



The University of Southern Queensland

## Course specification

### Description: Bioinformatics

Subject	Cat-nbr	Class	Term	Mode	Units	Campus
BIO	2211	41196	1, 2005	ONC	1.00	Toowoomba

<b>Academic group:</b>	FOSCI
<b>Academic org:</b>	FOS002
<b>Student contribution band:</b>	2
<b>ASCED code:</b>	010999

### STAFFING

Examiner: Grant Daggard

Moderator: Christine McDonald

### REQUISITES

Pre-requisite: STA2300 Co-requisite: BIO2209

### OTHER-REQUISITES

Recommended Pre-requisite: CSC1400 or CSC1402 or CIS1000 or ELE1301

### RATIONALE

Bioinformatics brings together the fields of life science, computer science and statistics. Bioinformaticians are involved in the development of technologies for storing, extracting, organizing, analysing, interpreting and utilizing biological information. With the ever increasing size of genome and other biological data sets, students are required to extend their knowledge of existing statistical methodologies to the analysis of huge amount of data. Students of bioinformatics gain a better understanding of biological systems by creative application of statistics and computer analysis. Cross-disciplinary knowledge courses are essential to the development of this emerging discipline.

### SYNOPSIS

You will be introduced in an integrated approach to the cross-disciplinary field of Bioinformatics. This course provides an introduction to both theoretical and practical aspects of DNA and protein sequence analysis including the searching of DNA, protein and nucleic acid databases using homology-based and pattern-based search algorithms, as well as sequence comparisons and alignments and evolutionary analysis. You will develop skills in interfacing with and retrieving information from sequence and genome databases and in Perl programming as applied to bioinformatics. Methods of sequence alignment including dynamic programming and the supporting statistical theory are introduced. Topics include collection of sequences, sequence alignment, prediction of RNA secondary structure, phylogenetic relationships, gene prediction and protein structure prediction.

## OBJECTIVES

On completion of this course students will be able to:

1. explain the principles of DNA sequencing and conduct database analyses;
2. predict molecular structures from genetic material;
3. analyse gene homology and predict evolutionary relationships;
4. write and interpret basic Perl programs with application to bioinformatics;
5. apply appropriate statistical tests of significance in relation to the interpretation of output from a range of bioinformatics software;
6. show a high level of skill in the use of informatics techniques with an emphasis on the organisation, display and interrogation of complex data; and
7. describe the limitations of existing techniques.

## TOPICS

	Description	Weighting (%)
1.	Bioinformatics: collecting and assessing genome related data. An historical perspective including the development of public databases and related internet resources.	20.00
2.	Sequence alignment - pairs, multiple sequence alignment and identifying similar sequences including statistical approaches	30.00
3.	Perl programming in bioinformatics	25.00
4.	Genome analysis	15.00
5.	Protein structure prediction	5.00
6.	Phylogenetic relationships	5.00

## TEXT and MATERIALS required to be PURCHASED or ACCESSED

ALL textbooks and materials are available for purchase from USQ BOOKSHOP (unless otherwise stated). Orders may be placed via secure internet, free fax 1800642453, phone 07 46312742 (within Australia), or mail. Overseas students should fax +61 7 46311743, or phone +61 7 46312742. For costs, further details, and internet ordering, use the 'Textbook Search' facility at <http://bookshop.usq.edu.au> click 'Semester', then enter your 'Course Code' (no spaces).

## REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

Durbin, R, Eddy, S, Krogh, A & Mitchison, G 1998, *Biological sequence analysis - probabilistic models of proteins and nucleic acids*, Cambridge University Press, Cambridge.

Dwyer, RA 2003, *Genomic perl from bioinformatics basics to working code*, 1st edn, Cambridge University Press, Cambridge.  
(ISBN 0 521 80177 X)

Higgins, D & Taylor, W 2000, *Bioinformatics: sequence, structure and databanks*, Oxford University Press, New York.

(ISBN 0 19 963790 3)

Krane, DE & RAYner, ML 2003, *Fundamental concepts of bioinformatics*, Benjamin Cummings Publishing, San Francisco.

(ISBN 0 8053 4722 4)

Mount, DW 2001, *Bioinformatics: sequence and genome analysis*, Cold Spring Harbour Laboratory Press, New York.

Ting Lee, Mei-Ling 2004, *Analysis of microarray gene expression data*, Kluwer Academic Publishers,

(ISBN 0-7923-7087-2)

Tisdall, J 2001, *Beginning Perl for Bioinformatics*, O'Reilly & Associates, Sebastopol, CA.

(ISBN 0 596 00080 4)

Wong, L (ed) 2004, *The practical bioinformatician*, World Scientific Publishing,

(ISBN 981-238-846-X)

## STUDENT WORKLOAD REQUIREMENTS

ACTIVITY	HOURS
Assessment	40.00
Examinations	2.00
Lectures	26.00
Practical Experience	26.00
Private Study	73.00

## ASSESSMENT DETAILS

Description	Marks out of	Wtg(%)	Due date
ASSIGNMENT 1	20.00	20.00	01 Mar 2005 (see note 1)
ASSIGNMENT 2	20.00	20.00	01 Mar 2005 (see note 2)
2HR RESTRICTED EXAM	60.00	60.00	END S1 (see note 3)

### NOTES

1. Lecturer will advise due date for Assignment 1
2. Examiner to advise due date for Assignment 2
3. Examination dates will be available during the Semester. Please refer to the examination timetable when published.

## IMPORTANT ASSESSMENT INFORMATION

- 1 Attendance requirements:

There are no attendance requirements for this course. However, it is the students' responsibility to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.

- 2 Requirements for students to complete each assessment item satisfactorily:  
To complete each of the assignments satisfactorily, students must obtain at least 50% of the marks available for each assignment. To complete the examination satisfactorily, students must obtain at least 50% of the marks available for the examination.
- 3 Penalties for late submission of required work:  
If students submit assignments after the due date without prior approval then a penalty of 20% of the total marks gained by the student for the assignment will apply for each working day late.
- 4 Requirements for student to be awarded a passing grade in the course:  
To be assured of a passing grade, students must demonstrate, via the summative assessment items, that they have achieved the required minimum standards in relation to the objectives by obtaining at least 50% of the total weighted marks available for the summative assessment items.
- 5 Method used to combine assessment results to attain final grade:  
The final grades for students will be assigned on the basis of the weighted aggregate of the marks obtained for each of the summative assessment items in the course.
- 6 Examination information:  
In a Restricted Examination, candidates are allowed access to specific materials during the examination. The only materials that candidates may use in the restricted examination for this course are: writing materials (non-electronic and free from material which could give the student an unfair advantage in the examination); calculators which cannot hold textual information (students must indicate on their examination paper the make and model of any calculator(s) they use during the examination. With the Examiner's approval, candidates may, take an appropriate non- electronic translation dictionary into the examination. This will be subject to perusal and, if it is found to contain annotations or markings that could give the candidate an unfair advantage, it may be removed from the candidate's possession until the appropriate disciplinary action is completed.
- 7 Examination period when Deferred/Supplementary examinations will be held:  
Any Deferred or Supplementary examinations for this course will be held in the fourth week of the semester following this course offering and the examiner will advise students involved in writing of the date time and location of any such examination.
- 8 University Regulations:  
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL <http://www.usq.edu.au/corporateservices/calendar/part5.htm> or in the current USQ Handbook.

## **ASSESSMENT NOTES**

- 9 Supplementary and Deferred Examinations: Students who obtain an overall passing mark, but who do not perform satisfactorily in the examination, may, at the discretion of the examiner, be granted a supplementary examination. Students will be granted a deferred examination only if they perform satisfactorily in the assignments.
- 10 Students must retain a copy of any assignment submitted. If requested, students will be required to provide a copy of assignments submitted for assessment purposes. Such copies should be despatched to USQ within 24 hours of receipt of a request being made.