

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
WC1B 4HS

Office address:

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Department of Mathematics
University College London
Room 610, 25 Gordon Street
London WC1H 0AY

Phone: 020 3108 2265
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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 2026 - 2027

LTCC

London Taught Course Centre

for PhD students in the mathematical sciences

5 October - 2 November 2026 (Block 1)

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.

Cohomology of Abelian Varieties

Dr Sudip Pandit, KCL

This course provides a concise introduction to singular, de Rham, étale, and crystalline cohomology theories through their explicit descriptions. Additionally, it highlights their relevant applications to the arithmetic and geometric properties of abelian varieties.

Spectral Gap In Smooth Dynamics

Dr Zhiyuan Zhang, Imperial

This course covers the bridge between classical ergodic theory and modern functional analysis. It investigates chaotic, hyperbolic systems—like geodesic flows and Anosov maps—by tracking density evolutions via transfer operators. Utilizing anisotropic Banach spaces and Dolgopyat's inequality, the material demonstrates spectral gaps, exponential mixing, and equidistribution for deterministic and random dynamics.

9 November - 7 December 2026 (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.

Continuum Mechanics Beyond Newtonian Fluids

Dr Cheng-Tai Lee, OU

This course introduces continuum modelling approaches for soft and biological materials beyond Newtonian fluid mechanics. It focuses on elasticity and viscoelasticity as basic extensions of fluid mechanics, then connects these ideas to internally driven living matter, where nonequilibrium mechanical responses and instabilities can emerge.

Landau-Ginzburg Models

Professor Tyler Kelly, QMUL

Landau-Ginzburg models are natural objects in mirror symmetry. Their geometry is encoded in the singularity theory of a regular function from a quasi-affine variety to the affine line. We will explain some of the theories built from them used in mirror symmetry, derived categories, and/or enumerative geometry.

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.

Spectral Geometry

Dr Emily Dryden, KCL

Spectral geometry studies the interplay between the geometry of an object and the eigenvalues of an operator acting on functions on that object. The field is often introduced with Mark Kac's question, "Can one hear the shape of a drum?" We focus on the Laplace operator in two dimensions.

11 January – 8 February 2027 (Block 3)

Intersection Theory

Dr Simon Cooper, KCL

Intersection theory concerns the study of algebraic cycles, which play an important role in modern algebraic geometry and the theory of motives. This course will introduce the Chow ring, an invariant of algebraic varieties that houses their algebraic cycles. We will study its basic properties and touch upon some conjectures.

Mathematical Topics of 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.

Nonlinear Free Surface Flows with Gravity and Surface Tension

Professor Jean-Marc Vanden-Broeck, UCL

This course is concerned with the computation of nonlinear free surface flows. Both the effects of surface tension and gravity are included in the dynamic boundary condition. Special attention is devoted to the singular behaviour at the points where free surfaces intersect rigid walls.

Torelli Theorems

Dr Nikon Kurnosov, LIMS

In this course we study how a geometric object can be uniquely reconstructed from its Hodge structure or period domain. We will introduce a notion of the period map and see its subjectivity for a large class of varieties. We will start with curves and establish variational techniques.

Selective Inference

Professor Alastair Young, Imperial

Standard statistical procedures are unreliable when the parameter of interest is selected using the same data as used to perform the inference. This is particularly relevant in contemporary high-dimensional settings, where inference is only provided for those aspects of a statistical model that appear most worthy of formal analysis. This course covers the main methodological approaches to adjusting for such 'data snooping'.

15 February – 15 March 2027 (Block 4)

Elliptic 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.

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.

Matroid Theory

Professor Federico Ardila, QMUL

Matroid theory originated in linear algebra and graph theory, and found connections to field theory, matching theory, submodular optimization, Lie combinatorics, and total positivity, among others. Recently the (classical, polyhedral, algebraic, and tropical) geometric roots of the field have grown much deeper, bearing new fruits. We survey some recent successes.

Numerical Relativity

Dr Katy Clough, QMUL

In this course we use a python code called engrenage (<https://github.com/GRTLCollaboration/engrenage>) to illustrate the concepts of numerical relativity - the solution of Einstein's equations of general relativity on a computer as a Cauchy problem - and techniques for the numerical solution of coupled non-linear PDEs. The course will consist mainly of hands-on exercises.