The LTCC fosters the training of doctoral research students in the Mathematical Sciences. Its courses cover the areas of Statistics, Applied Mathematics and Pure Mathematics, with the aim of providing students with an overview of these areas, and of acquiring a working knowledge of classical results and recent developments in their own broad research fields but outside the specialised domains of their individual research projects. There is a wide range of expertise among the staff of the institutions currently in the LTCC consortium:

- Departments of Mathematics and Statistical Science, University College London (UCL)
- The School of Mathematical Sciences, Queen Mary University of London
- Department of Mathematics, Imperial College London
- Department of Mathematics, King's College London
- Departments of Mathematics and Statistics, The London School of Economics and Political Science (LSE)
- Department of Mathematics, City St George's, University of London
- Department of Mathematics, Statistics and Actuarial Science, University of Kent
- Department of Mathematics, Royal Holloway University of London
- School of Mathematics and Statistics, Open University

The LTCC programme emphasises direct teaching and personal contact rather than distance learning, and includes modular lecture courses and short intensive courses.

Note: A fee is payable by students from non-LTCC departments/institutions.

Lecture venue:

De Morgan House
57-58 Russell Square
London

Office address:
LTCC
Department of Mathematics
University College London
Room 610, 25 Gordon Street
London WC1H 0AY

Phone: 020 7679 4309
E-mail: office@ltcc.ac.uk
www.ltcc.ac.uk

This course list is subject to change. Further information, venue details, full text syllabi, the registration form and timetable are available online at **www.ltcc.ac.uk** or contact us at office@ltcc.ac.uk

Advanced Courses 2025 - 2026

LTCC

London Taught Course Centre

for PhD students in the mathematical sciences

6 October - 3 November 2025 (Block 1)

No Advanced courses scheduled.

10 November - 8 December 2025 (Block 2)

Advanced Computational Methods in Statistics
Dr Nikolas Kantas, Imperial

This course will provide an overview of Monte Carlo methods when used for problems in Statistics. We will cover Markov Chain Monte Carlo and Sequential Monte Carlo with a focus on the methodology and its relevance to applications. We will also often mention relevant theoretical results and their practical importance.

Toric Varieties
Professor Tyler Kelly, QMUL

This course introduces toric varieties, a class of algebraic varieties built from combinatorial data. Toric varieties have found use across many parts of algebraic geometry studied in London, including tropical geometry, enumerative geometry, and mirror symmetry.

12 January - 9 February 2026 (Block 3)

Advanced Time-Series Modelling and Estimation
Dr Giulia Livieri, LSE

This course explores methods for analysing multiple time series, focusing on Vector Autoregressive (VAR) models for forecasting and dynamic analysis. It covers model estimation, cointegration, and, time permitting, advanced techniques like structural VAR, multivariate GARCH, and Score-Driven models to enhance econometric analysis and economic decision-making.

Algebraic de Rham cohomology and flat connections
Dr Netan Dogra, KCL

We will provide an introduction to the definitions and basic properties of algebraic de Rham cohomology and flat connections, and discuss a few applications in geometry and number theory.

Elliiptic Partial Differential Equations
Dr Shengwen Wang, QMUL

Partial differential equations are widely used as a tool in many fields including geometry and physics. The course will be an introduction to elliptic partial differential equations and its existence and regularity theory. We aim to cover the maximum principle, Schauder theory, and De Giorgi-Nash-Moser estimate. Application of the theory to minimal surface equations will also be illustrated.

Explicit Inertial Langlands Correspondence for GL(2)
Dr Lassina Dembélé, KCL

In this minicourse, we will describe an algorithmic approach to the inertial Langlands correspondence for GL(2). We will start with a review of the correspondence in the theoretical setting, then we will explain how one can rewrite it in a way that is suitable for computer implementation. Our main reference will be the book by Bushnell and Henniart.

High-Dimensional Statistics
Dr Yanbo Tang, Imperial

A brief introduction to high-dimensional statistics, focusing on sparse linear regression, covariance estimation, and principal component analysis. This course will also introduce some concentration inequalities and basic random matrix theory, which are commonly used in theoretical statistics and probability outside of high-dimensional statistics.

Numerical Methods for Elliptic Partial Differential Equations
Professor Stephen Langdon, Brunel

Partial differential equations can be used to model many physical systems. Construction of analytical solutions is impractical for all but the most basic scenarios, hence numerical methods are often required. In this course we derive, implement and analyse some numerical methods for the solution of model elliptic partial differential equations.

Random-matrix Methods in Statistical Mechanics
Dr Lennart Dabelow, QMUL

After briefly introducing quantum statistical mechanics, we discuss selected methods from random matrix theory and pair them with applications in statistical mechanics. Macroscopic systems exhibit stable, regular behaviour despite the complicated, usually uncontrollable dynamics of their microscopic constituents. Random-matrix methods help explaining this through measure concentration and emerging typical behaviour that conforms with thermodynamic expectations.

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16 February - 16 March 2026 (Block 4)

Harmonic analysis and number theory
Professor Igor Wigman & Dr Steve Lester, KCL

This course explores harmonic analysis and number theory, focusing on estimating exponential sums and their applications, including lattice point distribution and uniform distribution mod 1. It is self-contained, assuming familiarity with undergraduate analysis and introductory Fourier analysis; prior exposure to analytic number theory is helpful but not required.

Integrable Systems and Solitons
Professor Rod Halburd, UCL

Integrable systems (equations with many conserved quantities) arise in many applications in pure and applied mathematics, such as fluid mechanics. We will study the inverse scattering transform for soliton equations as well as other solution-generating methods. Other topics will include the Hamilton-Jacobi equation, integrable PDEs of hydrodynamic type and soliton gases.

Kernel Methods in Machine Learning and Statistics
Dr Nikolas Nüsken, KCL

This course explores the mathematical foundations of reproducing kernel Hilbert spaces (RKHS) and Gaussian processes, highlighting connections and applications in machine learning and statistics. Regression serves as a running example to examine RKHS, Gaussian processes, kernel trick, and deep learning perspectives, concluding with an overview of kernel-based probability measure discrepancies.

Mathematical Topics in General Relativity
Professor Juan A. Valiente Kroon, QMUL

This course will provide a general discussion of General Relativity as an initial value problem. In addition, it will serve as an introduction to applied methods of Differential Geometry and Partial Differential Equations.

Towards moduli of foliations
Dr Sebastián Velazquez, KCL

This is a general introduction to the moduli theory of foliated varieties. We will review some notions regarding foliations and deformation theory, together with different approaches to constructing parameter spaces for foliations. Finally, we will present key ideas behind recent developments in the construction of KSBA type moduli spaces of foliated varieties.