



The University of Southern Queensland

## Course specification

The current and official versions of the course specifications are available on the web at <http://www.usq.edu.au/coursespecification/current>.  
Please consult the web for updates that may occur during the year.

### Description: Bioinformatics

Subject	Cat-nbr	Class	Term	Mode	Units	Campus
BIO	8211	87400	1, 2009	ONC	1.00	Toowoomba

<b>Academic group:</b>	FOSCI
<b>Academic org:</b>	FOS002
<b>Student contribution band:</b>	6
<b>ASCED code:</b>	010999

### STAFFING

Examiner: Grant Daggard  
Moderator: Guang Liu

### REQUISITES

Co-requisite: BIO2209

### 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. 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. Outline basic molecular tools involved in DNA analysis (e.g. sequencing) which underpin or support bioinformatics based analysis (Exam);
2. Conduct database analyses at the DNA, RNA and protein level. (Assignment 1, 2);
3. Predict molecular structures from genomic information including: promoters, open reading frames (introns, exons), genes and predicted protein structures. (Assignment 1, 2, Exam);
4. Be able to input data into and, interpret output from, a range of bioinformatics software tools (a focus being on widely available web-based packages). (Assignment 1, 2, Exam);
5. Analyse gene homology and predict evolutionary relationships. (Assignment 2, Exam);
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. (Assignment 1, 2, Exam); and
7. describe the limitations of existing techniques (Exam).

## TOPICS

	Description	Weighting (%)
1.	Review of DNA structure and organisation	10.00
2.	Bioinformatics: collecting and assessing genome related data. An historical perspective including the development of public databases and related internet resources.	5.00
3.	Review of basic molecular tools that may be used to generate bioinformatics related data (e.g. Southern Analysis, DNA sequencing)	10.00
4.	Database searching (e.g. FASTA and BLAST algorithms)	15.00
5.	Sequence alignment - pairs, multiple sequence alignment and identifying similar sequences including basic statistical approaches (e.g PAM and BLOSUM index)	20.00
6.	Genome analysis including gene prediction and identification	15.00
7.	Protein classification, structure and prediction	15.00
8.	Phylogenetic relationships	10.00

## 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).

Zvelebil, M & Baum JO 2008, *Understanding Bioinformatics*, Garland Science, (ISBN 0 81 534024 9)

## 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.

Baxevanis, AD & Ouellette, BFF 2005, *Bioinformatics: A practical guide to the analysis of genes and proteins*, 3rd edn, Wiley-Liss,

(ISBN 0471478784)

Higgins, D & Taylor, W 2000, *Bioinformatics: sequence, structure and databanks: a practical approach*, Oxford University Press, Oxford.

(ISBN 0 19 963790 3)

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

(ISBN 0 8053 4633 3)

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

(ISBN 0-7923-7087-2)

Mount, DW 2004, *Bioinformatics: sequence and genome analysis*, 2nd edn, Cold Spring Harbour Laboratory Press, New York.

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

(ISBN 981-238-846-X)

## STUDENT WORKLOAD REQUIREMENTS

ACTIVITY	HOURS
Assessments	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	02 Mar 2009 (see note 1)
ASSIGNMENT 2	20.00	20.00	02 Mar 2009 (see note 2)
2HR RESTRICTED EXAM	60.00	60.00	END S1 (see note 3)

### NOTES

1. Examiner to 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:  
It is the students' responsibility to attend and participate appropriately in all activities (such as lectures, tutorials, laboratories and practical work) scheduled for them, and 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 satisfactorily complete an assessment item a student must achieve at least 50% of the marks or a grade of at least C-. Students do not have to satisfactorily complete each assessment item to be awarded a passing grade in this course. Refer to Statement 4 below for the requirements to receive a passing grade in this course.
- 3 Penalties for late submission of required work:  
If students submit assignments after the due date without (prior) approval of the examiner then a penalty of 5% of the total marks gained by the student for the assignment may apply for each working day late up to ten working days at which time a mark of zero may be recorded. No assignments will be accepted after model answers have been posted.
- 4 Requirements for student to be awarded a passing grade in the course:  
To be assured of receiving a passing grade a student must achieve at least 50% of the total weighted marks available for the course.
- 5 Method used to combine assessment results to attain final grade:  
The final grades for students will be assigned on the basis of the aggregate of the weighted marks obtained for each of the summative assessment items in the course.
- 6 Examination information:  
Candidates are allowed access only to specific materials during a Restricted 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). Students whose first language is not English, may, take an appropriate unmarked non-electronic translation dictionary (but not technical dictionary) into the examination. Dictionaries with any handwritten notes will not be permitted. Translation dictionaries will be subject to perusal and may be removed from the candidate's possession until appropriate disciplinary action is completed if found to contain material that could give the candidate an unfair advantage.
- 7 Examination period when Deferred/Supplementary examinations will be held:  
Any Deferred or Supplementary examinations for this course will be held during the next examination period.
- 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**

- 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.