Calculus and Vectors (2005) *MT1121*

Syllabus:

Numbers and Functions: real numbers and real line, ordering and inequalities, intervals, infinity; complex numbers and complex plane, complex conjugate, absolute value (modulus); basic algebra of real and complex numbers; graphs and curve sketching; functions, domain and range; sums, products, quotients, composition, inverse functions; standard functions and their inverses; transformation, scaling, shifting, change of variable.

Limits and Differentiation: basic notion of limit and continuity; limits of sums, products, quotients, compositions; intermediate value theorem; discontinuities, left and right limits; finding some limits, l'Hopital's rule, big-O notation; definition of derivative; mean value theorem; derivatives of standard functions and their inverses; sums, products, quotients and chain rule; implicit and parametric functions; logarithmic differentiation; higher derivatives (use in curve-sketching).

Infinite series: notation, basic notion of convergence, radius of convergence; infinite Taylor's series; expansions for standard functions; truncation of infinite series, error terms, use of big-O notation; approximation of functions.

More on Complex Numbers: Euler's theorem and de Moivre's theorem; polar form of complex numbers; roots of unity; complex forms of sin and cos, relationship to trigonometric identities.

Integration: definite and indefinite integrals; fundamental theorem of calculus; proper and improper integrals; techniques for integration: linearity, integration by parts, partial fractions, substitution; lengths of curves, surfaces and volumes of revolution.

Vectors in 2-D and 3-D: representation as directed line segments (magnitude, direction) choice of axes, components, Cartesian representation; basic properties, addition, subtraction; scalar and vector product; representation of lines, planes, curves and surfaces; polar representation and relation to complex numbers in 2-D; cylindrical and spherical polar representation in 3-D; other orthogonal coordinate systems.

Functions of more than one variable: partial derivative, chain-rule, Taylor expansion; turning points (maxima, minima, saddle-points); Lagrange multipliers; grad, div, 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; Green's and Stokes' theorem in the plane.

Classes:

Monday	9:00am	Chemistry G.51
Tuesday	10:00am	Chemistry G.51
Thursday	9:00am	Reynolds C.2
Friday	11:00am	Schuster - Rutherford

plus one small-group supervision class per week

Texts:

James Stewart. Calculus, Early Transcendentals, 5th Edition (International Student Edition).
This text covers almost every aspect of what you will be learning, with many examples.
It is recommended that you purchase this book, or ensure that you can have easy access to a copy.

Hugh Neill and Douglas Quadling. Cambridge Advanced Mathematics Core 3 & 4.
This text describes well and clearly what should be known from A-level.
It (as for other A-level texts) provides an introduction to what should be known before entering a university calculus course.

Web Page: `www.ma.umist.ac.uk/jwd/calculus`