2020/1 - MTHA4001B PROBABILITY

Spring Semester, Level 4 module
(Maximum 90 Students)
UCU: 10 Organiser: Dr Davide Proment
(UG) MODULE - 40% PASS ON AGGREGATE
Module Type: Examination with Coursework or Project
Timetable Slot:G1, B2, D3/, C3
Exam Paper(hrs):

Probability is the study of the chance of events occurring. It has important applications to understand the likelihood of multiple events happening together and therefore to rational decision-making. This module will give you an introduction to the modern theory of probability developed from the seminal works of the Russian mathematician A.N. Kolmogorov in 1930s. Kolmogorov's axiomatic theory describes the outcomes (events) of a random experiment as mathematical sets. Using set theory language you will be introduced to the concept of random variables, and consider different examples of discrete random variables (like binomial, geometric and Poisson random variables) and continuous random variables (like the normal random variable). In the last part of the module you will explore two applications of probability: reliability theory and Markov chains. Aside of the standard lectures and workshop sessions, there will be two computer-lab sessions of (2 hours each) where you will apply probability theory to specific everyday life case studies. The only pre-requisites for this module are a basic knowledge of set theory and of calculus that you would have acquired during the Autumn semester. If you have done probability or statistic at A-level you will rediscover its contents now taught using a proper and more elegant mathematical formalism.

2020/1 - MTHE6003B SET THEORY

Spring Semester, Level 6 module
(Maximum 30 Students)
UCU: 20 Organiser: Dr David Aspero
(UG) MODULE - 40% PASS ON AGGREGATE
Module Type: Examination with Coursework or Project
Timetable Slot:D
Exam Paper(hrs):

BEFORE TAKING THIS MODULE YOU MUST TAKE MTHA5001Y

This module is concerned with foundational issues in mathematics and provides the appropriate mathematical framework for discussing 'sizes of infinity'. On the one hand we shall cover concepts such as ordinals, cardinals, and the Zermelo-Fraenkel axioms with the Axiom of Choice. On the other, we shall see how these ideas come up in other areas of mathematics, such as graph theory and topology. Familiarity with and a taste for mathematical proofs will be assumed. Therefore, second year Analysis is a desired prerequisite.

2020/1 - MTHE6007B DYNAMICAL OCEANOGRAPHY

Spring Semester, Level 6 module
(Maximum 40 Students)
UCU: 20 Organiser: Professor David Stevens
(UG) MODULE - 40% PASS ON AGGREGATE
Module Type: Examination with Coursework or Project
Timetable Slot:C
Exam Paper(hrs):3

BEFORE TAKING THIS MODULE YOU MUST TAKE MTHA5002Y OR TAKE MTHB5007B OR TAKE ENV-5007B

The ocean is an important component of the Earth's climate system. This module covers mathematically modelling of the large-scale ocean circulation and oceanic wave motion. This module builds upon the techniques in fluid dynamics and differential equations that you developed in year two. It then uses these techniques to explain some interesting phenomena in the ocean that are relevant to the real world. We begin by examining the effects of rotation on fluid flows. This naturally leads to the important concept of geostrophy, which enables ocean currents to be inferred from measurements of the sea surface height or from vertical profiles of seawater density. Geostrophy also plays a key role in the development of a model for the global scale circulation of abyssal ocean. The role of the wind in driving the ocean will be examined. This enables us to model the large-scale circulation of the ocean including the development of oceanic gyres and strong western boundary currents, such as the Gulf Stream. The module concludes by examining the role of waves, both at the sea surface and internal to the ocean. The differences between wave motion at mid-latitudes and the Equator are examined, as is the roll of the Equator as a wave-guide. The equatorial waves that you will study are intimately linked with the El Niño phenomenon that affects the climate throughout the globe.

2020/1 - MTHE6026B FINANCIAL MATHEMATICS

Spring Semester, Level 6 module
(Maximum 50 Students)
UCU: 20 Organiser: Dr Davide Proment
(UG) MODULE - 40% PASS ON AGGREGATE
Module Type: Examination with Coursework or Project
Timetable Slot:H
Exam Paper(hrs):

BEFORE TAKING THIS MODULE YOU MUST TAKE MTHA4001Y AND TAKE MTHA5004Y OR TAKE MTHA5004Y AND TAKE MTHB4007B OR TAKE MTHB4009B

The Mathematical Modelling of Finance is a relatively new area of application of mathematics yet it is expanding rapidly and has great importance for world financial markets. The module is concerned with the valuation of financial instruments known as derivatives. Introduction to options, futures and the no-arbitrage principle. Mathematical models for various types of options are discussed. We consider also Brownian motion, stochastic processes, stochastic calculus and Ito's lemma. The Black-Scholes partial differential

equation is derived and its connection with diffusion brought out. It is applied and solved in various circumstances.

2020/1 - MTHE6031B WAVES

Spring Semester, Level 6 module
(Maximum 30 Students)
UCU: 20 Organiser: Professor Emilian Parau
(UG) MODULE - 40% PASS ON AGGREGATE
Module Type: Examination with Coursework or Project
Timetable Slot:A
Exam Paper(hrs):

You will gain an introduction to the theory of waves. You will study aspects of linear and nonlinear waves using analytical techniques and Hyperbolic Waves and Water Waves will also be covered. It requires some knowledge of hydrodynamics and multi-variable calculus. The module is suitable for those with an interest in Applied Mathematics.

2020/1 - MTHE6035B NUMBER THEORY

Spring Semester, Level 6 module
(Maximum 50 Students)
UCU: 20 Organiser: Professor Shaun Stevens
(UG) MODULE - 40% PASS ON AGGREGATE
Module Type: Examination with Coursework or Project
Timetable Slot:F
Exam Paper(hrs):

BEFORE TAKING THIS MODULE YOU MUST TAKE MTHA5001Y AND TAKE MTHA5003Y

Number Theory is the study of arithmetical properties of the integers: properties of, and patterns in, prime numbers, integer solutions of equations with integer coefficients, etc. Gauss called Number Theory "the queen of mathematics" and, following on from work of Fermat and Euler, is responsible for the emergence of Number Theory as a central subject in modern mathematics. Since then, Number Theory has developed in many directions, including Algebraic, Analytic and Probabilistic Number Theory, Diophantine Geometry and has found surprising applications in modern life (notably in Cryptography). In this module, building on first year material on prime factorization and basic congruences, and second year material on groups, rings and fields, you will study various aspects of Number Theory, including certain diophantine equations, polynomial congruences and the famous theorem of Quadratic Reciprocity.