

INSTITUTE OF ADVANCED STUDIES IN  
EDUCATION (DEEMED UNIVERSITY)  
GANDHI VIDYA MANDIR  
SARDARSHAHR

*Detailed Syllabus  
of*

**B.Sc. (Bio-Informatics)**

**DURATION : 06 Semesters**

**TOTAL MARKS : 1800**

**FIRST SEMESTER**

| COURSE TITLE                   | Paper Code | MARKS  |           |       |
|--------------------------------|------------|--------|-----------|-------|
|                                |            | THEORY | PRACTICAL | TOTAL |
| Biochemistry (I)               | BIF-S110   | 100    | 00        | 100   |
| Basics of Biocomputing         | BIF-S120   | 100    | 00        | 100   |
| Introduction to Bioinformatics | BIF-S130   | 100    | 00        | 100   |

**SECOND SEMESTER**

| COURSE TITLE      | Paper Code | MARKS  |           |       |
|-------------------|------------|--------|-----------|-------|
|                   |            | THEORY | PRACTICAL | TOTAL |
| Biochemistry (II) | BIF-S210   | 100    | 00        | 100   |
| Microbiology      | BIF-S220   | 100    | 00        | 100   |
| Biostatistics     | BIF-S230   | 100    | 00        | 100   |

**THIRD SEMESTER**

| COURSE TITLE           | Paper Code | MARKS  |           |       |
|------------------------|------------|--------|-----------|-------|
|                        |            | THEORY | PRACTICAL | TOTAL |
| Bio Programming (I)    | BIF-S310   | 100    | 00        | 100   |
| Molecular Genetics (I) | BIF-S320   | 100    | 00        | 100   |
| Genetic Engineering    | BIF-S330   | 100    | 00        | 100   |

**FOURTH SEMESTER**

| COURSE TITLE            | Paper Code | MARKS  |           |       |
|-------------------------|------------|--------|-----------|-------|
|                         |            | THEORY | PRACTICAL | TOTAL |
| BioProgramming (II)     | BIF-S410   | 100    | 00        | 100   |
| Molecular Genetics (II) | BIF-S420   | 100    | 00        | 100   |
| Biological Databases    | BIF-S430   | 100    | 00        | 100   |

**FIFTH SEMESTER**

| COURSE TITLE                    | Paper Code | MARKS  |           |       |
|---------------------------------|------------|--------|-----------|-------|
|                                 |            | THEORY | PRACTICAL | TOTAL |
| Bioinformatics Software & Tools | BIF-S510   | 100    | 00        | 100   |
| Bio Markup Languages            | BIF-S520   | 100    | 00        | 100   |
| Computational Biology           | BIF-S530   | 100    | 00        | 100   |

**SIXTH SEMESTER**

| COURSE TITLE            | Paper Code | MARKS  |           |       |
|-------------------------|------------|--------|-----------|-------|
|                         |            | THEORY | PRACTICAL | TOTAL |
| Drug Design & Discovery | BIF-S610   | 100    | 00        | 100   |
| Virology                | BIF-S620   | 100    | 00        | 100   |
| Cheminformatics         | BIF-S630   | 100    | 00        | 100   |

## SEMESTER-I

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|-------------------------|------------------------------|
| <b>Biochemistry (I)</b> | <b>Course Code: BIF-S110</b> |
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Introduction  
Carbohydrates  
Proteins  
Lipids  
Nucleic Acids  
Enzymes

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| <b>Basics of Biocomputing</b> | <b>Course code: BIF-S120</b> |
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Office Packages, Internet Architecture & Framework  
Unix O/S, UNIX Architecture,  
UNIX File system, UNIX Commands,  
Pipes and Filters,  
Shell Programming, Useful Utilities ,  
Vi Editor,  
Communication & Networking.

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|---------------------------------------|------------------------------|
| <b>Introduction to Bioinformatics</b> | <b>Course code: BIF-S130</b> |
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Bioinformatics,  
Evolution of Bioinformatics,  
Use of Bioinformatics,  
History of Bioinformatics, Bioinformatics,  
Future scope of Bioinformatics.

## SEMESTER-II

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|--------------------------|------------------------------|
| <b>Biochemistry (II)</b> | <b>Course Code: BIF-S210</b> |
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Amino Acid Metabolism  
Intracellular Protein Degradation  
Breakdown of amino acids  
De – amination  
Nitrogen Fixation  
Urea Cycle  
Biosynthesis of essential and non essential amino acids  
Carbohydrate Metabolism  
Glycolysis, Pentose Phosphate  
TCA Cycle  
Pathway & Gluconeogenesis  
Electron transport System & Oxidative Phosphorylation  
Glycogen synthesis and Glycogenolysis  
Thermodynamic principles in Biology & energy rich bond  
Regulation of Carbohydrate metabolism      Metabolic disorders  
Lipid Metabolism

General reactions & functions of triglycerides, phospholipids & Cholesterol, Prostaglandins, Biosynthesis & Catabolism of triglycerides, phospholipids, Cholesterol and Prostaglandins, Beta – oxidation of Fatty acids, Metabolic disorders  
Inborn Errors of Metabolism.

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| <b>Microbiology</b> | <b>Course code: BIF-S220</b> |
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Scope and Relevance of Microbiology  
Microbial structure, Prokaryotic protist cell structure and function, Eukaryotic protist cell structure and function  
Microbial Nutrition, Growth and Control (Microbial Nutrition)  
Nutritional requirements & Nutritional Types, Synthesis of Culture media & Culture Techniques, Uptake of nutrients, Isolation & Enumeration of Microbes, Nutritional Types, Uptake of nutrients  
(Growth and Control), Growth Curve, Measurement of Growth  
Growth as influenced by Environmental Factors, Physical and Chemical Agents for Controlling growth of microbes.  
Microbial Reproduction Genetics, Recombination and Plasmids  
Bacterial Multiplication, Transposable Elements, Bacterial Recombination – General, Transformation and Transduction, Principles, Bacterial Plasmids

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| <b>Biostatistics</b> | <b>Course code: BIF-S230</b> |
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Biostatistics : A foundation for Bioinformatics, Estimation, Hypothesis Testing, Data Presentation, Applications of Hypothesis  
Data Characteristics : Descriptive ,Testing, Statistics ,Categorical Data Analysis and Probability: Basic Concepts, Analysis of Variance, Normal Distribution, Simple Linear Regression and Correlation, Sampling Distributions.

### SEMESTER-III

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|---------------------------|------------------------------|
| <b>Bio Programming(I)</b> | <b>Course code: BIF-S310</b> |
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Visual Basic 6.0, Introduction to Visual basic, Working with controls, Variables & Procedures, Crystal Reports, Control Flow & Data, ADO, Component Object Model, Dynamic Link Libraries (DLL), C and C++ Language, Java

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| <b>Molecular Genetics (I)</b> | <b>Course code: BIF-S320</b> |
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Mendelian Genetics  
DNA  
Biochemical Structure, Excision Repair, DNA as a genetic material, Recombination  
Transcription  
Synthesis of RNA from template, Types of RNA, Structure and functions of mRNA, tRNA & rRNA  
Translation

Genetic code, Post – Translational modifications, Biochemical basis of protein, Protein targeting

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| <b>Genetic Engineering</b> |
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| <b>Course code: BIF-S330</b> |
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Enzymology involved in Manipulation of Genetic Material  
Restriction Endonucleases, DNA polymerase, DNA ligases, Kinases, Vectors  
Plasmid and Cosmid, Yeast artificial chromosome, Phages, Transposes

Detecting Target DNA

Phosphatases, Radioactive and non-radioactive, Labelling of nucleic acids, labeling techniques, Reverse transcriptase, Nick translation, end labeling, Exonucleases, ribonucleases and proteases, Primer extension, random priming methods, Concept and use of linkers and adaptors, Chemical synthesis of oligonucleotides.

Techniques involved in Gene Manipulation

Genomic and cDNA Library, RAPD and RFLP, In vivo expression techniques, DNA footprinting, Southern and northern blotting, PCR and its applications, DNA figure printing, Cell fusion techniques, Gene Transfer, In plant cells, In animal cells.

Applications of Genetic Engineering

In diagnostics, Generation of novel plants and animals, Protein & metabolite engineering, Gene therapy, Ethical Issues and Patenting of Genetically Modified Objects

## SEMESTER-IV

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| <b>Bio Programming (II)</b> |
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| <b>Course code: BIF-S410</b> |
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Advance Java :

RMI

JDBC

JAVA Beans

Servlets

Perl,

Linux (installations and Basics)

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| <b>Molecular Genetics (II)</b> |
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| <b>Course code: BIF-S420</b> |
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Gene Mutations lac, trp & his Operon, Operon concept and operon models:  
Chromosomal Aberrations, Polyploidy during cell differentiation, Regulation of gene expression, Multiple Genes, Regulation of Gene Expression, Co-regulation of genes, Regulatory regions of gene – SNP, (Single Nucleotide polymorphism) origin analysis & significance, Gene expression, regulation in prokaryotes and eukaryotes.

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| <b>Biological Data Bases</b> |
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| <b>Course code: BIF-S430</b> |
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Database Concepts, Introduction to SQL, Database Management System, Constraints  
Types of Databases, Types of SQL Commands, Codd's Rules, Data Correlations, Data Normalization, Introduction to Index, Types of Indexes.

Biological Database

Introduction, Sequence Database, Biological Database and its importance, Nucleotide Sequence Databases, Biological Database and their functioning, Types of Biological Databases, Protein Sequence Databases, Structure Databases

## SEMESTER-V

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|--------------------------------------|------------------------------|
| <b>Bioinformatics Software/Tools</b> | <b>Course code: BIF-S510</b> |
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Clustal W,Phylip,  
Oligo Primer Analysis  
Software,Swisspdb viewer And many more advance softwares,  
Tree View,  
ALSCRIPT,  
Rasmol.

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| <b>Bio Markup Languages</b> | <b>Course code: BIF-S520</b> |
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HTML  
Header, Linking, Images, Special Characters & Line Break, List, Table & Formatting,  
Forms, Internal Linking, Frame Set

XML  
Cascading Style sheet, Document Type definition, Extensible style sheet, XML Parser

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| <b>Computational Biology</b> | <b>Course code: BIF-S530</b> |
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Datamining and Sequence Analysis  
Biological background for sequence analysis, Identification of protein sequence from DNA sequence,Searching of database for similar new sequence, Calculation of sequence alignment for evolutionary,inferences to aid in structural and functional analysis

Database Similarity Searches  
Introduction to Sequence, Alignment, Optimal Alignment Methods, Substitution Scores and Gap,Database Similarity Searching,FASTA,BLAST, Penalties

Practical Aspects Of Multiple Sequence Alignment  
Distance and similarity,Motifs & Patterns,The evolutionary basis for Sequence alignment,Profilescan,MoST, PROBE ,Progressive Alignment Methods.

Phylogenetic Analysis  
Introduction  
Searching for Trees, Evaluating trees and data, Phylogenetic tree building methods,  
Multiple alignment procedure, Phylogenetic softwares, Internet Resources  
Predictive Methods Using Protein and Nucleic Acid Sequences

Propsearch and Mouse, Detecting functional sites in DNA, Sequence based physical Properties, Internet tools for identification of Protein coding genes, Secondary structure and folding classes, Internet resources for repeat analysis, nnPredict, predict protein, Predictive methods using protein sequences, ssPRED, SOPMA, Tertiary structure

AA Compldent and AACompsin, Internet Resources, Submitting DNA Sequences to the Database, Introduction, Submitting an aligned set of sequences, What, Where and How to submit, SEQUIN Updates,Genome Centers,Internet resources.

## SEMESTER-VI

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|------------------------------------|------------------------------|
| <b>Drug Design &amp; Discovery</b> | <b>Course code: BIF-S610</b> |
|------------------------------------|------------------------------|

Contour of Drugs Development of new Drugs Synthesis of Drugs, Molecular modification of lead compounds, Use of Silica chips to find lead molecules, Prediction of Bioactivities based on Physicochemical constants, Chemical and Physicochemical parameters in Drug Design Ionization Constant, Chelation, Structure based on Drug design, Designing in Enzyme inhibitors, Synthesis of lead Compound, Drug Discovery, Role of Computer in Drug Design, Theory of Drug Design, Difficulties implementing de novo, Rational Drug design software, Computational Techniques.

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|-----------------|------------------------------|
| <b>Virology</b> | <b>Course code: BIF-S620</b> |
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Viruses  
General characteristics & Structure, Isolation, Purification & Enumeration  
Viruses and Cancer  
Major Groups of Viruses  
Bacteriophages-Lysogeny and Lytic cycles Viruses of Eukaryotes Animal Viruses-  
Structure and Reproduction, Plant Viruses-Morphology, Transmission and Amplification  
Viruses infecting insects, fungi & algae, Viroids, Virnsoids and Prions.

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| <b>Cheminformatics</b> | <b>Course code: BIF-S630</b> |
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Cheminformatics,  
Evolution of Cheminformtics,  
History of Cheminformatics,  
Future scope of Cheminformatic,  
Use of Cheminformatics,  
Implementation & Algorithms in Cheminformatics