

SARDAR PATEL UNIVERSITY
Programme & Subject: B.Sc. (Bioinformatics)
Syllabus with effect from: June – 2020

BSc Bioinformatics Programme Outcomes

After successful completion of B.Sc Bioinformatics Course the graduates

- Eligible for pursuing higher education, M.Sc. programmes in the different field of life science, IT and computer science.

- Eligible for doing jobs in pharmaceutical and IT Industry.

- Understand the potentials, and impact of bioinformatics outcome on environment and to find out the sustainable solutions to problems regarding web designing, drug designing, software development, medical, and agriculture sector, etc.

- Can work individually as well as in team to thrive in multidisciplinary environment.

- Both oral and written communication skills

SARDAR PATEL UNIVERSITY

Programme& Subject: B.Sc. (Bioinformatics) Semester: V

Syllabus with effect from: June – 2020

PaperCode:US05CBNF21	TotalCredit: 4 (4 lectures/wk)
PERL programming Language	

UNIT Getting started with Scripting Language

I A Low and Long Learning Curve, Perl's Benefits, How to Install PERL, How to run PERL Program, Text editors, Representing Sequence data, A Program to store DNA sequence
Concatating DNA fragments, DNA to RNA :Transcription,Calculate Reverse Complement

Protein Files and Arrays

Files, Arrays, Proteins Reading Proteins in File, Arrays, Scalar and list Context

II Motifs and Loops

Flow Control, Code Layout, Finding Motifs, Counting Nucleotides, Exploding String into Array
Operating on String, Writing to Files

III Subroutines and Bugs

Subroutines, Scoping and Subroutines, Command Line Argument and Array, Passing Data to
Subroutine, Modules and Libraries of Subroutine, Fixing Bugs in Your Code

IV Mutations and Randomization

Random Number Generator, A Program Using Randomization

A Program to Simulate DNA Mutation

Generating Random DNA

Analyzing DNA

The Genetic Code

Hashes, Genetic Code, Translate DNA to Protein

Basic Text and Reference Books:

1. Beginning of PERL for bio Informatics by James D. Tisdall

Learning outcome:

- proficient programming in the Perl language and programming in general
- design and revision of Perl scripts
- debugging techniques appropriate for the Perl language

SARDAR PATEL UNIVERSITY

Programme & Subject: B.Sc. (Bioinformatics) Semester : V

Syllabus with effect from: June – 2020

PaperCode: US05CBNF22	TotalCredit: 4
Relational Database Management Systems	(4 lectures/wk)

Unit

I Introduction to DBMS, RDBMS and Data Modeling

DBMS : Meaning, Advantages, Disadvantage, The three-schema architecture for a Database Management System (DBMS), Codd Rules, Entity-relationship modeling (different types of entities, attributes, relationships and their representation in the E-R diagram), Case studies of data modeling using E-R modeling
Consequences of poor Data base Design, Normalization, 1st Normal Form, 2nd Normal Form, 3rd Normal Form, Boyce-Codd Normal Form, Examples of normalization

II Introduction to SQL

SQL - introduction , advantages and disadvantages, Data types – built-in (number, char, varchar2, date, raw, long raw), Types of SQL Statements : DDL (Data Definition Language),
DML (Data Manipulation Language), DCL (Data Control Language), TCL (Transaction Control Language)
Working with SQL*Plus – overview and basic commands like ed, start, get, save, exit, connect, set linesize, set pagesize and host, Creating table and inserting data - CREATE TABLE, INSERT, retrieving data using query – SELECT , manipulating data – DELETE and UPDATE , modifying and removing table – ALTER TABLE and DROP TABLE.

III Data Constraints and Functions

Pseudo columns – ROWID, ROWNUM, USER, UID, SYSDATE
Null values, TAB table, DUAL table, Operators – arithmetic, relational, logical, range searching, pattern matching and set, Data constraints – Introduction, advantages and disadvantages
Type of data constraints – NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY and CHECK
Modifying constraints, working with data dictionary and use of USER_CONSTRAINTS
Functions – introduction, merits and demerits, types of functions (scalar and aggregate)
Scalar : Numeric functions (FLOOR, MOD, POWER, ROUND, SQRT and TRUNC), Character functions (CHR, ASCII, CONCAT, INITCAP, LOWER, SUBSTR, TRIM, UPPER), Date functions (ADD_MONTHS, LAST_DAY, NEXT_DAY, MONTHS_BETWEEN), Conversion functions (TO_NUMBER, TO_CHAR and TO_DATE) Aggregate fun : AVG, COUNT, MAX, MIN, SUM

IV Query, Subquery, Joins, Transaction Management , Basics of PL/SQL

Query and subquery, types of subquery
Creation and manipulation of database objects – indexes, views, sequences.
Joining tables – ANSI Style, types of joins (cross join, natural join, equijoin, outer joins, self join)
Data control language statements – GRANT and REVOKE
Transaction control language statements – COMMIT, ROLLBACK and SAVEPOINT
PL/SQL - Introduction and advantages
Understanding PL/SQL Block structure

Basic Text and Reference Books:

1. An introduction to Database Systems : Bipin C. Desai, Galgotia Publications Pvt. Ltd.
2. Ivan Bayross : SQL, PL/SQL The programming language of Oracle, 3rd revised edition, BPB Publications
3. SQL/PLSQL for Oracle9i, P. S. Deshpande, dreamtech press, reprint edition 2009
4. Understanding Database Management Systems : S. Parthasarthy and B.W. Khalkar, First edition – 2007, Master Academy
5. Oracle9i The Complete Reference , Kevin Loney, George Koch, Oracle Press

Learning outcome: Demonstrate an understanding of the elementary & advanced features of DBMS & RDBMS Prepare various database tables and joins them using SQL commands. Understand the basic concept how storage techniques are used to backup data and maintain data access performance in peak hours. Evaluate options to make informed decisions that meet data storage, processing, and retrieval needs.

SARDAR PATEL UNIVERSITY

Programme & Subject: B.Sc. (Bioinformatics) Semester : V

Syllabus with effect from: June – 2020

Paper Code:US05CBNF23	TotalCredit: 4 (4 lectures/wk)
Genetic engineering	

UNIT-I Recombinant DNA technology:Introduction to r DNA, Cutting and Joining DNA – Restriction Endonucleases, Nucleic acid modifying enzymes (Polymerase, Alkaline phosphatase, Exonuclease, DnaseI and RNase) Ligation, How to clone a gene - What is clone, Overview and steps of the procedure.

UNIT-II Vectors: Vectors – Plasmid vectors, Vectors based on the lambda Bacteriophage, Cosmids, M13 vectors, Expression vectors, Vectors for cloning and expression in Eukaryotic cells, retroviral vector, Super vectors : YACs and BACs. Application of vector in construction of genomic and cDNA library

UNIT-III Hybridization: Nucleic Acid Hybridization : Principle and application - Preparation of nucleic probes, Principle of Nucleic acid hybridization, Nucleic acid hybridization assays, and microarrays. Molecular Mapping – RFLP, RAPD , AFLP , repetitive DNA. DNA finger printing and its application.

UNIT-IV Stem cell technology: Potential, Classes and application of stem cell (tissue engineering, Gene and cancer therapy). Methods to create transgenic animals (Microinjection and retrovirus). Application of transgenic animals.

Basic Text and Reference Books:

1. Principle of Genetic Manipulation by Old and Primrose
2. Genomes by T. A. Brown
3. Gene Cloning T.A.Brown
4. An introduction to Genetic Analysis – Griffith Miller , Suzuki Levonting

Learning Outcome:

- The objective of the course is to familiarize the students with the basic concepts in genetic engineering; to acquaint the students to versatile tools and techniques employed in genetic engineering and recombinant DNA technology; and to appraise them about applications genetic engineering.
- Student will able to understand general techniques used by genetic engineers to modify DNA.
- Analyze the benefits and drawbacks of manipulating an organism's DNA.

SARDAR PATEL UNIVERSITY

Programme&Subject : B.Sc. (Bioinformatics) Semester : V

Syllabus with effect from: June – 2020

PaperCode:US05CBNF24	TotalCredit: 4 (4 lectures/wk)
TitleofPaper: Bioinformatics Applications	

Unit 1: Genomics: Introduction to genomics and type. Organization of the Human genome, Nuclear genome and Mitochondrial genome, Repeats, coding regions, non-coding regions. Organization of Prokaryotic genome, Comparative genomics. Genome sequencing: Basic concept, Shot gun method and Clone contig method and their importance. Tools for genome analysis. Human Genome Project – Overview, Goals & Applications.

Unit 2: Introduction to Genome Informatics: First Generation of Sequencing techniques: – manual & automated: Maxam and Gilbert and Sangers method. Chain termination method, Pyrosequencing
Second Generation of Sequencing techniques: Roche/454 sequencing, Ion torrent sequencing, Illumina/Solexa sequencing
Third Generation of Sequencing technique: Pacific Biosciences SMRT sequencing, nanopore sequencing
Comparison of Next generation sequencing techniques, Significance and Drawbacks of NGS, NGS File formats, Softwares for NGS data analysis.

Unit 3:Gene Prediction and Expression analysis: Gene structure in Prokaryotic and Eukaryotic. Gene prediction methods: Prediction of promoters, splice sites and regulatory regions, detecting of Open Reading Frames in sequences. Microarray analysis definition, types of microarray, microarray analysis life cycle (sample preparation and labeling, hybridization, washing and image acquisition), microarray data analysis.

Unit 4: Phylogenetic & molecular evolution: molecular basis of evolution, Phylogenetic trees & different methods for phylogenetic inference, Construction- Maximum Parsimony Method, Maximum likelihood method and Distance Methods Phylogenetic Tree Evaluation: Bootstrapping & significance of phylogenetic tree. Tools for phylogenetics analysis.

Reference Readings

1. Claverie, J.M. and Notredame C. 2003 Bioinformatics for Dummies. Wiley Editor.
2. Letovsky, S.I. 1999 Bioinformatics. Kluwer Academic Publishers.
3. Baldi, P. and Brunak, S. 1998 Bioinformatics. The MIT Press.
4. Setubal, J. and Meidanis, J. 1996 Introduction to Computational Molecular Biology. PWS Publishing Co., Boston.
5. Lesk, A.M. 2002 Introduction to Bioinformatics. Oxford University Press.
6. Fogel, G.B. and Corne, D.W., Evolutionary Computation in Bioinformatics.
7. Genetic Library Construction and Screening: Advanced Techniques and Applications: Lab Manual
8. Patterson, B.K., Techniques in Quantification and Localization of Gene Expression.
9. Mont, D.W., Bioinformatics: Sequence and Genome Analysis.
10. Evens, W.J. and Grant, G.R., Statistical Methods in Bioinformatics: An Introduction.

Learning outcome:

The course aims to appraise the students to basic and high throughput techniques in Genomics and Proteomics and their applications.

Suggest and outline solution to theoretical and experimental problems in Genomics and Proteomics fields.

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar
Programme & Subject :B.Sc. BIONFORMATICS
Semester – V
US05CBNF25 :Practicals
(Syllabus Effective from June 2020)

Credits : 2 External : 15 Marks
Contact Hrs per Week : 4 Internal : 35 Marks
All units carry equal weightage University Examination Duration: 2 Hrs

	Description	Weightage
	Practicals Based on US05CBNF21 and US05CBNF22	50%

1. Problems based on reagent preparations: Molarity, Molality.
2. Isolation of genomic DNA from plant cells.
3. Isolation of genomic DNA from *E.coli* cells.
4. Isolation of Plasmid DNA.
5. Gel electrophoresis- Agarose (for separation of above isolated genomic DNA)
6. Competent cells preparation and transformation
7. SDS PAGE. (Demo)
8. Radial Immunodiffusion,
9. ELISA.
10. Separation and identification of amino acid by paper chromatography.

1. Multiple alignment using tool M-Coffee.
2. To perform Sequence analysis by using EMBOSS.
3. To study the phylogentic relationships of nucleotide and protein sequence(s) by using PHYLIP Package and PhyML.
4. To model a protein sequence using swiss model.
5. To model a protein sequence using modeler software.
6. To study physiochemical properties of protein using Protparam.
7. To perform secondary structure analysis using GOR.
8. Gene identification using ORF Finder at NCBI.
9. To study protein structure using RASMOL.
10. Use Finger PRINTScan program to get information about protein functions.
11. To study conserved region in the sequence using Sequence logo.

SARDAR PATEL UNIVERSITY

Discipline specific

Programme & Subject : B.Sc. (Bioinformatics) Semester : V

Syllabus with effect from: June – 2020

Paper Code:US05DBNF26	TotalCredit: 2 (2 lectures/wk)
Title of Paper: Biological Chemistry and Metabolism	

UNIT I: VITAMINS

Vitamins: Definition, Overview of General characteristics, Properties, Metabolism , Effects of deficiencies of water soluble & fat soluble vitamins, Vitamin related co-enzymes and chemical reactions. Structure and Hydrolysis of ATP & introduction to energy rich compounds- Biological oxidation-reduction reactions and Redox potential.

UNIT II: ENZYMES

Definition, Nomenclature and Classification of enzymes, Introduction to Allosteric enzymes, Inhibitors, Active site (lock and key theory, induced fit theory). Enzyme kinetics- Derivation of Michaelis-Menten equation, Km and its significance, line-weaver Burk plot and its limitations and solutions (Eadie Hofstee and Hannes Woolf's curve and equations).

UNIT III: LIPIDS

Lipids: Definition, Overview of [Importance, Nomenclature, General Structure of Fatty acids (Saturated, Unsaturated, Hydroxy and Cyclic)], Biological Roles of Lipids, Lipid metabolism (β , α , ω oxidation, lipolysis, , fatty acid synthesis)

UNIT IV: METABOLISM

Carbohydrate metabolism (Glycolysis, Krebs's cycle) . Nucleic acid metabolism: *de novo* synthesis and degradation of purines and pyrimidines Proteins: General features of Trans-amination, Trans-deamination and Urea cycle.

REFERENCES:

1. Biochemistry – J. M. Berg, John L. Tymoczko, Lubert Stryer W. H. Freeman & Co.
2. Essentials of Biochemistry- David Lee Nelson, Albert L. Lehninger, Michael M. Cox . W. H. Freeman & Co.
3. Principles and Techniques of practical biochemistry - Keith Wilson, Cambridge University Press.
4. Principles of Anatomy and Physiology- Gerard J. Tortora & B. H. Derrickson, John Wiley & Sons.
5. Outlines of biochemistry-Conn & Stumpf 5th Ed, John Wiley & Sons,
6. Biochemistry - U. Satyanarayana. 2nd Ed, New Central Book Agency (p) Ltd.
7. Medical Biochemistry - Chhaterjee and Ranashinde. 7th Ed, Jaypee Publishers
8. Fundamentals of Biochemistry: Life at the Molecular level- Voet Donald , John Wiley & Sons.

Learning outcome: Students will be able to know about Vitamins, enzymes, lipids and metabolism

SARDAR PATEL UNIVERSITY
Programme & Subject: B.Sc. (Bioinformatics) Semester: VI
Syllabus with effect from: June – 2020

Paper Code: US06CBNF21	Total Credit: 4 (4 lectures/wk)
Python Programming	

Unit	Description
I Introduction to Python	Installing and Working with Python. Features of Python, Python Variables, Data Types, and Operators, Conditional Statements, Iteration Statements, Control structures: Break, Continue, Pass. Build in Functions.
II Python Data Structures and Manipulation	Understanding Strings, Lists, Tuples, Sets and Dictionaries, Data Structure Manipulation using loops
III Functions, File Management, Exception Handling and Debugging	Functions- Defining Functions, Testing Functions, Name Scopes, Inline Functions, Using global names inside function, Recursive Functions, Modules, File Handling – Introduction , Creating files, Read and Write files, Delete files, Exception handling, Debugging
IV Object-Orientated Concepts, Regular Expression, Python MySQL	Class, Object, Instances, Inheritance, Encapsulation, Polymorphism, Method Overriding, Object Overloading, Packages, Regular Expression, Python MYSQL – Create Database, Create Table, Insert, Select, Where, Order By, Delete, Drop Table, Update, and Join.

Basic Text and Reference Books:

1. Paul A. DeBarry: Head First Python, 2010, O'Reilly Media, Inc.
2. Martin C. Brown: The Complete Reference Python, McGraw Hill
3. David M. Beazley: Python Essential Reference, Pearson Addison-Wesley Professional.
4. Allen Downey, Jeffrey Elkner, Chris Meyers : How to think like a computer scientist learning with Python , Freely available online.2012
5. Exploring Python, Timothy A. Budd ,McGraw Hill

Online Reading / Support material:

1. <http://docs.python.org/3/tutorial/index.html>
2. <http://interactivepython.org/courselib/static/pythonds>
3. <http://www.ibiblio.org/g2swap/byteofpython/read/>
4. Python Tutorial/Documentation : www.python.org

The learning objectives of this course are:

- To understand why Python is a useful scripting language for developers.
- To learn how to design and program Python applications.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to identify Python object types.

SARDAR PATEL UNIVERSITY

Programme & Subject: B.Sc. (Bioinformatics) Semester: VI

Syllabus with effect from: June – 2020

PaperCode: US06CBNF22	TotalCredit: 4 (4 lectures/wk)
R Programming	

Unit	Description in detail
I Introduction to R	History of R, Features of R, How to install R, How to run R, Comments in R, Reserved words, Identifiers, Constants, Variables Operators: Arithmetic, Relational, Logical, Assignment, Miscellaneous, Basic Data Types: Numeric, Integer, Complex, Logical, Character Vectors: Creating Vectors, Combining Vectors, Accessing Vector Elements, Modifying Vectors, Deleting Vectors, Vector Arithmetic & Recycling, Vector Element Sorting, Reading Vectors
II Data Structure in R	Matrices: Creating Matrices, Accessing Matrix Elements, Matrix Manipulation, Matrix Operations Arrays: Creating Arrays, Accessing Array Elements, Array Element Manipulation, Array Arithmetic Lists: Creating Lists, Accessing List Elements, Updating List Elements, Merging Lists, List to Vector Conversion Factors: Creating Factors, Accessing Factor Components, Merging Factors Data Frames: Creating Data Frames, Accessing Data Frame Components, Modifying Data Frames, Aggregating Data, Sorting Data, Merging Data, Reshaping Data, Subsetting Data
III Flow Control & Functions in R	Decision Making: if statement, if..else statement, Nested if..else statement, switch statement, Loops: for Loop, while Loop, repeat Loop, Loop Control Statements: break Statement, next Statement Built-in Functions: Mathematical Functions, Character Functions, Statistical Functions, Date and Time Functions Functions Definition, Function Calling: Function without arguments, Functions with named arguments, Function with default arguments.
IV Connecting R to External interfaces	Packages: Installing a Package, Loading a Package Charts and Graphs: Bar Charts, Line Graph, Pie Chart, Scatter Plots, Dot Plots CSV Files: Reading from a CSV File, Writing to a CSV File Microsoft Excel: Reading from a xlsx File, Writing to xlsx File Databases: Connecting R to MySQL, Creating Tables, Inserting Rows, Updating Rows, Deleting Rows, Querying Tables, Dropping Table

Basic Text and Reference Books:

- R Programming for Data Science, Roger D. Peng (2015), Leanpub publisher
- Statistics Using R Purohit, G.S., Gore, S.D. and Deshmikh, S.R. (2008), Narosa Publishing House
- Data Analysis and Graphics Using R: An example-based approach, Maindonald J. and Braum, J. (2007) Second Edition, Cambridge Series in Statistical and Probabilistic Mathematics.
- An R Companion to Linear Statistical Models, Hey-Jahans, C.(2012), CRC Press

The learning objectives of this course are: How to program in R and how to use R for effective data analysis.

- Install and configure software necessary for a statistical programming environment.
- Reading data into R, accessing R packages, writing R functions, debugging, profiling R code, and organizing and commenting R code.

SARDAR PATEL UNIVERSITY

Programme & Subject: B.Sc. (Bioinformatics) Semester : VI

Syllabus with effect from: June – 2020

Paper Code: US06CBNF23	Total Credit: 4 (4 lectures/wk)
Title of Paper: Immunotechnology	

Unit - I: Introduction to Immunology, Types of Immunity-Innate & Acquired, Humoral & cell mediated, Active & passive immunity, Antigens- Antigenic determinants, Haptens, Components of Innate & acquired immunity. Primary and secondary Immune response, Cells of the immune system,

Unit - II: Primary and secondary lymphoid organs -Bone Marrow, Thymus, Lymph nodes, Spleen, MALT & GALT. Antibodies-structure, types & function. Monoclonal antibodies-Hybridoma technology (HAT selection), Applications of Monoclonal Antibodies.

Unit-III: Antigen–Antibody interactions – Agglutination and precipitations reactions, variants and applications, ELISA- principle, variants (Indirect, sandwich & competitive) and applications. MHC-structure, types & function,

Unit-IV: Cytokines-Introduction & types, Role of cytokines in immune response, Classical, Alternative & lectin pathway, Disorders of the immune system: Autoimmunity, Hypersensitivity and Immunodeficiency (Introduction and examples), Role of Bioinformatics in Immunology & vaccine development.

References

1. Judy Owen, Jenni Punt, Sharon Stranford 2013 Kuby Immunology: International Edition W. H. Freeman
2. Abbas AK, 2011, Cellular and Molecular Immunology 7th Ed. Elsevier Health Sciences – India.
3. Murphy K, 2011 Janeway's Immunobiology. 8th Ed. Garland Science Publishers, New York.

learning outcome:

This course will provide students with knowledge on how the immune system and able to articulate the roles of innate recognition receptors (i.e. Toll-Like Receptors) in immune responses and to compare and contrast humoral versus cell-mediated immune responses.

The students will be able to describe the roles of the immune system in both maintaining health and contributing to disease.

SARDAR PATEL UNIVERSITY

Programme & Subject: B.Sc. (Bioinformatics) Semester : VI

Syllabus with effect from: June – 2020

PaperCode: US06CBNF24	TotalCredit: 4 (4 lectures/wk)
Title of Paper: Structural Bioinformatics	

Unit 1:- Macromolecular Structures: DNA: Types of Double helices (A,B,Z).RNA: Secondary structures, Tertiary structures. Amino acid: Structure and Properties of Amino acids, Structure of proteins: Hierarchical organization of protein structure- Primary, Secondary, Supersecondary, Tertiary, Quaternary structure. Ramachandran Plot and its importance

Unit 2:- Protein folding: Principle of Protein folding & Unfolding: Levinthal Paradox, Anfinsen's experiment, thermodynamics of protein folding, Protein misfolding, Disorders/Diseases of Protein Misfolding (Alzheimer's disease, Cystic fibrosis, Mad Cow disease, Prions). Protein – protein interaction and protein DNA interaction, methods and significance.

Unit 3 :- Structure Prediction & Comparison : RNA secondary structure prediction methods and its application (mfold method of Zuker), Methods for protein secondary and tertiary structure prediction-Algorithms of Chou Fasman, GOR, PSI-PRED and Artificial Neural network,Steps involved in Homology Modeling, Concepts in 3D structure comparison

Unit 4:- Drug design & discovery :Definition of drugs, steps in development of new drugs, chemical & physiochemical parameters in drug-designing, drug metabolism, Interaction energy calculations, structure based drug designing, Combinatorial chemistry, virtual & high throughput screening, Docking and its importance, Introduction to Molecular Dynamics.

Reference Readings

1. Liebler, D. 2002 Introduction to Proteomics: Tools for New Biology. Human Press Totowa.
2. Campbell, A.M. & Heyer, L.J. 2002 Discovering Genomics, Proteomics and Bioinformatics. Benjamin/Cummings.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley.
4. Introduction to Protein structure by Brandel C. and Tooze, J.
5. Structure and Mechanism in Protein science – Fersht WH freeman & Co
6. Protein folding – Creighton TE (ed) WH Freeman & Co.
7. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley

Learning outcome: Student at the end of course will be able-

- To estimate the validity of information in macromolecular structure databases, and use computer programs to visualise and analyse macromolecular structures from a functional perspective
- use bioinformatics tools for sequence alignment, sequence motif identification and prediction of secondary and tertiary structures
- account for the purpose, theoretical background, and limitations of the above mentioned bioinformatics methods and use this knowledge to interpret relevant results.

SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar
Programme & Subject :B.Sc. BIONFORMATICS
Semester – VI
US06CBNF25 :Practicals
(Syllabus Effective from June 2020)

Credits : 2 External : 15 Marks
Contact Hrs per Week : 4 Internal : 35 Marks
All units carry equal weightage University Examination Duration: 2 Hrs

	Description	Weightage
	Practicals Based on US06CBNF21 and US06CBNF22	50%

PRACTICAL VI SEM

1. Separation and identification of Amino Acids by Thin Layer Chromatography
2. Quantitative estimation of carbohydrates by Nelson-Somogyi method.
3. Quantitative estimation of reducing sugar by DNS method (Dinitro salicylic acid)
4. Quantitative estimation of fats by Dichromate method.
5. Enzyme assay: effect of pH, temperature and incubation time on enzymatic activity.
6. Restriction digestion and ligation
7. RAPD analysis of plant DNA.
8. Effect of UV Radiation on Bacterial Growth.
9. Determination of total protein by Biuret method.
10. Study of chromosomal Abberations using colchicine.

A mini Project in Bioinformatics.

SARDAR PATEL UNIVERSITY

Discipline specific

Subject: B.Sc. (Bioinformatics) Semester : VI

Syllabus with effect from: June – 2020

Paper Code: US06DBNF26	Total Credit: 2 (2 lectures/wk)
Title of Paper: Instrumental Methods of Analysis	

UNIT I: MICROSCOPY

Microscope: Definition. Properties of Light (Def. of Wavelength, Frequency, Amplitude, Polarization, Diffraction, Refraction, Magnification, Resolution) Compound microscope, Phase contrast microscope, Fluorescent microscope and Electron microscope (SEM & TEM), Tissue processing for electron microscope.

UNIT II: CENTRIFUGATION AND SPECTROSCOPY

Basic principle of sedimentation – Relative centrifugal force (RCF), Sedimentation rate, Svedberg unit or Sedimentation coefficient, Types of Centrifugation: Analytical and Preparative, Differential, Density gradient, Types of Centrifuge & rotors.
Overview of Electromagnetic radiation, Laws relating to absorption of radiation. Principle, Instrumentation and Applications of Colorimeters, Spectrophotometers – Ultraviolet and Visible Absorption Spectroscopy.

UNIT III: CHROMATOGRAPHY

Principles of Chromatography (Distribution Coefficient), Types of Chromatography: Principles, Instrumentation and applications of - Thin Layer Chromatography (TLC), Column Chromatography, Ion-Exchange Chromatography, Affinity Chromatography, Gel permeation Chromatography, GLC, High Performance Liquid Chromatography (HPLC)

UNIT IV: ELECTROPHORESIS

Gel Electrophoresis: General Principles, Agarose gel electrophoresis, SDS-PAGE, Pulse Field Gel Electrophoresis (PFGE), Iso electric Focusing, Capillary Electrophoresis.

1. Biochemistry – J. M. Berg, John L. Tymoczko, Lubert Stryer W. H. Freeman & Co.
2. Essentials of Biochemistry- David Lee Nelson, Albert L. Lehninger, Michael M. Cox . W. H. Freeman & Co.
3. Principles and Techniques of practical biochemistry - Keith Wilson, Cambridge University Press.
4. Principles of Anatomy and Physiology- Gerard J. Tortora & B. H. Derrickson, John Wiley & Sons.
5. Outlines of biochemistry-Conn & Stumpf 5th Ed, John Wiley & Sons,

Learning outcome: Students will be able to know techniques and instrumentation microscopy, centrifugation, chromatography, electrophoresis