MATH0010 Mathematical Methods 1

Year:	2024–25
Code:	MATH0010
Level:	4 (UG)
Normal student group(s):	UG: Year 1 Mathematics degrees
Value:	15 credits (= 7.5 ECTS credits)
Term:	1
Assessment:	The final weighted mark for the module is given by: 75% examination, 15% coursework, 10% mid-sessional exam. In order to pass the module you must have at least 40% for both the examination mark and the final weighted mark.
Normal Pre-requisites:	A* in A-level Mathematics and Further Mathematics
Lecturer:	Dr S Coskey

Course Description and Objectives

The aim of the course is to bring students from a background of diverse A-level syllabuses to a uniform level of confidence and competence in vectors, complex numbers, calculus and differential equations. The course covers vectors, complex numbers, standard functions of a real variable, methods of integration, ordinary differential equations and probability. Each topic is given a formal treatment and illustrated by examples of varying degrees of difficulty.

The *elementary techniques test* will be run online and may be taken multiple times during the term. It will consist of 10 basic calculational questions; you must get at least 9 correct answers to pass. It is necessary to pass this test **in order to pass the module.**

Recommended Texts

(i) Safier, *Precalculus.*

(ii) Spiegel, *Advanced Calculus.*

(iii) Ayres, *Differential Equations* (all Schaum's Outline Series).

(iv) Gilbert, Jordan, Towers *Guide to Mathematical Methods* (Palgrave Macmillan).

(v) Riley, Hobson, and Bence, *Mathematical Methods for Physics and Engineering* (Cambridge University Press).

(vi) Kreyszig, *Advanced Engineering Mathematics* (Wiley).

(vii) Stephenson, *Mathematical Methods for Science Students* (Prentice Hall).

(viii) Stirzaker, *Probability and Random Variables: A Beginner's Guide* (Cambridge University Press).

Detailed Syllabus

Vector algebra: Scalar and vector products including triple products. Cartesian components. Applications to 3-dimensional geometry: lines and planes.

Complex numbers: Argand diagram, loci, roots of unity, geometry.

Revision of simple functions: Powers, exponentials, trig, hyperbolic. Differentiation. Maclaurin and Taylor series. Elementary properties of plane curves, curve sketching.

Systematic revision of integration: Partial fractions, by parts, substitution. Definite and indefinite integrals. Improper integrals.

Functions of several variables: Surface sketching, partial and directional derivatives, gradient of a function, level surfaces and tangent planes.

Introduction to ordinary differential equations: First order (linear and non-linear). Second order reducible to first order. Linear equations of second and higher order (particular integral and complementary function).

Probability: Sets. Sample spaces. Probability. Binomial distribution. The Poisson distribution. Normal distribution.