

## **MSc Bioinformatics - SC513 (Under Review)**

### **1. Objectives**

Bioinformatics has arisen from the need to make sense of the vast quantities of data generated in the fields of Molecular and Biological Sciences. The main objective of this Programme is to provide students with a practical and theoretical knowledge of DNA sequences, genomes, protein sequences, protein structure, transcription and proteome information that will prepare them for careers in bioinformatics, academia, industry and research. The multidisciplinary training will enable students to acquire problem-solving skills and gain experience in understanding, handling and developing important software that are currently in great demand in pharmaceutical, chemical and biotechnology industries.

### **2. General Entry Requirements**

Successful completion of an undergraduate degree with

- at least a Second Class or 50%, whichever is applicable or
- a GPA not less than 2.5 out of 4 or equivalent, from a recognised higher education institution

**OR** alternative qualifications acceptable to the University of Mauritius

### **3. Programme Requirements**

A first Degree in Science (including Computer Science) or Engineering, or any other equivalent qualifications (academic or professional) acceptable to the University of Mauritius.

Depending on the background of the students, the latter will be required to undertake Audit Modules as recommended by the Interdisciplinary Board of Studies.

### **4. General and Programme Requirements – Special Cases**

The following may be deemed to have satisfied the General and Programme requirements for admission:

- (i) Applicants who do not satisfy any of the requirements as per Regulations 2 and 3 above but who submit satisfactory evidence of having passed examinations which are deemed by the Senate to be equivalent to any of those listed.
- (ii) Applicants who do not satisfy any of the requirements as per Regulations 2 and 3 above but who in the opinion of Senate submit satisfactory evidence of the capacity and attainments requisite to enable them to pursue the programme proposed.
- (iii) Applicants who hold a full practising professional qualification obtained by examination.

## 5. Programme Duration

The duration of this Part-Time Postgraduate Programme should normally not exceed 4 years (8 semesters) and in any case (under Flexible Learning Programme) not exceed 7 years (14 semesters).

	<b>Normal</b>	<b>Maximum</b>
Master's Degree:	4 Semesters	8 Semesters
Postgraduate Diploma:	4 Semesters	8 Semesters
Postgraduate Certificate:	2 Semesters	4 Semesters

6. **Credits per Semester:** Minimum 3 credits subject to Regulation 5.

## 7. Minimum Credits Required for Award

Master's Degree:	36
Postgraduate Diploma:	24
Postgraduate Certificate:	12

Breakdown as follows:

### i) **MSc Bioinformatics: 36**

Core modules:	21 credits
+ Project:	9 credits
+ Elective modules:	6 credits

**ii) Postgraduate Diploma in Bioinformatics: 24**

Core modules: 18 credits  
+ Elective modules: 6 credits

**iii) Postgraduate Certificate in Bioinformatics: 12**

Core modules (at least 3): 9 credits  
+ any other module: 3 credits

**8. Assessment**

Each module will carry 100 marks and will be assessed as follows (unless otherwise specified):

Assessment will be based on a written examination of 3-hour duration and continuous assessment carrying a range of 10% to 30% of total marks except for a Programme where the structure makes for other specific provision(s). Continuous assessment may be based on laboratory works, and/or assignments and will include at least one Class test.

BIOINF 6002(1) - PERL PROGRAMMING will be assessed solely on Continuous Assessment.

A minimum of at least 30% should be attained in each of Continuous Assessment and Written Examination, with an overall total of 40% for a candidate to pass a module.

Modules will carry the weightings of 1. Weighting for a particular module is indicated within parentheses in the module code

**9. Plan of Study**

Students are required to submit at the end of Semester 1 a Plan of Study for their whole Programme of Studies, indicating the list of elective modules and in which semester each of them will be taken.

## 10. Reservation

The University reserves the right not to offer a given elective module if the critical number of students is not attained and/or for reasons of resource constraints.

## 11. Important Note

The rules as stipulated in this Programme Structure and Outline Syllabus will replace all other rules and regulations.

## 12. List of Modules

<b>Code</b>	<b>Module Name</b>	<b>Hrs/Wk L+P</b>	<b>Credits</b>
<b><u>CORE MODULES</u></b>			
BIOINF 6000(1)	Project	-	9
BIOINF 6001(1)	Fundamentals of Bioinformatics	3+0	3
BIOINF 6002(1)	Perl Programming	2+2	3
BIOINF 6003(1)	Statistical Methods for Bioinformatics	2+2	3
BIOINF 6004(1)	Molecular Biology and Applied Genetics	3+0	3
BIOINF 6005(1)	Databases & Data Mining	2+2	3
BIOINF 6006(1)	Bioinformatics Algorithms I	2+2	3
BIOS 6013(1)	Genomics, Proteomics and Metabonomics	3+0	3
<b><u>ELECTIVES</u></b>			
BIOINF 6007(1)	Analytical Techniques used in Molecular Biology	2+2	3
BIOINF 6008(1)	Macromolecular Modelling	2+2	3
BIOINF 6009(1)	Learning Algorithms	2+2	3
BIOINF 6010(1)	Bioinformatics Algorithms II	2+2	3
BIOINF 6011(1)	Molecular Pathology	3+0	3
BIOS 6010(1)	Molecular Systematics	3+0	3

### 13. Programme Plan - MSc Bioinformatics

Year 1							
Semester 1				Semester 2			
Code	Module Name	Hrs/Wk L+P	Credits	Code	Module Name	Hrs/Wk L+P	Credits
<b>CORE</b>				<b>CORE</b>			
BIOINF 6001(1)	Fundamentals of Bioinformatics	3+0	3	BIOINF 6004(1)	Molecular Biology and Applied Genetics	3+0	3
BIOINF 6002(1)	Perl Programming	2+2	3	BIOINF 6005(1)	Databases & Data Mining	2+2	3
BIOINF 6003(1)	Statistical Methods for Bioinformatics	2+2	3	BIOS 6013(1)	Genomics, Proteomics and Metabonomics	3+0	3
Year 2							
Semester 1				Semester 2			
Code	Module Name	Hrs/Wk L+P	Credits	Code	Module Name	Hrs/Wk L+P	Credits
<b>CORE</b>				<b>CORE</b>			
BIOINF 6006(1)	Bioinformatics Algorithms I	2+2	3	BIOINF 6000(1)	Project	-	9
<b>ELECTIVES CHOOSE TWO FROM</b>							
BIOINF 6007(1)	Analytical Techniques used in Molecular Biology	2+2	3				
BIOINF 6008(1)	Macromolecular Modelling	2+2	3				
BIOINF 6009(1)	Learning Algorithms	2+2	3				
BIOINF 6010(1)	Bioinformatics Algorithms II	2+2	3				
BIOINF 6011(1)	Molecular Pathology	3+0	3				
BIOS 6010(1)	Molecular Systematics	3+0	3				

## 14. Outline Syllabus

This outline syllabus is not prescriptive and is intended to serve as a guide only.

### **BIOINF 6001(1) - FUNDAMENTALS OF BIOINFORMATICS**

This module is designed to provide an overview of bioinformatics. Relevant concepts in molecular biology will be reviewed including DNA structure and replication, gene expression, genome structure. Lectures will also focus on publicly available databases (DNA and RNA sequence databases, protein sequence databases, genomic databases, mutation and polymorphism databases).

### **BIOINF 6002(1) - PERL PROGRAMMING**

Program testing, debugging and documentation, programming style, data manipulation, file maintenance, pipelining, packaging and interfacing system facilities.

### **BIOINF 6003(1) - STATISTICAL METHODS FOR BIOINFORMATICS**

Probability and probability distributions, Bayes and implications, Estimation and Hypothesis Testing for parametric and non-parametric Set-up, Bootstrapping, Analysis of Variance and Experimental Design, Regression Analysis. Use of softwares like SPSS, Minitab, R and S-Plus for computing and graphics.

### **BIOINF 6004(1) - MOLECULAR BIOLOGY AND APPLIED GENETICS**

This module will provide students with a firm grounding in the genetics and molecular biology of both normal physiological and disease processes using selected case studies emphasising current research. Introduction to bioethics. The module will also place emphasis on approaches and techniques which are applied in diagnosis and care.

### **BIOINF 6005(1) - DATABASES & DATA MINING**

Introduction to Oracle, SQL and XML, Advanced database work using SQL, Interfacing programs with databases, data interoperability using XML, Object oriented techniques, Data Mining techniques and applications.

### **BIOINF 6006(1) - BIOINFORMATICS ALGORITHMS I**

Algorithm Design Process, Computer Representation of Probabilities and Distributions, Generation of Random Numbers, Principle of Accept Reject Methods, Understanding Alignment Statistics, Pairwise Alignment Methods, Heuristic Algorithms for Database Search: BLAST and FASTA Dynamic Programming.

**BIOINF 6007(1) - ANALYTICAL TECHNIQUES USED IN MOLECULAR BIOLOGY**

This module will cover in depth the theory and practice of modern analytical techniques used in molecular biology including genomics and proteomics. Special emphasis will be laid on biotechnology methods (DNA sequencing, PCR, analysis of cloned genes, microarray technology). Applications of DNA science.

**BIOINF 6008(1) - MACROMOLECULAR MODELLING**

Elements of molecular modelling. Modelling softwares. Acquisition of chemical information and molecular structures. Visualisation. Simulation of molecular interactions. Applications.

**BIOINF 6009(1) - LEARNING ALGORITHMS**

Discrimination and classification algorithms, Bayesian networks, Hidden Markov models, Algorithms in machine learning.

**BIOINF 6010(1) - BIOINFORMATICS ALGORITHMS II**

Monte Carlo Markov Chain Methods: Metropolis Algorithm, Hastings Algorithm, Tierney Algorithm, Multiple Alignments, Patterns and Profiles, Artificial Neural Networks, Genetic Algorithms and Programming, Swarm Intelligence.

**BIOINF 6011(1) - MOLECULAR PATHOLOGY**

Molecular biology and genomics have now given new impetus for research on important living organisms. This module will reinforce foundation knowledge and then focus on the current trends in molecular research in plant pathology, parasitology and vectors of medical and veterinary importance.

**BIOS 6010(1) - MOLECULAR SYSTEMATICS**

This module will focus on how to use RNA, DNA and protein sequences in order to infer phylogenetic relationships. The application of molecular biology techniques in systematics will be reviewed. The evolutionary relevance of the molecular data will be discussed.

**BIOS 6013(1) - GENOMICS, PROTEOMICS AND METABONOMICS**

Genome sequences will be examined at the structural and functional level (Gene prediction). The synergistic areas among genomes, proteomes and metabonomics will be discussed. The important tools and strategies utilised in understanding the metabolic responses of living systems will be emphasised.

