The LTCC

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, 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, LSE
- Departments of Mathematics, City, University of London
- SMSAS, University of Kent
- Department of Mathematics, Brunel University London
- Department of Mathematics, Royal Holloway University of London
- School of Mathematics and Statistics, Open University
- Department of Economics, Mathematics and Statistics, Birkbeck

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.

Basic courses 2021-2022

Lecture venues will be on the UCL campus.

For up-to-date information on courses and venue, please visit www.ltcc.ac.uk/timetable.

Office address:
LTCC
Department of Mathematics
University College London
Gower Street
London WC1E 6BT

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

London Taught Course Centre

for PhD students in the mathematical sciences

LTCC

London Taught Course Centre

Basic Courses 2021–2022

4 October - 1 November 2021 (Block 1)

Measure Theory
Dr R. Simon, LSE
We cover the basic structure of measures, starting with the algebra of sets on which a measure is defined. We explore the concept of outer measure and its most common application, the Lebesgue measure on Euclidean space. We end the course by applying measures to functions and their integration, including the monotone and dominated convergence theorems.

Applied Bayesian Methods
Prof P. Dellaportas, UCL
This course introduces the Bayesian approach to statistical inference and relevant theories, methodologies and computational techniques for its implementation.

Models
Dr O. Kerr, City
This course examines basic principles behind modeling, and looks at a variety of qualitative and quantitative models and their application.

Advanced Computational Methods in Statistics
Dr N. Kantas, Imperial
This course will provide an overview of Monte Carlo methods when used for problems in Statistics. After an introduction to simulation, its purpose and challenges, we will cover in more detail Importance Sampling, Markov Chain Monte Carlo and Sequential Monte Carlo. Whilst the main focus will be on the methodology and its relevance to applications, we will often mention relevant theoretical results and their importance for problems in practice.

This course list is subject to change. For up-to-date information on courses and venue, please visit www.ltcc.ac.uk/timetable.

Further information, full text syllabi, the registration form and timetable are available online at www.ltcc.ac.uk or contact us at office@ltcc.ac.uk.

8 November - 6 December 2021 (Block 2)

Stochastic Processes
Dr T. Soo, UCL
This course aims to introduce the main ideas and methods of simple applied probability, together with examples of a variety of applications. Main topics: Markov chains in discrete and continuous time, and Poisson-based processes.

Measure-theoretic Probability
Prof A. Gnedin, QMUL
The course provides a measure-theoretic background for modern Probability Theory and introduces important stochastic processes. The selected topics include construction of measures, conditioning and martingales, types of convergence and limit theorems, construction and properties of Brownian motion, weak convergence of measures in application to Donsker's invariance principle. Each lecture is supplemented by a set of exercises of varying levels of difficulty.

Graph Theory
Prof J. Boettcher, LSE
Our aims in this course would be twofold. First, to discuss some of the major results of graph theory, and to provide an introduction to the language, methods and terminology of the subject. Second, to emphasise various approaches (algorithmic, probabilistic, etc) that have proved fruitful in modern graph theory: these modes of thinking about the subject have also proved successful in other areas of mathematics, and the skills learnt in this course should be transferable to other areas of mathematics.

Fundamental Theory of Statistical Inference
Prof A. Young, Imperial
This course describes the key aspects of Bayesian, Fisherian and frequentist approaches to statistical inference. The module will cover: statistical inference from a decision-theoretic perspective; Bayesian methods; exponential and transformation families of models; principles of statistical inference and data reduction; key elements of frequentist theory of point estimation and hypothesis testing.

Analytical Methods
Prof N. Ovenden, UCL
We will study perturbation methods in the context of ordinary and partial differential equations. Topics covered will include matched asymptotics, steepest descents, conformal mappings, WKB expansions and multi-scale analysis.

10 January - 7 February 2022 (Block 3)

Introduction to Harmonic Analysis
Prof A. Sodin, QMUL
The course will serve as an introduction to harmonic analysis, including the Discrete Fourier transform, Fourier series, and Fourier integrals. Particular emphasis will be put on the applications of harmonic analysis in other parts of mathematics, including number theory, probability theory and partial differential equations.

Theory of Linear Models
Dr K. Mylona, KCL
This course covers the theory of linear models, with an emphasis on the most general results for estimation and inference in both small and large samples. Extensions to other classes of models will be discussed, especially where this builds on linear models theory.

Applications of Complex Analysis
Prof R. Halburd, UCL
After an introduction to elliptic functions we will study Abelian and Baker-Akhiezer functions from the theory of Riemann surfaces and use them to find classes of solutions to some important nonlinear PDEs appearing in applications such as water waves. Rigorous asymptotic methods for ODEs will also be discussed.

14 February - 14 March 2022 (Block 4)

Variational and Computational Methods for PDEs
Prof S.E. Mikhailov, Brunel University
The main aim of the course is to familiarise the students with basic ideas of variational methods for partial differential equations and applications in finite element method.
We will discuss variational formulations of elliptic problems, their relations with the finite element method, and the Sobolev spaces.

Mathematical Aspects of Quantum Computing
Prof. S. Majid, QMUL
We provide an introduction to the mathematics of quantum computing. After elementary notions such as qubits, entanglement, quantum gates and so-called quantum teleportation, the course focuses on algebraic and categorical structures, particularly Frobenius algebras, ZX-calculus based on interacting pairs of Hopf algebras, monoidal and braided monoidal categories. The course ends with an introduction to Kitaev surface code models for topologically fault-tolerant quantum computing.

Maximum Entropy Models of Complex Networks
Prof G. Bianconi, QMUL
This course will introduce the most relevant properties of complex networks and the fundamental statistical principles at the basis of maximum entropy models of networks.