULAR PLANT BREEDING LAB CREDIT- 1

1. General Breeding Techniques: Emasculation, pollination and tagging.
2. Selection of parents for wide hybridization and embryo rescue
3. Tissue culture techniques: Preparation of various tissue culture media.
4. Tissue culture of various explants.
5. Isolation and culture of protoplasts.
6. Isolation and culture of microspores.
7. Application of RFLP technique in plant breeding.
8. Demonstration of AFLP technique in plant breeding.
9. Detection of multiple genes by employing SNP primers

BIOT –511 RECOMBINANT DNA TECHNOLOGY CREDIT- 3

UNIT I 8h

Vectors for cloning: Plasmids, phages, ssDNA phages, cosmids, YACs. Enzymes used in gene manipulation-restriction enzymes, DNA polymerases, reverse transcriptase, ligases, polynucleotide kinase, alkaline phosphatase and nucleases.

UNIT II 8h

Transfer of DNA into cells: transformation, transduction, electroporation, microinjection. Agrobacterium mediated gene transfer.

UNIT III 8h

Cloning strategies: Genomic libraries, cDNA Cloning subcloning, shot gun cloning. Cloning in *E. coli*, *Bacilli* and *yeast*. Yeast two hybrid system. cDNA phage display library. Recombinant clones: Detection of recombinant DNA and its Products.

UNIT IV 8h

Site-directed mutagenesis of cloned genes. DNA sequencing: Oxy, deoxy chemical methods, Pyrosequencing, Nanosequencing. PCR: Design of PCR primers, RT-PCR, RACE, AP-PCR, PAF. Antisense and ribosome technology: siRNA, miRNA, Ras, Dicer. Applications of PCR.

UNIT V 8h

Applications of genetic engineering in medicine, agriculture, veterinary and industry. Safety aspects of recombinant DNA technology; Intellectual property rights (IPR) and patents. DNA forensics. Somatic cell gene therapy.

TEXT BOOKS

1. Primrose, S.B., Twyman, R.M., and R.W. Old. Principles of Gene Manipulation. Sixth Edition. Blackwell Science, 2001.
2. Lodish, H., Baltimore, D., and A. Berk. Molecular Cell Biology. W H Freeman & Co (Sd); 3rd edition, 1995.

REFERENCE BOOKS

1. Sambrook, J., Fritsch, E.F., and T. Maniatis. Molecular Cloning. A Laboratory Manual. 2nd Ed. Cold Spring Harbor Laboratory Press, New York, 1989.
2. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., and P. Walter. Molecular Biology of the Cell, Fourth Edition. Garland & Co. 2002.

BIOT – 561 RECOMBINANT DNA TECHNOLOGY LAB CREDIT- 1

1. Plasmid DNA extraction from *E. coli*
2. Genomic DNA extraction from *Bacillus thuringiensis*
10. Agarose gel Electrophoresis and elution of DNA
11. Restriction mapping of genomic and plasmid DNA
12. Preparation of competent cells
13. CaCl₂ mediated transformation and electroporation
14. SDS-PAGE analysis
15. Western Blot analysis
16. Multiplex PCR for detection of cry genes in *Bacillus*

UNIT I

8 h

Genome organization and protein targeting: General organization of nuclear, mitochondrial and chloroplast gene. Targeting of proteins synthesized in cytoplasm to chloroplast, mitochondria and within the endomembrane system of plants.

UNIT II

7 h

Structure and expression of gene: Tissue specific genes, structure and organization of nuclear genes concerning storage proteins, phytochrome, microbial infection and other stresses. Maize transposable elements, organization and function of transposons.

UNIT III

10 h

Development of plant transformation cassettes: Structure and function of Ti plasmid of *Agrobacterium*, Mechanism of T-DNA transfer to plants. Ti plasmid vectors for plant transformation. Promoter and marker genes in plant transformation. Criticisms regarding the use of different promoters and markers.

UNIT IV

5 h

Gene transfer and tissue culture techniques: Physical, chemical and biological methods for plant gene transfer. Shoot-tip culture, Rapid clonal propagation, somoclonal variation and synthetic or artificial seeds, cytoplasmic male sterility.

UNIT V

10 h

Transgenic plants for virus resistance, herbicide tolerance, delay of fruit ripening, resistance to insect, fungi and bacteria. Production of antibodies, viral antigens and peptide hormones in plants.

TEXT BOOKS

1. Plant Molecular Genetics - Monica A. Hughes. Harlow, England: Addison Wesley Longman, 1996.
2. Plant Biotechnology and Transgenic Plants. Editors: Kirsi-Marja, Wolfgang Barz. Marcel Dekker, 2002.

REFERENCES

1. Plant Biochemistry and Molecular Biology, Lea, PJ, Leegood, RC, eds. John Wiley and Sons, Chichester and New York , 1993.
2. Plant development and Biotechnology. Editors: Robert N. Trigiano, Dennis J. Gray. CRC press, 2004.

1. Isolation of genomic DNA from dicot and monocot plants
2. Qualitative and quantitative analysis of plant genomic DNA
3. Amplification and cloning of a plant gene
4. Mapping of a plant gene. Analysis of a plant gene sequence using Clone Map Software
5. Overexpression of plant protein in *Escherichia coli*
6. Western analyses of expressed plant protein.
7. Cloning of pathogenesis related proteins in *Agrobacterium*
8. *Agrobacterium*-mediated plant transformation.
9. Analysis of transgene integration and expression in plants.

BIOT 513 BIOPROCESS TECHNOLOGY AND DOWNSTREAM PROCESSING

CREDIT- 3

UNIT I Types, cells, production strains, preservation- history, industrial applications, chemical technology vis a vis biotechnology, commercial evolution, potential	8h
UNIT II Mechanism of enzyme reactions, Michaelis Menten kinetics, inhibition, factors affecting rate, parameter estimations, growth characteristics of microbial cells, Monod model, batch culture.	8h
UNIT III Agitation and mixing, transport in cells, transfer resistances, mass transfer coefficients, enhancement of oxygen transfer, heat transfer correlations, batch and continuous sterilisation	8h
UNIT IV Ideal bioreactors, Batch, fed batch, CSTR, PFR, Multiphase bioreactors, packed bed, bubble column fluidized trickle bed, immobilization. Aseptic, septic and anaerobic fermentors.	8h
UNIT V Filtration, centrifugation, sedimentation, extraction, sorption, reverse osmosis, ultrafiltration, electrophoresis, waste water treatment.	7h

TEXT BOOKS

1. Bioprocess Engineering by M.Shuler & F.Kargi (2002) Prentice Hall (I) Ltd., N.Delhi.
2. Bioprocess Engineering Principles by P. M. Doran (1995) Academic Press

REFERENCE

1. Biochemical Engineering fundamentals" 2nd ed. by J E Bailey and D F Ollis, McGraw-Hill (1986).

BIOT -514**MARINE BIOTECHNOLOGY****CREDIT- 3**

Unit I	10 h
Biotechnology in Marine Sciences. Aquaculture: culture of shrimp, crab, edible mollusc ,oysters and pearl oysters, Culture of milkfish, mullets and eel. Culture of live feed organisms- brine shrimp, rotifers, marine algae.	
Unit II	6 h
Marine hydrocolloids-agar,agarose, carageenan, alginates, chitosans and chitin. Marine enzymes - Applications of enzyme for fish processing. Marine Lipids-application of lipases for modification of fats and oils. Marine flavourants. Bioconversion of organic materials and fish ensilage,	
Unit III	8 h
Aquaculture biotechnology- hormonal manipulation of sex,chromosomal manipulation of sex fish, cryopreservation of fish gametes and embryo. Diseases of cultured shrimp, fish . Diagnostics and their application to aquaculture.	
Unit IV	8 h
Production of transgenic fishes.-growth hormone, antifreeze protein, disease resistant fish, Cloning and expression of GnRH , application of hormones in induced breeding in aquaculture. Antifreeze protein and its applications.	
Unit V	8 h
Pharmaceuticals from marine realms, type of drugs and their medical applications. Biofouling and their control. Control of oil spills and bioremediation Role of halophiles.	

TEXT BOOKS

- 1.. Aquaculture: Principles and Practices - T.V.R. Pillay -1990
- 2.. Marine Microbiology - Austin. Cambridge press.1992
- 3.. Aquaculture: The farming and husbandry of Freshwater & Marine organisms by J.Bardach, Ryther J. Mclarhey.W. 1972.

REFERENCE

1. Advances in Fisheries Technology and biotechnology for increased profitability - Ed. Michael N. Voigt, J. Richard Botta. Technomic Publishing Co. Inc.(1990)
- 2.. Biotechnology in the Marine Science- Proceedings of the first Annual MIT Sea Grant Lecture and Seminar - Colwell R.R. 1982.
- 3.. New Developments in Marine BiotechnologyEd. LeGal and H.O.Halvorson Plenum press 1998.

1. Estimation of water quality parameters : dissolved oxygen, salinity, ammonia in sea water.
2. Antagonistic test with probiotics and fish pathogens
3. Identification and partial characterization of fish and shrimp pathogens .
4. Ploidy detection using karyotyping
5. PCR diagnosis of white spot syndrome virus, monodon baculovirus, hematopoietic necrosis virus
6. Immunodiagnosis of fish pathogen (Western blot)
7. Enrichment of live feed organisms –Artemia ,Rotifers
8. Induction of breeding in fish using ovaprim-invitro fertilization and rearing of Fry .
9. Extraction of hydrocolloids from sea weeds
- 10.. Field visit to shrimp hatchery, farms and salt pans.

UNIT I

6 h

Introduction, history, nature and source of drug, classification of drugs, route of drug administration: types, advantages and disadvantages, prodrug: definition, antibody directed enzyme prodrug therapy (ADEPT).

UNIT II

10 h

Models of pharmacokinetics: concentration dependent model and flowtype model, drug interaction, properties of drugs: Physiochemical properties of drugs, biochemical aspects of drugs, mechanism of action of drugs, Bioavailability: definition, factors influencing bioavailability, first pass elimination, extraction ratio, dose: loading dose, maintenance dose, target concentration strategy.

UNIT III

10 h

Absorption: Biological membrane and drug absorption, fluid mosaic model of membrane, types of drug transport, factors influencing drug absorption, drug transport – types, distribution: models of distribution, redistribution of drugs and influence of protein binding on distribution, elimination: models of eliminations, types of elimination: capacity limited elimination and flow dependent elimination.

UNIT IV

6 h

Biotransformation (metabolism): Synthetic and nonsynthetic reactions, drug metabolizing enzymes: microsomal and non-microsomal enzymes, inhibition of drug metabolism, enzymes induction, drug assay, half life and its significance.

UNIT V

4 h

Drug toxicity in relation to pharmacokinetics – therapeutic index, types of toxicity, role of biotechnology in channelizing pharmacokinetics: patenting of biopharmaceutical products.

TEXT BOOKS

1. Rang H. Pharmacology, Fifth Edition, Churchill-Livingstone, 2003.
2. Ho et al., Biotechnology and Biopharmaceuticals – Transferring Proteins and Genes. 2003

REFERENCE

1. Leach et al., Molecular Modelling. 2nd Ed, Printieall Publication, 2001.
2. Grandi et al., Genomics, Proteomics and Vaccines. Wiley publication, 2003
3. Baxevanis and Quellette. Bioinformatics: A practical guide to the analysis of genes and Proteins. Wiley publication, 2002

BIOT -516 MICROBIAL BIOTECHNOLOGY CREDIT - 3

UNIT I General concepts of microbial biotechnology. Microorganisms as factories for the production of novel compounds. Genetic engineering of microbes to improve production of antibiotics, amino acids, lipids, enzymes, steroids and secondary metabolites. Biopolymers and bioplastics	4 h
UNIT II Definition, Concepts- history, biotechnological potentials of microalgae – food – feed – colourant – fuel and pharmaceutically valuable compounds. Cultivation methods of algae with reference to <i>Dunaliella</i> and <i>Phormidium valderianum</i> . Production of microbial biofertilizers – cyanobacteria, <i>Rhizobium</i> , <i>Azotobacter</i> , <i>Azospirillum</i> , <i>Phosphobacteria</i> and VAM.	8 h
UNIT III Biological pest control, scheme for selection of microbial antagonist for biological control of insects, bacterial, fungal and viral diseases. Mode of action of biological control involved in different biocontrol agents. Genetics of antimicrobial metabolite production in biocontrol bacteria. Risks associated with GMOs, Potential impacts on the environment and human health.	8 h
UNIT IV Bioconversion of cellulosic and non-cellulosic wastes. Mechanism of novel carboxylase genes involved in bioconversion. Agrobypoducts. Bioremediation of wood, fuels lubricants, rubber, plastics.	10 h
UNIT V Waste utilization: Waste water treatment - Aerobic and Anaerobic processes, Treatment schemes for waste waters of dairy, distillery, tannery, sugar, antibiotic industries. Sewage disposal, compost making, methane generation. Microbiology of degradation of xenobiotics in environment: Ecological considerations, decay behavior, hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides.	10 h

TEXT BOOKS

1. Bernad R. Glick and Jack J. Pasternak. Molecular Biotechnology Principles and Applications of Recombinant DNA. WCB, 2002
2. Dasilva EJ, Domm ergues YR, Nyns EJ, Ratledge C. Microbial Technology in the Developing world, Oxford Scientific Publications, 1987.

REFERENCE

1. Prescott and Dunn. Industrial Microbiology. 4th Ed, 1992
2. Watson, JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AM. Molecular Biology of the Gene. The Benjamin Cummings, 1987.

BIOT -565 MICROBIAL BIOTECHNOLOGY LAB CREDIT - 1

1. Production of *Taq* polymerase using recombinant *E. coli*
2. Mushroom cultivation
3. Different methods of antimicrobial susceptibility testing
4. Isolation of antagonistic bacteria for growth suppression of pathogens
5. Detection of antimicrobial phenazines and phloroglucinols genes by PCR
6. Microbial bioconversion of agricultural wastes using fungi.
7. Microbial bioconversion of agricultural wastes using bacteria.
8. Microbial degradation agricultural pollutants, fungicides and insecticides
9. Cultivation and mass multiplication of azolla
10. Microbial degradation of hydrocarbons.

UNIT I 6h

Physics of ionizing interaction: α , β , γ , n; Free radical production, LET, absorption and dosimetry; Units of radiation measurement, radiation level and limits. Direct and indirect effects of radiations, Irradiation products of water, G-values and Fricke's dosimetry

UNIT II 8h

Cell survival curves, Target theory, RBE, Dose response relationship models. Laws of Bergoneau and Tribondeau, Application of radiation therapy/ differential response; Mitotic cycle and radiosensitivity, Dose rate effects; fractionation; oxygen-effect, Radioprotectors, radiation hormesis mechanism.

UNIT III 8h

Acute radiation effects of whole body irradiation, late somatic effects; effect on immune response, LD50, radiation syndromes: bone marrow, gastrointestinal and cerebrovascular. acute radiation syndrome, Leukemia and other cancers, cataracts, life shortenings, risk estimates, oncogenes and mechanism of life shortening, Risk estimates, oncogenes and mechanism of carcinogenesis, probability of causation, epidemiological populations

UNIT IV 10h

Radiation damage to DNA, RNA and proteins. DNA strand breaks, Chromosomal aberrations. Methods of detecting damage for both ionizing and UV light. Virus as probe for DNA repair, Role of defective DNA repair mechanism in human disease.

UNIT V 8h

Genetic effects, radiation carcinogenesis, Differential response, reoxygenation, Tumor kinetics, fractionation, sensitizers and radioprotectants, hyperthermia. Ultrasound, optical radiations, radiofrequency and microwave radiations.

TEXT BOOKS

Radiation Biology for Radiologist- Eric J Hall, 1997, 3rd edition, J B Lippincott Company, UK.

DNA repair and mutagenesis: E C Friedberg, G G Walker, W Siede. (1995). ASM Press. Washington, DC.

REFERENCE

Principles and Practice of Radiation Oncology-. Perez, C. A., Brady, L.W., Halperin, E. C., Schmidt-Ullrich, R. K. , 2004, 4th edition, Lippincott Williams & Wilkins (LWW).

1. Fricke's dosimetry for calculating dose rate of gamma-rays.
2. Biophysical analysis of gamma-irradiated DNA.
3. Agarose gel electrophoresis of the gamma-irradiation of plasmid DNA.
4. Determination of death rate of gamma-irradiated of bacterial cells.
5. Identification of albino mutants consequent to gamma –irradiation of seeds.
6. Effect of electron scavengers on the post- irradiation treatment of the seeds.
7. Identification of chromosomal aberrations in root tips of rice seedlings subsequent to gamma-irradiation.
8. Comparison of Superoxide dismutase activity in gamma-irradiated rice seedlings
9. Determination of total peroxide obtained after various treatments of gamma-irradiated seeds.

BIOT- 522**ANIMAL BIOTECHNOLOGY****CREDIT - 3****UNIT I**

8h

Animal Cell culture –primary and established cell line cultures, functions of different constituents of culture media, serum and protein free media and their applications ,scaling up of animal cell culture, cell synchronization, cell cloning and micro manipulation. Application of animal cell culture. Stem cell culture and their applications .Cell culture based vaccines .Organ and histotypic culture. Apoptosis.

UNIT II.

8h

Reproductive Biotechnology- cryopreservation of gametes and embryos in mammals. In- vitro fertilization, embryo splicing and embryo transfer. Production of transgenics –birds, mammals and knockout mice. Application of transgenic animals –models for diseases, oncogenes , drug screening and gene farming

UNIT III.

8h

Integrated insect pest management using biocides, hormone analogues, pheromones and genetic manipulations. Biotechnology of silk worms-Life cycle, culture of silk worm, diseases of silk worm ,improvement of silk production and quality, Biology of viral vectors-SV40,adeno virus, retro virus, vaccina virus papiloma virus, and .baculoviruses. Insect as a bioreactor.

UNIT IV

8h

RFLP and its applications in domestic animals. Biotechnological approaches to vaccine production Development of animal vaccines for –Reinderpest, foot and mouth disease, blue tongue disease, rabbies and anthrax . Peptide vaccines, fusion protein vaccines, synthetic peptide vaccines, anti-idotype antibody vaccines. Ethical issues in animal biotechnology. Management aspects of biotechnology and genetic engineering.

UNIT V

8h

Biotechnology in animal production-manipulation of growth using hormones and probiotics, manipulation of lactation , manipulation of wool growth in sheep and rabbits

TEXT BOOKS

1. Animal Biotechnology (1989): Comprehensive Biotechnology First Supplement: (Ed.)L.A. Babink and J.P.Phillips. Pregamon press, Oxford,
2. Experimental approaches to Mammalian Embryonic Development. (1986) Rossant,J. and R.A.Pederson Cambridge University Press, Cambridge
3. Animal cell culture – A practical approach. (1992) Ed. R.I.Freshney .IRL press.

REFERENCE

1. Future Developments in the Genetic Improvements of Animals. Ed. J.S.F.Barrer, K.Hammond and A.E.McClintock, Academic Press, 1992.
2. Human Genetics : Concept and Applications. Ricki Lewis .McGraw Hill. 2003.

UNIT I	10 h
Introduction, world wide market in medical biotechnology, revolution in diagnosis, changing approaches of therapy, FDA – Organization chart and regulatory measures for drug discovery: Investigational new drug. Drug discovery: Overview, rational drug design, combinatorial chemistry in drug development, computer assisted drug design, role of bioinformatics in genome – based therapy, antisense DNA technology for drug designing.	
UNIT II	10 h
Genetically modified food – advantages and disadvantages, production of single cell proteins, biotechnological approaches to obtain blood products: Tissue plasminogen activator and erythropoietin, Vaccine technology: Subunit vaccines, drawbacks of existing vaccines, criteria for successful vaccine, peptide vaccine, minicells as vaccines, impact of genetic engineering on vaccine production, viral vector vaccines and AIDS vaccine chiral technology: Principle and applications.	
UNIT III	6 h
Stem cells in therapy: Therapeutic proteins, interleukins, interferons – principle, production and applications, Gene Therapy: Basic approaches to gene therapy, vectors used in gene therapy, applications of gene therapy in cancer, genetic disorders and AIDS	
UNIT IV	4 h
Neutraceuticals, fast-based nutraceuticals technology of typical food/ food products (bread, cheese, idli, agro-products (oilseeds) and Food derived bioactive peptides. Biosensors in clinical diagnosis, Use of nucleic acid probes and antibodies in clinical diagnosis and tissue typing. Nanotechnology in diagnosis.	
UNIT V	6 h
Clinical trails – Phase –I Phase II and II trail norms – ICMR guidelines for design and conducting clinical trails, licensing procedure in India, intellectual Property Rights and patents in biotechnology	

TEXT BOOKS

1. Albert Sasson. Medical Biotechnology: Achievements, Prospects and Perceptions. United Nations University Press, 2005.
2. Lee Yaun Kun. Microbial Biotechnology – Principles and applications. World Science publications, 2004

REFERENCE

1. Michels et al., Genetic techniques for Biological Research. Wiley Publications, 2002.
2. Glazer AN, Nikaido H. Microbial Biotechnology – Fundamentals of Applied Microbiology WH Freeman, New York 1994.
3. Vyas. Methods in Biotechnology and Bioengineering, CBS publications, 2003.
4. Marshak et al., Stem cell Biology. CSHL publications, 2002.

BIOT -566 MEDICAL BIOTECHNOLOGY LAB CREDITS - 1

1. Identification and characterization of selected medically important pathogens –
Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, Streptococcus pneumoniae
2. Culturing of single cell protein (SCP) (Spirulina)
3. Ammonium sulfate precipitation of cystic sacrosis antigen
4. Quality control of antibodies – HPLC
5. Role of bioinformatics in drug development
6. Computer assisted drug designing
7. Computer based ligand and Receptor interaction
8. Segregation techniques used for obtaining blood products
9. Genetic and biochemical analysis of novel molecule

UNIT I Whole genome analysis: Prokaryotes and Eukaryotes, Foundations of genomics. Mapping of genome – linkage mapping, High resolution physical mapping – Marker associated and clone assisted genome mapping: Genome library construction – YAC, BAC and PAC libraries of genome.	7h
UNIT II Genome sequencing – Hierarchical and shot gun sequencing methods – variation in sequencing methods – Pyrosequencing – Automation in genome sequencing – Sequence analysis – Databanks – datamining.	6h
UNIT III Annotation of genome – experimental and computational approaches – Functional genomics – Experimental and computational approaches – Gene knockouts, yeast two hybrid system – gene expression profiling – microarrays – cDNA and Oligo arrays – DNA chips – Application of DNA arrays – SNPs.	8h
UNIT IV Genomics verses Proteomics – Tools for proteomics – 2D Electrophoresis – Protein digestion techniques and mass spectrometry – MALDI TOF – Analysis of proteins.	7h
UNIT V Proteome analysis – Algorithms for proteomics – Protein expression profiling – protein arrays – Protein-Protein interactions – Protein microarrays. Advantages and disadvantages of DNA and protein microarrays.	7h

TEXT BOOKS

1. Twyman, RM and Primrose, SB (2003). Principle of Genome Analysis, Blackwell Publisher
2. Brown TA (2006), Genomes 2, Wiley-Liss

REFERENCE BOOKS

1. T.W. Veenstra, TW and Tates III, JR (2006). Proteomics for biological discovery, Wiley
2. Durbin R, Eddy SR, Krogh A and Mitchison G (2000). Biological Sequence Analysis, Probabilistic Models of Proteins and Nucleic Acids, Cambridge University Press

1. One and two dimensional separation of protein.
2. Scanning and image analysis of 2-D gels.
3. Spectral analysis of proteins.
4. Computer assisted demonstration of microarray technology: DNA and protein
5. Liposome preparation.
6. Identification of cystic fibrosis gene from Human genome and fattyacyl desaturase gene in Arabidopsis genome.
7. Characterization of the protein coded by gene sequence above (in Expt 4) using NCBI software online.
8. Primer designing methods: degenerate and general oligonucleotide primers
9. Protein-protein interaction: immunoneutralization (Antigen-antibody precipitation)

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