



The University of Southern Queensland

## Course Specification

### Description: Algebra and Calculus I

Subject	Cat-Nbr	Class	Term	Mode	Units	Campus
MAT	1102	10381	1, 2002	ONC	1.00	TWMBBA

<b>Academic Group:</b>	FOSCI
<b>Academic Org:</b>	FOS003
<b>HECS Band:</b>	2
<b>ASCED Code:</b>	010101

### STAFFING

Examiner: Patricia Cretchley

Moderator: Chris Harman

### RATIONALE

Rates of change and summations are key elements in the analysis of the relationships between measurable quantities. In fields ranging from engineering to economics, mathematically continuous formulations often provide adequate models for reality and the techniques of the differential and integral calculus provide powerful investigative tools. This course provides the opportunity to master the fundamental concepts and operations of calculus. Linear systems arise commonly in many fields of application, including business, economics, engineering and science. Matrix, vector and complex number techniques are often used to model and solve these and associated problems.

### SYNOPSIS

This course deals with the elementary functions of mathematics: polynomials, logarithms, trigonometric functions, their inverses, arithmetic combinations and compositions of these functions and functions implicitly defined through relationships between them. The properties of these functions, the rules for finding their derivatives and anti-derivatives are developed and used in applications and the solution of problems. Systems of linear algebraic equations are formulated and solved in a variety of settings. Vectors, matrices and complex numbers are used to formulate and solve problems from various fields of application, and to describe the geometry of two and three dimensional space.

### OBJECTIVES

On successful completion of this course students should be able to demonstrate:

- Competence in geometric, numeric, and algebraic approaches to concept development and problem solving using the fundamental techniques of algebra and calculus;

- Meaningful representation and solution of practical applications of algebra and calculus;
- The ability to use computer aided methods to develop concepts in algebra and calculus;
- Competence in communicating mathematical ideas and conclusions in writing.
- ability to evaluate approximate rates of change;
- ability to evaluate limits to compare relative sizes of quantities in given neighbourhoods and to find instantaneous rates of change;
- ability to find the derivatives of polynomial, algebraic, exponential and trigonometric functions, and their inverses (where they exist), as well as combinations and compositions of these functions;
- ability to find derivatives of functions defined implicitly;
- ability to find areas under curves;
- understanding of the concept of the definite integral and the fundamental theorem of calculus;
- ability to reconstruct a function from its derivative;
- ability to construct anti-derivatives using definite integrals;
- ability to find integrals using tables, substitution, and integration by parts;
- ability to apply techniques of calculus to solve problems of function behaviour, rates of change, optimisation, and summation;
- ability to use matrices to store and manipulate data;
- ability to apply vectors and their decompositions to physical problems in 2 and 3 dimensions;
- ability to find equations of lines and planes in three dimensions and use these to establish their relative positions and intersections;
- ability to formulate systems of linear equations, where appropriate, find solutions when they exist, and interpret the results meaningfully;
- ability to use matrices and matrix algebra to store and manipulate data;
- ability to simplify and evaluate expressions containing vectors, matrices and complex numbers, and demonstrate understanding of their geometric and algebraic properties;
- ability to solve simple polynomial equations for complex-valued solutions;
- ability to find elementary functions of a complex variable.

## TOPICS

Description	Weighting (%)
1. Calculus Limits and Derivatives, including definitions of the derivative and basic differentiation rules. Applications of Differentiation including the chain rule and maxima and minima problems. Transcendental Functions, including inverse Trigonometric Functions. Techniques of Integration including Mid-point and Trapezoidal approximations and anti-derivative techniques using tables, algebraic and trigonometric substitutions, and integration by parts. Applications of Integration, including areas, arc lengths, volumes, and other physical problems.	50.00

2. Linear Algebra Matrix operations; Gaussian elimination; the inverse matrix. Vectors, dot and cross products, lines and planes. Determinants, adjoint matrices. Arithmetic and geometry of complex numbers, elementary functions of a complex variable. 50.00

**TEXT and MATERIALS required to be PURCHASED or ACCESSED:**

Books can be ordered by fax or telephone. For costs and further details use the 'Book Search' facility at <http://bookshop.usq.edu.au> by entering the author or title of the text.

Note that both these books will also be used for the unit 64613.

Hughes-Hallett, D. (et al), 1998 *Calculus. Single and Multivariable*, 2nd edn, Wiley, New York.

Larson, R. & Edwards, B. 2000 *Elementary Linear Algebra*, 4th edn, Heath, Massachusetts. Study Book, 2002 *Course MAT1102 Algebra and Calculus I*, USQ Distance Education Centre, Toowoomba.

**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.

*MATLAB*, 1999 Version 5, Student Edition, CD and Users Guide, Prentice Hall.

Anton, H. & Rorres, C. 1994 *Elementary Linear Algebra - Applications Version*, 7th Edn, John Wiley, New York.

Hughes-Hallett, D. (et al), 1998 *Calculus. Single and Multivariable*, Student Solution Manual, 2nd edn., Wiley, New York.

Larson, A., Hostetler, R. & Edwards, B. 1994 *Calculus*, 5th edn, D.C. Heath. - or similar calculus texts.

Larson, R. & Edwards, B. 1996 *Student Solutions Guide - Elementary Linear Algebra*, ISBN: 0-660-30643-5.

Larson, R. & Edwards, B. 1996 *Technology Keystroke Guide: Elementary Linear Algebra*, Heath, ISBN: 0-669-39645-1.

**STUDENT WORKLOAD REQUIREMENTS**

ACTIVITY	HOURS
Assessment	16
Examinations	4
Lectures	52
Private Study	65
Tutorial	26

## ASSESSMENT DETAILS

Description	Marks Out of	Wtg(%)	Required	Due Date
ASSIGNMENT 1	100.00	10.00	Y	04 Mar 2002
ASSIGNMENT 2	100.00	10.00	Y	04 Mar 2002 (see note 2)
ASSIGNMENT 3	100.00	10.00	Y	04 Mar 2002 (see note 3)
2 HR RESTRICTED EXAM (PART A)	120.00	35.00	Y	END S1 (see note 4)
2 HR OPEN EXAMINATION (PART B)	120.00	35.00	Y	END S1 (see note 5)

### NOTES:

- Further details about the due dates are detailed in the assessment section of the Course Specifications.
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- Examination dates will be available during the Semester. Please refer to Examination timetable when published.
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## OTHER REQUIREMENTS

- Attendance Requirements:** It is the student's responsibility to ensure that he or she attend the classes, tutorials and computer laboratories for this course, to stay informed about the course, to receive guidance and support, and to ensure the best chance of meeting the objectives and requirements of the course.
- Minimum Requirements to Pass the Course:** To be certain of obtaining a passing grade in this course, students must (i) obtain an overall mark of 50%, and (ii) perform satisfactorily (i.e. get at least close to 50%) in each of the examination papers, and (iii) perform satisfactorily (i.e. get at least close to 50%) in the assignments as a whole.
- Supplementary and Deferred Examination:** If a student obtains an overall mark of 50%, but does not perform satisfactorily in one examination paper, the student may, at the discretion of the examiner, be granted a supplementary examination to increase the mark for that paper before being awarded a pass in the course. A student will normally not be granted a deferred examination for one paper unless he/she performs satisfactorily in the other examination paper and the assignments. Any supplementary or deferred examinations for this course will be held at the end of the next semester in which this course is offered. This course is offered in semesters 1 and 3, but not in semester 2.
- Assignments:** The due date for assessments is the date by which a student must despatch an assignment to the USQ. The onus is on the student to provide proof of the despatch date, if requested by the examiner. Students must retain a copy of

all assignments which must be produced if and when required by the examiner. In accordance with University's Policy on Assignments (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances. This policy may be found in the USQ Handbook, the Distance Education Student Guide and the Faculty of Sciences' Orientation Handbook for new on-campus students. All students are advised to study and follow the guidelines associated with this policy. Assignments submitted late without an approved extension will be penalised 20% per working day late. No marks at all will be granted for submission one week after the due date, because solutions need to be released as a valuable resource for students in this course. Extensions of more than a week are not granted for assignments in this course, because solutions will be available at that stage.

- 5 Examinations: Restricted Examination: a restricted examination is an examination where only those materials specified in the examination paper are permitted during the examination. Students are permitted access to any battery operated calculator, but are NOT permitted to have access to any text, study books or other written materials. Open Examination: an open examination indicates that the candidate may have access to any material during the examination except the following: electronic communication devices, bulky material, devices requiring mains power and material likely to disturb other students. Students may only bring basic writing materials and a calculator into the examination. Graphics calculators and programmable calculators may be used, but not to access or make use of textual information. Nor may students use any other electronic device to give unfair advantage. This may be checked by the invigilator of the examination.
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