MATH0046 Calculus in Several Dimensions

Year:	2021–2022
Code:	MATH0046
Level:	4 (UG)
Normal student group(s):	UG: Students outside Mathematics
Value:	15 credits(= 7.5 ECTS credits)
Term:	2
Assessment:	85% examination, 15% coursework
Normal Pre-requisites:	MATH0045
Lecturer:	Dr Y Naqvi

Course Description and Objectives

This course is a continuation of the MATH0045 course. The emphasis is on developing technique rather than full rigour. Topics covered include optimisation with a constraint, complex numbers, differential equations, multiple integrals, eigenvalues and eigenvectors and quadratic forms.

Recommended Texts

G Stephenson, *Mathematical Methods for Science Students* (Longman).
Riley, Hobson and Bence, *Mathematical Methods for Physics and Engineering* (CUP).

Detailed Syllabus

Review of unconstrained optimisation. Optimisation problems with a constraint. Use of Lagrange multipliers. Examples of optimisation problems with inequality constraints.

Complex numbers. The Argand diagram, modulus and argument, complex-conjugate. Cartesian and polar forms. De Moivre's Theorem. Roots of polynomials. Introduction to the Fundamental Theorem of Algebra.

Review of the linear independence of vectors and determinants of larger matrices. Eigenvalues and eigenvectors of a matrix. Diagonalisation of a matrix. Properties of symmetric matrices. Quadratic form.

First order differential equations. Separation of variables. General linear equation and integrating factor. First–order linear systems with constant coefficients.

Multiple integrals. Reduction to a repeated integral. Change of the order of integration in a repeated integral. Cylindrical and spherical polar co-ordinates. Change of variables and the Jacobian. Gamma and Beta functions, Stirling's formula.