UNIT OUTLINE
LINEAR ALGEBRA AND CALCULUS

Aims and Rationale

Exposure to and a sound knowledge of mathematical theory, skills and techniques is essential for any scientific or quantitative discipline. This unit provides an introduction to these aspects of mathematics and is applicable to studies in science, technology and business.

Students will become familiar with the mathematical concepts of functions, calculus, vectors and matrices, which will be illustrated through applied problems. Practice in solving these problems will establish an understanding of the mathematical concepts and develop competency in general problem solving.

Learning outcomes

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

1. Demonstrate competency in the interpretation, use and logical communication of mathematical language
2. Use mathematical concepts and techniques to manipulate and solve mathematical expressions involving functions of a single variable, their derivatives and integrals, matrices and vectors.
3. Employ mathematical techniques to solve elementary problems provided in a particular context.

Content

The major topics covered are vectors, matrices, simultaneous equations, determinants, eigenvalues, eigenvectors, extreme value theorem, maxima and minima, sequences, series, techniques of integration, numerical methods and applications.

This unit covers the mathematical definition of vectors and matrices, and presents applied problems to illustrate how these may be used to model real world applications through systems of equations and their solutions by Gaussian elimination. Determinants are discussed as are eigenvalues and eigenvectors and associated applied problems.

The processes of differentiation and integration of elementary functions are revised and simple examples for problem solving involving functions of a single variable are developed. Techniques such as implicit differentiation and integration by substitution are all employed to solve contextualized problems.

Mathematical software will be integrated into the learning activities to support and illustrate the understanding of concepts.

Class contact

3 Lecture hours, 1 Tutorial hour, 1 Computer Laboratory hour

It is expected that all students will attend all lectures where unit content will be introduced and the associated skills will be demonstrated and discussed. Content and skills will be reinforced in tutorials where students will be given the opportunity to discuss the unit material. These compulsory sessions are designed to reinforce key elements of content and to provide students with direct assistance.

The computer sessions are also compulsory and are designed to allow students to develop and consolidate knowledge of the scientific manipulation package MATLAB.

Participation in the voluntary First Year Learning Centre support sessions is recommended for those students needing additional specific learning help.

Lecture material, tutorial sheets, assignment details and related resources are provided via Blackboard. It is each student's responsibility to check the unit site regularly.

Assessment

The assessment items in this unit are designed to determine the student's level of competency, measured against given criteria, in meeting the unit outcomes while providing a range of activities that will also increase skills. For in-semester assessment, formative feedback will be provided through written comments and discussion in tutorials.

A table of assessment components and weightings is below.

Tutorial Exercise	20%	There will be 5 assignments each comprising of short answer questions on recently presented course material. Assignments will be available on the unit webpage. Each assignment is worth 4%. A cover sheet must be included and can be found on the unit webpage or next to the assignment boxes. Marked assignments will be returned at tutorials and solutions will be posted on the course web-page.
MATLAB worksheets	10%	There will be 10 MATLAB worksheets to be completed during your weekly MATLAB laboratories. These will be available on the unit webpage. Each worksheet contributes 1% to the total assessment.
Exam Mid Semester (during class)	15%	This 45 minute test will be held during class and will comprise of short answer questions and problem solving.
Exam During Examinaton	55%	This 120 minute examination will be scheduled during the final examination sessions and will

Period (central)_		comprise of short answer questions and problem solving.

Resource materials

A unit webpage has been set up and contains a range of information and support materials. This webpage should be check at least once a week.

There is a UNIT WORKBOOK, which will form the outline for lectures. During each lecture a number of pages will be covered and students will be encouraged to write various hints, interpretations, solutions and comments in the appropriate spaces in the workbook. This workbook can be purchased from the bookshop or downloaded from the unit webpage.

Recommended Textbook

James Stewart, Calculus (6th Ed), Thomson Brooks/Cole, 2009

Anton and Rorres, Elementary linear algebra, 9th edition, Wiley 2005.