



SIR PADAMPAT SINGHANIA UNIVERSITY

Udaipur

SCHOOL OF ENGINEERING

Course Curriculum of 2-Year M.Tech. Degree Programme

in

Biotechnology

(Batch: 2018- 2020)

Credit Structure

M.Tech. Core		M.Tech. Elective	
Category	Credits	Category	Credits
Departmental Core Subjects	48	Departmental Electives	9
Basic Sciences Subjects	3		
Total	51	Total	9
		Grand Total	60

Distribution of Total Credits and Contact Hours in all Semesters

S. No.	Semester Number	Credits/Semester	Contact hours/semester
1	I	16	20
2	II	15	18
3	III	17	23
4	IV	12	21
Total		60	--

Course Structure: M. Tech 2018-2020

Semester – I

S.No.	Course Code	Course Title	L	T	P	Credit(s)
1	BT-551	Advanced Cell and Molecular Biology	3	0	0	3
2	BT-552	Microbial Technology	3	0	2	5
3	BT-553	Preparative and Analytical Techniques in Biotechnology	0	0	2	2
4	BT-554	Mechanism of Gene Expression	3	0	0	3
5	MA-557	Biostatistics & Design of Experiments	3	0	0	3
Total Credits						16
Total Contact hours/week						20

Semester – II

S.No.	Course Code	Course Title	L	T	P	Credit(s)
1	BT-555	Advanced Genetic Engineering	3	0	2	5
2	BT-556	Enzyme technology and industrial applications	3	0	1	4
3	BT-557	Bioethics and IPR	3	0	0	3
4	BT-5XX	Departmental Elective-I	3	0	0	3
Total Credits						15
Total Contact hours/week						18

Semester – III

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	BT-558	Bioinformatics and Computational Biology	2	0	1	3
2	BT-559	Immunotechnology	2	0	1	3
3	BT-5XX	Departmental Elective-II	3	0	0	3
4	BT-5XX	Departmental Elective-III	3	0	0	3
5	BT-580A	Dissertation-I	0	0	5	5
Total Credits						17
Total Contact hours/week						24

Semester – IV

S.No.	Course Code	Course Title	L	T	P	Credit(s)
1	BT-580B	Dissertation-II	0	0	9	9
2	BT-580C	Dissertation Viva Voce	-	-	-	3
Total Credits						12
Total Contact hours/week						21

List of Departmental Elective(s) - I

S. No.	Course Code	Course Title	L	T	P	Credit
1	BT-566	Plant Biotechnology	3	0	0	3
2	BT-567	Medical virology	3	0	0	3
3	BT-568	Developmental biology	3	0	0	3

List of Departmental Elective(s) - II

S. No.	Course Code	Course Title	L	T	P	Credit
1	BT-569	Neurobiology	3	0	0	3
2	BT-570	Metabolic regulation, energetics and engineering	3	0	0	3
3	BT-571	Cancer and immunity	3	0	0	3
4	BT-572	Fermentation technology	3	0	0	3

List of Departmental Elective(s) - III

S. No.	Course Code	Course Title	L	T	P	Credit
1	BT-573	Nano-biotechnology	3	0	0	3
2	BT-574	Protein modeling and drug design	3	0	0	3
3	BT-575	Bioremediation and bio-metallurgy	3	0	0	3

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – I

(Departmental Core Subject)

BT-551	L-T-P-C
Advanced Cell and Molecular Biology	3-0-0-3

Objective: *This course is designed to revise the basic knowledge of the Molecular biology & cell biology. This course will focus on advanced knowledge of cell structures, cellular transport, cell junction & molecular biology associated with them and it will also discuss molecular aspects & present scenario of cancer.*

Course Content

Cells and Genomes: The Universal Features of Cells on Earth The Diversity of Genomes and the Tree of Life, Genetic Information in Eukaryotes. Cell Chemistry and Biosynthesis: The Chemical Components of a Cell, Catalysis and the Use of Energy by Cells, How Cells Obtain Energy from Food? Proteins: The Shape and Structure of Proteins, Protein Function. Basic Genetic Mechanism: DNA and Chromosomes, The Structure and Function of DNA, Chromosomal DNA and Its Packaging in the Chromatin Fiber, The Global Structure of Chromosomes. Visualizing Cells: Looking at the Structure of Cells in the Microscope, Visualizing Molecules in Living Cells. Internal Organization of the Cell: Membrane Structure, The Lipid Bilayer, Membrane Proteins. Membrane Transport of Small Molecules and the Electrical Properties of Membranes: Principles of Membrane Transport, Carrier Proteins and Active Membrane Transport, Ion Channels and the Electrical Properties of Membranes. Intracellular Compartments and Protein Sorting: The Compartmentalization of Cells. The Transport of Molecules between the Nucleus and the Cytosol, The Transport of Proteins into Mitochondria and Chloroplasts, Peroxisomes, The Endoplasmic Reticulum. Intracellular Vesicular Traffic: The Molecular Mechanisms of Membrane Transport and the Maintenance of Compartmental Diversity, Transport from the ER through the Golgi Apparatus,

Transport from the *Trans* Golgi Network to Lysosomes, Transport into the Cell from the Plasma Membrane: Endocytosis, Transport from the *Trans* Golgi Network to the Cell Exterior: Exocytosis. Cell Communication: General Principles of Cell Communication, Signaling through G-Protein-Linked Cell-Surface Receptors, Signaling through Enzyme-Linked Cell-Surface Receptors, Signaling Pathways That Depend on Regulated Proteolysis .Signaling in Plants. The Cytoskeleton: The Self-Assembly and Dynamic Structure of Cytoskeletal Filaments, How Cells Regulate Their Cytoskeleton Filaments, Molecular Motors,The Cytoskeleton and Cell Behavior The Cell Cycle and Programmed Cell Death: An Overview of the Cell Cycle Components of the Cell-Cycle Control System, Intracellular Control of Cell-Cycle Events, Programmed Cell Death (Apoptosis), Extracellular Control of Cell Division, Cell Growth, and Apoptosis. Cell Junctions: Cell Adhesion, and the Extracellular Matrix ,Cell Junctions,Cell-Cell Adhesion, The Extracellular Matrix of Animals, Integrins, The Plant Cell Wall. Development of Multicellular Organisms: Universal Mechanisms of Animal Development, *Caenorhabditis Elegans*: Development from the Perspective of the Individual Cell, *Drosophila* and the Molecular Genetics of Pattern Formation: Genesis of the Body Plan, Homeotic Selector Genes and the Patterning of the Anteroposterior Axis, Organogenesis and the Patterning of Appendages, Cell Movements and the Shaping of the Vertebrate Body Cancer: Cancer as a Micro evolutionary Process, The Preventable Causes of Cancer, Finding the Cancer-Critical Genes, The Molecular Basis of Cancer-Cell Behaviour Cancer Treatment: Present and Future

Text/Reference Books

1. The Cell – A Molecular Approach .Cooper G.M, Hausman R.E. 6th Ed. Sinauer Associates.
2. Cell & Molecular Biology. De Robertis & De Robertis Jr.8th Ed. Waverly Pvt. Ltd.1998
3. Cell & Molecular Biology .Karp Gerald. 2nd Ed. Wiley Publishers.
4. Molecular Biology of the Cell .Alberts Bruce.5th Ed. Taylor & Francis.
5. The Biochemistry of Cell Signalling. Ernst J.M, Helmreich. Oxford Press.
6. The World of Cell. Becker, Kleinsmith & Harden. 5th Ed. Pearson Publishers.
7. Cell & Molecular Biology. Sheeler Philips, Donald E. & Bianchi. 3rd Ed. John Wiley & Sons.

Detailed Syllabus for M.Tech. Degree Programme in Biotechnology

Semester – I

(Departmental Core Subject)

BT-552
Microbial Technology

L-T-P-C
3-0-2-5

Objective: *This course is designed to impart and revise the basic knowledge of the microbial systems & their biochemical reactions used for the production of various useful products to serve the mankind. This course will deal with the concepts of microbiology (such as bacteria, fungi, algae, viruses & protozoa) & their applications for the development of various foods, beverages & medicinal products.*

Course Content

General Microbiology: Cell structure, composition, function and life cycle of bacteria, fungi, algae and protozoa. Structure, composition, function and life cycle of viruses. Reserve food materials of microorganisms- polyhydroxybutyrate - polyphosphate granules - oil droplets cyanophycin granules and sulphur inclusions. Cultivation of microorganisms: Aerobic - anaerobic - shaker - still - nutritional types - culture media used - growth curve - generation time - growth kinetics - asynchronous - synchronous - batch - continuous culture - measurement of growth and factors affecting growth, control of bacteria - physical and chemical agents - preservation methods. Introduction to fermentation process: Microbial biomass, Enzymes and Metabolites. Recombinant products, Transformation processes. Development of fermentation industry, Component parts of fermentation process, Microbial growth kinetics: Batch culture and Continuous culture, Multistage systems, Comparison of batch and continuous culture, biomass, metabolite productivity. Isolation and preservation of microorganisms: Criteria for choice of organisms, Isolation methods utilizing and not utilizing selection of desired characteristics, Screening methods, Preservation: Storage at reduced temperature and dehydrated form. Selection of strains for stable, resistant to infection, non-foaming, resistant to

components, Morphologically favorable. Strain development for producing new fermentation products. Media for industrial fermentations: Medium formulation: Water, Energy sources, Carbon sources, Nitrogen sources, minerals, Buffers, Precursors, Inhibitors and Inducers. Oxygen requirements: Fast Metabolism, Rheology and Antifoams. Medium optimization: Animal cell media, Serum, Serum-free media and Protein-free media. Trace elements, Osmolality, pH, Non-nutritional media supplements. Sterilization and development of inocula: Design of Batch Sterilization: Calculation of Del factor and Holding time. Methods of Batch Sterilization. Design of Continuous Sterilization: Sterilization of fermentor, feeds and liquid wastes. Filter Sterilization. Criteria for transfer of inoculum, Development of inocula for Bacterial and Mycelial processes. Instrumentation and control: Methods of measuring process variables: Temperature, Flow measurement and control, Safety valves, Agitator shaft power, Foam sensing control, Dissolved oxygen control, pH measurement and control, Redox, Online analysis of chemical factors. Control systems: Manual control and automatic control.

List of Experiments

1. Drinking water quality test by MPN method
2. Isolation & Identification of known & unknown bacteria
3. To perform Minimum inhibitory concentration (MIC) tests
4. To carry out Microbial sampling of air
5. To conduct Microbiological examination of milk methylene blue reduction test
6. To perform IMVIC biochemical tests
7. To carry out Fermentation of alcohol
8. To perform Solid State fermentation.

Text/Reference Books

1. General Microbiology. Purves W K. 7th Ed., W. H. Freeman and Co. 2003.
2. Microbiology. Pelczar MJ, ECS Chan & Krieg Noel. 5th Ed. Tata McGraw Hill. 2001.
3. Fundamentals of Microbiology. Alcamo Edward. Jones and Barriett Publishers.
4. Brock Biology of Microorganisms. T Michael, Madiagan et al. 12th Ed. Pearson International.
5. Microbiology principles & Applications. Black JJ. Wiley John. Prentice Hall
6. An introduction to Fungi. Dube HC. Vikas Publishing House Pvt. Ltd.
7. Introductory Mycology. Alexopoulos CJ.
8. The Cell – A Molecular Approach. Cooper G.M, Hausman R.E. 6th Ed. Sinauer Associates.

9. Cell & Molecular Biology. De Robertis & De Robertis Jr. 8th Ed. Waverly Pvt. Ltd. 1998
10. Biochemical Engineering Fundamentals. Bailey, Ollis. 2nd Ed. McGraw Hill. 1986.
11. Bioprocess Engineering, Shule & Kargi. Prentice Hall. 1992.
12. Principles of Fermentation Technology. Stanbury, P. F., Whitaker, A., & Hall, S. J. 2nd Ed. Elsevier Science Publishers. 1998
13. Introduction to Biochemical Engineering. Rao D.G. Tata Mc Hill. 2005.
14. Bioprocess engineering principles. Doran Pauline. 1st Ed. Academic Press. 1995.

Detailed Syllabus for M.Tech. Degree Programme in Biotechnology

Semester – I

(Departmental Core Subject)

BT-553
Preparative and Analytical Techniques

L-T-P-C
0-0-2-2

Objective: *This course is designed for improving the practical approaches of the students in biotechnology. This will help students to perform experiments such as buffer preparation, protein estimation, DNA estimation and to analyze the results. This will also give a hands on exposure to different instruments used for biotechnology experiments such as spectrophotometer, Electrophoresis Unit etc.*

Course Content

1. Preparation of Acetate, Tris and Phosphate Buffer systems and validation of Henderson-Hasselbach equation.
2. Reactions of amino acids – Ninhydrin, Pthaldehyde, Dansyl chloride – measurement using colorimetric and fluorimetric methods.
3. Differential estimations of carbohydrates – reducing vs non-reducing, polymeric vs oligomeric, hexose vs pentose.
4. Estimation of protein concentration using Lowry's method, Dye-binding method
5. DNA determination by UV-Vis Spectrophotometer – hyperchromic effect
6. Separation of lipids by TLC.
7. Enzyme Kinetics: Direct and indirect assays – determination of K_m , V_{max} and K_{cat} , K_{cat}/K_m
8. Restriction enzyme – Enrichment and unit calculation
9. Ion-exchange Chromatography – Purification of IgG and Albumin
10. Gel filtration – Size based separation of proteins
11. Affinity chromatography – IMAC purification of His-tagged recombinant protein
12. Assessing purity by SDS-PAGE Gel Electrophoresis

13. Chemical modification of proteins – PITC modification of IgG and Protein immobilization

Text / Reference Books

1. Biochemical Methods: A Concise Guide for Students and Researchers. Pingoud Alfred, Claus Urbanke & Hogget Jim. John Wiley & Sons Publishers. 2002.
2. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry. Irwin H. Segel. 2nd Ed. John Wiley & Sons Publishers. 1976
3. Principles and Techniques of Practical Biochemistry- Wilson K. & Walker J. Cambridge Press.

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – I

(Departmental Core Subject)

BT-554	L-T-P-C
Mechanism of gene expression	3-0-0-3

Objective: *This course is designed to teach the mechanism about the gene expression, regulation of gene in our body. This will help students to learn the concepts of gene, DNA, proteins & their regulation & expression.*

Course Content

Genes: Genes are DNA, Gene code for proteins, The interrupted gene. Genome: The content of the genome, Genome sequences and gene numbers. Clusters and repeats. Messenger RNA. Protein synthesis, Protein localization, Transcription, The operon, Regulatory RNA Phage strategies, The replicon, Extra chromosomal replicons. Bacterial replication is connected to the cell cycle, DNA replication, Homologous and site-specific recombination Repair systems, Transposons, Retroviruses and retroposons, Immune diversity, Promoters and enhancers, Activating transcription, RNA splicing and processing, Catalytic RNA, Chromosomes, Nucleosomes, Controlling chromatin structure, Epigenetic effects are inherited.

Text /Reference Books

1. Lewin's Gene X. Krebs, Goldstein & Killpatrick. 10th Ed. Jones and Bartlett Publishers.2010.
2. Concepts of Genetics. Klug William S, Cummings Michael R .7th Edition. Cram101.
3. The Biochemistry of Nucleic Acids. Adams. 11th Ed.
4. Molecular Biology of Gene. Watson James , Baker Tania Bell & Losick Richard.7th Ed. Benjamin Cummings.2013

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – I

(Basic Science Subject)

MA-557	L-T-P-C
Biostatistics & Design of Experiments	3-0-0-3

Objective: *In this course the student is familiarized with basic concepts of probability and statistics used in Biotechnology.*

Course Content

Data summarization – measures of averages and dispersion. Probability: Random Experiment; Events; Mutually Exclusive Events, Probability Axioms, Sample spaces, Conditional Probability, General Multiplication Theorem; Independent events; pair wise and mutually . Baye's Rule. Random variables (discrete & continuous); Probability mass function; Probability density function & distribution function. Expectation & Variance; Moment generating function; Probability Distribution— Binomial, Poisson and Normal distribution properties and applications. Correlation & Regression: Bivariate Data, Correlation coefficient & its properties, Linear Regression & Regression equations, Regression coefficients & their properties. Multiple Partial Correlation & Regression. Curve Fitting: The Method of Least Squares-Linear & Non-Linear. Sampling: Concept of Population & Sample, Random Sample, Methods of drawing a simple random sample. Basic principles of testing of hypothesis , Tests of significance: sampling distribution of mean & standard error, test of significance for large samples ;Test of significance for single mean, Test of significance for difference of Means. Small sample tests ; t-test for single mean , t-test for differences of means. Paired t –test for differences of means. t-test for testing the significance of an observed sample correlation coefficient. F-test and its application. Chi-Square test and its application. Non parametric methods. Experimental Designs: Principles of Experimental Designs, Completely Randomized,

Randomized Block & Latin Square Designs. Analysis of Variance (ANOVA) & Its use in the analysis of RBD.

Text/Reference Books

1. Statistical Methods in Biology. Bailey N T J .3rd Ed. Cambridge University Press .1995.
2. Engineering Mathematics. Ramana B. V. 1st Ed. McGraw-Hill 2013.
3. Probability and statistics for engineers. Miller I & Freund J. 8th Ed. PHI. 2010.
4. Fundamentals of Mathematical Statistics, Gupta SC & Kapoor V. K. S. Ch. & Sons 2008.
5. Statistical methods (Vol. II). Das N.G. 1st Ed. McGraw-Hill. 2009.

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – II

(Departmental Core Subject)

BT-555	L-T-P-C
Advanced Genetic Engineering	3-0-2-5

Objective: *The course is designed to provide the knowledge and skills of growing and fascinating field of genetic engineering by different tools used for gene transfer such as restriction endonucleases, vectors & plasmids, ligases, screening of recombinants, expression and regulatory systems in prokaryotes and eukaryotes. It also discusses about the concept and applications of gene libraries, various uses of cloned gene, and transgenics*

Course Content

Overview: Vectors-Artificial chromosome vectors (YAC and BAC), Viral vectors (Lambda, M13 and SV-40), Expression vectors and Shuttle vectors; Restriction Enzymes; DNA ligase; Linkers; Adaptors; Labeling of DNA- Nickt ranslation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques Northern,Southern and Colony hybridization, Fluorescence in situ hybridization, Chromatin Immunoprecipitation; DNase footprinting. Gene cloning methods: Construction of libraries-cDNA and genomic DNA; cloning of PCR products; Expression cloning; Jumping an hopping libraries; Southwestern and Far-western cloning; Protein-protein interactive cloning and Yeast two hybrid system; Phage display.Nucleic acid sequencing and gene silencing: Sequencing methods- Enzymatic DNA sequencing, Chemical sequencing of DNA, Automated DNASEquencing, RNA sequencing; Introduction to siRNA; siRNA technology; Micro RNA; Construction of siRNAvectors; Principle and application of gene silencing.PCR and its applications:Primer design; Fidelity of thermostable enzymes; DNA polymerases- different types; Types of PCR – multiplex,nested, reverse

transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR,; PCR in generecombination; Deletion; addition; Overlap extension; PCR in molecular diagnostics- Viral and bacterial detection; PCR based mutagenesis, Mutation detection- SSCP, DGGE, RFLP, Oligo Ligation Assay (OLA),MCC (Mismatch Chemical Cleavage, ASA (Allele-Specific Amplification), PTT (Protein Truncation Test).Gene knockouts and gene therapy: Creation of knockout mice; Disease model; Somatic and germ-line therapy- *in vivo* and *ex-vivo*; Suicide genetherapy; Gene replacement; Gene targeting.

List of Experiments

1. Restriction digestion of λ DNA with *EcoR* I and *Hind* III enzymes
2. Analysis of restriction pattern by agarose gel electrophoresis
3. Ligation of λ digests using T4 DNA Ligase
4. Preparation of competent bacterial host cells for transformation
5. Transformation of cloned DNA in host cell
6. Screening of recombinant using blue white screening method
7. Amplification of genomic DNA by PCR (Polymerase Chain Reaction) using molecular markers
8. Southern Hybridization and non-isotopic detection of DNA of interest
9. Electrotransfer of protein onto nitrocellulose membrane (Western Blotting) and immunodetection of the transferred protein (Blot development)
10. Cloning of GFP gene (Green Fluorescent Protein)

Text/Reference Books

1. An Introduction to Genetic Engineering. Desmond S. T. Nicholl. 3rd Ed. Cambridge University Press. 2008.
2. From Genes to Genomes: Concepts & Applications of DNA Technology. Dale J.W., Schantz M.V. John Wiley & Sons Ltd. 2007.
3. Principles of Gene Manipulation. Old R.W, Primrose S B. Blackwell Scientific Publications.
4. Gene Cloning & Manipulation. Howe Christopher. 2nd Ed. Cambridge University Press. 2007.

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – II

(Departmental Core Subject)

BT-556	L-T-P-C
Enzyme technology and industrial applications	3-0-1-4

Objective: *This course is designed to impart basic knowledge of enzyme kinetics, the parameters of the enzymatic reaction, mechanisms of action of enzymes and inhibitors, dependence on the temperature and pH of the enzymatic activity, knowledge of the structure of enzymes and amino acids that build active sites of enzymes and immobilization of enzymes & immobilization kinetics.*

Course Content

Kinetics and mechanism of enzyme action: Classification of enzymes; quantification of enzyme activity and specific activity. Estimation of Michaelis Menten parameters, Effect of pH and temperature on enzyme activity, kinetics of inhibition. Modeling of rate equations for single and multiple substrate reactions. Immobilised enzyme reactions: Techniques of enzyme immobilisation-matrix entrapment, ionic and cross linking, column packing; Analysis of mass transfer effects of kinetics of immobilised enzyme reactions; Analysis of Film and Pore Diffusion Effects on Kinetics of immobilized enzyme reactions; calculation of Effectiveness Factors of immobilized enzyme systems; Bioconversion studies with immobilized enzyme packed -bed reactors. Mass Transfer Effects in immobilised Enzyme System: Analysis of film and Pore diffusion Effects on kinetics of immobilised enzyme reactions; Formulation of dimensionless groups and calculation of Effectiveness Factors .Application Of Enzymes: Extraction of commercially important enzymes from natural sources; Commercial applications of enzymes in food, pharmaceutical and other industries; enzymes for diagnostic applications. Industrial production of enzymes. Use of enzymes in analysis-types of sensing-gadgetry and methods. Case studies on application - chiral conversion, esterification etc. Enzyme Biosensors: Applications of

enzymes in analysis; Design of enzyme electrodes and case studies on their application as biosensors in industry, healthcare and environment.

List of Experiments

1. To study enzyme kinetics of trypsin, chymotrysin
2. To determine effect of inhibitor on enzyme kinetics
3. To perform enzyme immobilization & its reaction
4. To check thermo stability of enzymes
5. To perform isolation of enzymes
6. To perform salt precipitation of enzymes
7. To purify enzymes by chromatography

Text/Reference Books

1. Enzymes. Palmer.2nd edition. East West Press
2. Biochemical Engineering Fundamental. Bailey , Ollis.2nd Ed. Mc. Graw Hill Intl.
3. Basic Biotechnology. Ratledge Colin, Bjorm Kristiansen.2nd Ed. Cambridge University Press.
4. Fundamentals of Enzymology. Price & Stevens .Oxford University Press.
5. Enzyme Technology . Uhling Helmut .John Wiley. 1998.
6. Hand book of Enzyme Biotechnology. Wiseman, Alan. 3rd ed. Ellis Harwood. 1995.

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – II

(Departmental Core Subject)

BT-557
Bioethics & IPR

L-T-P-C
3-0-0-3

Objective: *This course is designed to know the ethics concerning the recombinant DNA technology. It also involves learning various conventions of a patents and applications of them.*

Course Content

The legal and socioeconomic impact of biotechnology. public education of the process of biotechnology involved in generating new forms of life for informed decision making, biosafety regulation and national and international guidelines, r-DNA guidelines, experimental protocol approvals, levels of containment, Environmental aspect of biotech applications, use of genetically modified organism and their release in environment Special procedures for r-DNA based product production. Intellectual property rights, TRIPS, International conventions patents and methods of application of patents. Legal implications, biodiversity and farmers right, other Acts. Beneficial application and development of research focus to the need of the poor. Identification of directions for yield effect in agriculture, aquaculture etc

Text/Reference Books

1. Bioethics. Ignacimuthu S. Alpha Science International.2009
2. Biotechnologies in developing countries present and future. Sasson A. Unesco Publishers.
3. Intellectual Property Rights on Biotechnology. Singh K. BCIL New Delhi.

Detailed Syllabus for M.Tech. Degree Programme in Biotechnology

Semester – III

(Departmental Core Subject)

BT-558
Bioinformatics and Computational Biology

L-T-P-C
2- 0-1-3

Objective: *This course is designed to provide the in depth knowledge of different tools of bioinformatics and computational biology.*

Course Content

Introduction to computational biology: Molecular sequences. Sequence analysis. Dynamic programming. Pairwise and multiple sequence alignment and motifs. Applications. Databases: Scoring matrices, heuristic methods of database searching: BLAST family of programs, FASTA. Phylogenetic trees. Introduction to genomics and proteomics: Functional, structural and comparative genomics. Gene finding and annotation. Protein structure. Homology modeling. Differential gene expression. Machine learning techniques: Hidden Markov models, Neural nets, Decision trees and their application in computational biology. Eukaryotic and prokaryotic gene finding. DNA Computing. Introduction to Perl: Variables, Data types, control flow constructs, arrays, lists and hashes, String manipulation, File handling.

List of Experiments

1. Sequence analysis : Pairwise and multiple sequence alignment. Tools available for sequence analysis. Motif generation.
2. Databases : Exploring biological databases
3. Database searching: Using BLAST, PSIBLAST and PHIBLAST, FASTA.
4. Gene finding : Using Genscan, HMMGene etc.
5. Protein structure : Tools for protein structure prediction.
6. Annotation : Functional annotation.
7. Writing utilities using Perl.

Text /Reference Books

1. Algorithms on strings Trees and Sequences. . Gusfield, Dan. Cambridge University Press.
2. Bioinformatics: The Machine Learning Approach Baldi, P., Brunak, S. 2nd ed., East West Press. 2003
3. Bioinformatics: Sequence and Genome Analysis. Mount D.W. Cold Spring Harbor Laboratory Press. 2001.
4. A Practical Guide to the Analysis of Genes and Proteins. Baxevanis A.D. & Oullette, B.F.F. 2nd Ed. John Wiley. 2002.
5. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids .Cambridge University Press. 1998.

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – III

(Departmental Core Subject)

BT-559
Immunotechnology

L-T-P-C
2- 0-1-3

Objective: *This course is designed to discuss the immune system at the cellular level, role of different organelles involved in immune responses, structure of antibodies, antigens, antibody-antigen reactions etc. This will also discuss about the various assays for antigen detection, current scenario of vaccines, Immunotherapeutics & engineered molecules used in immunology*

Course Content

Introduction :Cells of the immune system and their development; primary and secondary lymphoid organs; humoral immune response; cell mediated immune responses; complement. Antibodies: Monoclonal antibodies and their use in diagnostics; ELISA; Agglutination tests; Antigen detection assay; Plaque Forming Cell Assay. Cellular Immunology: PBMC separation from the blood; identification of lymphocytes based on CD markers; FACS; Lymph proliferation assay; Mixed lymphocyte reaction; Cr51 release assay; macrophage cultures; cytokine bioassays- IL2, gamma IFN, TNF alpha.; HLA typing. Vaccine technology: Basic principles of vaccine development; protein based vaccines; DNA vaccines; Plant based vaccines; recombinant antigens as vaccines; reverse vaccinology. Development of Immunotherapeutics: Engineered antibodies; catalytic antibodies; idiotypic antibodies; combinatorial libraries for antibody isolation.

List of Experiments

1. To conduct ELISA
2. To perform pregnancy test
3. To perform purification of Ig G
4. To perform Widal test

5. To perform blood Grouping

Text /Reference Books

1. Kuby- Immunology. Goldsby R.A, Kindt, B.A & Osborne.6th Ed.
2. Essentials of Immunology. Riot. Blakswell Scientific Publications, Oxford.1988.
3. Fundamentals of Immunology: Paul W.E.Raven Press, New York.1988.
4. Antibodies a laboratory Manual: Harlow & Lane David. Cold Spring Harbor Laboratory.1988

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – III

(Departmental Core Subject)

BT-580A
Dissertation I

L-T-P-C
0-0-5-5

The Dissertation for M. Tech programme consists of two parts: Dissertation-I and Dissertation-II. Dissertation-I is undertaken during the III Semester.

The Dissertation is by far the most important single piece of work in the post-graduate programme. It provides the opportunity for student to demonstrate independence and originality, to plan and organize a large Dissertation over a long period and to put into practice some of the techniques students have been taught in the course. Students will choose a dissertation, in consultation with a faculty member, who will act as the Supervisor. Dissertation involves a combination of sound background research, a solid implementation, or piece of theoretical work, and a thorough evaluation of the dissertation's output in both absolute and relative terms. The very best dissertations invariably covers some new ground, e.g. by developing a complex application which does not already exist, or by enhancing some existing application or method to improve its functionality, performance etc.

The student will prepare the Dissertation report as per the prescribed format/guidelines, and present the same as a seminar at the end of the semester.

The Dissertation will be evaluated continuously over the span of the III Semesters, as per the approved procedure.

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – IV

(Departmental Core Subject)

BT-580B
Dissertation II

L-T-P-C
0-0-9-9

After completion of Dissertation-I, students will undertake the Dissertation-II in the IV Semester. The idea conceived and progress made in the Dissertation-I shall be extended as Dissertation-II under the supervision of a faculty member. Students shall complete the theoretical and practical aspect of the project. Thereafter they will prepare a report, as per the prescribed format/ guidelines, incorporating the results, their analysis and interpretation. The report, duly certified by the Supervisor, should be submitted to the Head of the Department. The report should also be presented as a seminar at the end of the semester.

Progress made by the student will be continuously monitored throughout the semester and evaluated as per the approved procedure.

**Detailed Syllabus for M.Tech. Degree Programme
in
Biotechnology**

Semester – IV

(Departmental Core Subject)

BT-580C	L-T-P-C
Dissertation Viva Voce	-----3

Dissertation Viva Voce is the verbal defence of the dissertation carried out by the student in front of a panel of examiners. The objective of Viva Voce examination is to confirm that the piece of work submitted as a dissertation is student's own work, he/she has a sound understanding of the subject of the dissertation, aware of the recent works in the area of dissertation, methodology adopted, and importance/relevance/merits of the output in relation with the existing results in the area.