



## COURSE OUTLINE

# MBT355 Bioinformatics

**Course Coordinator:** Renfu Shao (rshao@usc.edu.au) **School:** School of Science, Technology and Engineering

2022 | Semester 1

USC Sunshine Coast  
USC Moreton Bay

**BLENDED  
LEARNING**

Most of your course is on campus but you may be able to do some components of this course online.

*Please go to the USC website for up to date information on the teaching sessions and campuses where this course is usually offered.*

## 1. What is this course about?

### 1.1. Description

This course will introduce you the principles and key concepts of bioinformatics and will start with basics about DNA, RNA and protein, then progress to databases, sequence alignments, evolutionary history reconstruction, genome annotation, and analysis of gene and protein expression. Systems biology, linux system and programming will also be introduced. Computer-based labs will provide you hands-on experience with databases and bioinformatics tools, and develop your skills in the analysis of biological data.

### 1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
<b>BLENDED LEARNING</b>			
<b>Learning materials</b> – The learning materials will introduce you the principles and key concepts of bioinformatics. You will review the basics about DNA, RNA and protein, then progress to databases, sequence alignments, evolutionary history reconstruction, genome annotation, and analysis of gene and protein expression. Systems biology, linux system and programming will also be introduced.	2hrs	Week 1	12 times
<b>Laboratory 1</b> – Computer-based lab practicals will provide you hands-on experience with databases and bioinformatics tools, and develop your skills in the analysis of biological data.	2hrs	Week 1	12 times
<b>Seminar</b> – This seminar in week 13 will guide students to revise the course learning materials and prepare for the end of semester exam.	2.5hrs	Week 13	Once Only

### 1.3. Course Topics

Bioinformatics, sequence, structure, database, genomics, transcriptomics, systems biology, programming

## 2. What level is this course?

300 Level (Graduate)

Demonstrating coherence and breadth or depth of knowledge and skills. Independent application of knowledge and skills in unfamiliar contexts. Meeting professional requirements and AQF descriptors for the degree. May require pre-requisites where discipline specific introductory or developing knowledge or skills is necessary. Normally undertaken in the third or fourth full-time study year of an undergraduate program.

### 3. What is the unit value of this course?

12 units

### 4. How does this course contribute to my learning?

COURSE LEARNING OUTCOMES		GRADUATE QUALITIES
On successful completion of this course, you should be able to...		Completing these tasks successfully will contribute to you becoming...
1	Explain and describe the principles and key concepts of bioinformatics.	Knowledgeable
2	Critically analyse how bioinformatics is used to make discoveries in biological sciences.	Creative and critical thinker
3	Develop skills in literature review, database search, and the use of bioinformatics tools to address questions in biology.	Empowered
4	Demonstrate skills to communicate scientific ideas to a variety of audiences regarding concepts in bioinformatics.	Empowered

### 5. Am I eligible to enrol in this course?

Refer to the [USC Glossary of terms](#) for definitions of “pre-requisites, co-requisites and anti-requisites”.

#### 5.1. Pre-requisites

LFS252 or SCI212

#### 5.2. Co-requisites

Not applicable

#### 5.3. Anti-requisites

Not applicable

#### 5.4. Specific assumed prior knowledge and skills (where applicable)

Basic knowledge in genetics and molecular biology and basic computer skills

### 6. How am I going to be assessed?

#### 6.1. Grading Scale

Standard Grading (GRD)

High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL).

#### 6.2. Details of early feedback on progress

Early feedback will be provided in Weeks 1-4 in the practical reports.

#### 6.3. Assessment tasks

DELIVERY MODE	TASK NO.	ASSESSMENT PRODUCT	INDIVIDUAL OR GROUP	WEIGHTING %	WHAT IS THE DURATION / LENGTH?	WHEN SHOULD I SUBMIT?	WHERE SHOULD I SUBMIT IT?
All	1	Report	Individual	35%	150 words	Throughout teaching period (refer to Format)	Online Submission
All	2	Essay	Individual	30%	2000 words	Week 12	Online Assignment Submission with plagiarism check
All	3	Examination - Centrally Scheduled	Individual	35%	2 hours	Exam Period	Exam Venue

### All - Assessment Task 1: Practical reports

<b>GOAL:</b>	This task is designed to assist you to develop your conceptual understanding and practical skills in bioinformatics. You will use bioinformatics tools to address questions in biology.		
<b>PRODUCT:</b>	Report		
<b>FORMAT:</b>	There are weekly practical activities in this course. Each practical comprises a set of short-answer questions. You are required to submit a report to answer the questions from each practical. Submit each report electronically in the following week after you undertake the practical.		
<b>CRITERIA:</b>	<b>No.</b>	<b>Learning Outcome assessed</b>	
	1	Completeness of all reports	1
	2	Explanations and descriptions	2
	3	Application of bioinformatics tools	3

### All - Assessment Task 2: Essay

<b>GOAL:</b>	To develop research and writing skills and in-depth understanding of scientific literature on a chosen bioinformatics tool and its use in biological discoveries.		
<b>PRODUCT:</b>	Essay		
<b>FORMAT:</b>	You are required to submit an essay developed from your research concerning a bioinformatics tool of your choice. Search and review the literature published in peer-reviewed journals such as Bioinformatics, Genome Research, Molecular Biology and Evolution, Nucleic Acids Research, etc. Limit your essay to 2,000 words (excluding figures, tables, references and appendixes). Your essay must cover the following four aspects:1. Introduction of your chosen bioinformatics tool. Include information such as who developed the tool, what the tool is for, where the tool was published, how users can access this tool, who used the tool, etc. (20%)2. Principles and rationale of your chosen bioinformatics tool. Explain how the tool is designed (30%)3. Use of the bioinformatics tool in biological research. Explain what questions the bioinformatics tool has been used to address. Provide at least two examples in which the tool has facilitated discoveries. (40%)4. Future improvement of the tool. Offer your opinions and comments how the tool may be improved. (10%) Submit your essay electronically to Canvas - Turnitin before 5 pm, Friday, in Week 12 unless you have won an extension by completing the weekly online quizzes and short-answer questions. You will get 1-day extension for submission if you complete all of the online quizzes, and an additional 1-day extension if you complete all of the online short-answer questions. Furthermore, if your total score from the online quizzes and short-answer questions is 165 or above, you will get an extra 1-day extension.		
<b>CRITERIA:</b>	<b>No.</b>	<b>Learning Outcome assessed</b>	
	1	Description of the chosen bioinformatics tool	1
	2	Explanation of the principles and rationale of the tool	2
	3	Application of the tool	3
	4	Appropriate selection of academic literature.	2
	5	Critique of the literature	2
	6	Critical analysis of the tool	2
	7	Communication and use of references	4

### All - Assessment Task 3: End of semester exam

<b>GOAL:</b>													
<b>PRODUCT:</b>	Examination - Centrally Scheduled												
<b>FORMAT:</b>	You will sit a 2-hour exam based on the learning materials given in the course. The exam will be held under official exam conditions in a centralised exam venue. The exam will comprise multiple choice and short-answer questions. Online quizzes and short-answer questions will be provided from each week's learning materials to help you prepare the end of semester exam. You are strongly encouraged to complete all of the online quizzes and short-answer questions.												
<b>CRITERIA:</b>	<table border="1"><thead><tr><th>No.</th><th></th><th>Learning Outcome assessed</th></tr></thead><tbody><tr><td>1</td><td>Knowledge, explanations and descriptions of bioinformatics concepts and principles.</td><td>1</td></tr><tr><td>2</td><td>Critical analysis of how bioinformatics is used to make discoveries in biological sciences.</td><td>2</td></tr><tr><td>3</td><td>Communication of scientific ideas to a variety of audiences regarding concepts in bioinformatics</td><td>3</td></tr></tbody></table>	No.		Learning Outcome assessed	1	Knowledge, explanations and descriptions of bioinformatics concepts and principles.	1	2	Critical analysis of how bioinformatics is used to make discoveries in biological sciences.	2	3	Communication of scientific ideas to a variety of audiences regarding concepts in bioinformatics	3
No.		Learning Outcome assessed											
1	Knowledge, explanations and descriptions of bioinformatics concepts and principles.	1											
2	Critical analysis of how bioinformatics is used to make discoveries in biological sciences.	2											
3	Communication of scientific ideas to a variety of audiences regarding concepts in bioinformatics	3											

## 7. Directed study hours

A 12-unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Directed study hours may vary by location. Student workload is calculated at 12.5 learning hours per one unit.

### 7.1. Schedule

PERIOD AND TOPIC	ACTIVITIES
Week 1 Course introduction; DNA, RNA and protein	Learning materials, Computer lab practical
Week 2 DNA sequencing technology, data generation and quality assessment	Learning materials, Computer lab practical
Week 3 Molecular biology databases	Learning materials, Computer lab practical
Week 4 Sequence alignment	Learning materials, Computer lab practical
Week 5 Revealing genome features	Learning materials, Computer lab practical
Week 6 Human genome analysis	Learning materials, Computer lab practical
Week 7 Protein secondary structure	Learning materials, Computer lab practical
Week 8 Protein tertiary structures	Learning materials, Computer lab practical
Week 9 Protein - from structure to function	Learning materials, Computer lab practical
Week 10 Gene and protein expression analysis	Learning materials, Computer lab practical
Week 11 Systems biology	Learning materials, Computer lab practical
Week 12 Linux system and programming	Learning materials, Computer lab practical
Week 13 Revision and exam prep	Seminar

## 8. What resources do I need to undertake this course?

Please note: Course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Canvas site– Please log in as soon as possible.

### 8.1. Prescribed text(s) or course reader

There are no required/recommended resources for this course.

### 8.2. Specific requirements

Nil

## 9. How are risks managed in this course?

Risk assessments have been performed for all laboratory classes and a low level of health and safety risk exists. Some risk concerns may include equipment, instruments, and tools; as well as manual handling items within the laboratory. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the [online induction training for students](#), and following the instructions of the University staff.

## 10. What administrative information is relevant to this course?

### 10.1. Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Canvas, are electronically checked through Turnitin. This software allows for text comparisons to be made between your submitted assessment item and all other work to which Turnitin has access.

### 10.2. Assessment: Additional Requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

The final mark is in the percentage range 47% to 49.4%

The course is graded using the Standard Grading scale

You have not failed an assessment task in the course due to academic misconduct

### 10.3. Assessment: Submission penalties

Late submission of assessment tasks may be penalised at the following maximum rate (the rates are cumulative):

- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task.

- 10% (of the assessment task's identified value) for the third day

- 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task.

- A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.

To request an extension you must contact your course coordinator to negotiate an outcome.

### 10.4. SafeUSC

USC is committed to a culture of respect and providing a safe and supportive environment for all members of our community. For immediate assistance on campus contact SafeUSC by phone: [07 5430 1168](tel:0754301168) or using the [SafeZone](#) app. For general enquires contact the SafeUSC team by phone [07 5456 3864](tel:0754563864) or email [safe@usc.edu.au](mailto:safe@usc.edu.au).

The SafeUSC Specialist Service is a Student Wellbeing service that provides free and confidential support to students who may have experienced or observed behaviour that could cause fear, offence or trauma. To contact the service call [07 5430 1226](tel:0754301226) or email [studentwellbeing@usc.edu.au](mailto:studentwellbeing@usc.edu.au).

### 10.5. Study help

For help with course-specific advice, for example what information to include in your assessment, you should first contact your tutor, then your course coordinator, if needed.

If you require additional assistance, the Learning Advisers are trained professionals who are ready to help you develop a wide range of academic skills. Visit the [Learning Advisers](#) web page for more information, or contact Student Central for further assistance: +61 7 5430 2890 or [studentcentral@usc.edu.au](mailto:studentcentral@usc.edu.au).

### 10.6. Wellbeing Services

Student Wellbeing provide free and confidential counselling on a wide range of personal, academic, social and psychological matters, to foster positive mental health and wellbeing for your academic success.

To book a confidential appointment go to [Student Hub](#), email [studentwellbeing@usc.edu.au](mailto:studentwellbeing@usc.edu.au) or call 07 5430 1226.

## 10.7. AccessAbility Services

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, learning disorder mental health issue, injury or illness, or you are a primary carer for someone with a disability or who is considered frail and aged, [AccessAbility Services](#) can provide access to appropriate reasonable adjustments and practical advice about the support and facilities available to you throughout the University.

To book a confidential appointment go to [Student Hub](#), email [AccessAbility@usc.edu.au](mailto:AccessAbility@usc.edu.au) or call 07 5430 2890.

## 10.8. Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website: <https://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching>

## 10.9. Student Charter

USC is committed to excellence in teaching, research and engagement in an environment that is inclusive, inspiring, safe and respectful. The [Student Charter](#) sets out what students can expect from the University, and what in turn is expected of students, to achieve these outcomes.

## 10.10. General Enquiries

### In person:

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **USC SouthBank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **USC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **USC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **USC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

**Tel:** +61 7 5430 2890

**Email:** [studentcentral@usc.edu.au](mailto:studentcentral@usc.edu.au)