MATH10131 - 2006/07

General Information

- Title: Calculus and Vectors
- Unit code: MATH10131
- Credits: 15
- Prerequisites: A-Level Mathematics
- Co-requisite units: This course unit can only be taken with MATH10131 *Sets, Numbers and Functions*
- School responsible: Mathematics
- Member of staff responsible: Dr. Jack Williams

Specification

Aims

The programme unit aims to provide an introduction to the basic elements of calculus.

Brief Description of the unit

This lecture course introduces the basic ideas of complex numbers relating them the standard transcendental functions of calculus. The basic ideas of the differential and integral calculus are revised and developed. Vectors in two and three dimensions are introduced and this leads on to the calculus of functions of more than one variable and the beginnings of vector calculus.

Learning Outcomes

On successful completion of this module students will have acquired an active knowledge and understanding of some basic concepts and results in calculus.

Future topics requiring this course unit

Almost all Mathematics course units will rely on material in this course unit.

Syllabus

1. Numbers and Functions. Basic algebra of real and complex numbers; real line and complex plane; graphs and curve sketching; functions, domain and range, inverse functions; standard functions and inverse functions; basic algebra of real and complex numbers.
2. Limits and Differentiation. Basic notion of limit and continuity; discontinuities, left and right limits; finding some limits; definition of derivative; derivatives of standard functions and their inverses; sums, products, quotients and the chain rule; implicit functions; logarithmic differentiation; higher derivatives (use in curve sketching).
3. Infinite Series. Notation, basic notions of convergence, radius of convergence; infinite Taylor's series; expansions for standard functions.
4. More on Complex Numbers. Euler's Theorem and De Moivre's Theorem; polar form of complex numbers (polar representation of the plane); roots of unity; complex forms of *sin* and *cos*, relationship to trigonometric identities.
5. Integration. Definite and indefinite integrals; Fundamental Theorem of Calculus; techniques: linearity, integration by parts, partial fractions, substitution; lengths of curves, surfaces and volumes of revolution.
6. Vectors in 2 and 3 Dimensions. Representation as directed line segments (magnitude, direction); choice of axes, components, Cartesian representation; basic properties, addition, subtraction, polar representation and relationship with complex numbers in 2 dimensions; scalar and vector product; representation of lines, planes, curves and surfaces.

7. Functions of more than One Variable. Partial derivative, chain-rule, Taylor expansion; turning points (maxima, minima, saddle-points); *grad*, *div* and *curl* and some useful identities in vector calculus; integration in the plane, change of order of integration; Jacobians and change of variable; line integrals in the plane; path-dependence, path independence.

Textbooks

The course is based on the following text:

James Stewart, Calculus, Early Transcendentals, Thomson, fifth edition (international student edition), 2003.

Notes will be issued for the material not covered in the course text.

Teaching and learning methods

Three lectures and one supervision class each week.

Assessment

Supervision attendance and participation; Weighting within unit 10%
Coursework; Weighting within unit 15%
Two and a half hours end of semester examination; Weighting within unit 75%

Arrangements