The University of Southern Queensland

# Course Specification

| Description: Algebra and Calculus II | | | | | | |
|---|---|---|---|---|---|---|
| Subject | Cat-Nbr | Class | Term | Mode | Units | Campus |
| MAT | 2100 | 14387 | 2, 2002 | EXT | 1.00 | TWMBA |

**Academic Group:** FOSCI
**Academic Org:** FOS003
**HECS Band:** 2
**ASCED Code:** 010101

## STAFFING

Examiner: David Mander
Moderator: Patricia Cretchley

## PRE-REQUISITES

Pre-requisite: MAT 1102

## RATIONALE

This course follows on directly from MAT1102 Algebra and Calculus I in developing the concepts and techniques of calculus and linear algebra for application to problems in engineering and science, or as a basis for higher study in mathematics.

## SYNOPSIS

Module 1 covers multivariable calculus including representation of function of several variables, surfaces and curves in space, partial differentiation, optimisation, directional derivatives, gradient, divergence and curl, line integrals, iterated integrals, Green's theorem. Module 2 is an introduction to differential equations including direction fields, Euler's method, first order separable, first order linear and second order linear with constant coefficients. Module 3 extends the linear algebra of MAT1102 Algebra and Calculus I to cover vector space, bases, dimensions, rank, nullspace, systems of linear equations, projections, transformations, eigenvalues and eigenvectors, diagonalisation with applications.

## OBJECTIVES

On successful completion of this course students will be able to:

- demonstrate an understanding of the differential equations and their solutions;
- distinguish between linear and non-linear differential equations and describe the properties of the solutions of linear differential equations;

- apply qualitative and quantitative methods to obtain solutions of differential equations to an appropriate level of accuracy;
- interpret differential equations and their solutions in terms of models for various physical systems;
- represent functions of two variables as surfaces in space, or contour diagrams;
- find partial derivatives of vector and scalar functions of several variables and demonstrate an understanding of their meaning;
- find directional derivatives and gradients of scalar fields and demonstrate an understanding of their meaning;
- find and classify the critical points of a scalar function of two variables;
- represent curves and surfaces in space by parametric equations, or as a vector function of one or two variables;
- evaluate line integrals through vector or scalar fields;
- find the curl and divergence of a vector field;
- evaluate iterated integrals, demonstrate an understanding of their meaning and apply them appropriately;
- apply Green's theorem;
- describe the properties of the solutions of linear algebraic equations;
- compute appropriate bases for the solution of linear algebra problems including orthogonal projections, linear transformations and eigenvalues and eigenvectors.

## TOPICS

| Description | Weighting (%) |
|---|---|
| 1. Differential Equations - Direction fields - First order linear - Series solution - Taylor series - Euler's method - Second order linear with constant coefficients - Applications | 30.00 |
| 2. Multivariable calculus - Curves in space, vector functions - Geometrical interpretation of derivatives of vector Functions - Surfaces in space, functions of several variables - Partial differentiation - Geometrical interpretation of partial derivatives - Maxima/minima problems - Directional derivatives, gradient of scalar fields - Vector fields, conservative fields, curl and divergence - Line and work integrals - Independence of path - Iterated integrals, order of integration - Areas and volumes - Change of variables in iterated integrals - Green's theorem - Applications of multiple integrals | 40.00 |
| 3. Linear Algebra - Vector spaces, spanning sets, bases, linear independence, dimension - Column and row space, rank, null space, nullity - Linear algebraic equations - Inner products, norm, orthogonality - Projections, least squares fitting - Linear transformations and operators - Markov chains - Eigenvalues and eigenvectors, diagonalisation - Systems of first order differential equations - Powers of a matrix - Symmetric matrices. | 30.00 |

## 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.

Hughes-Hallett, D. et al. (eds.) 1998, 'Calculus. Single and Multivariable' (Available: 2nd edn, Wiley, New York. NOTE: Hughes-Hallett may be purchased in separate single and multivariable volumes.) .

Larson, R. & Edwards, B. 2000, *Elementary Linear Algebra*, 4th edition, Houghton Mifflin, Boston.

## 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.

1997, *Matlab, Student Edition, CD and Users Guide, Version 5*, Prentice Hall.

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

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

Kreysig, E 1999, *Advanced Engineering Mathematics*, 8th edition, Wiley, New York.

Larson, R., Hostetler, R. & Edwards, B 1994, *Calculus with Analytic Geometry*, 5th edition, D.C. Heath, Lexington.

Larson, R. & Edwards, B 2000, *Elementary Linear Algebra: Solutions Guide*, Houghton Mifflin, Boston.

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

## STUDENT WORKLOAD REQUIREMENTS

| ACTIVITY | HOURS |
|---|---|
| Assessment | 16 |
| Examinations | 3 |
| Private Study | 145 |

## ASSESSMENT DETAILS

| Description | Marks Out of | Wtg(%) | Required | Due Date |
|---|---|---|---|---|
| ASSIGNMENT 1 | 50.00 | 15.00 | Y | 30 Aug 2002 |
| ASSIGNMENT 2 | 50.00 | 15.00 | Y | 11 Oct 2002 |
| 3 HR OPEN EXAMINATION | 100.00 | 70.00 | Y | END S2 (see note 3) |

**NOTES:**

3. Examination dates will be available during the Semester. Please refer to Examination timetable when published.

## OTHER REQUIREMENTS

1 Attendance: It is the students' responsibility to participate actively in all classes scheduled for them, and to study all materials provided to them or required to be accessed by them to maximize their chance of meeting the objectives of the course and to be informed of course-related activities and administration.

2 Requirements to Complete Satisfactorily Each Assessment Item: To complete satisfactorily each of the assignments, students must obtain at least half of the marks available for each assignment. To complete satisfactorily the examination, students must obtain at least half of the marks available for the examination.

3 Minimum Requirements to Pass the Course: To be assured of a pass in this course, students must : (i) obtain an overall mark of at least 50%; and (ii) obtain at least 50% of the marks available in the examination; and (iii) obtain an overall mark of at least 50% in the assignments.

4 Grading: Final grades for students will be determined by the addition of the marks obtained in each assessment item, weighted as in the Assessment Details.

5 Supplementary and Deferred Examinations: Students who obtain an overall passing mark, but who do not perform satisfactorily in an 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 all other assessment items. Any supplementary or deferred examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.

6 Assignments: The due date for an assignment is the date by which a student must despatch it to the Faculty of Sciences. Assignments must be received by 5pm on the due date. Students MUST retain a copy of all assignments which must be produced if and when required by the examiner. In accordance with University's Assignment Extension Policy (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.

7 Examinations: 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 materials likely to disturb other students.

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