Department of Biotechnology

Faculty of Science and Humanities

SRM University, Kattankulathur

Curriculum and Syllabi

M.Sc., – Biotechnology
(w.e.f 2012)

REGULATIONS (w.e.f. 2012)

Eligibility

Minimum academic qualification for candidates to join in Master's Degree in Biotechnology program is Bachelor Degree in Life sciences from any recognized University/Institution recognized by the government.

Duration and Structure of the M.Sc. Program

The course is organized on semester basis with a total of IV semesters. The minimum period for completion of the M.Sc., program is IV semesters. The curriculum of M.Sc. program is designed with fourteen theory papers, nine practical papers, two elective papers and one Major Project. The electives chosen by the students from the curriculum shall be offered, provided that the minimum number of students, to be fixed by the department concerned, register for the same.

Instruction

Medium of instruction is English and will be imparted through classroom and laboratory sessions as well as on-the-job training. Theoretical instruction will be imparted in the form of lectures and through seminars and discussions. Laboratory Sessions are for imparting practical knowledge of the subjects. On-the-job training will comprise visits to various biotechnology industries where students can study first-hand the various techniques and applications adopted.

Academic Year

The academic year is divided into two semesters: mid-July to December, and January to May. The actual dates of commencement and conclusion of each term of the academic year will be intimated to the students by the University.

Attendance

A minimum of 75 per cent attendance at lectures is compulsory in each term and student falling short of this minimum attendance is liable to be barred from appearing for the final examination.

A candidate who is not permitted to appear for the university examinations due to lack of attendance requirements will have to reregister and do the courses when they are offered subsequently.

Classroom/Laboratory Sessions

Lecture sessions are normally held for five days in a week, Monday through Friday. The timetable for the various lecture sessions will be displayed on the notice board. The teaching faculty will generally provide guidance to candidates in the matter of selection of subjects for the study paper or project work.

Industrial Training

For the benefit of the students, it has been mandatory to attend a minimum of one Industrial training programs. At the end of the first year of the course i.e. II semester the students must attend an industrial training program for duration of minimum three weeks. By the beginning of the subsequent semester they must submit a report of their training undergone. The report will be evaluated by duly appointed teaching faculty. A maximum of FOUR credits will be allotted for successful completion and report submission of the industrial trainings undergone by the student.

Discipline

Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the University.

Revision of Regulation and Curriculum

The University may revise, amend or change the regulations, scheme of examinations and syllabi as found necessary.

M.Sc BIOTECHNOLOGY

ADVANCED BIOCHEMISTRY

Course code	Category	Course Name	L	C	P	TH
BT12101	Major	Advanced Biochemistry	4	4		69

Objective:
The students will get an overall understanding of structure of atoms, molecules and chemical bonds, enzyme kinetics, bio polymers and metabolic reactions in a living system.

UNIT I: Carbohydrates **14**
Classification of carbohydrates their structure, properties and function; glycolysis; Tricarboxylic acid cycle; Pentose phosphate pathway; Cori cycle;. Gluconeogenesis, glycogenesis and glycogenolysis.

UNIT II: Lipids **15**
Classification of lipids,and their structure,properties and functions, fatty acids, trighlycerides, phospholipids, waxes, prostaglandins; Lipoprotein systems; Oxidation and synthesis of fatty acids; Choloesterol synthesis; Acetic acid as a central precursor for biosynthesis of lipids.

UNIT III: Aminoacids **14**
Amino acid sequence of proteins; structure,properties and function Biological functions of proteins; sequencing of aminoacids, Oxidative degradation of one carbon units. Biosynthesis of amino acids and; Urea cycle;

UNIT IV: Nucleic Acids **12**
Chemistry of Nucleic acids; Structure of Nucleic acids; Types of DNA, RNA; Metabolism of purines and pyrimidines; Electron transport chain- Nucleic acid sequencing

UNIT V: Clinical and nutritional biochemistry **12**
Chemistry and mechanism of Hormonal action; Structure and functions of vitamins; Functions of minerals, BMR – Determination of BMR, Nitrogen balance, Protein malnutrition,ECG,EEG,Blood pressure measurement.

References:

1. Lehninger, Nelson & Cox, Principles of Biochemistry, 5th Edition 2008-W.H.Freeman & Company
2. Modern Experimental Bio Chemistry, Boyer, Pearson Education-2008
3. Biochemistry, Mathews, Pearson Education-1996
4. Elliot, Biochemistry & Molecular Biology, OUP-2009
5. Lubert Stryer, Bio chemistry, Freeman & Co, NY-2010
6. Voet & Voet, Fundamentals of Biochemistry, John Willey & Sons-2010
7. Hames, B.D. (Ed.), Biochemistry, Viva Books-1998
8. MN Chatterjea, Rane Shinde, Textbook of Medical Biochemistry, Jaypee Publications, VI Edn, 2005.

Advanced Biochemistry Practicals

Course code	Category	Course Name	L	C	P	TH
BT12102	Major	Advanced Biochemistry Practicals		2	5	

1. Estimation of protein by Folin Lowry method
2. TLC separation of Amino acids /sugars
4. Determination of Iodine number of a fat
5. Estimation of RNA by Orcinol method
6. Estimation of DNA by diphenyl amine method
7. Qualitative and quantitative analyses of carbohydrates
8. Qualitative and quantitative analyses of amino acids.
9.Blood pressure measurement.

ADVANCED MICROBIOLOGY

Course code	Category	Course Name	L	C	P	TH
BT12103	Major	Advanced Microbiology	4	4		64

Objective:
The course helps the student to understand the microbial world and their growth nature and the pathogenecity and the exploitation of the microbes for industrial applications.

Unit-1 **12**
Microbiology - definition, history and scope – Prokaryotes and eukaryotes – Microorganisms- bacterial cell – size, shape and arrangement - General structure – functions of microbial cellular compounds (viruses, bacteria, algae, fungi, protozoa) – Microscopy – transmission electron Microscope and Scanning electron Microscope,

Unit-2 **12**
Principles & classification of microbes – binomial nomenclature Whittaker five kingdom classification– sterilization and disinfection - Physical and chemical methods of sterilization – stain and staining methods – principles of staining - simple, differential, capsule, nuclear and spore staining methods. Microbial media – types Isolation and enumeration of microorganisms in soil, water and air – methods of obtaining Pure cultures - methods for microbial identification. Microbial growth – Phases of growth curve, Factors influencing the growth of microbes-classification based on that. (Temperature, pH, Nutrition) and nutritional types of microorganisms.

Unit-3 **12**
Food and Industrial Microbiology - Role of microbes in food production - Microbiology of fermented food and dairy products – cheese, yogurt, Alcoholic beverages-beer, wine etc. Food spoilage and Preservation processes. Microbes as source of food - single cell protein, Application of Microbes in industries production of antibiotics (penicillin, streptomycin), amino acids (Glutamic Acid) organic Acids (citric acid and Lactic acid),

Unit-4 **14**
Medical microbiology – pathogenesis, lab diagnosis, prevention and control of important microbial diseases, Pathogenic bacteria diseases (E.coli, Tuberculosis, Leprosy, Salmonella typhi, Staphylococcus aureus, Vibro cholerae, Mycotoxicoses- Fungal diseases (Candida sp, Aspergillus, cryptococcus) Viral Diseases (HIV,Rabies,Hepatitis and Polio Virus) and Protozoan diseaseas (Plasmodium, Trypanosoma)

Unit-5 **14**
Environmental microbiology – role of microbes in the ecosystems – Microorganisms, in soil, air and water, sewage treatment methods, biological nitrogen fixation, biofertilizers, microbial insecticides(Bacillus thuringiensis). biopolymers – biosurfactants and bioremediation.

Reference Books

Microbiology -Principles and Explorations , Jecquelyn G.Black, Wiley publications.-2008
Microbiology – Pelezar, chan, Krieg Tata McGraw Hill Publications-2007.
Microbiology – concepts and application by Paul A. Ketchum, Wiley publications-1988.
Prescott, Harley and Klein, 'Microbiology", McGraw Hill publications, Fifth edition-2002
2003.ents of Microbiology – Frobisher, Sauders & toppan publications.
Microbiology – Ronald M. Atlas-1996.
Introductory Biotechnology – R.B. Singh C.B.D India(1990)
Industrial Microbiology – casidal. E.Wiley Eastern Ltd-1968.
Fundamentals of Biotechnology – Salley-1980
Biotechnology: International Trends of perspectives A.T.Bull, G.Holl M.D.Lilly Oxford & TBH Publishers-1982.
General Microbiology – C.B.Powar, H.F.Daginawala, Himalayan Publishing House-2005.
microbial physiology – Albert G. Moat and John W. Foster- Wiley-interscience publication-1991
Food microbiology-W.C. Frazier and D.C. Westhoft, tata Mcgra Hill publication-2008.
Microbial Biotechnology – Alexander N. Glazer, Hiroshni – Kaido,
W.H. Freeman and Co. 1995.

Advanced Microbiology Practicals

Course code	Category	Course Name	L	C	P	TH
BT12104	Major	Advanced Microbiology Practicals		2	5	

1. Preparation of media for growth of various organisms.
2. Identification and culturing of various organisms
3. Staining of microorganisms. – Grams staining, AFB staining, Capsular staining and spore staining
4. Growth curve, measure of bacterial population by turbidometry and studying the effect of temperature, pH, carbon and nitrogen.
5. Assay of antibiotics production and demonstration of antibiotic resistance.
6. Bacterial transformation.
7. Culturing of phages and assaying of plaques (Titration of Phage T4)
8. Use of antimicrobial chemotherapeutic agents to control microorganisms – MIC and MBC
9. Biochemical tests to identify various organisms.

BIOINSTRUMENTATION

Course code	Category	Course Name	L	C	P	TH
BT12105	Major	Bioinstrumentation	4	4		64

Objective:

The course provides the students an invariant approach towards various techniques and helps them to apply the same in the biological field.

Unit I: Centrifugation and Cell Disintegration **12**

Basics: Basic principles of centrifugation, RCF and other factors affecting sedimentation, sedimentation velocity, sedimentation equilibrium, sedimentation coefficient, factors affecting Standard Sedimentation Coefficient. Instrumentation: Types of centrifuge machines, Rotors, Preparative and analytical centrifuges, Applications of Boundary Sedimentation, Band sedimentation, Determination of Molecular weights. Cell Disintegration: Physical, chemical and enzymatic methods of microbial, plant and animal cell disintegration.

Unit II: Chromatography **14**

Chromatographic techniques: History Basic principles, Partition coefficient, the nature of partition forces, counter current distribution, Introduction to planar and column chromatography. Theory, principle and applications of Paper, Thin Layer, Gel Filtration, Ion Exchange, Affinity, Reverse phase chromatographic techniques, GLC and HPLC, Some specialized techniques of chromatography.

Unit III: **12**

Electrophoretic Techniques: Basic Principles of Electrophoresis, Types of electrophoresis: free,zone and capillary electrophoresis. Theory, principles and applications of Paper, Cellulose acetate and Gel Electrophoresis, Isoelectric focusing, Specialized Electrophoretic techniques viz., Discontinuous gel electrophoresis, Immunoelectrophoresis, Gradient, 2-D gel and Pulse-field gel electrophoresis, High voltage electrophoresis.

Unit IV Spectroscopy **12**

Basics: Basic principles, Laws of absorption, Absorption spectrum, Chromophore concept.Theory, Principles, Instrumentations and Applications of UV-Visible and IR spectrophotometry, Fluorescence, NMR, Atomic absorption, Mass, Raman, CD, ORD and Flame spectrophotometry,Luminometry, Flowcytometry.

Unit V: Radio-Isotopic Techniques **14**

History, Introduction to Isotopes and Radioactivity, Radioactive Decay, Production of Isotopes,Synthesis of radioactive compounds, Radioactive labeling procedures, Interaction of radioactivity with matter, Use of radio isotopes in Life Sciences, Commonly used isotopes, Safety aspects.Detection and Measurement of radioactivity: Methods based upon Gas Ionization (ionization chambers, Proportional Counters and Geiger-Muller counters), Photographic methods, Methods based upon Excitation (Scintillation counters and their types). Principles and applications of Tracer Techniques, Autoradiography and its applications,

Reference:

1. Physical Biochemistry: Application to Biochemistry and Molecular Biology – Freilder-1982.

2. Biochemical Technique: Theory and Practice, - Robyt & White-1990
3. Principle of Instrumental Analysis – Skoog & West-1998
4. Principle & Technique – Practical Biochemistry 5th Ed. (2000) - Walker J. & Wilson.
5. Biochemical Technique Theory & Practical- White, R-1990.
6. Principle of Instrumental Analysis – Skoog *et al-1997*.
7. Biophysical Chemistry – Upadhyay & Nath-2009.

Bioinstrumentation Practicals

Course code	Category	Course Name	L	C	P	TH
BT12106	Major	Bioinstrumentation PRACTICALS		2	5	

1. Paper chromatography.
2. TLC
3. Column chromatography for proteins, pigments.
4. Paper electrophoresis.
5. Agarose gel electrophoresis.
6. PAGE and determination of molecular weights.
7. HPLC
8. Affinity Chromatography.

BIOPHYSICS

Course code	Category	Course Name	L	C	P	TH
BT12107	Major	Biophysics	4	4		61

OBJECTIVE

The course helps the students to understand the macromolecules with the knowledge of physics and helps in understanding the structural conformations

UNIT I - Principles of protein structure **12**

Peptide bond - rigid planar peptide unit - cis and trans configuration - torsion angles phi and psi -steric hindrance - Ramachandran plot - allowed and disallowed conformations - conformational maps for ala and gly. Levels of molecular organization –primary, secondary, tertiary and quaternary levels, super secondary structures, domains.

UNIT II - Structure and Function of Nucleic Acids **11**

Nucleosides and nucleotides - conformational possibilities of monomers and polymers - Watson and Crick model of DNA - Polymorphism - A, B and Z DNA – Unusual structure of DNA- Structure of tRNA.

UNIT III - Techniques to study biomolecules **15**

Principle, Instrument design and application of UV spectroscopy - Infrared spectroscopy - NMR and ESR spectroscopy. Viscosity, Osmosis, Diffusion. Atomic force microscopy, Scanning Electron Microscopy. Transmission electron microscope, Principle of X - ray diffraction

UNIT IV - Radiation biophysics **13**

Radioactivity, laws of Radioactivity, Alpha, Beta, Gamma rays, Isotope, Radioactive decay, Measurement of radioactivity - Autoradiography, Biological effects of radiation, Biological application of radioisotopes.

UNIT V - Biological transport mechanisms **10**

Properties of biomembranes, Nervous system, Synapse, Physics of membrane potential, Resting and action potential, Propagation of action potential, Voltage clamp technique

TEXT BOOKS

1. Biophysics by Vasantha Pattabhi and N. Gautham, Narosa Publishmg House, New Delhi, 2002.
2. Essentials of Biophysics by P. Narayanan, New Age International (P) Ltd. Publishers, New Delhi 2000.
3. Biochemistry , D.Voet & J.G.Voet, John Wiley & Sons, New York (1995).
4. Introduction to Protein Structure by C. Branden and J. Tooze, Gar land Publishing, 1991.
5. Guyton A.C. (1981), Textbook of Medical Physiology, Sounders co.

REFERENCE BOOKS

1. Cantor C.R. and Schimmel P.R. (1980), Biophysical chemistry, W.A.Fremman and Co.
2. Lehninger A. (1981), Biochemistry, Butter Worth Publication
3. Radiation Biophysics, E. L. Alpen, Prentice-Hall, New Jersey, USA, (1990).
4.X-ray Structure Determination, G.H. Stout and L.H. Jensen, John Wiley and Sons Inc., New York (1989).
5.Biophysical Chemistry, C.R. Cantor & P.R. Schimmel,1980.W.H. Freeman & Co.,
6. Principles of Protein Structure by G. Schulz and R.H. Schirmer, Springer - Verlag, 1984.
7.Proteins Structure and Molecular Properties Thomas E. Creighton, W.H. freeman and Company, New York, 1993.
8. Principles of Nucleic acid Structure, W. Saenger, Springer verlag, 1984.
9. Ruch J. and Patton H.D. (1973), Physiology and Biophysics (all volumes), W.B. sounders co.

MOLECULAR GENETICS AND DEVELOPMENTAL BIOLOGY

Course code	Category	Course Name	L	C	P	TH
BT12201	Major	Molecular Genetics And Developmental Biology	4	4		60

OBJECTIVE:

The major objective of the paper is to envisage thorough knowledge in genetics ,genome organizations in organisms and their developmental aspects.

UNIT I **10**

Mendelian inheritance: Mendel's laws, multiple alleles ,Chromosomes and heredity. Gene: gene concept, genetic code, mutation – Fine structure of gene.

UNIT II **14**

Human Cyto-Genetics – Human karyotype, Molecular basis of spontaneous and induced mutations, DNA repair mechanisms Chromosomal abnormalities- chromosomal deletions & duplications, chromosomal inversions & translocations, linkage and linkage groups

UNIT III **12**

Crossing over, mechanism of Meiotic Crossing over, kinds of Crossing over, theories about the mechanism of Crossing over, significance of Crossing over. Chromosomal variation in Number & Structure – Euploidy, Non-disjunction & Aneuploidy, Polyploidy ,Chromosome Mapping .

UNIT IV **12**

Principles of development , Developmental Genetics ,gametogenesis, fertilization, cleavage, gastrulation, cell fate, differentiation, morphogenesis, and organ formation. Growth, Aging, & Cancer , mutagenesis

UNIT V **12**

Organogenesis- Focus on Various Tissue Organization and Development, endocrinology, metamorphosis and regeneration.

References:

1. Genetics, Winter,P.C., Hickey,G.I. and Fletcher, H.L., Viva Books 2002
2. Klug, Concepts of Genetics, Pearson Education-1997.
3. Genes VII, Benjamin Lewin, OUP-2001.
4. Genetics a Molecular Approach, 2nd Ed. Brown, T.A., Chapman and Hall, 1992

Molecular Genetics and Developmental Biology Practicals

Course code	Category	Course Name	L	C	P	TH
BT12202	Major	Molecular Genetics and Developmental Biology Practicals		2	5	

- Quantifying cells and phages; Isolation of single colonies
- PCR
- Transformation
- Minipreparation and restriction digestion
- Conjugation
- UV Mutagenesis
- Isolation of Mutants
- Replica plating

REGENERATIVE MEDICINE

Course code	Category	Course Name	L	C	P	TH
BT12203	Major	Regenerative Medicine	4	4		64

Objective:
The course deals with the understanding of invitro regeneration of organs, therapeutics and application of stem cells in medicine.

Unit – I: Tissues **12**
Introduction: Basic definition, Structural and organization of tissues: Epithelial, connective, vascularity and angiogenesis. Current scope of development and use in therapeutic and in-vitro testing.

Unit –II: Cell Culture **12**
Cell culture: Different cell types, progenitor cells and cell differentiations, different kinds of matrix, cell-cell interaction. Aspect of cells in culture, Bioreactors.

Unit – III: In vitro organogenesis **12**
Scaffolds & tissue engineering – Basic properties. In vitro organogenesis -Engineering tissues for replacing bone, skin and liver

Unit IV: Stem Cells and Wound healing: **14**
Stems cells: introduction, haematopoiesis, Es cells, Blood from Es cells. Basic wound healing. Cell migration, transport limits on 3D cultures.

Unit V: Mass Transfer: **14**
Introduction to mass transfer – Diffusion of simple metabolites, Diffusion & Reaction, Diffusion & reaction of proteins,

Text / reference books:
1. Principles of tissue engineering, Robert. P.Lanza, Robert Langer & William L. Chick, Academic press-2008
2. Tissue Engineering, B. Palsson, J.A. Hubbell, R.Plonsey & J.D. Bronzino, CRC-Taylor & Francis-2004
3. Tissue Engineering, Bernhard Palsson, Sangeeta Bhatia , , Pearson Prentice Hall, 2003
4. Culture of Cells for Tissue Engineering, Academic press,1997 3. Gordana Vunjak-Novakovic, R. Ian Freshney,

ENZYME TECHNOLOGY & INDUSTRIAL BIOTECHNOLOGY

Course code	Category	Course Name	L	C	P	TH
BT12204	Major	Enzyme Technology & Industrial Biotechnology	4	4		60

Objective:

The course helps the students to render immense knowledge about enzymes, their kinetics, application of enzymes along the techniques in fermentation. It also deals about the use of fermentation technology in production of the various biological compounds and their uses.

Unit-1 Enzymes **12**

Classification - IUB system, rationale, overview and specific examples - Characteristics of enzymes, enzyme substrate complex. Concept of active centre, binding sites, stereospecificity and ES complex formation. Effect of temperature, pH and substrate concentration on reaction rate. Activation energy. Transition state theory. Enzyme activity, international units, specific activity, turnover number, end point kinetic assay.

Unit-2 Enzyme Kinetics & Immobilized enzymes **12**

Enzyme Kinetics-Michaelis - Menten Equation - form and derivation, steady state enzyme kinetics.Significance of Vmax and Km. Bisubstrate reactions. Graphical procedures in enzymology - advantages and disadvantages of alternate plotting. Enzyme inhibition - types of inhibitors - competitive, noncompetitive and uncompetitive, their mode of action and experimental determination.Methods of immobilization techniques - Immobilized multienzyme systems. Industrial application , analytical application, clinical application of enzymes. Abzymes.

Unit 3 Introduction to Industrial Biotechnology **14**

Introduction to industrial Biotechnology, basis principles of fermentation Technology, Screening and Isolation of Microorganisms, maintenance & preservation of strain, strain improvement (Mutant selection, Recombinant DNA methods). Fermentation Media, Natural and synthetic Media, Sterilization techniques – Heat, Radiation and Filtration method.

Unit 4 Fermentation **12**

Fermenters – design and types, Process of Aeration, Agitation, Temperature regulation, pH and Filteration method. Type of Fermentation - Solid State, submerged fermentation and continuous fermentation. Plant and animal cell bioreactors. Process Development – Shake flask fermentation, Down stream processing (DSP).

Unit 5 Microbiological fermentation & Fermented Foods 10

Production of Microbial products, fermentation of Alchol - Alcoholic Beverages, Organic acid – Citric acid, Antibiotic – Penicillin, Amino acids - Glutamic acid, Vitamin-B12, Brief account of Steroid biotransformation. Fermented Foods and diary products, Microbial Foods – Single cell proteins (SCP), single cell oils (SCO). Plant cell suspension culture - production of food addictives - Saffron and Capsaicin. Microbial Polysaccharides and polyesters; production of xanthan gum and Polyhydroxyalkonodies (PHA)

References:

1. Sullia S. B& Shantharam S: (1998) General Microbiology, Oxfoed & IBH
    a. Publishing Co. Pvt. Ltd.
2. Bisen P.S (1994) Frontiers in Microbial Technology, 1sr Edition, CBS Publishers
3. Glaser A.N & Nilaido.H (1995) Microbial Biotechnology. W.H. Freeman & co.
4. Prescott & Dunn (1987) Industrial Microbiology 4th Edition, CBS Publishers & Distributors.
5. Prescott & Dunn (2002) Industrial Microbiology, Agrobios (India) Publishers
6. Crueger W. & Crueger A. (2000) A text of Industrial Microbiology, 2nd Edition, Panima Publishing Corp.
7. Stanbury P.F. Ehitaker H, Hall S.J (1997) Principles of Fermentation Technology., AdityaBooks (P) Ltd
8. Bioprocess technology by P.T. Kalaichelvan and Arulpandi-2007; MJP Publishers.

Enzyme Technology & Industrial Biotechnology Practicals:

Course code	Category	Course Name	L	C	P	TH
BT12205	Major	Enzyme Technology & Industrial Biotechnology Practicals		2	5	

1. Production of amylase
2. Determination of amylolytic activity
3. Isolation and characterization of cellulolytic enzymes and its synthesis
4. Determination of cellulolytic activity by DNS method
5. Isolation of lactic acid bacteria and production of lactic acid
6. Immobilization of cells and enzymes
7. Analysis of enzyme kinetics (urease and amylase)
8. Instrumentation of fermentor
9. Design of various types of fermentors & bioreactors
10. Production of ethanol & wine from grapes
11. Production of ethanol from wheat flour
12. Sauerkraut production

GENOMICS AND PROTEOMICS

Course code	Category	Course Name	L	C	P	TH
BT12206	Major	Genomics and Proteomics	4	4		62

Objective:
The course helps the students to have a vast knowledge in the field of genomics and proteomics and helps them to exploit the same in the growing field of biotechnology.

UNIT – I: Biological Databases and Sequence analysis 12
Introduction to bioinformatics - classification of biological databases, Biological data formats, Application of bioinformatics in various fields. Introduction to Sequence alignment - Substitution matrices –PAM and BLOSUM. Pairwise alignment methods; Multiple sequence alignment methods. Evolutionary analysis: distances - clustering methods – rooted and unrooted tree representation – Bootstrapping strategies

Unit II: Gene and Promoter Prediction 12
Categories of gene prediction programs – gene prediction in prokaryotes and eukaryotes. Prediction Algorithms. Promoter and regulatory elements in prokaryotes and eukaryotes Prediction algorithms.

Unit – III: Structural Bioinformatics 12
Protein secondary structure prediction - for globular proteins and for transmembrane proteins. Coiled coil prediction. Protein tertiary structure prediction – methods – homology modelling, threading and fold recognition; ab initio protein structural prediction. CASP.

Unit IV: Pharmacoinformatics 14
Introduction To Drug Designing - Molecular targets, Characteristics of a drug compound, Drug discovery pipeline, Target identification & validation, Lead compound identification; Serendipity, High throughput screening, Structure-based & ligand based approaches. Pharmacophore identification, QSAR method; ADME Predictions.

Unit V: Expression Bioinformatics 12
DNA Microarray: cDNA Microarray technology, oligonucleotide Microarray technology,Microarray databases, Applications of microarrays. Microarray experimentation.An introduction to Microarray analysis. Image processing; Normalizing expression measurements, Cluster analysis- Hierarchical clustering, k-means clustering, Self-organizing maps. CHIP-on-chip arrays. Protein Microarray

Reference Books

1. Introduction to Genomics by Arthur Lesk. Published by Oxford University Press,2007.
2. Bioinformatics: sequence and genome analysis, by David Mount, second edition. Cold spring harbor lab press(2004)
3. Essential Bioinformatics by Jin Xiong, Cambridge University Press, 1st edition, 2006.
4. Molecular modeling: Principles and applications by Andrew,R. Leach, Prentice Hall Publications, 2009.
5. Microarray Bioinformatics by Dov Stekel, published by Cambridge University Press, 1st Edition, 2003.
6. Bioinformatics: A practical guide to the analysis of genes and proteins. Ed. By Baxevanis and Oullette, 3rd Edition, (2004) John Wiley & Sons, Inc.

GENOMICS AND PROTEOMISC PRACTICALS

Course code	Category	Course Name	L	C	P	TH
BT12207	Major	Genomics and Proteomics		2	5	

1. Sequence retrieval from biological databases – NCBI, EMBL, DDBJ, SWISS PROT
2. Sequence alignment – Local and global algorithm
3. Detection of open reading frames in given sequences using ORF finder at NCBI
4. Gene identification on the web – GenScan, Glimmer and JIGSAW
5. Splice site predictions on the web - NetGene2 and GeneSplicer
6. Small molecule building using ISIS DRAW and CHEM SKETCH
7. Homology Modeling using SPDBV
8. Model validation using What Check and Pro Check
9. Docking using DOCK or AUTODOCK or HEX
10. Protein structure visualization tool – Rasmol

Industrial Training

Course code	Category	Course Name	L	C	P	TH
BT12208		Industrial Training		**4**		

IMMUNOTECHNOLOGY

Course code	Category	Course Name	L	C	P	TH
BT12301	Major	Immunotechnology	4	4		64

Objective;

The course helps the students to understand about the immune system in our body and the immune response of the cells and their role in effective resistance mechanism.

Unit I **12**

Immunology- fundamental concepts and anatomy of the immune system

Components of innate and acquired immunity; Phagocytosis; Complement and Inflammatory responses; Haematopoesis; Organs and cells of the immune system-primary and secondary lymphoid organs; Lymphatic system; Lymphocyte circulation; Lymphocyte homing; Mucosal and Cutaneous associated Lymphoid tissue.(MALT&CALT); Mucosal Immunity; Antigens - immunogens, haptens; Major Histocompatibility Complex - MHC genes, MHC and immune responsiveness and disease susceptibility, HLA typing

Unit II **14**

Immune responses generated by B and T lymphocytes

Immunoglobulins-basic structure, classes and subclasses of immunoglobulins, antigenic determinants; Multigene organization of immunoglobulin genes; B-cell receptor; Immunoglobulin superfamily; Principles of cell signaling; Immunological basis of self – non-self discrimination; Kinetics of immune response, memory; B cell maturation, activation and differentiation; Generation of antibody diversity; T-cell maturation, activation and differentiation and T-cell receptors; Functional T Cell Subsets; Cell-mediated immune responses, ADCC; Cytokines-properties, receptors and therapeutic uses; Antigen processing and presentation- endogenous antigens, exogenous antigens, non-peptide bacterial antigens and super-antigens; Cell-cell co-operation, Hapten-carrier system

Unit III **12**

Antigen-antibody interactions

Precipitation, agglutination and complement mediated immune reactions; Advanced immunological techniques - RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, flow cytometry and immunoelectron microscopy; Surface plasmon resonance, Biosenor assays for assessing ligand –receptor interaction, CMI techniques-lymphoproliferation assay, Mixed lymphocyte reaction, Cell Cytotoxicity assays, Apoptosis.

Unit IV **12**

Vaccinology

Active and passive immunization; Live, killed, attenuated, sub unit vaccines; Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate

vaccines; Antibody genes and antibody engineering- chimeric and hybrid monoclonal antibodies; Catalytic antibodies and generation of immunoglobulin gene libraries.

Unit V **14**

Clinical Immunology

Hypersensitivity – Type I-IV; Autoimmunity; Types of autoimmune diseases; Mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; Treatment of autoimmune diseases; Transplantation – Immunological basis of graft rejection; Clinical transplantation and immunosuppressive therapy; Tumor immunology – Tumor antigens; Immune response to tumors and tumor evasion of the immune system, Cancer immunotherapy; Immunodeficiency-Primary immunodeficiencies, Acquired or secondary immunodeficiencies.

REFERENCES

1. J. Kuby, 2003, Immunology 5th edition, W.H. Freeman and Company, Newyork..
2. C.V.Rao. 2002, An Introduction to Immunology, Narosa Publishing House, Chennai.
3. K.M.Pavri. 1996, Challenge of AIDS, National Book Trust, India.
4. I.R.Tizard, 1995, Immunology: An Introduction, 4th edition, Saunders College Publishers, New York.
5. I.Roitt, 1994, Essential Immunology, Blackwell Science, Singapore. 6. A. Bul and K.Abbas, 1994, Cellular and Molecular immunology, W.D. Saunders and Co, Philadelphia

Immunotechnology Practical

Course code	Category	Course Name	L	C	P	TH
BT12302	Major	Immunotechnology Practical		2	5	

1. Selection of animals, Preparation of antigens, Immunization and methods of bleeding, Serum separation, Storage.
2. Antibody titre by ELISA method.
3. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.
4. Complement fixation test
5. Isolation and purification of IgG from serum
6. SDS-PAGE, Immunoblotting, Dot blot assays
7. Blood smear identification of leucocytes by Giemsa stain
8. Separation of leucocytes
9. Separation of mononuclear cells by Ficoll-Hypaque
10. Immunodiagnostics using commercial kits
11. Blood examination for Rh factor
12. MIC assay of any one antibiotic – Kirby Boyer method
13. Hemagglutination
14. Methods of injection and bleeding
15. Purification of IgG from serum

PLANT AND ANIMAL BIOTECHNOLOGY

Course code	Category	Course Name	L	C	P	TH
BT12303	Major	Plant and Animal Biotechnology	4	4		64

PLANT BIOTECHNOLOGY

UNIT I: Plant Genome organization 12

Structural organization of plant genes - nuclear genome- chloroplast genome - mitochondrial genome. Cytoplasmic male sterility. *Arabidopsis thaliana* – model plant for genome analysis. Molecular biology of N2 fixation

.

UNIT II: Introduction to Plant Tissue Culture 12

Plant biotechnology – overview. History of plant cell, tissue and organ culture- media – nutrients – basic of plant tissue culture – callus induction, organogenesis, embryogenesis – embryo rescue, somatic embryogenesis, somaclonal variation, artificial seeds, plant cell culture, secondary metabolite production and its uses. Protoplast technology – hybridization and Cybridization- Plant hormones- structure and regulation. Pigment receptors – function.

UNIT III: Plant Genetic Engineering 14

Chloroplast engineering. Transposons in Maize. Seed storage proteins. Seed plant technology – development of economically important seeds. Transposons in transgenic plants – their uses – terminator gene technology- crop improvement, Production of transgenic plants against biotic and abiotic stress – disease resistant, herbicide resistant, stress tolerant, saline tolerant, drought tolerant plants –- plant cell as bioreactors – therapeutic vaccines, edible vaccines, interferons, antibodies, therapeutic proteins - molecular farming

ANIMAL BIOTECHNOLOGY

UNIT IV: Introduction to Animal cell culture 14

Basic principles of Biotechnology as applicable to animal Science Setting up a new cell culture laboratory-Animal Cell lines-overview- Adaptation of mammalian cells to growth in serum-free media - Viral evaluation of animal cell lines used in Biotechnology - Optimizing gene expression in mammalian cells - Recombinant cells - Immortalization strategies for mammalian cells- Cell Bank preparation and characterization of animal cells-Cell counting and viability measurements-animal cell growth and productivity - Measurement of cell death in culture - Nuclear magnetic resonance methods of monitoring cell metabolism: Culturing animal cells in Fluidized bed reactors-Stem cell biology - the concept, methods and applications in medicine - tissue engineering and transplantation

UNIT V: Animal biotechnology & medicine 12

Transgenic animals –development & uses – Knock out mice, chimeric mice- Baculoviruses and transgenic silkworm- Hybridoma Techniquefor Monoclonal antibodies- Pharmaceuticals from animal systems for humanized pharmaceuticals -

Animal system as bioreactors. Assisted reproduction techniques – germplasm preservation, germ cell storage - methods of cryopreservation, pregnancy diagnosis – prenatal diagnosis

REFERENCES:

1. Plant Molecular biology – Grierson and S.N. Covey-1985
2. Plant Genetic Engineering – D.H. Doods-1985
3. Recombinant DNA (2nd ED) – J.D. Watson M. Gillman, J. Witknowski and M. Zoller (1992) Scientific American Books NY.
4. Genetic Engineering of crop plants – (Eds) G.W. Lycett and D. Grierson-1991
5. Plants, genes and agriculture – M.J. Chrispeels and D.F. Sadava Jhones and Bartlett-1994.
6. Plant biotechnology new products and application by A. Hammond, P. Mecgarvey and Yusibov-2000
7. Plant Molecular Genetics by Monica A. Hughes-1996
8. Transgenic plants by Esra, Gauln and Adena breimann-1997
9. Engineering chloroplast – review: An alternate site for foreign gene, protein, reactions and products. Trends in biotechnology, 2010-18, 253-263.
10. Moloecular biotechnology by Glick-2010, ASM Press
11. Plant cell & tissue culture by Kalyan kumar Dey-1992
12. Plant biotechnology by Ignachimuthu-1995
13. Textbook of biotechnology by R.C. Dubey-2001
14. Biotechnology by P.K. Gupta-2005
15. General techniques of cell culture by Harrison and I an F.Rae-1997
16. In vitro cultivation of animal cells by Butterworth-1987
17. Culture of animal cells and manual of basic technique by Ian freshnwy-2005
18. Recombinant DNA and Biotechnology: A guide for teachers, 2ndedition – H Kreuzer & A Massey, ASM Press, Washington, 2001.
19. Molecular biology and Biotechnology, 3rd edition– J M Walker & E B Gingold, Panima publishing corporation, 1999.
20. Animal cell Biotechnology: Methods and protocols – Nigel Jenkins (Ed), Humana press, New Jersy, 1999.
21. Recombinant DNA (2nd edition) – J S Watson, M Gillman, J Witknowski and M Zoller, Scientific American Books, NY , 1992.
22. Revolution in Biotechnology – J.L. Marx -1989
23. Animal Biotechnology – Ramadoss-1985
24. Animal biotrechnology by M.M. Ranga-2010

Plant and Animal Biotechnology Practicals

Course code	Category	Course Name	L	C	P	TH
BT12304	Major	Plant and Animal Biotechnology Practicals		2	5	

PLANT BIOTECHNOLOGY PRACTICALS

1. Isolation of plant genomic DNA
2. Isolation of Chloroplast and Mitochondrial DNA
3. Isolation of total RNA from sprouting seeds
4. Preparation of Plant tissue culture media and Stock solutions
5. Callus induction
6. Regeneration of plantlets
7. Germination of seed
8. Shoot/ Root induction - organogenesis
9. Hardening
10. Haploid production – Anther & ovule culture
11. Somatic embryogenesis
12. Single cell suspension culture
13. Protoplast isolation – enzymatic method
14. Protoplast fusion by PEG
15. Agrobacterium mediated transformation
16. Gus assay/ GFP cloning

ANIMAL BIOTECHNOLOGY PRACTICALS

17. Isolation of genomic DNA from animal cells
18. Preparation of animal cell culture media
19. Filter sterilization of Animal cell culture media.
20. Development of cell culture and cell lines
21. Subculturing / passaging
22. Quantitation of animals cells using hemocytometer
23. Cell viability test
24. Isolation of WBC and RBCs
25. Differential counting of WBC
26. Human lymphocyte culture
27. Chick embryo fibroblast
28. MTT Assay
29. Karyotyping

GENETIC ENGINEERING

Course code	Category	Course Name	L	C	P	TH
BT12305	Major	Genetic Engineering	4	4		64

Objective:
The Genetic Engineering helps the students to understand about the cloning strategies, expression pattern, and various techniques involved and their applications in the advancement of Biotechnology.

Unit 1: Basics of rDNA Technology 12
Tools of rDNA technology: Cloning strategies- Restriction, methylation, modification, ligation and manipulation enzymes involved in cloning a gene- Isolation and screening of desired gene - DNA labeling techniques- Construction of genomic and cDNA libraries- Screening a genomic library

Unit 2: Cloning Vectors and Expression of Proteins 14
Prokaryotic Vectors:Plasmids, phagemids, cosmids, Artificial chromosomes, Yeast vectors, *Bacillus* and *Streptomyces* vectors
Plant Vectors: Ti plasmids, Plant viral vectors – Gemini virus vectors, Caulimo viral vectors, Tobamo virus vectors
Animal viral vectors (SV40, Retrovirus, Adenovirus, Adeno associated virus, Vaccinia virus), Baculovirus vectors.

Gene regulation and expression in prokaryotes: Operons, repressors and activators, sigma switch in *Bacillus subtilis*- Gene Regulation in Eukaryotes: Repetitive DNA, Gene rearrangement, Promoters, enhancer elements, gene amplification - High level expression of proteins in different host systems (*E. coli,* yeast, Insect, mammalian cells)

Unit 3: Gene Transfer and Detection 12
Gene Recombination and Gene transfer: Bacterial Conjugation, Transformation, Transduction, Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication, Liposome fusion, Microlaser - Detection of clones and its expression: yeast two hybrid systems, phage display - Blot analysis - Southern, Northern & Western blot; dot and slot blot - Immunological techniques.

Unit 4: Techniques in rDNA Technology 14
PCR - Principles, designing of primers, PCR methodology, PCR variants- RT - PCR, multiplex PCR,nested PCR- Identification of PCR product- Factors influencing PCR- Cloning of PCR products- Application of PCR technology - Molecular markers: RFLP, RAPD, AFLP, SSCP and SNP, 16s r-DNA typing, gene chip and micro array; applications in disease profile, DNA finger printing and forensic science – DNA Footprinting- DNA-protein interactions and analysis- DNA, RNA and protein sequencing. Chemical Synthesis of oligonucleotides and oligopeptides - Chromosome Mapping- Chromosome walking and jumping

Unit 5: Advancements in rDNA Technology **12**

Limitation and advantages and novel technologies generation of transgenic animals - Gene silencing and siRNA techniques- micro RNA, construction of siRNAvectors, applications of gene silencing - Gene knockouts and Gene Therapy: Exvivo, invivo, suicide gene therapy, gene replacement, gene targeting - Antisense and ribozyme technology: application of ribozymes and antisense technologies.

REFERENCES

1. Microbial genetics – Friedfelder-1994
2. Principles of gene manipulation – Old and Primrose -1981
3. Genes VII by Lewine-2001
4. Hartl. D.L. A primer of population genetics. III edition, Sinauer associates inc. Sunderland, 2000
5. Molecular cell Biology, Darnell, Lodish, Baltimore, Scientific American Books, Inc., 1994. 6. Molecular and cellular Biology, Stephen L.Wolfe, Wadsworth publishing company, 1993
6. An Introduction to Genetic Engineering by Desmond S. T. Nicholl-2008
7. Genetic Engineering: Manipulating the Mechanisms of Life (Genetics & Evolution) by Russ Hodge and Nadia Rosenthal -2009
8. Principles of Gene Manipulation and Genomics by Sandy B. Primrose and Richard Twyman-2009
9. Gene Cloning and Manipulation by C. J. Howe-2007
10. Genome by T.A.Brown-2002
11.Gene Cloning and DNA analysis by T.A.Brown-2006

Genetic Engineering Practicals

Course code	Category	Course Name	L	C	P	TH
BT12306	Major	Genetic Engineering Practicals		2	5	

1. Strain Improvement- Mutation experiments, Protoplast isolation.
2. Isolation of DNA from Bacteria, plants and animal cells
3. Isolation of plasmid from bacterial culture
4. Restriction Digestion
5. Ligation technique
6. Preparation of competent cell
7. Gene transfer in microbes – calcium mediated, vector mediated
8. Identification of recombinants – antibiotic markers, Blue-white colony selection
9. Isolation of RNA
10. Quantification of DNA and RNA
11. Purification of proteins by Chromatography
12. PCR
13. Blotting techniques (Southern)

BIOSTATISTICS

Course code	Category	Course Name	L	C	P	TH
BT12307	Major	Biostatistics	4	4		62

OBJECTIVE

This part of the curriculum helps the students to understand the statistical approach of biology and its applications in the biological field.

Unit 1. Introduction **14**

Data Collection:- Primary and Secondary data- Types of Numerical data- Qualitative data-Nomial data-ordinal data- Quantitative data-Discrete data-Continuous data-Ranked data. Classification and Tabulation- Diagrammatic (Bar diagram, percentage bar diagram, Sub-divided bar diagram, Multiple bar diagram) and Graphic (Histogram, Frequency curve, Frequency polygon, Ogives) representation. Measures of Central Tendency: Mean, Median and Mode. Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance and Coefficient of Variation. Measures of Skewness and Kurtosis

Unit 2. Probability Theory and Distributions **12**

Probability-Definition-Operations on events and Probability- Conditional Probability-Baye's Theorem and its applications. Theoretical Probability Distributions; Binomial, Poisson and Normal Distributions (No derivations, simple problems)

Unit :3 Correlation and Regression Analysis **12**

Correlation: Meaning- Scatter diagram- Karl Pearson's correlation coefficient-Spearman's Rank correlation coefficient. Simple Linear Regression: Concepts-regression lines-regression coefficients-properties-The method of Least squares- Probable error.

Unit 4. Sampling Theory and Sampling Distribution. **12**

Simple random sampling, Stratified random sampling, Systematic sampling. Sampling distribution- Standard error- Sampling and Non-sampling errors- The Central Limit Theorem. Hypothesis Testing: General concepts- one sided and two sided tests of hypothesis. Concept of Point and Interval estimation.

Unit 5. Parametric and Non-parametric tests **12**

Large Sample Tests: mean and difference between the means. Small Sample Test: Students's t-test: mean, Comparison of two means:- (Paired sample and Independent Samples). Chi-square Tests: Goodness of fit, Independence of attributes. Analysis of variance- One way and Two way classifications.

Books for Study and Reference

1. **Marcello Pagano and Kimberlee Gauvreau** : Principles of Biostatistics, Duxbury Printed in India by (Chennai Micro Print Pvt Ltd, No.34,Nelson Manickam Road, Chennai-29)-2000
2. **Veer Bala Rastogi,"** Fundamentals of Biostatistics, Ane Books Pvt.Ltd, Avarthika Niwas.1st Floor, 19,, Duraisamy Road, T.Nagar, Chennai-2009
3. **'Khan and Khanum**, Fundamentals of Biostatistics ,2004, Ukaaz Publications.
4. **Wayne.W Daniel,** BioStatistis, A Foundation for Analysis in Health Sciences, Jphn Wiley & Sons-2008.
5. **S.Ewans & G. Grant,** Statistical Methods in Bioinformatics-2005
6. **Gupta, S.C and Kapoor, V.K**., Fundamentals of Mathematical Statistics**,** Sultan Chand, New Delhi-2000

Environmental Biotechnology

Course code	Category	Course Name	L	C	P	TH
BT12401	Elective I	Environmental Biotechnology	4	4		62

Objective;

The course deals with the study of ecosystem, bioremediation and metal mining. This ensures the students in better understanding of environmental crisis and its remediation.

Unit 1

Ecosystem **12**

Limiting factors, energy transfer and biogeochemical cycling in ecological systems; Response of microbes, plant and animals to environmental stresses; Concept of ecosystems and ecosystem management, Environmental problems- ozone depletion, green house effect, water, air and soil pollution, land degradation.

Unit 2

Bioremediation **12**

GEMs in environment; Role of environmental biotechnology in management of environmental problems, Bioremediation, advantages and disadvantages; In situ and ex-situ bioremediation; slurry bioremediation; Bioremediation of contaminated ground water and phytoremediation of soil metals; microbiology of degradation of xenobiotics

Unit 3

Waste management **12**

Sewage and waste water treatment and solid waste management, chemical measure of water pollution, conventional biological treatment, role of microphyte and macrophytes in water treatment; Recent approaches to biological waste water treatment, composting process and techniques, use of composted materials.

Unit 4

Biofuels **14**

Biofuels and biological control of air pollution, plant derived fuels, biogas, landfill gas, bioethanol, biohydrogen; use of biological techniques in controlling air pollution; Removal of chlorinated hydrocarbons from air. biotechnology application to hazardous waste management - examples of biotechnological applications to hazardous waste management – cyanide detoxification - detoxification of oxalate, urea etc. - toxic organics - phenols.

Unit 5

Metal biotechnology **12**

Mining –heavy metals. Microbial transformation, accumulation and concentration of metals, metal leaching, extraction and future prospects.

Reference

1. Wastewater Engineering – Treatment, Disposal and Reuse, Metcalf and Eddy. Inc. Tata McGraw Hill, New Delhi. 1991
2. Environmental Science (5th Edition) by WP Cunninghum & BW Saigo., Mc Graw Hill. 1999.
3. Introduction to Biodeterioration , D Allsopp and K J Seal, ELBS/Edward Arnold. Cambridge Univ
Press. 2004.
4. Biotechnology for Wastewater Treatment. P Nicholas Cheremisinoff. Prentice Hall Of India. 2001
5. Biotechnological Methods of Pollution Control. SA Abbasi and E Ramaswami. Universities Press 19-1999

Nanobiotechnology

Course code	Category	Course Name	L	C	P	TH
BT12402	Elective I	Nanobiotechnology	4	4		62

Objective:

This helps the students to understand the various nanomaterials, their construction and biological approach of the same in medical field

UNIT I Introduction **12**

Nanotechnology – definition and scope, nanobiotechnology- recent development and applications, Bioconjugation mediated drug delivery, carbon nanotubes – types and their biomedical applications. Immunotoxin are targeted cell killers. General medicine is changing into personalized nanomedicine.

UNIT II Biopolymer **14**

Biopolymer- classification and types, polymer nanofibers - electrospinning method and their biomedical applications, biocompatible polymer and their application in tissue engineering, polymer nanocomposite- bone and dental restorations, polymer controlled drug delivery for the treatment of cancer and other diseases. Biodegradable polymer derived from amino acid.

UNIT III Biocompatible nanometerials: **12**

Metal Microbes interaction, Biological metal nanoparticle synthesis and biomedical application – Dendrimers, quantum dots, Biodegradable optical nanoparticles for tumor diagnosis and treatment. PLA and PLGA Based nanoparticulate delivery system.

UNIT IV Nucleic acid based nanomaterials: **12**

DNA based artificial nanostructures; Fabrication, properties and application-Nucleic acid engineered nanomateials and their applications. Protein patterning for applications in biomaterials. DNA lipoplexes – Lipofection efficiency In Vitro and In Vivo, Polymer controlled delivery of therapeutic nucleic acid.

UNIT V Liposphere in drug target and delivery **12**

Liposome - liposomes in sensor technology, polymeric Micelles – Production of Lipospheres for Bioactive compound delivery – Melt dispersion technique, Solvent evaporation technique and InVitro drug release - Polymeric biodegradable liposphere for vaccine delivery.

Recommended Texts:

1. Challa S.S.R. Kumar (Ed). 2006. Biological and pharmaceutical nonmaterial's. Wiley-VCH Verlag Gmbh & Co., KgaA.
2. K.K. Jain 2006 Nanobiotechnology in Molecular Diagnostics: Current Techniques and Application Horizon Biosciences.
3. Niemeyer, C.M. Mirking C.A., (Eds.) 2004 . Nano biotechnology concepts.
4. Applications and Perspectives, Wiley- VCH, Weinheim-2004
5. Claudio Nastruzzi – 2005 (Ed) Liposphere in drug targets and delivery, CRC press.

BIOETHICS, IPR AND BIOSAFETY

Course code	Category	Course Name	L	C	P	TH
BT12403	Elective II	Bioethics, IPR and Biosafety	4	4		60

OBJECTIVE

This part of the curriculum helps the students to understand the ethical, social, legal aspects in biology and the biocontainment

BIOETHICS

UNIT 1 **10**

Bioethics – Social, Legal, and Ethical issues in biotechnology, ethical concerns of biotechnology research, Bioethics committees

UNIT 2 **12**

Animal ethics - Norms in India-Licensing of animal house - Ethical clearance norms for conducting studies on human subjects, IAEC

UNIT 3 – IPR AND HUMAN RELATIONS **13**

IPR – patents- other forms of IPR (Copyright - Trademark – Designs),
Farmer's rights – WTO – GATT. Economic views of Thiruvalluvar, Adam smith's philosophy on human relations

BIOSAFETY

UNIT 4 **12**

Biosafety for human health and environment. - Global scenario of transgenic micro organisms and plants. Ecological risk of engineered microorganisms/plants and remedial measure

UNIT 5 **13**

Biosafety guidelines for research - Containment facilities (physical and biological) - Advantage and disadvantage of genetically modified organisms and genetically modified foods, Biosafety guidelines

TEXT BOOKS:

1. Sasson A, Biotechnologies and Development, UNESCO Publications, 1988.
2. Sasson A. Biotechnologies in developing countries present and future, UNESCO publishers, 1993.

REFERENCE:

1. Singh K. Intellectual Property Rights on Biotechnology, BCIL, and Newdelhi-1993.
2.Shaleesha A. Stanley, Bioethics, Wisdom educational service-2010
3. Biotechnology by U. Sathyanarayana-2011
4. Biotechnology by B.D.Singh, kalyani publishers,2009

RESEARCH METHODOLOGY

Course code	Category	Course Name	L	C	P	TH
BT12404	Elective II	Research Methodology	4	4		61

OBJECTIVE

This part of the curriculum helps the students to understand the methodology involved in conducting research and helps in understanding the various techniques followed in research and helps in writing down their thesis to the international standards.

Unit – I: Microscopic techniques **12**

Bright field, Dark field, Phase contrast, Fluorescent and Polarization microscopes – Electron microscopy – principle, instrumentation and applications of TEM & SEM –Atomic force microscope

Unit – II: Analytical and Separation techniques **15**

Atomic absorption spectrophotometer, NMR, Mass spectrometry - MALDI -TOF, IR spectrum, X-ray crystallography. Measurement of radioactivity - scintillation counting methods.

Ultra centrifugation, HPLC - Electrophoresis - Principle, types and applications -PAGE (proteins), Agarose (Nucleic acids), Two dimensional electrophoresis

Unit – III: rDNA techniques **14**

Restriction mapping - RFLP, Cloning strategies, DNA sequencing - manual and automated methods. Southern, Northern, Western and Dot blotting & hybridization. Polymerase Chain Reaction - principles, types and applications, DNA finger printing. Microarray techniques

Unit – IV- Biostatistics **10**

Stastistics – definition and functions. Collection, classification, tabulation of data, diagrammatic and graphical representation of data, Measures of central tendency, Measures of dispersion

Unit – V: Bioinformatics **10**

NCBI, Entrez, Sequence data bases(Nucliec acids and proteins) - GENBANK, SWISS PROT. Structure database - PDB. Sequence alignment and database searching – FASTA, BLAST - Secondary and 3D structure prediction using DNA and protein sequences.

Student's activity

Case study, Term paper, Assignment writing, Dissertation preparation

TEXT BOOKS

1. Arora PN & Malhon PK, (1996) Biostatistics. Imalaya Publishing House, Mumbai.
2. Sokal & Rohif, (1973) Introduction to Biostatistics Toppan Co. Japan.
3. Baxevanis, A.D. & Ouellette, B.F.F. (2001). Bioinformatics: A practical guide to the analysis of genes and proteins – Wiley Interscience – New York
4. Des Higgins & Willie Taylor (2000) Bioinformatics: Sequence, structure and databanks. Oxford University Press
5. John G Webster(2004).Bioinstrumentation .Student edition, John Wiley &sons, Ltd.
6. Palanivelu P (2001)Analytical biochemistry and separation Techniques A Laboratory maual. 2nd edition ,Published by Tulsi Book Centre, Madurai, Tamilnadu.
7. Kleinsmith, L. J. & Kish, V.M. 1995. Principles of Cell and Molecular Biology. 2nd edn., McLaughlin, S., Trost, K., Mac Elree, E. (eds.)., Harper Collins Publishers, New York.
8. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by Andreas D. Baxevanis and B. F. Francis Ouelle -2004
9. Statistical methods ,S.P.Gupta,S.Chand & Sons,1997
10.Fundamentals of biostatistics, Khan and Khanum, Ukaaz Publications(2004)
11.Gurumani N (2006) Research methodology for biological sciences.1st Edition , MJP Publishers, A unit of Tamilnadu Book House .
12. Keith Wilson& John Walker (2003) Practical Biochemistry Principles & techniques.5th edition,Cambridge university press.
13. Karp, G. 1999. Cell and Molecular Biology – Concepts and experiments. 2nd edn.

Project

Course code	Category	Course Name	L	C	P	TH
BT12405		Project		**10**		