



# **MAHARANI LAKSHMI AMMANI COLLEGE FOR WOMEN**

**(NAAC ACCREDITED B++)**

**UGC SPONSORED CAREER ORIENTED COURSE**

**COURSE STRUCTURE**  
**DIPLOMA COURSE IN BIOINFORMATICS**

**Prerequisite : Certificate**

**Total Hours: 160**

(Theory:100 hrs & Practicals:60 hrs)

**Objective :** To turn the flood of new bio-information into useable knowledge and to enhance the students in data mining and knowledge management technologies that are being deployed today to assist researchers and regulators.

Module	Title of the Paper	Theory Hours	Practical Hours	Total Hours
I	<b>Basics of Cell and Molecular Biology,Biochemistry and Genetics</b>	40	-	40
II.	<b>Introduction to Bioprograming and Biological Databases</b>	10	20	30
III.	<b>Computational Biology</b>	30	10	40
IV	<b>Mathematics and Statistics</b>	20		20
V	<b>Project work</b>		30	30

**Diploma- Bioinformatics**  
**Detailed Syllabus**

**Module 1. Basics of Biochemistry and Genetics (Biology)**

**40**

**Biochemistry**

1. **Proteins:** amino acids and peptides: primary, secondary, tertiary and quaternary structures.
2. **Nucleic acids:** Bases, nucleotides, RNA and DNA. Different conformation of DNA, denaturation and renaturation of DNA.
3. **Energy molecules, Signal molecule** (Classification, structure and function)

**Genetics**

4. **Prokaryotic genome** organization and structure.
5. **Eukaryotic genome** organization and structure, mechanism of gene expression in eukaryotes, promoter & regulator sequences, restriction enzymes  
Phenotype and genotype relationships, role of environment from gene to phenotype, gene interactions, study of quantitative traits
6. **Mutations-** molecular, gene/point and chromosomal types and molecular basis.
7. **Phenotype and genotype** relationship, gene interactions
8. **Gene expression :** In prokaryote & In Eukaryotes
9. Human genome and Bioethics

**Module 2. Introduction to Bioinformatics, Bio-programming & Biological Databases 30**

1. Overview and functions of a computer system, input and output devices, storage devices(primary and secondary ), memory (register, buffer, RAM, ROM, PROM, EPROM, EEPROM )
2. Relationship of IT & Bioinformatics; Introduction to Bioinformatics, Application of Bioinformatics, Applied Bioinformatics, Operating Systems (including windows and UNIX), Web access , Introduction to networking.
3. **HTML (Hyper Text Markup Language)**  
Overview of HTML and HTTP, Web servers, HTML technology and applications with examples related to Biotechnological field. Building biological database with HTML.
4. **RDBMS.**  
What are Biological databases? Objectives and scope of databases, general perspective on DBMS.
6. **PERL:**  
**Basic;** Perl facts, features, advantages, starting perl, variables, perl functions, conditionals, subroutines, files.

- 1. INTRODUCTION:**  
Definition, Scope, Targets and applications of Computational Biology and Bioinformatics.
- 2. NINE WEB RESOURCES ON INTERNET**
- 3. BIOLOGICAL DATABASES AND SEARCH ENGINES:**
  - a. Sequence Databases:** The nucleotide and protein sequence Databases: Introduction, Primary and Secondary Databases, Format Vs. Content, The Database. The Gene bank file- A dissection.
  - b. Structure Databases:** Introduction to Structures, PDB: Protein Data Bank, Molecular Modeling Database at NCBI, Structure file formats, visualizing structural information, Database structure viewers.
  - c. Sequence searches in Biological databases:**  
The search process, search engine technology, Information theory, search algorithms, approximate searches; search engines; Data retrieval tools; data mining and data annotation.
- 4. SEQUENCE ALIGNMENT**
  - (I) Pairwise sequence alignment:**  
Basic concept of sequence alignment. Needleman& Wuncsh. Smith & Waterman algorithms for pairwise alignments. Use of pair wise alignment for analysis of Nucleic acid and protein sequence and interpretation of result.
  - (II) Multiple sequence alignment:**  
The need for MSA. Basic concepts various approaches for MSA. Algorithm of CLUSTAL W and Pileup and their application for sequence analysis (including interpretation of result). Concept of dendrograms and its interpretation.
- 5. PHYLOGENETIC ANALYSIS**  
Introduction to Phylogeny; Methods of Phylogenetic analysis, construction of Phylogenetic trees; Deriving Phylogenetic inferences through Phylogenetic trees.

**Number integration,** interpolation and approximate methods, concept of Eigenvectors and eigenvalues, Poisson and extreme value distribution  
**System of linear equations**  
**Partial Differential equations:** Review of basic concepts, Numerical methods, Mathematical modeling and simulation, multivariate analysis, Hypothesis testing, Markov process

**References**

1. Bioinformatics- Managing scientific data, Lacroix and Critchlow.
2. Bioinformatics-Concepts, skills and Applications, Rastogi *et.al*.
3. Bioinformatics computing, Bergeron.
4. Developing Bioinformatics Computer skills, Gibbon and Jambeck.
5. Bioinformatics –A practical Guide. Gibbon and Jambeck.
6. Bioinformatics – a beginners Guide, J. M. Claverie and C. Notredame.
7. Bioinformatics- Methods and applications, Rastogi *et. al*
8. An Introduction to computational Biochemistry, StanTsai,
9. Biological sequence analysis, probabilistic models of proteins and nucleic acids, Dubin *et.al*.
10. Introduction to Bioinformatics- a theoretical and practical Approach, Krawetz and Wamble
11. Bioinformatics- A practical guide to the analysis of genes and proteins, Baxeavanis and Ouellette (Eds).
12. Bioinformatics- Sequence and genomic analysis, David Mount.
13. Microarray Bioinformatics by Stekel.
14. Mastering perl for Bioinformatics by James D.Tisdall
15. Bioinformatics by Dr. K.Mani & N.vijayaraj
16. Advanced Perl programming by sriram srinivasan.
17. Programming Perl by Lany wall& Tom christiansel
18. Effective perl programming by Addison – Wesley.
19. Elements of programming with Perl by Andrew .johnson
20. Zeta perl module:  
www.loc.gov/z3950/ zig/meetings/texas/tutorials/zetaperl.ppt
21. <http://www.dddc.ac.cin/emb004/>
22. <http://chemweb.ucc.ie/people/JJKeating/jjkeating.htm>
23. JGP files
24. Genome by T.A.Brown