



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: Advanced Bioinformatics

Subject	Cat-nbr	Class	Term	Mode	Units	Campus
BIO	8213	91460	2, 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>	010900

### STAFFING

Examiner: Grant Daggard

Moderator: Guang Liu

### REQUISITES

Pre-requisite: BIO2209 and BIO8211

### RATIONALE

Bioinformatics brings together the fields of life science, computer science and statistics and is becoming increasingly important 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 large data sets. The creative application of statistics and computer analysis provided by the application of advanced tools in bioinformatics allows students gain a better understanding of the evolution and regulation of biological systems at the molecular level.

### SYNOPSIS

This course builds upon an understanding of basic principles and tools of bioinformatics introduced in BIO8211 Bioinformatics and in particular focuses on the development and application of advanced bioinformatics based tools for analysis of biological information including the building of phylogenetic trees, gene detection and annotation strategies, prediction of RNA and Protein structures and the analysis of gene expression and the proteome. The goal of this course is to be able to apply bioinformatics based discovery techniques to assist in the understanding of cells and organisms at both the molecular and systems level. In a practical context, the course will focus particularly on the use of readily accessible web based databases and analytical tools.

### OBJECTIVES

On completion of this course students will be able to:

1. Outline a range of approaches to the construction of phylogenetic trees (Assignment 1, Examination);
2. Describe theory underlying approaches to gene detection and annotation (Assignment 1, 2, Examination);
3. Describe approaches to prediction of nucleic acid and protein secondary structures (Assignment 2, Examination);
4. Outline approaches to gene expression analysis (Assignment 2, Examination);
5. Describe the concept of Systems Biology (Examination);
6. Describe the limitations of existing bioinformatics techniques (Examination);
7. Interpret output from a number of bioinformatics tools (Assignment 1, 2 and Examination);
8. Use a range of bioinformatics databases and tools to solve biological problems (Assignment 1, 2).

## TOPICS

Description	Weighting (%)
1. Review of basic bioinformatics tools	10.00
2. Evolutionary history and the construction of phylogenetic trees	15.00
3. Theory of gene detection and genome annotation	20.00
4. Prediction of nucleic acid and protein secondary structures	15.00
5. Modelling protein tertiary structures and potential functional relationships	15.00
6. Proteome and gene expression analysis	15.00
7. Systems Biology	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, New York. (ISBN 0815340249)

## 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, Hoboken, NJ. (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 98 1-238-846-X)

## STUDENT WORKLOAD REQUIREMENTS

ACTIVITY	HOURS
Directed Study	39.00
Examinations	2.00
Private Study	89.00
Tutorials	36.00

## ASSESSMENT DETAILS

Description	Marks out of	Wtg (%)	Due date
ASSIGNMENT 1	20.00	20.00	24 Jul 2009 (see note 1)
ASSIGNMENT 2	20.00	20.00	24 Jul 2009 (see note 2)
2 HOUR RESTRICTED EXAM	60.00	60.00	END S2 (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**

- 1 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.