Queen Mary
University of London

MTH4101 — Calculus II

Syllabus and book coverage — Spring 2013

1. **Derivatives IV**. Functions of two variables. Domain, range and level curves. Graphing a function of two variables. Limits and continuity in the xy-plane. Partial derivatives. Statement and use of "mixed derivatives theorem" without proof. Differentiability and continuity and related theorems without proof. Chain rule for functions of two and three variables. Implicit differentiation revisited (Implicit Function Theorem). (Thomas, Chapters 14.1 to 14.4, pages 747–783 + lecture notes)

2. **Derivatives V**. Directional derivatives and gradient vector. Tangent planes and normal lines. Estimating change in a specific direction. Linearization and differentials. Extreme values and saddle points. Lagrange multipliers. (Thomas, Chapter 14.5 to 14.8, pages 784–820 + lecture notes)

3. **Integration III**. Double integrals as volumes under surfaces and areas in the plane. Properties of double integrals. Double integrals as repeated integrals, rectangular regions, simple non-rectangular regions. (Thomas, Chapters 15.1 to 15.2, pages 836–845 + lecture notes)

4. **Integration IV**. Double integrals over non-rectangular regions, bounded and unbounded. Determining limits of integration. Reversing the order of integration. Transformations of variables – maps, domains, one-to-one maps, inverse maps. (Thomas, Chapters 15.2 to 15.3, pages 845–852 + lecture notes)

5. **Integration V**. Change of variables in double integrals. Jacobians. Transformation to polar coordinates. Other transformations. Applications to normal distribution in probability. Triple and multiple integrals. Change of variables of integration. Applications of integrals. (Thomas, Chapter 15.8, pages 887–898, Chapter 15.4, pages 853–859, Chapter 15.5, pages 859–868 + lecture notes)

6. **Series I**. Infinite sequences. Converging sequences. Diverging to infinity sequences. Calculating limits of sequences, including use of l'Hopital's rule. Infinite series (n-th term, partial sum, convergence, sum). Examples of converging series. Examples of diverging series. The n-th term test for divergence. (Thomas, Chapters 10.1 to 10.2, pages 532–552 + lecture notes)

7. **Series II**. Series of positive terms and the Integral Test for convergence (second look at improper integrals). The ratio test. (Thomas, Chapters 10.3, pages 553-558, Chapter 10.5, pages 563–565 + lecture notes)

8. **Series III**. Power series and convergence. Term-by-term differentiation and integration. Power series in the complex plane including existence of radius of convergence. Taylor and Maclaurin series and polynomials (via integration by parts). First look at the remainder term. Various forms of the remainder term. Convergence of the Taylor series. Taylor series for common transcendental functions (exp, log, sin, cos, square root, cosh and sinh). Examples of applications of power series (power series solutions of differential equations, evaluating non-elementary integrals, evaluating indeterminate forms) (Thomas, Chapters 10.7, pages 575-584, Chapter 10.8, pages 584–589, Chapter 10.9, pages 589–596, Chapter 10.10, pages 596–604 + lecture notes)

9. **A first look at differential equations**. First-order separable differential equations. First-order linear differential equations by the method of integrating factor. (Thomas, Chapter 7.4, pages 387–390, Chapters 9.1 to 9.2, pages 504–507 + lecture notes)

The **Learning Outcomes** for this module are available online under the link
`http://www.maths.qmul.ac.uk/undergraduate/modules/learning-outcomes#MTH4101`.

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