C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: BIOPROCESS TECHNOLOGY

SUBJECT CODE: 4SC05BPT1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	2	0	4	5	30	1	70	3	-	-	-	100

Objectives:- The objective of this course is that the students can learn about basics of bioprocess technology.

Prerequisites:- Basic knowledge of Biological Sciences.

Course Content:

Sr. No.	Course contents	Teaching Hours
1	Introduction to bioprocess technology: Range of bioprocess technology and its chronological development. Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics– Batch, Fedbatch and Continuous culture.	10
2	Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing – Media preparation, Inocula development and sterilization.	20
3	Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting KLa. Bioprocess measurement and control system with special reference to computer aided process control.	15
4	Introduction to downstream processing: Product recovery and purification. Effluent treatment. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.	15
	Total Hours	**60**

Learning Outcomes:- The students are expected to

- Various bioprocess technology
- Fermentor and its application

Books Recommended:

1. **Casida LE.** (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. **Crueger W and Crueger A.** (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
3. **Patel AH.** (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
4. **Stanbury PF, Whitaker A and Hall SJ**. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.

PRACTICALS

S.No	Experiment
1	Bacterial growth curve.
2	Calculation of thermal death point (TDP) of a microbial sample.
3	Production and analysis of ethanol.
4	Production and analysis of amylase.
5	Production and analysis of lactic acid.
6	Isolation of industrially important microorganism from natural resource.

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES
DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: IMMUNOLOGY

SUBJECT CODE: 4SC05IMM1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	4	8	6	30	1	70	3	30	-	70	200

Objectives:- The objective of this course is that the students can learn about basics of Immunology.

Prerequisites:- Basic knowledge of Biological Sciences.

Sr. No.	Course contents	Teaching Hours
1	**Introduction:** Concept of Innate and Adaptive immunity; Contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter and Susumu Tonegawa	4
2	**Immune Cells and Organs** Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT	7
3	**Antigens** Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens; Adjuvants	4
4	**Antibodies** Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Monoclonal and Chimeric antibodies	6
5	**Major Histocompatibility Complex**	5

	Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways)	
6	**Complement System** Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement Activation	4
7	**Generation of Immune Response:** Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals); Killing Mechanisms by CTL and NK cells, Introduction to tolerance	10
8	**Immunological Disorders and Tumor Immunity:** Types of Autoimmunity and Hypersensitivity with examples; Immunodeficiencies - Animal models (Nude and SCID mice), SCID, DiGeorge syndrome, Chediak- Higashi syndrome, Leukocyte adhesion deficiency, CGD; Types of tumors, tumor Antigens, causes and therapy for cancers.	10
9	**Immunological Techniques:** Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluoresence, Flow cytometry, Immunoelectron microscopy.	10
	Total Hours	60

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Immunology and various techniques.

Books Recommended:

1. **Abbas AK, Lichtman AH, Pillai S.** (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. **Delves P, Martin S, Burton D, Roitt IM**. (2006). Roitt's Essential Immunology.11th edition Wiley- Blackwell Scientific Publication, Oxford.
3. **Goldsby RA, Kindt TJ, Osborne BA**. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. **Murphy K, Travers P, Walport M.** (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. **Peakman M, and Vergani D**. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.

6. **Richard C and Geiffrey S.** (2009). Immunology. 6th edition. Wiley Blackwell Publication.

PRACTICALS

S.No	Experiment
1	Identification of human blood groups.
2	Perform Total Leukocyte Count of the given blood sample.
3	Perform Differential Leukocyte Count of the given blood sample.
4	Separate serum from the blood sample (demonstration).
5	Perform immunodiffusion by Ouchterlony method.
6	Perform DOT ELISA.
7	Perform immunoelectrophoresis.

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES
DEPARTMENT OF ENGLISH
COURSE: B.Sc. SEMESTER-V (All Sciences)

SUBJECT NAME: Professional Etiquettes-I SUBJECT CODE: 4SC05PET1

Teaching & Evaluation Scheme:

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
2	2	0	4	3	30	1.5	70	3	--	--	--	100
* 2 hours practical is considered as one credit					* theory is for teaching purpose and practical is for drill work							

Objectives:

- To define before the students professional behavior and suggest standards for appearance, actions, and attitude in a business environment.
- To explain them different communication styles and how to adjust to each.
- Prepare participants to handle a variety of social and business situations: networking events, business meetings, business meals, and more.
- Review the essentials of online and offline business networking.
- Develop an action plan to improve personal professionalism.

Prerequisites:

- Students should have basic knowledge of English Language and grammar.
- Students should have ability to speak and write correct sentences in their day to day language.
- Students should be familiar with correct usage of language.

Course outline:

Unit No.	Content In Details Including Its Sub Topics	Minimum Number of Hours		
	Section: A: Career Advancement Program 1	Theory	Tu	Total
01	**Resume Building** Introduction Difference between curriculum vitae and resume Characteristics Types Formats Sample of resumes	04	04	08

	Practical Resume and Curriculum Vitae			
02	**Official (Job) Letters** Cover letter/job application Job acceptance letter Job refusal letter Resignation letter Practical Letters Writing	04	04	08
03	**Interview** Introduction Importance Procedure Types Qualities observed by the employer Frequently asked questions Failure factors Practice of interview and revision of important aspects of interview Drill Interview	04	04	08
04	**Group Discussion** Introduction Importance Characteristics of successful group discussion Types of Group Discussion Class room Group Discussion	03	02	05
05	**Public Speaking and Technical Presentation** Introduction Difference between presentation and public speaking Qualities of good speaker Non verbal communication Using technological aids for presentation Preparing slides and Presentation	04	04	08
06	**Meeting** Introduction Participation in meeting Key features/ characteristics of meeting Etiquettes	03	02	05
07	**Section-B: Literature** Arthur Miller: *The Death of a Salesman*	08	10	18

Resources:

1. *Resumes and Interviews***M Ashraf Rizvi**,Tata McGraw-Hill.
2. *Technical Communication,***D.K.Chakradev**, Tech-max Publication.
3. *Technical Communication: Principles and Practice***Meenaxi Raman & Sangeeta Sharma**, Oxford University Press.
4. *Effective Technical Communication,***M Ashraf Rizvi**, Tata McGraw-Hill.
5. *Death of A Salesman*, **Arthur Miller**, Penguin Books Ltd, New Delhi.

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: DSE I (INHERITANCE BIOLOGY)

SUBJECT CODE: 4SC05INB1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	4	8	6	30	1	70	3	30	1	70	200

Objectives:- The objective of this course is that the students can learn about basics of Inheritance biology.

Prerequisites:- Basic knowledge of Biological Sciences.

Sr. No.	Course contents	Teaching Hours
1	**Introduction to Genetics:** Historical developments Model organisms in genetic analyses and experimentation :*Escherichia coli*, *Saccharomyces cerevisiae, Neurosporacrassa, Caenorhabditiselegans Drosophila melanogaster, Arabidopsis thaliana*	5
2	**Mendelian Principles:** Mendel's Laws: Dominance, segregation, independent assortment, deviation from Mendelian inheritance, Re discovery of Mendel's principles, Chromosome theory of inheritance: Allele, multiple alleles, pseudo allele, complementation tests, Extensions of Mendelian genetics: Allelic interactions, concept of dominance, recessiveness, Incomplete dominance and co dominance, Multiple alleles, Epistasis, penetrance and expressivity	15
3	**Linkage and Crossing over:** Linkage and recombination of genes, Cytological basis of crossing over, Crossing over at four-strand stage, Molecular mechanism of crossing over, mapping	10
4	**Extra-Chromosomal Inheritance:** Rules of extra nuclear inheritance, Organelle heredity-Chloroplast mutations in *Chlamydomonas*, mitochondrial, mutations in *Saccharomyces,* Maternal effects–	10

	Shell Coilin In *Limnaeaperegra* Infectious heredity-Kappa particles in *Paramecium*	
5	**Characteristics of Chromosomes:** Structural organization of chromosomes-centromeres, telomeres and repetitive DNA, Packaging of DNA Variations in chromosome structure: Deletion, duplication, inversion and translocation, Variation In chromosomal number and structural abnormalities-Klinefelter syndrome, Turner syndrome, Down syndrome	15
6	**Recombination:** Homologous and non-homologous recombination, including transposition, site-specific recombination.	5
	Total Hours	60

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Inheritance Biology.

Books Recommended:

1. **Gardner EJ, Simmons MJ, Snustad** DP (2008). Principles of Genetics. 8th Ed. Wiley-India.
2. **Snustad DP, Simmons** MJ (2011). Principles of Genetics.6thEd. John Wiley and Sons Inc.
3. **Weaver RF, Hedrick PW** (1997).Genetics.3rd Ed. McGraw-Hill Education.
4. **Klug WS, Cummings MR, Spencer CA, PalladinoM** (2012). Concepts of Genetics.10th Ed. Benjamin Cummings.
5. **Griffith AJF, Wessler SR, Lewontin RC, CarrollSB.** (2007). Introduction to Genetic Analysis.9thEd.W.H.Freemanand Co.,NewYork.
6. **HartlDL, JonesEW** (2009). Genetics:Analysis of Genes and Genomes.7th Ed, Jones and Bartlett Publishers.
7. **RussellPJ**.(2009). *I* Genetics-A Molecular Approach.3rdEd,Benjamin Cumming.

PRACTICALS

S.No	Experiment
1	Mendelian deviations in dihybrid crosses
2	Studying BarrBody with the temporary mount of human cheek cells
3	Studying *Rhoeo* translocation with the help of photographs
4	Karyotyping with the help of photographs
5	Chi-Square Analysis
6	Study of polytene chromosomes using temporary mounts of salivary glands of *Chiromonas/ Drosophila* larvae
7	Study of pedigree analysis
8	Analysis of a representative quantitative trait

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DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: DSE I (BIOINFORMATICS)

SUBJECT CODE: 4SC05BIF1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	4	8	6	30	1	70	3	30	1	70	200

Objectives:- The objective of this course is that the students can learn about basics of bioinformatics.

Prerequisites:- Basic knowledge of Biological Sciences.

Sr. No.	Course contents	Teaching Hours
1	**Introduction to Computer Fundamentals:** RDBMS-Definition of relational data base Mode of data transfer (FTP, SFTP, SCP), advantage of encrypted data transfer.	08
2	**Introduction to Bioinformatics and Biological Databases:** Biological databases-nucleic acid, genome, protein sequence and structure, gene expression databases, Database of metabolic pathways, Mode of data storage-File formats-FASTA, Genbank and Uniprot, Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot , PDB	14
3	**Sequence Alignments, Phylogeny and Phylogenetic trees :** Local and Global Sequence alignment, pairwise and multiple sequence alignment. Scoring an alignment, scoring matrices, PAM & BLOSUMv series of matrices. Types of phylogenetic trees, Different approaches of phylogenetic tree construction-UPGMA, Neighbour joining, Maximum Parsomony, Maximum likely hood.	16
4	**Genome organization and analysis:** Diversity of Genomes: Viral, prokaryotic & eukaryotic genomes Genome, transcriptome, proteome,2-Dg elelectrophoresis, MaldiToff spectroscopy. Major	10

	features of completed genomes: *E.coli, S.cerevisiae, Arabidopsis,* Human	
5	**Protein Structure Predictions:** Hierarchy of protein structure primary, secondary and tertiary structures, modeling, Structural Classes, Motifs, Folds and Domains. Protein structure prediction in presence and absence of structure template Energy minimizations and evaluation by Ramachandran plot. Protein structure and rational drug design.	12
	Total Hours	**60**

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Bioinformatics.

Books Recommended:

1. **Saxena Sanjay** (2003)A First Course in Computers , Vikas Publishing House.
2. **Pradeep and Sinha Preeti** (2007) Foundations of Computing, 4th ed., BPB Publications.
3. **Lesk M.A**. (2008) Introduction to Bioinformatics. Oxford Publication, 3rd International Student Edition.
4. **Rastogi S.C., Mendiratta N. and RastogiP.** (2007) Bioinformatics: methods and applications, genomics, Proteomics and drug discovery, 2nded. Prentice Hall India Publication.
5. **Primrose and Twyman** (2003) Principles of Genome Analysis & Genomics. Blackwel.

PRACTICALS

S.No	Experiment
1	Introduction to different operating systems-UNIX, LINUX and Windows
2	Introduction to bioinformatics databases (anythree): NCBI/ PDB/ DDBJ, Uniprot, PDB
3	Sequence retrieval using BLAST
4	Sequence alignment & phylogenetic analysis using clustalW & phylip
5	Picking out a given gene from genomes using Genscanorother softwares(promoter region identification, repeating genome, ORF prediction). Gene finding tools(Glimmer, GENSCAN),Primer designing, Genscan /Genetool
6	Protein structure prediction: primary structure analysis, secondary structure prediction using psi- pred, homology modeling using Swiss model. Molecular visualization using jmol, Protein structure model evaluation(PROCHECK)
7	Prediction of different features of a functional gene

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COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: DSE II (MICROBIAL BIOTECHNOLOGY)

SUBJECT CODE: 4SC05MBT1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	4	8	6	30	1	70	3	30	1	70	200

Objectives:- The objective of this course is that the students can learn about basics of Microbial biotechnology.

Prerequisites:- Basic knowledge of Biological Sciences.

Sr. No.	Course contents	Teaching Hours
1	**Microbial Biotechnology and its Applications:** Microbial biotechnology: Scope and its applications in human therapeutics, agriculture (Biofertilizers, PGPR, Mycorrhizae), environmental, and food technology.Use of prokaryotic and eukaryotic microorganisms in biotechnological applications. Genetically engineered microbes for industrial application: Bacteria and yeast	10
2	**Therapeutic and Industrial Biotechnology:** Recombinant microbial production processes in pharmaceutical industries-Streptokinase, recombinant vaccines (Hepatitis B vaccine). Microbial polysaccharides and polyesters, Microbial production of bio-pesticides, bioplastics, Microbial biosensors	14
3	**Applications of Microbes in Bio transformations:** Microbial based transformation of steroids and sterols, Bio-catalytic processes and their industrial applications: Production of high fructose syrup and production of coco a butter substitute	12
4	**Microbes for Bio-energy and Environment:** Bio-ethanol and bio-diesel production: commercial production from lingo cellulosic waste and algal biomass, Bio gas production: Methane and hydrogen production using	16

	microbial culture. Microorganisms in bioremediation: Degradation of xenobiotics , mineral recovery, removal of heavy metals from aqueous effluents	
5	**RNAi:** RNAi and its applications in silencing genes, drug resistance, therapeutics and host pathogen interactions **Intellectual Property Rights:** Patents, Copyrights, Trademarks	8
	Total Hours	60

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Microbial biotechnology.

Books Recommended:

1. **Ratledge, C and Kristiansen, B**. (2001). Basic Biotechnology, 2ndEdition, Cambridge University Press.
2. **Demain, A. Land Davies, J.E.**(1999). Manual of Industrial Microbiology and Biotechnology,2nd Edition, ASM Press.
3. **Swartz, J.R**. (2001). Advances in Escherichia coli production of therapeutic proteins. Current Opinion in Biotechnology, 12,195–201.
4. **Prescott, Harley and Klein's Microbiology by Willey JM, Sherwood LM, Wool verton CJ**(2014), 9thedition, McGraw Hill Publishers.
5. **GuptaPK**(2009)ElementsofBiotechnology2nd edition, Rastogi Publications.
6. **Glazer AN and NikaidoH** (2007) Microbial Biotechnology,2nd edition, Cambridge University Press.
7. **GlickBR, PasternakJJ, and PattenCL** (2010) Molecular Biotechnology 4th edition, ASM Press.
8. **StanburyPF , Whitaker A, HallSJ** (1995) Principles of Fermentation Technology 2nd edition., Elsevier Science.
9. **Crueger W, Crueger A**(1990)Biotechnology :A text Book of Industrial Microbiology 2nd edition Sinauer associates, Inc.

PRACTICALS

S.No	Experiment
1	Study of yeast cell immobilization in calcium alginate gels
2	Study of enzyme immobilization by sodium alginate method
3	Pigment production from fungi(*Trichoderma* / *Aspergillus*/ *Penicillium*)
4	Isolation of xylanase or lipase producing bacteria
5	Study of algal Single Cell Proteins
6	Study of enzyme production.
7	Study of effect of pH on enzyme production
8	Study of effect of Temperature on enzyme production

FACULTY OF SCIENCES

DEPARTMENT OF LIFE SCIENCES

COURSE: B.Sc. **SEMESTER: V**

SUBJECT NAME: DSE II (BIOMATHEMATICS AND BIOSTATISTICS)

SUBJECT CODE: 4SC05BMS1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
					Marks	Hrs	Marks	Hrs	Pr	TW		
4	0	4	8	6	30	1	70	3	30	1	70	200

Objectives:- The objective of this course is that the students can learn about basics of Biomathematics and Biostatistics.

Prerequisites:- Basic knowledge of Biological Sciences.

Sr. No.	Course contents	Teaching Hours
1	**Biomathematics:** Sets. Functions and their graphs: polynomial, sine, cosine, exponential and logarithmic functions. Motivation and illustration for these functions through projectile motion, simple pendulum, biological rhythms, cell division, muscular fibres etc. Simple observations about these functions like increasing, decreasing and, periodicity. Sequences to be introduced through the examples arising in Science beginning with finite sequences, followed by concepts of recursion and difference equations. For instance, the Fibonacci sequence arising from branching habit of trees and breeding habit of rabbits. Intuitive idea of algebraic relationships and convergence. Infinite Geometric Series. Series formulas for ex, log (1+x),sinx, cosx. Step function. Intuitive idea of discontinuity, continuity and limits. Differentiation. Conception to be motivated through simple concrete examples as given above from Biological and Physical Sciences. Use of methods of differentiation like Chain rule, Product rule and Quotient rule. Second order derivatives of above functions. Integration as reverse process of differentiation. Integrals of the functions introduced above. Differential Equations of first order, Linear Differential Equations. Points in plane and space and coordinate form. Examples of matrices arising in Biological Sciences and Biological networks. Sum and Produce of matrices upto order3.	**30**
2	**Biostatistics**	**30**

	Measures of central tendency, Measures of dispersion; skewness, kurtosis; Elementary Probability and basic laws; Discrete and Continuous Random variable, Mathematical Expectation; Curve Fitting; Correlation and Regression. Emphasison examples from Biological Sciences; Mean and Variance of Discrete and Continuous Distributions namely Binomial, Poisson, Geometric, Weibull, Logistic and Normal distribution. Fitting of Distributions; Statistical methods: Scope of statistics: utility and misuse .Principles of statistical analysis of biological data. Sampling parameters. Difference between sample and Population, Sampling Errors, Censoring, difference between parametric and non-parametric statistics; Sampling Distributions, Standard Error, Testing of Hypothesis, Level of Significance and Degree of Freedom; Large Sample Test based on Normal Distribution, Small sample test base dont-test ,Z-test and F test; Confidence Interval; Distribution-free test-Chi-square test; Basic introduction to Multivariate statistics, etc.	
	Total Hours	**60**

Learning Outcomes:-

At the end of the course the student would have sufficient knowledge of Biomathematics and Biostatistics.

Books Recommended:

1. **H.S. Bear: Understanding Calculus, John Wiley and Sons** (Second Edition); 2003.
2. **E. Batschelet** : Introduction to Mathematics for Life Scientists, Springer Verlag, International Student Edition, Narosa Publishing House, New Delhi(1971,1975).
3. **A. Edmondson and D.Druce**: Advanced Biology Statistics, Oxford University Press; 1996.
4. **W. Danial: Biostatistics**: A foundation for Analysis in Health Sciences, John Wiley and Sons Inc; 2004.

PRACTICALS

S.No	Experiment
1	Word Problems based on Differential Equations
2	Mean, Median, Mode from grouped and ungrouped Dataset
3	Standard Deviation and Coefficient of Variation
4	Skewness and Kurtosis
5	Curve fitting
6	Correlation
7	Regression
8	Finding area under the curve using normal probability
9	Testing of Hypothesis-Normal Distribution ,t-test and Chi-Square-test
10	Confidence Interval