

Uttarakhand Technical University

B.TECH (BIOTECHNOLOGY)

II YEAR, SEMESTER III

S.No.	Subject Code	Subject Title	Contact Hours / Week			Evaluation Scheme						Subject Total Marks
						Sessional Marks			ESE			
			L	T	P	CT	TA	Total	Marks	Duration (hrs)		
THEORY SUBJECTS												
1.	TCS 302	Computer based numerical techniques	2	0	0	15	10	25	50	2	75	
2.	TBT 301	Cell Biology	3	1	0	30	20	50	100	3	150	
3.	TBT 302	Biochemistry	3	1	0	30	20	50	100	3	150	
4.	TBT 303	Microbial Biotechnology	3	1	0	30	20	50	100	3	150	
5.	TBT 304	Bioanalytical Techniques	3	1	0	30	20	50	100	3	150	
6.	TBT 305	Bioinformatics I	2	1	0	15	10	25	50	3	75	
PRACTICAL / TRAINING / PROJECT												
7.	PBT 301	Cell Biology + Bioinformatics	0	0	2	10	15	25	25	2	50	
8.	PBT302	Biochemistry+ Bioanalytical Techniques	0	0	2	10	15	25	25	2	50	
9.	PBT 303	Microbiology	0	0	2	10	15	25	25	2	50	
10.	PCS 302	Computer based numerical techniques	0	0	2	10	15	25	25	2	50	
TOTAL			-	-	-	-	-	350	600	-	950	
11.	GP 301*	General Proficiency (NSS/NCC/Sports/cultural)	00	00	00	-	-	50	-	-	50	
Total								400	600		1000	

(* These marks will be awarded at the end of semester IV based upon the performances in both semester III & IV.)

CT- Cumulative Test

TA - Teacher Assessment

ESE- End Semester Examination

3rd Semester

COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES

TCS 302

Unit-I

Floating point Arithmetic: Representation of floating point numbers, Operations, Normalization, Pitfalls of floating point representation, Errors in numerical computation.

Iterative Methods: Zeros of a single transcendental equation and zeros of polynomial using Bisection Method, Iteration Method, Regula Falsi method, Newton Raphson method, Secant method, Rate of convergence of iterative methods.

Unit-II

Simultaneous Linear Equations: Solutions of system of Linear equations, Gauss Elimination direct method and pivoting, Ill Conditioned system of equations, Refinement of solution. Gauss Seidal iterative method, Rate of Convergence. **Interpolation and approximation:** Finite Differences, Difference tables, Polynomial Interpolation: Newton's forward and backward formula, Central Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. **Interpolation with unequal intervals:** Langrange's Interpolation, Newton Divided difference formula, Hermite's Interpolation, Approximation of function by Taylor's series and Chebyshev polynomial

Unit-III

Numerical Differentiation and Integration: Introduction, Numerical Differentiation, Numerical Integration, Trapezoidal rule, Simpson's rules, Boole's Rule, Weddle's Rule Euler Maclaurin Formula. **Solution of differential equations:** Picard's Method, Euler's Method, Taylor's Method, Runge Kutta methods, Predictor corrector method, Automatic error monitoring, stability of solution.

Unit-IV

Curve fitting, Cubic Spline and Approximation: Method of least squares, fitting of straight lines, polynomials, exponential curves etc. **Frequency Chart:** Different frequency chart like Histogram, Frequency curve, Pi chart. **Regression analysis:** Linear and Non linear regression, multiple regressions.

References:

1. Rajaraman V., "Computer Oriented Numerical Methods", PHI
2. Gerald & Wheatley, "Applied Numerical Analyses", AW
3. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Int.
4. Grewal B. S., "Numerical methods in Engineering and Science", Khanna Publishers, Delhi
5. T. Veerarajan, T Ramachandran, "Theory and Problems in Numerical Methods", TMH
6. Pradip Niyogi, "Numerical Analysis and Algorithms", TMH

CELL BIOLOGY

TBT-301

Unit I

Cell: An introduction, classification of organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation.

Unit II

Cell membrane and permeability: Chemical components of biological membranes, organization and fluidity of membrane components, the membrane as a dynamic entity, cell recognition and membrane transport.

Unit III

Organization of transport activity in cell; Signal Transduction. Cell signaling: Types of signaling, Cell surface receptor mediated signaling (RTK, pathway, JAK-STAT pathway), G-proteins and G- protein coupled receptors, Secondary messengers and intracellular communication, Target cell adaptation.

Unit IV

Cytoskeleton and cell motility: Structure and functions of microtubules, microfilaments, intermediate filaments. Structure and Functions of Cellular Organelles: Endoplasmic reticulum, golgi complex, lysosomes, vacuoles and microbodies, ribosomes, mitochondria, plastids.

Unit V

Nucleus: Structure, cell-cycle (interphase and M phases), regulation of cell cycle.

Extracellular matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extracellular matrix macromolecules, regulation of receptor expression and function.

Text/ References Books:

1. Molecular Biology of cell, 4th ed. Alberts, Bruce(*et... al*)(2002) Garland Science Publishing, New York..
2. Cell Biology- Smith and Wood by Chapman and Hall.
3. Cell Biology: Organelle structure and function, Sadava, D E.(2004) Panima pub., New Delhi.
4. Cell and Molecular Biology, 8th ed. Robertis, Edp De and Robertis, Emf De (2002) Lippincot Williams and Wilkins Pvt. Ltd.,(International Student Edition) Philadelphia.
5. Molecular Cell Biology 4th ed. Lodish, Harvey and Baltimore, D(2000) W.H. freeman & Co. Newyork

CELL BIOLOGY / BIOINFORMATICS LAB

Practical

PBT301

1. Study of microscopy
2. Study of general methods for cytological preparation
3. Study of cell ultrastructure
4. Study of general methods for cytological preparation
5. Study of mitotic chromosome in Plant Material
6. Study of mitotic chromosome in Bone-marrow cells of RAT/GUINEA PIG
7. Study of mitosis
8. Study of meiosis
9. Construction of database for specific class of proteins/enzymes, genes/ ORF/ EST/Promoter sequences/ DNA motifs or protein motifs using oracle.
10. Access and use of different online protein and gene alignment softwares
11. Gene finding related search for a given nucleotide sequence in order to predict the gene
12. ORF prediction for different proteins out of some given nucleotide sequences.
13. Exon identification using available softwares for a given nucleotide sequences
14. Secondary structure prediction for amino acid sequences of a given protein.

BIOCHEMISTRY

TBT 302

Unit I

Hydrogen bonding and structure of water molecule, Ionization of water, pH, Buffers. Colligative properties of water. Carbohydrates-Structure and functions: Structures and properties of monosaccharides, oligosaccharides and polysaccharides. Ring structure and mutarotation. Homo- and hetero-polysaccharides. Mucopolysaccharides.

Unit II

Amino acids & Proteins: Structure and properties of amino acids. Essential and non-essential amino acids. Peptide bonds. Types of proteins and their classification. Forces stabilizing protein structure and shape. Different levels of structural organization of proteins. Lipids- Structure and functions: Classification of lipids and their general functions. Essential fatty acids. Hydrolysis of fats, Saponification value, Rancidity of fats, Cholesterol-its structure and biological functions.

Unit III

Nucleic Acids- Structure and functions: Structure and properties of purine and pyrimidine bases. Nucleosides and nucleotides. Biologically important nucleotides. Vitamins: Role of Vitamins, metals ions, significance.

Unit IV

Metabolism: Basic concepts, Anabolism and catabolism, Carbohydrate Metabolism: Glycolysis. Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway and its significance. Gluconeogenesis pathway.. Maintenance of blood glucose level. Energetics and regulation of carbohydrate metabolism. Lipid Metabolism: Beta -oxidation of saturated fatty acids, oxidation of unsaturated and odd carbon fatty acids. Formation and utilization of ketone bodies.

Unit V

Amino Acid Metabolism: General reactions of amino acids metabolism- transamination, oxidative and non-oxidative deamination and decarboxylation. Urea cycle and its regulations. Nitrogen cycle. Nucleic Acid Metabolism: Catabolism, de novo-biosynthesis and regulation of purine and pyrimidine nucleotides. Formation of deoxyribonucleotides.

Recommended Books:

1. Principles of Biochemistry: A.L. Lehninger, Nelson and Cox, McMillan Worth Publishers.
2. Biochemistry: Voet and Voet, John Wiley and Sons, Inc. USA.
3. Biophysical Chemistry Vol. I, II & III: Cantor and Schimmel, Freeman.

4. Biochemistry: Zubey, WCB.
5. Biochemistry: Garrett and Grisham, Harcourt.
6. Biochemistry: Stryer, W. H. Freeman.
7. Understanding Enzymes: T. Palmer, Horwood.
8. Harper's review of Biochemistry: R.K. Murray et al., Prentice-Hall International Inc.
9. Fundamentals of Biochemistry: Cohn and Stumpf.

Biochemistry /**BIOANALYTICAL LAB**
Practicals

PBT 302

- Qualitative analysis of proteins, carbohydrates and lipids.
- Preparation and purification of casein from buffalo milk.
- Determination of acid value of fat/oil
- Determination of Iodine number of fat/oil
- Determination of Logic properties (pH value of Lysine by titration).
- To find lambda max for proteins.

- Demonstration of mitotic cell using microscopy
- Verification of Lambert Beers Law by UV Vis Spectrophotometer.
- Estimation of Different macromolecules by visible spectrophotometer.
- Estimation of pH of Different solutions and buffers by digital pH Meter
- Estimation of proteins and nucleic acids by UV method
- Separation of different macromolecules by paper and Thin Layer Chromatography.
- Membrane separation- dialysis and ultrafiltration.
- To study different cell lysis methods.

MICROBIAL BIOTECHNOLOGY

TBT 303

Unit 1

Development of microbiology, scope and relevance of microbiology, Fields in microbiology, History of Microbiology: Contribution of Koch, Contribution of Lister, germ theory of fermentation, Conflicts of Biogenesis and Abiogenesis, Contribution of Metchnikoff. Classification of Microorganism, Two Kingdom classification, Three kingdom classification, Five Kingdom classification, Eight kingdom classification. Difference between Eukaryote and Prokaryote, method of classification based on 16sRNA, DNA homology, Identification of Bacteria Biochemical and molecular Approach.

Unit II

Morphology and ultra structure of bacteria. Morphological types. Cell wall of archaeobacteria, Gram, negative and Gram-positive bacteria, eukaryotes. L- form cell wall synthesis. Capsules- types composition and function. Cell membranes- structure, composition and properties. Cultivation of aerobic and anaerobic bacteria.

Unit III

Structure and function of flagella, cilia, pili, gas vesicles, chromosomes, carboxysomes, magnetosomes and phycobilisomes, nucleoid, cell division. Spores, reserve food materials polyhydroxybutyrate, phosphate granules. Oil droplets, cyanophycin granules and sulfur inclusions.

Unit IV

Cultivation of bacteria –aerobic, anaerobic., nutritional types, culture media used, growth curve generation time. Growth kinetics, asynchronous and synchronous growth Batch and continuous cultures. Measurement of growth, factors affecting growth. Control of bacteria-physical and chemical agents. Isolation of Pure culture, Preservation methods. Sterilising techniques, Brief introduction of \

Unit V

Virology: Structure and cultivation of Virus, General, Brief outline on discovery of viruses. and. Types of envelopes and their compositions. Viral genome, their types structures, virus related agents (viroids virusoids and prions). Bacteriophage and its life cycle.

Recommended Books

1. Text book of Microbiology: R.C.Dubey and D.K.Maheshwari
2. Text book of Microbiology: Annathnarayan and Panicker
3. Microbiology ; Prescott
4. Practical Microbiology: .Dubey and D.K.Maheshwari

MICROBIAL BIOTECHNOLOGY

Lab

PBT 303

1. To study the working and principle of instrument used in the microbiology lab
2. Wrapping of glassware.
3. To stain the bacteria by simple staining using monochrome stain
4. To study the morphology of bacteria by Negative staining
5. To perform the gram staining to know the bacteria is gram positive or gram negative
6. Perform the spore staining to know the bacteria is spore former or not
7. Perform the fungal staining by lactophenol cotton blue.
8. To study the motility of bacteria by hanging drop method.

BIOANALYTICAL TECHNIQUES

TBT-304

Unit I: Introduction

Types of Analytical Methods, Instrument for analysis, Uncertainties in Instrumental measurements –Sensitivity and detection limit for instruments, pH meter, dissolved oxygen, agitation, sensors and their operation.

Unit II Microscopy

Bright field, Dark field, Fluorescent, Phase contrast, Confocal microscopy, SEM and TEM microscopy, Flow cytometry.

Unit III Centrifugation

General principles, Ultracentrifugation, Velocity Sedimentation and Measurements, Equilibrium Ultracentrifugation- Density Gradient Centrifugation.

Unit IV Spectroscopy

General Principles-Radiation, energy and atomic Structure-types of spectra and their biochemical usefulness-basic laws of light absorption. Electromagnetic radiation and spectrum, Beer-Lamberts law and Apparent deviations; UV-VIS spectrophotometer, Atomic absorption and Atomic emission spectroscopy, Circular Dichroism (CD)-principles, instrumentation and applications, X-ray diffraction and crystallography: principle, mode of operation and application.

Unit V Separation Equipments-Principle and Operation

HPLC, Gas Chromatography, Ion Exchange Chromatography, Gel Filtration Chromatography, Affinity Chromatography, Membrane separation, Ultrafiltration, Reverse Osmosis.

Text Books

1. A biologist Guide to principles and technique of practical biochemistry-By Keith Wilson, Kenneth H. Gouldind 3rd Edition, ELBS Series
2. Skoog and West, Fundamentals of Analytical Chemistry, 1982.
3. Vogel, Text Book of Quantitative Inorganic analysis, 1990.
4. Ewing, Instrumental Method of analysis, 1992
5. Hobert H Willard, D.L.Merritt and J.R.J.A. Dean, instrumental methods of analysis, CBS Publishers and Distributors, 1992
6. F.Settle. HandBook of Instrumental Techniques for Analytical chemistry, Prentice Hall, 1997.

Bioinformatics I

TBT 305

Unit I

Primary and secondary databases. Specialized sequence databases of EST, TFB Sites, SNP's, gene expression. Pfam, PROSITE, BLOCK(Secondary databases). Data retrieval with ENTREZ, SRS, DBGET

Unit II

Principles of DNA sequencing (chemical chain termination, Dideoxy chain termination method, Automatic sequencer). RNA sequencing . Protein sequencing (Edmand degradation method)

Unit III

Sequence alignment (pairwise and multiple, global and local). Sequence alignment algorithm (FAST , BLAST, Needleman and Wunsch, Smith Waterman). Database similarity searches (BLAST, FASTA and PSI BLAST). Amino acid substitution matrices (PAM BLOSUM)

Unit IV

Protein structure prediction (Chou Fasman method) : Secondary and tertiary structures. Homology Modelling, ORF prediction, Gene prediction, Micro array data analysis. Profiles and motifs.

Unit V

Structure visualization methods (RASMOL, CHIME etc.) . Protein Structure alignment and analysis. Application of Bioinformatics in drug discovery and drug designing.

Recommended books:

1. Bioinformatics : Principles and applications by Ghosh and Mallick (oxford) university press)
2. Bioinformatics by Andreas D Boxevanis (Wiley Interscience)
3. Fundamental concept of bioinformatics by Dan e. krane
4. Introduction to bioinformatics by Attwood and Parry Smith (Pierson education Publication

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II YEAR, SEMESTER IV

S.No.	Subject Code	Subject Title	Contact Hours / Week			Evaluation Scheme						Subject Total Marks
						Sessional Marks			ESE			
			L	T	P	CT	TA	Total	Marks	Duration (hrs)		
THEORY SUBJECTS												
1.	TBT401	Genetics	3	1	0	30	20	50	100	3	150	
2.	TBT402	Molecular Biology	3	1	0	30	20	50	100	3	150	
3.	TBT403	Immunotechnology	3	1	0	30	20	50	100	3	150	
4.	TBT404	Biostatistics	3	1	0	30	20	50	100	3	150	
5.	TBT 405	Bioinformatics II	2	1	0	15	10	25	50	3	75	
6.	TBT 406	Environmental Engg.	2	1	0	15	10	25	50	2	75	
PRACTICAL / TRAINING / PROJECT												
7.	PBT401	Genetics	0	0	2	10	15	25	25	2	50	
8.	PBT 402	Molecular Biology	0	0	2	10	15	25	25	2	50	
9.	PBT403	Immunotechnology	0	0	2	10	15	25	25	2	50	
10.	PBT 404	Biostatistics/Bioinformatics	0	0	2	10	15	25	25	2	50	
TOTAL			15	5	6	-	-	350	600	-	950	
11.	GP 401*	General Proficiency (NSS/NCC/Sports/cultural)	00	00	00	-	-	50	-	-	50	
Total								400	600		1000	

(* These marks will be awarded at the end of semester IV based upon the performances in both semester III & IV.)
 CT- Cumulative Test TA - Teacher Assessment ESE- End Semester Examination

ENVIRONMENTAL ENGINEERING

TBT- 406

Unit I: Introduction to Environment

Environment and its segments.

Atmospheric Structure

Environmental Pollution

Unit II: Water pollution

Water pollution

Wastewater and its treatment

Water quality standards, water treatment;

Sludge treatment and disposal.

Unit III : Air pollution

Criteria Pollutants

Sources and effects of air pollution,

Air pollution and Meteorology,

Treatment of emissions,

Unit III: Solid and hazardous waste management.

Solid waste and its classification

Solid waste management,

Energy from waste.

Unit IV: Global atmospheric change

Global warming and its impact,

Ozone layer depletion.

Unit V: Brief introduction about environmental legislation and environmental audit.

Books Recommended:

- 1) Introduction to Environmental Engineering and Science by G.M. Masters, Prentice Hall India Pvt. Ltd.
- 2) Environmental Science and Engineering by Wright, Pearson Publication.
- 3) Environmental Engineering by Vasilind, Cengage Learning, New Delhi.

GENETICS

TBT-401

Unit I

Heredity, Historical Perspectives: Definition-of genetics; Origin of life; spontaneous generation: Performationism; Inheritance of acquired characters; Pangenesis; Germplasm theory; Early Ideas on reproduction; Molecular theory on origin of life.

Unit II

Principles of Heredity and Variation: Mendel and his experiments, monohybrid crosses, incomplete dominance and codominance, dihybrid crosses, multiple alleles (blood group systems), epistasis, lethal genes. Probability in prediction and analysis of genetic data. Pedigree analysis. **Genes and Chromosomes:** General features of chromosomes, cell division, sexual reproduction. Chromosomal theory of inheritance, sex determination. Sex-linked, sex-limited and sex-influenced inheritance. Variation in chromosome number and structure.

Unit III

Molecular organization of chromosomes: Genome size and evolutionary complexity, supercoiling of DNA, structure of bacterial chromosome, structure of eukaryotic chromosome. **Gene Mutation and DNA Repair:** Classification of mutations, spontaneous mutations, induced mutations, application of induced mutations, detection of mutations, site-directed mutagenesis, mechanisms of DNA repair.

Unit IV

Gene Linkage and Chromosome Mapping: Linkage and recombination of genes in a chromosome, crossing over and genetic mapping, gene mapping by 2-point and three point test crosses. **Somatic Cell Genetics :** Somatic cell hybrids production and gene mapping.

Unit V

Population Genetics and Evolution : Allele frequencies and genotype frequencies, random mating and Hardy-Weinberg principle. Inbreeding. Genetics and evolution (Mutation and migration, natural selection, random genetics drift).

Quantitative Genetics : Quantitative inheritance, causes of variation.

Text/ Reference Books:

1. Genetics: Analysis of Genes and Genomes. 5th edition (2001) Hartl, D.L. and Jones, E.W., Jones and Bartlet Publishers, Boston.
2. Genetics. 5th edition (1998) Russell, P.J., Addison Wesley Longman, Inc., California.
3. Genetics: Analysis and Principles. (1999) Brooker, R.J. McGraw Hill, New York.
4. Basic Genetics. (2000) Miglani, G.S., Narosa Publishing House, New Delhi.
5. A text Book of animal Geneitics. P.Kanakraj, IBDC, New Delhi

GENETICS EXPERIMENTS

PBT-401

1. Study of simple and compound microscope
2. Study of Cell structure
3. Study of dihybrid cross
4. Study of epistasis
5. Study of polytene chromosome
6. Study of meiotic studies in animals
7. Study of behavior of chromosome during meiosis in Pollen Mother cells.
8. Study of Chi-Square Test

MOLECULAR BIOLOGY

TBT-402

Unit I

Structure and properties of Nucleic acid: Models of DNA structure; RNA structure, physical, chemical and Spectroscopic properties.

Unit II

Chromosome and gene organization: Histones, Non Histones, Nucleosome, chromatin, chromosome structure in prokaryotes and eucaryotes, split genes, overlapping genes, Transposons and Retrotransposon, Gene cluster.

Unit III

DNA replication: Models of DNA replication, Enzymology of DNA replication, the replication process, initiation, Elongation and termination of replication; Telomeres.

Unit IV

Transcription, mRNA processing and Translation: Components of transcriptional machinery in prokaryotes and eucaryotes; Initiation, elongation and termination of transcription; capping, polyadenylation, splicing, mRNA stability. The genetic code; tRNA and Aminoacyl synthetases, ribosomes, translation process, initiation, elongation and termination of transcription; capping, polyadenylation, splicing, mRNA stability.

Unit V

Regulation of gene expression: General aspects of regulation prokaryotes and eucaryotes; Operon model, Lac and Trp operon; DNA methylation; Tissue specific and developmental stage specific expression of genes.

Text Book

1. Gene IX by B. Lewin
2. Essential of Molecular Biology, Malacinski and Freifelder. Jones and Bartlet Publisher
3. Genomes. T.A.Brown, John Wiley and Sons PTE Ltd.
4. Cell and Molecular biology, Concepts and Experiment Gerald Karp, John Wiley and Sons.
5. The Cells- A molecular Approach, G M Cooper, ASM Press.

MOLECULAR BIOLOGY LAB
PBT-402

List of Experiment

1. Extraction and estimation of RNA
2. Extraction and estimation of DNA
3. To find Lambda max for nucleic acid
4. Detection of mutagens by Ames Test.
5. Isolation of plasmid DNA from E. coli (miniprep).
6. Electrophoretic separation of plasmid DNA
7. To determine the melting curve of DNA
8. Determination of base composition of DNA
9. Amplification of a gene fragment using PCR

IMMUNOTECHNOLOGY

TBT 403

Unit I

Introduction to Immunotechnology: Kinetics of immune response, memory; Principles of Immunization; Techniques for analysis of Immune response

Unit II

Immune system and Immunity: History of immunology, composition and function of cells and organs involved in immune system. Immune responses- innate immunity, acquired immunity. Determinants of innate immunity: species and strains, individual differences, influence of age.

Unit III

Immuno-chemistry of Antigens - Immunogenicity, Antigenicity, haptens, Toxins-Toxoids, Hapten-carrier system; Genetic bases of immune response – Heterogeneity; Role and properties of adjuvants, Immune modulators; B cell epitopes; Hybridoma Rabbit, human;

Unit IV

Antigen – Antibody interaction, affinity, cross reactivity, specificity, epitope mapping; Immuno assays RIA, ELISA, Western blotting, ELISPOT assay, immunofluorescence, Agglutination and Precipitation reaction.

Unit V

CD nomenclature, Identification of immune Cells; Principle of Immunofluorescence Microscopy, Fluorochromes; Staining techniques for live cell imaging and fixed cells; Flow cytometry, Instrumentation, Applications;

Unit 5

Hypersensitivity reaction: Antibody- mediated- Type- 1. Anaphylaxis – Type-II. Antibody dependent cell cytotoxicity. Type III. Immune complex mediated reactions. Type IV cell mediated hypersensitivity reactions. Defects in immune system

Recommended Book

1. Immunology by Janis Kubey
2. Immunology by Roiet and Roiet
3. Test book of Microbiology by Annanthnarayan and Panicer

IMMUNOTECHNOLOGY

PBT 403

List of Experiment

1. Perform experiment to isolate serum from blood sample
2. Perform experiment to isolate serum from blood sample
3. Perform Widal test by slide agglutination
4. Perform Widal test by using tube agglutination method
5. Perform ELISA for diagnosis of disease.
6. Perform Rocket electrophoresis to quantify antigen concentration.
7. Perform slide agglutination for detection of RA factor
8. Perform slide agglutination for detection of Syphilis.

BIOSTATISTICS

TBT 404

Unit I

Presentation of Data: Frequency distribution, graphical presentation of data by histogram, frequency curve and cumulative frequency curves. Measure of Location and Dispersion: Mean, Medium, Mode and their simple properties.(without derivation) and calculation of median by graphs: range, mean deviation, Standard deviation, Coefficient of variation.

Unit II

Probability and Distribution: Random distributions, events-exhaustive, mutually exclusive and equally likely, definition of probability (with simple exercises), definition of binomial, Poisson and normal distributions and their inter-relations, Simple properties of the above distributions (without derivation).

Unit III

Correlation and Regression: Bivariate data – simple correlation and regression coefficients and their relation, Limits of correlation coefficient, Effect of change of origin and scale on correlation coefficient, Linear regression and equations of line of regression, Association and independence of attributes.

Unit IV

Sampling: Concept of population and sample, Random sample, Methods of taking a simple random sample. Tests of Significance: Sampling distribution of mean and standard error, Large sample tests (test for an assumed mean and equality of two population means with known S.D.); small sample tests (t-test for an assumed mean and equality of means of two populations when sample observations are independent, Paired and unpaired t-test for correlation and regression coefficients, T-test for comparison of variances of two populations, Chi-square test for independence of attributes, Goodness of fit and homogeneity of samples.

Unit V

Experimental Designs: Principles of experimental designs, Completely randomized, Randomized block and latin square designs, Simple factorial experiments of 2², 2³, 2⁴ and 2³² types, Confounding in factorial experiments (mathematical derivations not required); Analysis of variance (ANOVA) and its use in the analysis of RBD.

Reference:

1. Statistical methods in biology by Norman T.J. Bailey (3rd Edition), Cambridge University Press (1995).

BIOINFORMATICS – II

TBT 405

Unit I

Inference problems and techniques for molecular biology. Overview of key inference problems in biology: homology identification, genomic sequence annotation, protein structure prediction, protein function prediction, gene expression characterization, network identification, and drug discovery.

Unit II

Overview of key computational induction techniques for density estimation, clustering, discrimination and regression. Statistical inference: significance testing, regression, Bayes' rule, dimensionality reduction. Machine learning: information theoretic decision tree induction, neural networks, the E/M algorithm (including K-means clustering and fitting hidden Markov models), genetic algorithms, simulated annealing, support vector machines, and the relation between statistics and machine learning. Evaluation of prediction methods: parametric tests, cross-validation and empirical significance testing.

Unit III

Overview of key computational simulation techniques: differential equation simulators, parameter estimation, and sensitivity analysis. Overview of key techniques for the management of large document collections and the biological literature: information retrieval, document clustering, and natural language information extraction.

Unit IV

Advanced topics in bioinformatics. This course will address recent developments in bioinformatics and focus on advanced issues in specific areas including (but not limited to), information extraction from biomedical literature, inference of biochemical networks from high throughput data, and prediction of protein function.

Text Books & References

1. Computational Methods in Biotechnology – Salzberg S. L. et al., Elsevier Science .
2. Statistical Methods in Bioinformatics-Evens & Grants, Springer-Verlag, NY.
3. Computational Molecular Biology- Setubal and Meidanis, PWS publishing Co., 1997.
4. Protein Structure Prediction-A Practical Approach, MJE Sternberg, Oxford University Press.
5. Purifying Protein for Proteomics, Richard J. Simpson, I.K. International Pvt. Ltd.

BIostatistics/ BIOinformatics – II LAB
PBT 404

1. Problems based on Biostatistics
 2. In silico gene identification/characterization in a prokaryotic organism using suitable
 3. annotation tools.
 4. 2. Secondary structure determination of a protein molecule using various tools.
 5. Comparative assessment of best available tools for gene annotation.
 6. Development of a gene finding program using statistical significance and C++/C/Perl etc.
- Establishments of methods for gene an