UNIVERSITY OF LIVERPOOL

Mathematics and Philosophy BA (Hons)

COURSE DETAILS

- A level requirements: ABB
- UCAS code: GV15
- Study mode: Full-time
- Length: 3 years

KEY DATES

- Apply by: 29 January 2025
- Starts: 22 September 2025

Course overview

What are numbers? Do they exist? How can we know about them if they are not to be found in the familiar world of space and time that we inhabit? These are just some of the philosophical questions raised by the study of Mathematics.

INTRODUCTION

The relationship between philosophy and mathematics runs both ways: mathematics has helped formalise the study of logical argument that lies at the base of all good philosophy. So, it is no surprise that some of the greatest philosophers (eg Descartes, Leibniz, Frege, and Russell) have been mathematicians too.

This programme allows you to study Mathematics and Philosophy in equal amounts over three years. The Philosophy component of the degree course includes modules in logic and the formal study of reasoning, in which you will learn how to assess arguments and construct proofs. You will learn how to understand complex and demanding texts, and to recognise good and bad arguments. In Mathematics, the core first-year modules introduce fundamental ideas, and are designed to bridge the gap between previous study and university. In subsequent years, you will generally take four modules in mathematics each year, choosing either to specialise or to continue to study a broad range of topics.

By the end of the programme, you will be able to understand complex and demanding texts, reason intelligently and imaginatively about ethical, metaphysical, and epistemological issues, and have a grasp of the advantages and problems of a wide range of metaphysical and ethical views. In addition, you will have mastered a wide range of mathematical disciplines, and have extended your numerical, logical, and quantitative skills.

Year in Industry

This programme is available with a Year in Industry. Year Three is spent on a paid placement within an organisation in industry, broadly defined. You will be supported by the School of the Arts and the Department of Philosophy throughout, and your reflective written account of the experience will contribute towards your final degree result. If you wish to study this programme with a Year in Industry, please put the option code 'YI' in the 'Further Choices' section of your UCAS application form.

WHAT YOU'LL LEARN

- A broad knowledge of Mathematics and of Philosophy
- Advanced numerical, logical, and quantitative skills
- Techniques for solving problems in several areas, and the ability to apply those techniques with confidence
- Competence in using a variety of educational resources
- Confidence in presenting technical material and previously unfamiliar ideas to small audiences
- Analytical, argumentative, communications and problem-solving skills
- Understanding of complex and demanding texts
- The ability to reason intelligently and imaginatively about ethical, metaphysical, and epistemological issues

Course content

Discover what you'll learn, what you'll study, and how you'll be taught and assessed.

YEAR ONE

You will take seven required modules: four from Philosophy, and three core foundation modules from Mathematics; and choose one optional module from Mathematics.

Please note: not all mathematics modules are listed and you will be required to take mathematics modules in each year.

COMPULSORY MODULES

CALCULUS I (MATH101)

Credits: 15 / Semester: semester 1

At its heart, calculus is the study of limits. Many quantities can be expressed as the limiting value of a sequence of approximations, for example the slope of a tangent to a curve, the rate of change of a function, the area under a curve, and so on. Calculus provides us with tools for studying all of these, and more. Many of the ideas can be traced back to the ancient Greeks, but calculus as we now understand it was first developed in the 17th Century, independently by Newton and Leibniz. The modern form presented in this module was fully worked out in the late 19th Century. MATH101 lays the foundation for the use of calculus in more advanced modules on differential equations, differential geometry, theoretical physics, stochastic analysis, and many other topics. It begins from the very basics – the notions of real number, sequence, limit, real function, and continuity – and uses these to give a rigorous treatment of derivatives and integrals for real functions of one real variable.

CALCULUS II (MATH102)

Credits: 15 / Semester: semester 2

This module, the last one of the core modules in Year 1, is built upon the knowledge you gain from MATH101 (Calculus I) in the first semester. The syllabus is conceptually divided into three parts: Part I, relying on your knowledge of infinite series, presents a thorough study of power series (Taylor expansions, binomial theorem); part II begins with a discussion of functions of several variables and then establishes the idea of partial differentiation together with its various applications, including chain rule, total differential, directional derivative, tangent planes, extrema of functions and Taylor expansions; finally, part III is on double integrals and their applications, such as finding centres of mass of thin bodies. Undoubtedly, this module, together with the other two core modules from Semester 1 (MATH101 Calculus I and MATH103 Introduction to linear algebra), forms an integral part of your ability to better understand modules you will be taking in further years of your studies.

INTRODUCTION TO LINEAR ALGEBRA (MATH103)

Credits: 15 / Semester: semester 1

Linear algebra is the branch of mathematics concerning vector spaces and linear mappings between such spaces. It is the study of lines, planes, and subspaces and their intersections using algebra.

Linear algebra first emerged from the study of determinants, which were used to solve systems of linear equations. Determinants were used by Leibniz in 1693, and subsequently, Cramer's Rule for solving linear systems was devised in 1750. Later, Gauss further developed the theory of solving linear systems by using Gaussian elimination. All these classical themes, in their modern interpretation, are included in the module, which culminates in a detailed study of eigenproblems. A part of the module is devoted to complex numbers which are basically just planar vectors. Linear algebra is central to both pure and applied mathematics. This module is an essential pre-requisite for nearly all modules taught in the Department of Mathematical Sciences.

INTRODUCTION TO LOGIC (PHIL127)

Credits: 15 / Semester: semester 2

This module teaches students how to assess arguments using formal methods. Taking this module will enhance your ability to work with abstract material and your problem solving skills. It will help you understand logical notation where you encounter it in your reading, and prepare you, where appropriate, for more advanced logical study. The module is taught by lecture (1 hour per week) and workshop (2 hours per Week from week 2 onwards). It also uses extensive online support materials. These include videos containing worked examples and a proof editor/checker. It is assessed via coursework (60%) and an examination (40%). The support materials for each week come with a short online formative quiz.

MIND, KNOWLEDGE AND REALITY (PHIL103)

Credits: 15 / Semester: semester 1

This module introduces students to philosophy of mind, metaphysics, and epistemology with an emphasis on a coherent historical narrative that explains the role that early modern philosophers have played in the development of contemporary philosophical problems and debates. Taking this module will give students a grasp of why philosophers ask big questions about the nature of reality, and the scope of our knowledge, and how those questions bear on their everyday lives. The module is taught by lecture (2 x 1 hour per week) and seminar (1 hour per week). Assessment has two components, a set of 5 short pieces of writing (5 x 150 words) worth 25% of the module mark and spread through the teaching term, and a final essay worth the remaining 75%.

PHILOSOPHICAL INSIGHTS (PHIL106)

Credits: 15 / Semester: semester 2

This module brings the history of philosophy to life by unpacking the meaning behind well-known philosophical quotations (e.g. 'The unexamined life is not worth living'; 'One is not born, but rather becomes, a woman'). The quotations will be selected from key thinkers in the history of philosophy, and will be presented in chronological order. They will also be selected so that the material covered complements, but does not overlap with, readings on other philosophy modules. Students are introduced to well-known philosophical quotations in lectures. The lectures provide background context required to understand the quotations. Students then carry out independent research into the meanings of these quotations after the lecture. In workshops they write short summaries of what is meant by these quotations. In seminars they present and discuss these summaries, and have a debate about the plausibility of the philosophical views underlying the quotations they are working on. At the end of the course they combine three of their five summaries into a wiki, and they write a blogpost on one of the quotations that explains its meaning and evaluates the philosophical views and ideas expressed in it.

Students taking this module will improve their skills in reading and writing philosophy. Students will gain skill in explaining complex information in a concise manner to an audience, in practising the intellectual virtues associated with philosophy, in conducting their own independent research and in critically discussing important ideas in the history of philosophy. They will also gain familiarity with modes of writing other than essays (wikis, blogposts). In addition, there is a two-hour information skills workshop provided by the Library.

PHILOSOPHY TOOLKIT (PHIL105)

Credits: 15 / Semester: semester 1

Students taking this module will develop key skills which are essential for studying philosophy. Students will learn how to approach philosophical texts written in a variety of styles – how to identify arguments, how to distinguish arguments from rhetoric, and how to evaluate arguments. They will also learn how to summarise views accurately, clearly and concisely, and how to write persuasively when presenting their own analysis of the philosophical topics covered. This module also includes lectures on successful presenting, and how to conduct fruitful philosophical discussions. Students will also be advised on understanding and learning from feedback. Students will gain skills in conducting their own independent, enquiry-led research, which is facilitated by a two-hour information and research skills workshop provided by the Library.
The seminar readings cover three particularly engaging philosophical topics: animal ethics, lying and bullshit (epistemology) and aesthetics. Since the lecture content is devoted to developing the skills involved with philosophical practice, this module also features three podcasts which serve as introductions to the three seminar topics.

The module is assessed as follows: seminar participation counts for 10% of the overall grade, a 1,000-word executive summary of any two of the seminar readings counts for 30% of the module result, and a 2000-word essay counts for the remaining 60%. Feedback on the executive summary and the essay is provided online using VITAL. It specifically relates the assessed work to the marking descriptors (which are published online in advance). Feedback on seminar participation is provided informally by the seminar leader (and by the students' peers). Students will also have the opportunity to discuss their participation by making use of their seminar leader's feedback and advice hours.

OPTIONAL MODULES

INTRODUCTION TO STATISTICS USING R (MATH163)

Credits: 15 / Semester: semester 2

Students will learn fundamental concepts from statistics and probability using the R programming language and will learn how to use R to some degree of proficiency in certain contexts. Students will become aware of possible career paths using statistics.

NEWTONIAN MECHANICS (MATH122)

Credits: 15 / Semester: semester 2

This module is an introduction to classical (Newtonian) mechanics. It introduces the basic principles like conservation of momentum and energy, and leads to the quantitative description of motions of bodies under simple force systems. It includes angular momentum, rigid body dynamics and moments of inertia. MATH122 provides the foundations for more advanced modules like MATH228, 322, 325, 326, 423, 425 and 431.

NUMBERS, GROUPS AND CODES (MATH142)

Credits: 15 / Semester: semester 2

A group is a formal mathematical structure that, on a conceptual level, encapsulates the symmetries present in many structures. Group homomorphisms allow us to recognise and manipulate complicated objects by identifying their core properties with a simpler object that is easier to work with. The abstract study of groups helps us to understand fundamental problems arising in many areas of mathematics. It is moreover an extremely elegant and interesting part of pure mathematics. Motivated by examples in number theory, combinatorics and geometry, as well as applications in data encryption and data retrieval, this module is an introduction to group theory. We also develop the idea of mathematical rigour, formulating our theorems and proofs precisely using formal logic.

Programme details and modules listed are illustrative only and subject to change.

YEAR TWO

In each semester, you will take 30 credits from Mathematics and 30 credits from Philosophy (**SOTA260** counts towards Philosophy credits).

- **SOTA260** is compulsory if you choose to study this programme with a Year in Industry.
- **MATH142** may be taken in year two only by students that did not take it in year one.

COMPULSORY MODULES

DIFFERENTIAL EQUATIONS (MATH221)

Credits: 15 / Semester: semester 2

Differential equations play a central role in mathematical sciences because they allow us to describe a wide variety of real-world systems and the mathematical techniques encountered in this module are useful to a number of later modules; this is why MATH201 is compulsory for a number of degree programmes. The module will aim to stress the importance of both theory and applications of ordinary differential equations (ODEs) and partial differential equations (PDEs), putting a strong emphasis on problem solving and examples. It has broadly 5 parts and each part contains two types of equations: those that can be solved by specific methods and others that cannot be solved but can only be studied to understand some properties of the underlying equations and their solutions. The main topics are first order ODEs, second order ODEs, systems of ODEs, first-order PDEs and some of the most well-known second-order PDEs, namely the wave, heat and Laplace equations.

LOGIC (PHIL207)

Credits: 15 / Semester: semester 1

This module teaches students how to construct consistency trees and derivations for first-order logic. PHIL127 is a prerequisite for this module and students on programmes other than GV15 Mathematics and Philosophy must have obtained a mark of at least 60% for PHIL127. Taking this module will enhance your ability to work with abstract material, your problem-solving skills and your personal resilience. It will help you understand logical notation when you encounter it in your reading and prepare you for more advanced logic study. This module is taught via support materials, pre-recorded worked examples, and by weekly tutorials and practical workshops. It will be assessed using continuous assessment, both formative and summative (40%) and via a final examination (60%). Each week, students will receive detailed feedback on their work.

OPTIONAL MODULES

BUSINESS ETHICS (PHIL272)

Credits: 15 / Semester: semester 2

This module deals with business ethics and the social responsibility of business organizations. It is designed to inform decision-making about ethical challenges arising in business. It will help students identify and manage difficult ethical dilemmas they are likely to encounter in their future career. It is not intended to convert sinners into saints, to preach ethical truths, or to convey the wisdom of moral philosophers. However, it will develop students' analytical skills in ethical reasoning and provide them with a substantive framework to deal with ethical challenges. The module is taught by lecture (2 x 1 hour lectures per week, or a set of recorded mini-lectures available online if necessary) and workshops (2 during the semester, 2 hours each, which may occur online if necessary). Assessment is via case study analysis (40%) and an open book examination (60%). There will also be formative tests during the term. This module is identical to PHIL271, except that it runs in Semester 2.

CLASSICAL MECHANICS (MATH228)

Credits: 15 / Semester: semester 2

This module is concerned with the motion of physical bodies both in everyday situations and in the solar system. To describe motion, acceleration and forces you will need background knowledge of calculus, differentiation, integration and partial derivatives from MATH101 (Calculus I), MATH102 (Calculus II) and MATH103 (Introduction to Linear Algebra). Classical mechanics is important for learning about modern developments such as relativity (MATH326), quantum mechanics (MATH325) and chaos and dynamical systems (MATH322). This module will make you familiar with notions such as energy, force, momentum and angular momentum which lie at the foundations of applied mathematics problems.

COMMUTATIVE ALGEBRA (MATH247)

Credits: 15 / Semester: semester 2

The module provides an introduction to the theory and methods of the modern commutative algebra (commutative groups, commutative rings, fields and modules) with some applications to number theory, algebraic geometry and linear algebra.

COMPLEX FUNCTIONS (MATH243)

Credits: 15 / Semester: semester 1

This module introduces students to a surprising, very beautiful theory having intimate connections with other areas of mathematics and physical sciences, for instance ordinary and partial differential equations and potential theory.

FINANCIAL MATHEMATICS (MATH260)

Credits: 15 / Semester: semester 2

Mathematical Finance uses mathematical methods to solve problems arising in finance. A common problem in Mathematical Finance is that of derivative pricing. In this module, after introducing the basic concepts in Financial Mathematics, we use some particular models for the dynamic of stock price to solve problems of pricing and hedging derivatives. This module is fundamental for students intending to work in financial institutions and/or doing an MSc in Financial Mathematics or related areas.

KNOWLEDGE AND EPISTEMIC JUSTICE (PHIL212)

Credits: 15 / Semester: semester 1

Taking this module will introduce students to some topics in contemporary epistemology. These will include some traditional questions about knowledge, and some of the main views that have been held about them. The module will also cover contemporary topics such as expertise, bias, epistemic justice, scientific knowledge, ignorance and fake news. Because these topics are relatively new, students will have the opportunity to engage with new and cutting-edge research in these areas. They will also have the opportunity to reflect on their own practices, especially on how they access information online.

This module is cognate with politics and economics, as well as with the philosophy of mathematics, and is required for students taking Mathematics and Philosophy. It is taught via 11 one-hour lectures and 11 one-hour seminars. Seminar discussion will be assessed and count towards 10% of the module result. During term-time students write an essay, which counts for 40% of the mark. A seen two-hour examination contributes the remaining 50%.

LINEAR ALGEBRA AND GEOMETRY (MATH244)

Credits: 15 / Semester: semester 1

Linear algebra provides a toolbox for analysing phenomena ubiquitous in many areas of mathematics: linear maps, or linearity in general. In all of these situations it is essential to first identify the kind of objects which are mapped or behave in a linear way. To cover the many different possibilities the concept of an abstract vector space is introduced. It generalizes the real vector spaces introduced in MATH103 (Introduction to Linear Algebra) and the calculational techniques developed there can still be used. Applications of ideas from Linear Algebra appear in Geometry (MATH201, MATH349), in Algebra (MATH247, MATH343), in solving Differential Equations (MATH201, MATH221), which in turn model many physical systems (MATH323, MATH324), in Physics, especially Quantum Mechanics (MATH325, MATH421), in Biology (MATH335, MATH426) and in Statistics (MATH363).

METAPHYSICS (PHIL228)

Credits: 15 / Semester: semester 2

Metaphysics deals with the largest and most fundamental questions concerning the nature of reality. What are the basic ingredients of reality? What is it to persist? Why is there anything at all? What is the nature of matter? What is the nature of space and time? Is space more than nothingness? Are the past and future as real as the present? What, if anything are you? In this module we will introduce you to current thinking on the central issue of metaphysics, as well as the differing views as to the nature of metaphysics itself. The module is taught via one weekly lecture, and one weekly seminar. It is assessed by a two hour examination worth 60% of the overall module mark, an essay 30% and a seminar presentation 10%.

METRIC SPACES AND CALCULUS (MATH242)

Credits: 15 / Semester: semester 2

This is a foundational module aimed at providing the students with the basic concepts and techniques of modern real Analysis. The guiding idea will be to start using the powerful tools of analysis, familiar to the students from the first year module MATH101 (Calculus I) in the context of the real numbers, to vectors (multivariable analysis) and to functions (functional analysis). The notions of convergence and continuity will be reinterpreted in the more general setting of metric spaces. This will provide the language to prove several fundamental results that are in the basic toolkit of a mathematician, like the Picard Theorem on the existence and uniqueness of solutions to first order differential equations with an initial datum, and the implicit function theorem. The module is central for a curriculum in pure and applied mathematics, as familiarity with these notions will help students who want to take several other subsequent modules as well as many projects. This module is also a useful preparation (although not a formal prerequisite) for MATH365 Measure theory and probability, a very useful module for a deep understanding of financial mathematics.

NUMBERS, GROUPS AND CODES (MATH142)

Credits: 15 / Semester: semester 2

A group is a formal mathematical structure that, on a conceptual level, encapsulates the symmetries present in many structures. Group homomorphisms allow us to recognise and manipulate complicated objects by identifying their core properties with a simpler object that is easier to work with. The abstract study of groups helps us to understand fundamental problems arising in many areas of mathematics. It is moreover an extremely elegant and interesting part of pure mathematics. Motivated by examples in number theory, combinatorics and geometry, as well as applications in data encryption and data retrieval, this module is an introduction to group theory. We also develop the idea of mathematical rigour, formulating our theorems and proofs precisely using formal logic.

NUMERICAL METHODS FOR APPLIED MATHEMATICS (MATH226)

Credits: 15 / Semester: semester 2

Most problems in modern applied mathematics require the use of suitably designed numerical methods. Working exactly, we can often reduce a complicated problem to something more elementary, but this will often lead to integrals that cannot be evaluated using analytical methods or equations that are too complex to be solved by hand. Other problems involve the use of ‘real world’ data, which don’t fit neatly into simple mathematical models. In both cases, we can make further progress using approximate methods. These usually require lengthy iterative processes that are tedious and error prone for humans (even with a calculator), but ideally suited to computers. The first few lectures of this module demonstrate how computer programs can be written to handle calculations of this type automatically. These ideas will be used throughout the module. We then investigate how errors propagate through numerical computations. The focus then shifts to numerical methods for finding roots, approximating integrals and interpolating data. In each case, we will examine the advantages and disadvantages of different approaches, in terms of accuracy and efficiency.

OPERATIONAL RESEARCH (MATH269)

Credits: 15 / Semester: semester 2

The term "Operational Research" came in the 20th century from military operations. It describes mathematical methods to achieve the goal (or to find the best possible decision) having limited resources. This branch of applied mathematics makes use of and has stimulated the development of optimisation methods, typically for problems with constraints. This module can be interesting for any student doing mathematics because it concentrates on real-life problems.

PHILOSOPHY OF RELIGION (PHIL215)

Credits: 15 / Semester: semester 2

This module helps students to gain knowledge of the main philosophical debates concerning the concept of God, such as God's omnipotence, omniscience, and perfect goodness. It considers, for example, the main arguments for and against God's existence: the ontological argument, the cosmological argument, the design argument, and the problem of evil. There is one lecture per week and one seminar per week. Each student must give a 10-15 minute long seminar presentation. This counts for 10% of the module mark. An assessed seminar reading analysis (1,000 words) counts for 25%. An examination contributes the remaining 65%.

PROFESSIONAL AND CAREER DEVELOPMENT (SOTA260)

Credits: 15 / Semester: semester 1

The module aims to prepare students for a smooth transition into a work placement year and, more broadly, to develop lifelong skills, attitudes and behaviours and support students in their continuing professional development. This will help students lead flexible, fulfilling careers working as a professional in their field, and enable them to contribute meaningfully to society.

STATISTICS AND PROBABILITY I (MATH253)

Credits: 15 / Semester: semester 1

Analysis of data has become an essential part of current research in many fields including medicine, pharmacology, and biology. It is also an important part of many jobs in e.g. finance, consultancy and the public sector. This module provides an introduction to statistical methods with a strong emphasis on applying and interpreting standard statistical techniques. Since modern statistical analysis of real data sets is performed using computer power, a statistical software package is introduced and employed throughout.

STATISTICS AND PROBABILITY II (MATH254)

Credits: 15 / Semester: semester 2

This module provides an introduction to probabilistic methods that are used not only in actuarial science, financial mathematics and statistics but also in all physical sciences. It focuses on discrete and continuous random variables with values in one and several dimensions, properties of the most useful distributions (e.g. geometric, exponential, and normal), their transformations, moment and probability generating functions and limit theorems. This module will help students doing MATH260 and MATH262 (Financial mathematics). This module complements MATH365 (Measure theory and probability) in the sense that MATH365 provides the contradiction-free measure theoretic foundation on which this module rests.

USES, MISUSES AND ABUSES OF LANGUAGE (PHIL276)

Credits: 15 / Semester: semester 2

This module will introduce students to key concepts and figures in the project of understanding natural language. Students will examine how philosophers have attempted to understand meaning, reference and communication. Students will be introduced to the distinction between semantics and pragmatics and to speech-act theory. They will learn to apply these conceptual and theoretical tools to contemporary debates around freedom of speech and censorship by the semantics and pragmatics of slurs, hate speech, dog whistles and pornographic speech. They will consider feminist perspectives on language. Students taking this module will understand the central concepts in philosophy of language and how questions in the philosophy of language can intersect with issues in philosophy of mind, ethics, political philosophy and feminist theory, and they will be able to apply this understanding to real world cases. The module is taught by lecture (1h each week for the first 6 weeks) and workshops (2h per week). Assessment is via a 750 word essay (comprising 15% of the module's mark) and a 2500 word essay (comprising 85% of the module mark).

VECTOR CALCULUS WITH APPLICATIONS IN FLUID MECHANICS (MATH225)

Credits: 15 / Semester: semester 1

This module provides an introduction to the subjects of fluid mechanics and electromagnetism, to the various vector integrals, the operators div, grad and curl and the relations between them and to the many applications of vector calculus to physical situations.

Programme details and modules listed are illustrative only and subject to change.

FINAL YEAR

In each semester, you will take 30 credits of Mathematics and 30 credits of Philosophy. Modules weighted at 30 credits are whole-year modules and count as 15 credits per semester. **SOTA300** counts as a Philosophy module.

- Students who have completed a Year in Industry may not take **SOTA300**.
- You must take at least one of **PHIL306**, **SOTA300**, **PHIL311** or **PHIL365**, but may not take both **PHIL306** and **PHIL311**.
- Students must consult with their academic advisor before taking both **PHIL306** and **SOTA300**.
- **PHIL306** normally requires a minimum average of 60% in year two.

OPTIONAL MODULES

APPLIED PROBABILITY (MATH362)

Credits: 15 / Semester: semester 1

This module studies discrete-time Markov chains, as well as introducing the most basic continuous-time processes. The basic theory for these stochastic processes is considered in detail. This includes the Chapman Kolmogorov equation, communication of states, periodicity, recurrence and transience properties, asymptotic behaviour, limiting and stationary distributions, and an introduction to Poisson processes. Applications in different areas, in particular in insurance, are considered.

APPLIED STOCHASTIC MODELS (MATH360)

Credits: 15 / Semester: semester 1

Stochastic processes are ways of quantifying the dynamic relationships of sequences of random events. Stochastic models play an important role in elucidating many areas of the natural and engineering sciences. They can be used to analyse the variability inherent in biological and medical processes, to deal with uncertainties affecting managerial decisions and with the complexities of psychological and social interactions, and to provide new perspectives, methodology, models and intuition to aid in other mathematical and statistical studies. This module is intended as a beginning course in introducing continuous-time stochastic processes for students familiar with elementary probability. The objectives are: (1) to introduce students to the standard concepts and methods of stochastic modelling; (2) to illustrate the rich diversity of applications of stochastic processes in the science; and (3) to provide exercises in the applications of simple stochastic analysis to appropriate problems.

CARTESIAN TENSORS AND MATHEMATICAL MODELS OF SOLIDS AND VISCOUS FLUIDS (MATH324)

Credits: 15 / Semester: semester 1

This module provides an introduction to basic concepts and principles of continuum mechanics. Cartesian tensors are introduced at the beginning of the module, bringing simplicity and versatility to the analysis. The module places emphasis on the importance of conservation laws in integral form, and on the fundamental role integral conservation laws play in the derivation of partial differential equations used to model different physical phenomena in problems of solid and fluid mechanics.

CHAOS AND DYNAMICAL SYSTEMS (MATH322)

Credits: 15 / Semester: semester 1

Math322 introduces the novel findings concerning the solving techniques and nature of solutions occurring in nonlinear difference and differential equations. The (counterpart) theory of linear equations is covered in Math122 (Dynamic Modelling) and Math201 (Differential Equations). The modern theory of fractals (occurred only in 1970s) is delivered and many examples of fractal objects, including the Mandelbrot set, are demonstrated. The classification of possible solutions occurring in dynamical systems together with the bifurcation theory is provided. The emphasis is made to the bifurcations leading to chaotic solutions. Detailed analysis of chaotic solutions (their nature and impact in understanding the universe) is provided. The qualitative analysis technique for solving nonlinear systems of difference/differential equations is introduced.

CLASSICAL CHINESE PHILOSOPHY (PHIL367)

Credits: 15 / Semester: semester 1

This module will introduce students to ideas formulated during the classical period of Chinese philosophy. The focus will be on the dialectic between the Daoist and Confucian schools. The module will help students to understand the ways in which Chinese philosophers approached topics that are also discussed in the Western traditions. It will also enable students to understand what is distinctive about the Chinese approaches. There will be one lecture and one seminar per week. Assessment is by examination (60%), essay (30%) and assessed seminar presentation (10%).

COMBINATORICS (MATH344)

Credits: 15 / Semester: semester 2

Combinatorics is a part of mathematics in which mathematicians deal with discrete and countable structures by means of various combinations, such as permutations, ordered and unordered selections, etc. The seemingly simple methods of combinatorics can raise highly non-trivial mathematical questions and lead to deep mathematical results, which are, in turn, closely related to some fundamental phenomena in number theory

DIGITAL INQUIRY PROJECT (PHIL311)

Credits: 15 / Semester: semester 2

Students will choose a topic of special interest related to their programme of study and conduct an independent research project upon up it in consultation with an allocated supervisor. The module is distinctive because the final project output is to be presented as if to a specified target external audience (such as sixth-form students, policy groups or the general public), and use a digital platform (eg website, vlog, animation, podcast). The module thus offers students opportunities to integrate their philosophical skills, knowledge and understanding with applied skills of digital communication relevant in arenas beyond the academic setting.

Students do not need digital skills beyond those they will have already acquired as final year students of Philosophy to take this module. Training is offered via a suite of learning materials as relevant to an individual's chosen mode of presentation and through scheduled supervised workshops. Advice and support are provided. Students will have the opportunity to offer peer feedback on each other's outputs before final submission.

Formal assessment is threefold:
a) Research Report (1500 words; 40%). The student, before embarking on the module, will have identified a question or problem which they wish to research and address. The Research Report offers a summary of this, arguments put forward and conclusions drawn. It also confirms the proposed audience and output format.

b) Digital Inquiry Project (40%). Guidance is supplied on appropriate size/length, which will vary according to platform, but be such that the project communicates the findings of the Report in a manner appropriate to the audience and digital format.

c) Reflective Commentary (500 words, 20%). This gives students the opportunity to reflect critically on the process, identifying challenges, how these were addressed and explaining presentational decisions made.

DIFFERENTIAL GEOMETRY (MATH349)

Credits: 15 / Semester: semester 1

Differential geometry studies distances and curvatures on manifolds through differentiation and integration. This module introduces the methods of differential geometry on the concrete examples of curves and surfaces in 3-dimensional Euclidean space. The module MATH248 (Geometry of curves) develops methods of differential geometry on examples of plane curves. This material will be discussed in the first weeks of the course, but previous familiarity with these methods is helpful. Students following a pathway in theoretical physics might find this module interesting as it discusses a different aspect of differential geometry, and might take it together with MATH326 (Relativity). MATH410 (Manifolds, homology and Morse theory) and MATH446 (Lie groups and Lie algebras).

EXISTENTIALISM (PHIL332)

Credits: 15 / Semester: semester 1

This module familiarises students with some of the main issues, theories and arguments in the existentialist movement from Kierkegaard and Nietzsche through to Sartre and de Beauvoir. Taking this module will enhance your abilities to read challenging philosophical texts in a critical manner. The module is taught by lecture (1 hour per week) and seminar (1 hour per week). Assessment is via an exam (comprising 55% of the module mark) and a 2,000 word essay (30% of the module mark). Students also take it in turns to give one 10-15 minute seminar presentation that provides the remaining 15% of the module mark.

FRONTIERS OF ETHICS (PHIL302)

Credits: 15 / Semester: semester 1

This module familiarises students with some of the main theories and arguments in debates about issues that raise problems for traditional ethics. These include the treatment of disability, the issue of humanitarian intervention and other matters of global concern, such as international justice, and issues raised by what some call the 'environmental crisis'. The module is taught by lecture (1 hour per week) and seminar (1 hour per week). Assessment is via a 3,500 word essay (comprising 90% of the module mark) due in the January assessment period. Students will have the opportunity to receive formative feedback on a draft essay plan towards the end of the autumn term. Students will also give one 10-15 minute seminar presentation that provides the remaining 10% of the module mark.

FURTHER METHODS OF APPLIED MATHEMATICS (MATH323)

Credits: 15 / Semester: semester 1

Ordinary and partial differential equations (ODEs and PDEs) are crucial to many areas of science, engineering and finance. This module addresses methods for, or related to, their solution. It starts with a section on inhomogeneous linear second-order ODEs which are often required for the solution of higher-level problems. We then generalize basic calculus by considering the optimization of functionals, e.g., integrals involving an unknown function and its derivatives, which leads to a wide variety of ODEs and PDEs. After those systems of two linear first-order PDEs and second-order PDES are classified and reduced to ODEs where possible. In certain cases, e.g., `elliptic' PDEs like the Laplace equation, such a reduction is impossible. The last third of the module is devoted to two approaches, conformal mappings and Fourier transforms, which can be used to obtain solutions of the Laplace equation and other irreducible PDEs.

GAME THEORY (MATH331)

Credits: 15 / Semester: semester 2

In this module you will explore, from a game-theoretic point of view, models which have been used to understand phenomena in which conflict and cooperation occur and see the relevance of the theory not only to parlour games but also to situations involving human relationships, economic bargaining (between trade union and employer, etc), threats, formation of coalitions, war, etc.

GROUP THEORY (MATH343)

Credits: 15 / Semester: semester 1

The module provides an introduction to the modern theory of finite non-commutative groups. Group Theory is one of the central areas of Pure Mathematics. Being part of Algebra, it has innumerable applications in Geometry, Number Theory, Combinatorics and Analysis, but also plays a very important role in Theoretical Physics, Mechanics and Chemistry. The module starts with basic definitions and some well-known examples (the symmetric group of permutations and the groups of congruence classes modulo an integer) and builds up to some very interesting and non-trivial constructions, such as the semi-direct product, which makes it possible to construct more complicated groups from simpler ones. In the final part of the course, the Sylow theory and its applications to the classification of groups are considered.

HEALTH CARE, ECONOMICS AND JUSTICE (PHIL366)

Credits: 15 / Semester: semester 2

This module covers the main normative issues surrounding the delivery of health care in modern societies. It discusses the purpose of health care, the notions of health and disease, just allocation of medical resources, issues of inequity in health dispositions, and problems of prioritising and rationing in health care. It acquaints students with the main theories of health care justice and also covers problems in public health and global health inequalities. After successfully taking the module, students will able be to explain the main moral and economic problems in the provision and allocation of health care resources. They will have sufficient knowledge of underlying philosophical debates and theories in these areas to engage critically with recent public debates about the just and economically viable provision for health care needs.

The module will be delivered by 8 x 2-hour seminar groups and two 2-hour workshops.

Modes of summative assessments are i) a group presentation (weighted at 15% of the module mark); ii) a brief argument (up to 500 words) in relation to the group presentation, in the style of a "Letter to the Editor" (15%); iii) a 2000-words essay (70%).

HELLENISTIC AND NEOPLATONIC PHILOSOPHY (PHIL368)

Credits: 15 / Semester: semester 2

This module familiarises students with some of the key texts, concepts and arguments from the post classical Greek and Roman periods. The module will focus particularly on prominent philosophical themes in the writings of Hellenistic and Neoplatonic traditions. Taking this module will enhance your abilities to analyse influential philosophical accounts and theories and to identify the philosophical assumptions that underlie them. The module is taught by lecture (1 hour per week) and seminar (1 hour per week). Assessment is via a 2,500 word essay (85% of the module mark). Students also take it in turns to give one 10-15 minute seminar presentation that provides the remaining 15% of the module mark.

INDIAN PHILOSOPHY (PHIL326)

Credits: 15 / Semester: semester 2

This module will introduce you to the various traditions of belief and practice that are obscured by the labels ‘Hinduism’ and ‘Buddhism’. It will help you to understand the ways in which Indian philosophers approached topics that are also discussed in the Western traditions. It will also enable you to understand what is distinctive about the Indian approaches. There will be one lecture per week, and from Week 2, a weekly seminar. Assessment is by examination 60%, essay 30% and seminar presentation 10%.

LINEAR STATISTICAL MODELS (MATH363)

Credits: 15 / Semester: semester 1

This module extends earlier work on linear regression and analysis of variance, and then goes beyond these to generalised linear models. The module emphasises applications of statistical methods. Statistical software is used throughout as familiarity with its use is a valuable skill for those interested in a career in a statistical field.

MATHEMATICAL RISK THEORY (MATH366)

Credits: 15 / Semester: semester 2

To provide an understanding of the mathematical risk theory used in practise in non-life actuarial depts of insurance firms, to provide an introduction to mathematical methods for managing the risk in insurance and finance (calculation of risk measures/quantities), to develop skills of calculating the ruin probability and the total claim amount distribution in some non - life actuarial risk models with applications to insurance industry, to prepare the students adequately and to develop their skills in order to be exempted for the exams of CT6 subject of the Institute of Actuaries (MATH366 covers 50% of CT6 in much more depth).

MEASURE THEORY AND PROBABILITY (MATH365)

Credits: 15 / Semester: semester 2

This module is important for students who are interested in the abstract theory of integrating and in the deep theoretical background of the probability theory. It will be extremely useful for those who plan to do MSc and perhaps PhD in Probability, including financial applications. If you plan to take level 4 module(s) on Financial Mathematics next year, MATH365 can be very helpful.

MEDICAL STATISTICS (MATH364)

Credits: 15 / Semester: semester 2

In recent years a culture of evidence-based practice has become the norm in the medical profession. Central to this is the medical statistician, who is required to not only analyse data, but to design research studies and interpret the results. The aim of MATH364 is to provide the student with the knowledge to become part of a "team" to enhance and improve medical practice. This is done by demonstrating the design of studies, methods of analysis and interpretation of results through a number of real-world examples, covering epidemiology, survival analysis, clinical trials and meta-analysis.

MIND, BRAIN AND CONSCIOUSNESS (PHIL309)

Credits: 15 / Semester: semester 1

Consciousness is sometimes thought of as 'the final frontier of science'. How does grey, lumpy, brain matter produce the rich inner world of thoughts, feeling and emotions we know from day to day? This module starts with a history of philosophers' attempts to find a place for consciousness in the universe as it is revealed to us by the physical sciences. It then engages with cutting-edge debates scientists and philosophers are currently having concerning the relationship between mind and brain, and between thought and consciousness. We also look at perception, and at various unconscious influences on our conscious mind. The module is taught by lecture (1 hour per week) and seminar (1 hour per week). Assessment is via a seen exam (comprising 45% of the module mark) and a 2,000 word essay (40% of the module mark). Students also take it in turns to give one 10-15 minute seminar presentation that provides the remaining 15% of the module mark.

NETWORKS IN THEORY AND PRACTICE (MATH367)

Credits: 15 / Semester: semester 2

MATH367 aims to develop an appreciation of optimisation methods for real-world problems using fundamental tools from network theory; to study a range of 'standard problems' and techniques for solving them. Thus, network flow, shortest path problem, transport problem, assignment problem, and routing problem are some of the problems that are considered in the syllabus. MATH367 is a decision making module, which fits well to those who are interested in receiving knowledge in graph theory, in operational research, in economics, in logistics and in finance.

NUMBER THEORY (MATH342)

Credits: 15 / Semester: semester 1

Number theory begins with, and is mainly concerned with, the study of the integers. Because of the fundamental role which integers play in mathematics, many of the greatest mathematicians, from antiquity to the modern day, have made contributions to number theory. In this module you will study results due to Euclid, Euler, Gauss, Riemann, and other greats: you will also see many results from the last 10 or 20 years.Several of the topics you will study will be familiar from MATH142 (Numbers, groups, and codes). We will go into them in greater depth, and the module will be self-contained from the point of view of number theory. However, some background in group theory (no more than is in MATH142) will be assumed.

NUMERICAL METHODS FOR ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS (MATH336)

Credits: 15 / Semester: semester 2

Many real-world systems in mathematics, physics and engineering can be described by differential equations. In rare cases these can be solved exactly by purely analytical methods, but much more often we can only solve the equations numerically, by reducing the problem to an iterative scheme that requires hundreds of steps. We will learn efficient methods for solving ODEs and PDEs on a computer.

PHILOSOPHICAL APPROACHES TO CONFLICT (PHIL365)

Credits: 15 / Semester: semester 2

This module gives students the opportunity to explore selected areas of conflict in social, political and legal domains. When rights or interests clash, or seem to clash, what philosophical issues are at stake? How should the state adjudicate? Key themes include rights, freedoms and responses to oppression. The module seeks to help students develop a philosophical manner of thought that will enable them to refine their views on other similar issues of public importance, often controversial in nature, which they might encounter later in life. Representative areas for inquiry include questions such as ‘Does the state have the right to display religious symbols in classrooms?’ and ‘How far should midwives be allowed to opt out of assisting with abortions?’, and topics such as freedom and the media, the ethics of immigration, forms of oppression within society, and sexual harassment.

There are no lectures for this module; it is based on student-led research and applied learning, facilitated by the tutor in weekly two-hour workshops. Some content is sensitive, and discussions are carefully moderated to respect this. The assessment asks students to integrate their academic skills with analysis of ‘real-world’ scenarios. There are three research-based applied components: a presentation (15% + submitted materials 5%), case study (2000 words, 45%), and an opinion piece (1000 words, 35%). The opinion piece is published electronically as a course wiki for peer comment prior to formal submission.

Samples and in-class support will be provided.

PHILOSOPHY AND LITERATURE (PHIL327)

Credits: 15 / Semester: semester 2

This is an interdisciplinary module which aims to get students to think critically about imaginative literature and philosophical approaches to literature. It familiarises students with some of the main issues, theories and arguments relating to the ontology, value and structure of literature, as well as concept critical theory.
The module discusses key themes at the intersection of philosophy and literature; there is usually a focus on the genre of tragedy. The module is taught by lecture 1 hour per week and seminar 1 hour per week. Assessment is via class presentation (10%) and two 3,000 word coursework essays (40%, 50%).

PHILOSOPHY DISSERTATION (PHIL306)

Credits: 30 / Semester: whole session

Students will choose a topic of special interest in philosophy and conduct research into this area of interest via reading and private study under the supervision of the supervisor to whom they have been allocated. Students will attend Research and Professional Skills workshops with the Subject Librarian and the Careers Services. All students will have the opportunity to participate in the Philosophy Dissertation Showcase.

PHILOSOPHY OF PLAY AND THE VIRTUAL (PHIL343)

Credits: 15 / Semester: semester 1

This module introduces students to the major philosophical issues associated with play, games (especially digital games) and virtual worlds. It examines both the philosophical literature around play and contemporary concerns expressed in relationship to the growth of the video games industry, including addiction, violence, 'gamification' and the use of play and software for education and therapy. Students will learn to challenge common assumptions, including their own, about the triviality of play in relation to modern constructions of labour and value, and develop an understanding of how these assumptions underpin both popular and academic discussions of games.

The module is taught by lecture (1 hour per week) and seminar (1 hour per week). Assessment consists of a 3-part project: a formative pitch meeting with the module leader in the first 5 weeks of the course, a short report on that meeting (500 words, 30%) including a research plan, and a final essay (2,500 words, 70%).

PHILOSOPHY OF THE FUTURE (PHIL312)

Credits: 15 / Semester: semester 2

The course focuses on the philosophical implications of likely (or possible) future technological developments.

The universe is billions of years old, there are billions of stars in our galaxy and billions of galaxies, and thanks to recent discoveries it now seems likely that most stars have planets. Yet so far we have seen no sign of intelligent life elsewhere in the universe. What is the significance of this 'great silence'? Advances in medical technology will soon make possible significant 'improvements' to our bodies and minds. How serious are the ethical objections to human enhancement? If teleportation technology were available many of the all too familiar problems associated with ordinary modes of transportation could be avoided.

But is teleportation actually survivable? Computers are advancing all the time, and some say that super-intelligent machines are inevitable. Are they right, and if so, what are the implications? Will it prove possible to upload ourselves into computer-sustained virtual paradises, as some transhumanists hope? Is it likely, as some have argued, that we are in fact living our lives in virtual worlds? If so, how should we conceive of these worlds? Are they as real as the real world? If we could achieve immortality, either through bio-enhancement or uploading, would it be something we could coherently desire? Is time travel really possible? Some quantum physicists maintain that the universe is continually branching. What are the implications for how we think of our lives if they are right about this?

Many of these scenarios and issues have been anticipated in science fiction. While some ('hard') sci-fi authors seek scientific plausibility, i.e. they do their best to stick within the known laws of physics, they generally pay far less attention to metaphysical and ethical issues. Yet in working out how we should respond to what the future may bring, metaphysical and ethical considerations are of paramount importance. It is with these that this course will be dealing.

The module is taught by a combination of lectures and seminars. Assessment consists of a seminar presentation (10%), an essay on a relevant topic (2,000 words, 30%) and a take-home exam (60% approx. equivalent to a 2 hour exam).

POPULATION DYNAMICS (MATH332)

Credits: 15 / Semester: semester 2

Understanding the behaviour of populations is essential for understanding extinctions, population growth, maintaining the security of our food supplies as well as controlling invasive species and th e spread of infectious diseases. Many aspects of dynamical systems theory arise in the study of population dynamics, making the mathematics in this module widely applicable. We will take a deterministic approach to populations and will construct simple models to represent the essential controlling features. By analysing these models, significant insights can be obtained with implications for real-world population dynamics.

QUANTUM MECHANICS (MATH325)

Credits: 15 / Semester: semester 1

The development of Quantum Mechanics, requiring as it did revolutionary changes in our understanding of the nature of reality, was arguably the greatest conceptual achievement of all time. The aim of the module is to lead the student to an understanding of the way that relatively simple mathemactics (in modern terms) led Bohr, Einstein, Heisenberg and others to a radical change and improvement in our understanding of the microscopic world.

RELATIVITY (MATH326)

Credits: 15 / Semester: semester 1

Einstein's theories of special and general relativity have introduced a new concept of space and time, which underlies modern particle physics, astrophysics and cosmology. It makes use of, and has stimulated the development of modern differential geometry. This module develops the required mathematics (tensors, differential geometry) together with applications of the theory to particle physics, black holes and cosmology. It is an essential part of a programme in theoretical physics.

SCHOOL OF THE ARTS WORK PLACEMENTS MODULE (SOTA300)

Credits: 30 / Semester: whole session

This module is an opportunity for you to undertake a placement in a setting which matches your academic and possible career/industry interests, develop materials and/or undertake tasks within a practical or vocational context, apply academic knowledge from your degree, and develop your personal and employability skills within a working environment. SOTA300 is not open to students who have taken SOTA600.

STATISTICAL PHYSICS (MATH327)

Credits: 15 / Semester: semester 2

Statistical Physics is a core subject in Physics and a cornerstone for modern technologies. To name just one example, quantum statistics is informing leading edge developments around ultra-cold gases and liquids giving rise to new materials. The module will introduce foundations of Statistical Physics and will develop an understanding of the stochastic roots of thermodynamics and the properties of matter. After successfully completing this module students will understand statistical ensembles and related concepts such as entropy and temperature, will understand the properties of classical and quantum gases, will be know the laws of thermodynamics and will be aware of advanced phenomena such as phase transition. The module will also develop numerical computer programming skills for the description of macroscopic effects such as diffusion by an underlying stochastic process.

THE MAGIC OF COMPLEX NUMBERS: COMPLEX DYNAMICS, CHAOS AND THE MANDELBROT SET (MATH345)

Credits: 15 / Semester: semester 2

A “dynamical system” is a system that changes over time according to a fixed rule. In complex dynamics, we consider the case where the state of the system is described by a single (complex) variable, and the rule of evolution is given by a holomorphic function. It turns out that this seemingly simple setting leads to very rich, subtle and intricate problems, some of which are still the subject of ongoing mathematical research, both at the University of Liverpool and internationally. This module will provide an introduction to this fascinating subject, and introduce students to some of these problems. In the course of this study, we will encounter many results about complex functions that may seem “magic” when compared with what might be expected from real analysis. A highlight of this kind is the theorem that every polynomial is “chaotic” on its Julia set. We will also see how this “magic” can help us understand phenomena that at first seem to have no connection with complex numbers at all.

THEORY OF STATISTICAL INFERENCE (MATH361)

Credits: 15 / Semester: semester 2

This module introduces fundamental topics in mathematical statistics, including the theory of point estimation and hypothesis testing. Several key concepts of statistics are discussed, such as sufficiency, completeness, etc., introduced from the 1920s by major contributors to modern statistics such as Fisher, Neyman, Lehmann and so on. This module is absolutely necessary preparation for postgraduate studies in statistics and closely related subjects.

TOPOLOGY (MATH346)

Credits: 15 / Semester: semester 2

Topology is the mathematical study of space. It is distinguished from geometry by the fact that there is no consideration of notions of distance, angle or other similar quantities. For this reason topology is sometimes popularly referred to as ‘rubber sheet’ geometry. It was introduced by Poincaré, under the name of analysis situs, in 1895 and became one of the most successful areas of 20th century mathematics. It continues to be an active research area to this day, and its insights and methods underlie many areas of modern mathematics. More recently, new applications of topological ideas outside mathematics have been developed, in particular to provide qualitative analysis of large data sets. This module introduces the basic notions of topological space and continuous map, illustrating them with many examples from different areas of mathematics. It also introduces homotopy theory, the study of paths in a space, which has become one of the most fundamental areas of modern mathematics.

Programme details and modules listed are illustrative only and subject to change.

HOW YOU'LL LEARN

In studying Philosophy you will learn how to defend your views with reasoned arguments, and to assess the arguments of others. Argumentative skills are learned through attending lectures and reading philosophical texts, developed by group seminar discussions, and formally assessed through essays and exams. You will complete modules to the value of 120 credits per year, from a wide range of options available. Most modules employ a blend of lectures, seminars and online support materials. You will learn by reading and studying outside class time, by attending and participating in classes, by doing coursework and, for dissertations, via one-to-one meetings with a supervisor. There is also scope, both formally in the placement module and informally, for you to develop practical skills by volunteering.

In Mathematics, your learning activities will consist of lectures, tutorials, practical classes, problem classes, private study and supervised project work. In year one, lectures are supplemented by a thorough system of group tutorials and computing work is carried out in supervised practical classes. Key study skills, presentation skills and group work start in first-year tutorials and are developed later in the programme. The emphasis in most modules is on the development of problem solving skills, which are regarded very highly by employers. Project supervision is on a one-to-one basis, apart from group projects in year two.

HOW YOU'RE ASSESSED

Philosophy employs a mixture of modes of assessment: exams and coursework in many different varieties including essays, oral presentations, dissertations, exercises, and supported independent work (eg in the placement module).

In Mathematics, most modules are assessed by a two and a half hour examination in January or May, but many have an element of coursework assessment. This might be through homework, class tests, mini-project work or key skills exercises.

LIVERPOOL HALLMARKS

We have a distinctive approach to education, the Liverpool Curriculum Framework, which focuses on research-connected teaching, active learning, and authentic assessment to ensure our students graduate as digitally fluent and confident global citizens.

Careers and employability

A mathematically-based degree opens up a wide range of career opportunities, including some of the most lucrative professions.

Recent employers of our graduates are:

- Barclays Bank plc
- Deloitte
- Forrest Recruitment
- Marks and Spencer
- Mercer Human Resource Consulting Ltd.
- Venture Marketing Group.
- BAE Systems
- BT
- Guardian Media Group
- Royal Bank of Scotland
- Siemens
- Unilever.

3 IN 4 **PHILOSOPHY STUDENTS FIND THEIR MAIN ACTIVITY AFTER GRADUATION MEANINGFUL.**

Graduate Outcomes, 2018-19.

Fees and funding

Your tuition fees, funding your studies, and other costs to consider.

TUITION FEES

UK fees (applies to Channel Islands, Isle of Man and Republic of Ireland)	
Full-time place, per year	£9,250
Year in industry fee	£1,850
Year abroad fee	£1,385

International fees	
Full-time place, per year	£24,800
Year in industry fee	£1,850
Year abroad fee	£12,400

Fees shown are for the academic year 2024/25. Please note that the Year Abroad fee also applies to the Year in China.

Tuition fees cover the cost of your teaching and assessment, operating facilities such as libraries, IT equipment, and access to academic and personal support. Learn more about paying for your studies..

ADDITIONAL COSTS

We understand that budgeting for your time at university is important, and we want to make sure you understand any course-related costs that are not covered by your tuition fee. This could include buying a laptop, books, or stationery.

Find out more about the additional study costs that may apply to this course.

SCHOLARSHIPS AND BURSARIES

We offer a range of scholarships and bursaries to provide tuition fee discounts and help with living expenses while at university.

Check out our Liverpool Bursary, worth up to £2,000 per year for eligible UK students. Or for international students, our Undergraduate Global Advancement Scholarship offers a tuition fee discount of up to £5,000 for eligible international students starting an undergraduate degree from September 2024.

Discover our full range of undergraduate scholarships and bursaries

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Entry requirements

The qualifications and exam results you'll need to apply for this course.

Your qualification	**Requirements** About our typical entry requirements
A levels	ABB Applicants with the Extended Project Qualification (EPQ) are eligible for a reduction in grade requirements. For this course, the offer is **ABC** with **A** in the EPQ. You may automatically qualify for reduced entry requirements through our contextual offers scheme. If you don't meet the entry requirements, you may be able to complete a foundation year which would allow you to progress to this course. Available foundation years: • Mathematical Sciences BSc (Hons) (Foundation, 4 year route with Carmel College) BSc (Hons)
GCSE	4/C in English and 4/C in Mathematics
Subject requirements	Applicants must have studied Mathematics at Level 3 within 2 years of the start date of their course.
BTEC Level 3 National Extended Diploma	Applications encouraged when combined with A Level Mathematics at grade A. BTEC applications are encouraged. We evaluate each BTEC application on its merits.
International Baccalaureate	33 including 6 in HL Mathematics with no score less than 4
Irish Leaving Certificate	H1, H2, H2, H2, H3, H3 including H1 in Mathematics

Your qualification	Requirements About our typical entry requirements
Scottish Higher/Advanced Higher	Scottish Highers at AABBB plus Scottish Advanced Highers grade A in Maths or Scottish Advanced Highers at ABB including Maths at grade A, combinations are also welcome.
Welsh Baccalaureate Advanced	Accepted at grade B including A Level Mathematics at grade A and another A Level at grade B
Access	Access to HE Diploma in a relevant subject including Distinctions in units in Mathematics
International qualifications	Many countries have a different education system to that of the UK, meaning your qualifications may not meet our entry requirements. Completing your Foundation Certificate, such as that offered by the University of Liverpool International College, means you're guaranteed a place on your chosen course.

ALTERNATIVE ENTRY REQUIREMENTS

- If your qualification isn't listed here, or you're taking a combination of qualifications, contact us for advice
- Applications from mature students are welcome.

THE ORIGINAL REDBRICK