MASTER OF SCIENCE MATHEMATICS AND STATISTICS AND CONCENTRATION MATHEMATICS

Summary

- Degree offered: Master of Science (MSc)
- Registration status options: Full-time; Part-time
- Language of instruction: English
- Program options (expected duration of the program):
  - with thesis (6 full-time terms; 24 consecutive months)
  - with project (3 full-time terms; 12 consecutive months)
  - with coursework (3 full-time terms; 12 consecutive months)
  - with coursework and Co-op option (4 full-time terms; 16 consecutive months)
- Academic units: Faculty of Science (http://science.uottawa.ca/en/), Department of Mathematics and Statistics (http://science.uottawa.ca/mathstat/en/), Ottawa-Carleton Institute of Mathematics and Statistics (OCIMS) (http://science.uottawa.ca/mathstat/en/about-department/ottawa-carleton-institute/).

For immigration purposes, the summer term (May to August) for this program is considered a regularly scheduled break approved by the University. Students should resume full-time studies in September.

Program Description

Ottawa-Carleton Joint Program

The University of Ottawa offers a rich academic environment to study mathematics and statistics under the supervision of professors who have gained an international reputation for their research. Most major fields of research in mathematics and statistics are represented within the Department of mathematics and Statistics. Moreover, the Department is a participating unit in the master's level collaborative programs in bioinformatics and in biostatistics. Additional information about the Department and its programs is posted on the departmental website at www.mathstat.uottawa.ca.

Since 1984, the graduate programs in mathematics and statistics have been under the umbrella of the Ottawa-Carleton Institute of Mathematics and Statistics (OCIMS). The OCIMS consists of the School of Mathematics and Statistics at Carleton University and the Department of Mathematics and Statistics at the University of Ottawa. The two units have pooled together their resources to offer each year a large selection of graduate courses.

Learn more about this program (https://www.uottawa.ca/faculty-science/mathematics-statistics/graduate/programs/)

Other Programs Offered Within the Same Discipline or in a Related Area

- Master of Science Mathematics and Statistics Concentration in Mathematics (MSc)
- Master of Science Mathematics and Statistics Concentration in Statistics (MSc)
- Master of Science Mathematics and Statistics Specialization in Bioinformatics (MSc)
- Master of Science Mathematics and Statistics Specialization in Biostatistics (MSc)
- Doctorate in Philosophy Mathematics and Statistics (PhD)
- Doctorate in Mathematics and Statistics Specialization in in Bioinformatics (PhD)

Fees and Funding

- Program fees:

  The estimated amount for university fees (https://www.uottawa.ca/study/fees-financial-support/university-fees/) associated with this program are available under the section Finance your studies (https://www.uottawa.ca/study/graduate-studies/funding-financing/).

  International students enrolled in a French-language program of study may be eligible for a differential tuition fee exemption (https://www.uottawa.ca/study/fees-financial-support/differential-tuition-fee-exemption-scholarship/).

- To learn about possibilities for financing your graduate studies, consult the Awards and financial support (https://www.uottawa.ca/study/graduate-studies/awards-financial-support/) section.

Notes

- Programs are governed by the general regulations (https://www.uottawa.ca/about-us/leadership-governance/policies-regulations/) in effect for graduate studies at both universities.
- In accordance with the University of Ottawa regulation, students have the right to complete their assignments, examinations, research papers, and theses in French or in English.
- Research activities can be conducted in English or French or both depending on the language used by the professor and the members of the research group.

Program Contact Information

Graduate Studies Office, Faculty of Science (https://science.uottawa.ca/en/faculty-services/graduate-studies/)
30 Marie-Curie Street, Gendron Hall, Room 181
Ottawa ON Canada
K1N 6N5

Tel.: 613-562-5800
Email: gradsci@uottawa.ca

Twitter | Faculty of Science (https://twitter.com/uOttawaScience/?lang=en)
Facebook | Faculty of Science (https://www.facebook.com/uOttawaScience/)

Admission Requirements

For the most accurate and up to date information on application deadlines, language tests and other admission requirements, please visit the specific requirements (https://www.uottawa.ca/graduate-studies/programs-admission/apply/specific-requirements/) webpage.

To be eligible, candidates must:

- Have a bachelor's degree with a specialization or a major in mathematics and statistics (or equivalent) with a minimum average of 75% (B+).

  Note: International candidates must check the admission equivalencies (https://www.uottawa.ca/study/graduate-studies/international-equivalencies/) for the diploma they received in their country of origin.

- Demonstrate a good academic performance in previous studies as shown by official transcripts, research reports, abstracts or any other documents demonstrating research skills.
- Meet the funding requirements.

  Note: International students must provide proof of financial support: i.e., a stipend provided by a supervisor as well as a combination of awards and/or trust funds.

- Identify at least one professor who is willing to supervise your research and thesis.
  - We recommend that you contact potential thesis supervisors as soon as possible.
  - To register, you need to have been accepted by a thesis supervisor.
  - The supervisor's name is required at the time of application.
  - The choice of supervisor will determine the primary campus location of the student. It will also determine which university awards the degree.

Language Requirements

Applicants must be able to understand and fluently speak the language of instruction (French or English) in the program to which they are applying. Proof of linguistic proficiency may be required.

Applicants whose first language is neither French nor English must provide proof of proficiency in the language of instruction.

Note: Candidates are responsible for any fees associated with the language tests.

Notes

- The admission requirements listed above are minimum requirements and do not guarantee admission to the program.
- Admissions are governed by the general regulations (https://www.uottawa.ca/about-us/leadership-governance/policies-regulations/) in place for graduate studies and by the general regulations of the Ottawa-Carleton Institute of Mathematics and Statistics (OCIMS).

Applying to the Co-op Option

In order to apply to the co-op option, you must first be admitted to a program that offers co-op.

Your application must be submitted by the end of the first month of enrollment in your primary program, i.e., by the end of September.

Admission to the co-op option occurs on a competitive basis and is managed by the Co-op Office (https://coop.uottawa.ca/en/). Inquiries should be directed to that office.

- To be admitted to the co-op option, you must:
  - be enrolled as a full-time student in the Master of Science Mathematics and Statistics Concentration in Mathematics;
  - have and maintain a minimum CGPA of B+ (75%);
  - begin the program in the Fall term;
  - pay the required co-op fees.
- International students who have not been exempted of this condition must:
  - have passed the CanTest with a score of 4.0.

Program Requirements
Master's with Thesis

At least 50% of the course units must be from the student's home university.

More than 50% of the course units must be taken from the Mathematics course list.[1]

Students must meet the following requirements:

Compulsory Courses:		
12 optional course units in mathematics (MAT) at the graduate level [2]		12 Units
Thesis:		
THM 7999	Master's Thesis [3]	

Note(s)

1. See below for the list of courses in mathematics.
2. A maximum of 3 course units may be selected in related disciplines approved by the Department of Mathematics and Statistics.
3. Students are responsible for ensuring they have met all of the thesis requirements (http://www.uottawa.ca/graduate-studies/students/theses/).

Master's with Project

At least 50% of the course units must be from the student's home university.

More than 50% of the course units must be taken from the Mathematics course list.[1]

Students must meet the following requirements:

Compulsory Courses:		
18 optional course units in mathematics (MAT) at the graduate level [2]		18 Units
Project:		
MAT 6997	Project in Mathematics and Statistics	6 Units

Note(s)

1. See below for the list of courses in mathematics.
2. A maximum of 3 course units may be selected in related disciplines approved by the Department of Mathematics and Statistics.

Master's with Coursework

At least 50% of the course units must be from the student's home university.

More than 50% of the course units must be taken from the Mathematics course list.[1]

Students must meet the following requirements:

Compulsory Courses:

24 optional course units in mathematics (MAT) at the graduate level [2]	24 Units

Note(s)

1 See below for the list of courses in mathematics.
2 A maximum of 3 course units may be selected in related disciplines approved by the Department of Mathematics and Statistics.

Co-op Option

(Available to students enrolled in the coursework option.)

Co-op students must enroll full-time and successfully complete one work term (SCI 6001).

Each work terms is graded P/F (pass/fail), based on the employer's report and on the written report completed by the student.

To remain enrolled in the Co-op option, a student must:

- maintain full-time status up to and including the term following the work term,
- maintain a cumulative grade point average of 75% (B+) in their program, and
- obtain a satisfactory grade (P) for the Co-op work term.

List of Courses by Field

Mathematics Courses

MAT 5105	Discrete Applied Mathematics I: Gra. Theory	3 Units
MAT 5107	Discrete Applied Mathematics II: Combinatorial Enumeration	3 Units
MAT 5121		3 Units
MAT 5122	Banach Algebras	3 Units
MAT 5125	Real Analysis I	3 Units
MAT 5126	Real Analysis II	3 Units
MAT 5127		3 Units
MAT 5131	Ordinary Differential Equations I	3 Units
MAT 5133	Partial Differential Equations I	3 Units
MAT 5134	Topics in Differential Equations	3 Units
MAT 5141	Algebra I: Rings and Modules	3 Units
MAT 5142	Algebra II: Groups and Galois Theory	3 Units
MAT 5143	Lie Algebras	3 Units
MAT 5144	Commutative Algebra	3 Units
MAT 5145	Group Theory	3 Units
MAT 5146		3 Units
MAT 5147	Homological Algebra and Category Theory	3 Units
MAT 5148	Groups Representations and Applications	3 Units
MAT 5149	Algebraic Geometry	3 Units
MAT 5150	Topics in Geometry	3 Units
MAT 5151	Topology I	3 Units
MAT 5152	Topology II	3 Units
MAT 5155	Differentiable Manifolds	3 Units
MAT 5158	Lie Groups	3 Units
MAT 5160	Mathematical Cryptography	3 Units
MAT 5161	Mathematical Logic	3 Units
MAT 5162		3 Units
MAT 5163	Analytic Number Theory	3 Units
MAT 5164	Algebraic Number Theory	3 Units
MAT 5165	Theory of Automata	3 Units
MAT 5167	Formal Language and Syntax Analysis	3 Units
MAT 5168		3 Units
MAT 5169	Foundations of Geometry	3 Units
MAT 5185	Asymptotic Methods of Applied Mathematics	3 Units
MAT 5187	Topics in Applied Mathematics	3 Units
MAT 5301	Topics in Combinatorial Mathematics	3 Units
MAT 5303	Linear Optimization	3 Units
MAT 5304	Nonlinear Optimization	3 Units
MAT 5106	Combinatorial Optimization	3 Units
MAT 5307	Topics in Operations Research	3 Units
MAT 5308	Topics in Algorithm Design	3 Units
MAT 5309	Harmonic Analysis on Groups	3 Units
MAT 5312	Topics in Topology	3 Units
MAT 5319	Topics in Probability and Statistics	3 Units
MAT 5324	Game Theory	3 Units
MAT 5325		3 Units
MAT 5326	Topics in Analysis	3 Units
MAT 5327	Topics in Algebra	3 Units
MAT 5328		3 Units
MAT 5329		3 Units
MAT 5330		3 Units
MAT 5331		3 Units
MAT 5341	Quantum Computing	3 Units
MAT 5343	Mathematical Aspects of Wavelets and Digital Signal Processing	3 Units
MAT 5361	Topics in Mathematical Logic	3 Units
MAT 5180	Numerical Analysis for Differential Equations	3 Units

Statistics Courses

MAT 5175	Robust Statistical Inference	3 Units
MAT 5181	Data Mining I	3 Units
MAT 5182	Modern Applied and Computational Statistics	3 Units
MAT 5192	Sampling Theory and Methods	3 Units
MAT 5193	Linear Models	3 Units
MAT 5195	Design of Experiments	3 Units
MAT 5196	Multivariate Analysis	3 Units
MAT 5199	Nonparametric Statistics	3 Units
MAT 5313	Topics in Probability and Statistics	3 Units
MAT 5314	Topics in Probability and Statistics	3 Units
MAT 5315	Advanced Design of Surveys	3 Units
MAT 5317	Analysis of Categorical Data	3 Units

MAT 5318	Reliability and Survival Analysis	3 Units
MAT 5375	Introduction to Mathematical Statistics	3 Units
MAT 5176		3 Units
MAT 5177		3 Units
MAT 5992	Seminar in Biostatistics	3 Units

Mathematics and Statistics Courses

MAT 5170	Probability Theory I	3 Units
MAT 5171	Probability Theory II	3 Units
MAT 5172		3 Units
MAT 5173	Stochastic Analysis	3 Units
MAT 5174	Network Performance	3 Units
MAT 5190	Mathematical Statistics I	3 Units
MAT 5191	Mathematical Statistics II	3 Units
MAT 5194	Stochastic Processes and Times Series Analysis	3 Units
MAT 5197	Stochastic Optimization	3 Units
MAT 5198	Stochastic Models	3 Units
MAT 5990	Seminar	3 Units
MAT 5991	Directed Studies	3 Units
MAT 5996	Research Internship	3 Units
MAT 6990		3 Units
MAT 6991	Directed Studies	3 Units
MAT 6997	Project in Mathematics and Statistics	6 Units
MAT 9998	Advanced Comprehensive Examination	
THD 9999	Doctoral Thesis	

Fast-Track from Master's to PhD

Students enrolled in the master's program in mathematics and statistics at the University of Ottawa may be eligible to fast-track directly into the doctoral program without writing a master's thesis. For additional information, please consult the "Admission Requirements" section of the PhD program.

Minimum Requirements

The passing grade in all courses is B.

Students who fail two courses (equivalent to 6 units), or whose progress is deemed unsatisfactory are required to withdraw.

Research

Research at the University of Ottawa

Located in the heart of Canada's capital, a few steps away from Parliament Hill, the University of Ottawa ranks among Canada's top 10 research universities. Our research is founded on excellence, relevance and impact and is conducted in a spirit of equity, diversity and inclusion.

Our research community thrives in four strategic areas:

- Creating a sustainable environment
- Advancing just societies
- Shaping the digital world
- Enabling lifelong health and wellness

From advancing healthcare solutions to tackling global challenges like climate change, the University of Ottawa's researchers are at the forefront of innovation, making significant contributions to society and beyond.

Research at the Faculty of Science

The Faculty of Science has become a true centre of excellence in research through its world-class professors as well as its programs and infrastructure in Biology, Chemistry, Earth Sciences, Mathematics and Statistics, and Physics.

The research accomplished by its 140 internationally recognized professors, its approximately 400 graduate students and its dozens of postdoctoral researchers and visiting scientists has positioned the Faculty of Science as one of the most research intensive science faculties in Canada. Our professors have received many international and national awards including three NSERC Gerhard Herzberg Gold Medal winners and numerous Fellows of the Royal Society of Canada.

The Faculty of Science, through its strategic use of infrastructure programs, hosts world-class Core Facilities and is at the leading edge for the study of Catalysis, Experimental and Computational Chemistry, Environmental Toxins, Nuclear Magnetic Resonance, Isotope Analysis, Molecular Biology and Genomics, X-Ray Spectrometry/Diffractometry, Geochemistry, Mass Spectrometry, Physiology and Genetics of Aquatic Organisms, and Photonics. The Faculty is also associated with the Fields Institute for research in mathematical science and the Centre de recherche mathématiques (CRM) at the Université de Montréal, providing a unique setting for mathematical research.

For more information, refer to the list of faculty members and their research fields on **Uniweb**.

IMPORTANT: Candidates and students looking for professors to supervise their thesis or research project can also consult the website of the faculty or department (https://www.uottawa.ca/study/graduate-studies/academic-unit-contact-information/) of their program of choice. Uniweb does not list all professors authorized to supervise research projects at the University of Ottawa.

Courses

Not all of the listed courses are given each year. The course is offered in the language in which it is described.

Course codes in parentheses are for Carleton University. A 3-unit course at the University of Ottawa is equivalent to a 0.5-unit course at Carleton University.

MAT 5105 Discrete Applied Mathematics I: Gra. Theory (3 units)

Paths and cycles, trees, connectivity, Euler tours and Hamilton cycles, edge colouring, independent sets and cliques, vertex colouring, planar graphs, directed graphs. Selected topics from one or more of the following areas: algebraic graph theory, topological theory, random graphs. This course is equivalent to MATH 5818 at Carleton University.
Course Component: Lecture

MAT 5106 Combinatorial Optimization (3 units)

Network flow theory and related material. Topics will include shortest paths, minimum spanning trees, maximum flows, minimum cost flows. Optimal matching in bipartite graphs. This course is equivalent to MATH 5808 at Carleton University.
Course Component: Lecture

MAT 5107 Discrete Applied Mathematics II: Combinatorial Enumeration (3 units)

Ordinary and exponential generating functions; product formulas; permutations; partitions; rooted trees; cycle index; WZ method. Lagrange Inversions; singularity analysis of generating functions and asymptotics. Selected topics from one or more of the following areas: random graphs, random combinatorial structures, hypergeometric functions. This course is equivalent to MATH 5819 at Carleton University.

Course Component: Lecture

MAT 5122 Banach Algebras (3 units)

This course is equivalent to MATH 5003 at Carleton University.

Course Component: Lecture

MAT 5125 Real Analysis I (3 units)

General measure and integral, Lebesgue measure and integration on R, Fubini's theorem, Lebesgue-Radon-Nikodym theorem, absolute continuity and differentiation, Lp-Spaces. Selected topics such as Daniell-Stone theory. This course is equivalent to MATH 5007 at Carleton University.

Course Component: Lecture

Prerequisites: MAT 3120 (MATH 3001).

MAT 5126 Real Analysis II (3 units)

Banach and Hilbert spaces, bounded linear operators, dual spaces. Topics selected from: weak- and weak-topologies, Alaoglu's theorem, compact operators, differential calculus in Banach spaces, Riesz representation theorems. This course is equivalent to MATH 5008 at Carleton University.

Course Component: Lecture

Prerequisite: MAT 5125 (MATH 5007).

MAT 5131 Ordinary Differential Equations I (3 units)

One or two specialized Linear systems, fundamental solution. Nonlinear systems, existence and uniqueness, flow. Equilibria, periodic solutions, stability.Invariant manifolds and hyperbolic theory. topics taken from, but not limited to: perturbation and asymptotic methods, normal forms and bifurcations, global dynamics.This course is equivalent to MATH 5405 at Carleton University.

Course Component: Lecture

MAT 5133 Partial Differential Equations I (3 units)

First-order equations, characteristics method, classification of second-order equations, separation of variables, Green's functions. Lp and Soboloev spaces, distributions, variational formulation and weak solutions, Lax-Milgram theorem, Galerkin approximation. Parabolic PDes. Wave equations, hyperbolic systems, nonlinear PDes, reaction diffusion equations, infinite-dimensional dynamical systems, regularity. This course is equivalent to MATH 5406 at Carleton University.

Course Component: Lecture

Permission of the Department is required.

MAT 5134 Topics in Differential Equations (3 units)

This course is equivalent to MATH 5407 at Carleton University.

Course Component: Lecture

MAT 5141 Algebra I: Rings and Modules (3 units)

Noetherian and artinian modules and rings. Algebraic sets, vanishing ideals, Hilbert Basis Theorem, radical ideals, Hilbert Nullstellensatz. Localization of rings and modules. Tensor product of modules and algebras. Semisimple rings and modules, Schur's lemma, Jacobson Density Theorem, Artin-Wedderburn Theorem. Short exact sequences, free modules, projective modules, injective modules, flat modules. This course is equivalent to MATH 5107 at Carleton University.

Course Component: Lecture

MAT 5142 Algebra II: Groups and Galois Theory (3 units)

Group actions, class equation, Sylow theorems, central, composition and derived series, Jordan-Holder theorem, field extensions and minimal polynomials, algebraic closure, separable extensions, integral ring extensions, Galois groups, fundamental theorem of Galois theory, finite fields, cyclotomic field extensions, fundamental theorem of algebra, transcendental extensions. This course is equivalent to MATH 5109 at Carleton University.

Course Component: Lecture

MAT 5143 Lie Algebras (3 units)

This course is equivalent to MATH 5104 at Carleton University.

Course Component: Lecture

MAT 5144 Commutative Algebra (3 units)

Prime spectrum of a commutative ring (as a topological space); localization of rings and modules; tensor product of modules and algebras; Hilbert's Nullstellensatz and consequences for finitely generated algebras; Krull dimension of a ring; integral dependence, going-up, going-down; Noether Normalization Lemma and dimension theory for finitely generated algebras over a field; noetherian rings and Hilbert Basis Theorem; introduction to affine algebraic varieties and their morphisms. This course is equivalent to MATH 5001 at Carleton University.

Course Component: Lecture

MAT 5145 Group Theory (3 units)

This course is equivalent to MATH 5106 at Carleton University.

Course Component: Lecture

MAT 5147 Homological Algebra and Category Theory (3 units)

This course is equivalent to MATH 5108 at Carleton University.

Course Component: Lecture

MAT 5148 Groups Representations and Applications (3 units)

This course is equivalent to MATH 5102 at Carleton University.

Course Component: Lecture

MAT 5149 Algebraic Geometry (3 units)

Brief overview of commutative algebra, Hilbert's Nullstellensatz, algebraic sets, and Zariski topology. Affine and projective varieties over algebraically closed fields. Regular functions and rational maps. Additional topics chosen from: the relation of varieties over complex numbers to complex analytic manifolds, genus, divisors, line bundles, Riemann-Roch Theorem, Bézout's Theorem. This course is equivalent to MATH 5002 at Carleton University.

Course Component: Lecture

MAT 5150 Topics in Geometry (3 units)

This course is equivalent to MATH 5201 at Carleton University.

Course Component: Lecture

MAT 5151 Topology I (3 units)

Topological spaces, product and identification topologies, countability and separation axioms, compactness, connectedness, homotopy, fundamental group, net and filter convergence. This course is equivalent to MATH 5205 at Carleton University.

Course Component: Lecture

MAT 5152 Topology II (3 units)

Covering spaces, homology via the Eilenberg-Steenrod axioms, applications, construction of a homology functor. This course is equivalent to MATH 5206 at Carleton University.
Course Component: Lecture
Prerequisites: MAT 3143 and MAT 5151 (MATH 3100 and MATH 5205).

MAT 5155 Differentiable Manifolds (3 units)

This course is equivalent to MATH 5208 at Carleton University.
Course Component: Lecture

MAT 5158 Lie Groups (3 units)

This course is equivalent to MATH 6104 at Carleton University.
Course Component: Lecture

MAT 5160 Mathematical Cryptography (3 units)

Analysis of cryptographic methods used in authentication and data protection, with particular attention to the underlying mathematics, e.g. Algebraic Geometry, Number Theory, and Finite Fields. Advanced topics on Public-Key Cryptography: RSA and integer factorization, Diffie-Hellman, discrete logarithms, elliptic curves. Topics in current research. This course is equivalent to MATH 5300 at Carleton University.
Course Component: Lecture
Prerequisite: undergraduate honours algebra, including group theory and finite fields.

MAT 5161 Mathematical Logic (3 units)

A basic graduate course in mathematical logic. Propositional and Predicate logic, Proof theory, Gentzen's Cut-Elimination, Completeness, Compactness, Henkin models, model theory, arithmetic and undecidability. Special Topics (time permitting) depending on interests of instructor and audience. This course is equivalent to MATH 5301 at Carleton University.
Course Component: Lecture
Prerequisite: Honours undergraduate algebra, analysis and topology (or permission of the instructor).

MAT 5163 Analytic Number Theory (3 units)

This course is equivalent to MATH 5305 at Carleton University.
Course Component: Lecture

MAT 5164 Algebraic Number Theory (3 units)

This course is equivalent to MATH 5306 at Carleton University.
Course Component: Lecture

MAT 5165 Theory of Automata (3 units)

This course is equivalent to MATH 5605 at Carleton University.
Course Component: Lecture

MAT 5167 Formal Language and Syntax Analysis (3 units)

This course is equivalent to MATH/COMP 5807 at Carleton University.
Course Component: Lecture

MAT 5169 Foundations of Geometry (3 units)

This course is equivalent to MATH 5207 at Carleton University.
Course Component: Lecture

MAT 5170 Probability Theory I (3 units)

Probability spaces and probability measures, sigma-fields, random variables and distributions, expected values as Lebesgue integrals, change-of-variable formula, laws of large numbers, integral inequalities, convergence theorems, uniform integrability, product measures, Fubini's theorem, independence and related topics, Borel–Cantelli lemmas, maximal inequalities, modes of convergence, central limit theorem, characteristic functions. This course is equivalent to STAT 5708 at Carleton University.
Course Component: Lecture
Prerequisites: MAT 3120, MAT 3172 (MATH 3001, MATH 3500).

MAT 5171 Probability Theory II (3 units)

Laws of large numbers, characteristic functions, central limit theorem, conditional probabilities and expectation, basic properties and convergence theorems for martingales, introduction to Brownian motion. This course is equivalent to STAT 5709 at Carleton University.
Course Component: Lecture
Prerequisite: MAT 5170.

MAT 5173 Stochastic Analysis (3 units)

Introduction to stochastic processes from a non-measure theoretic point of view. Conditional expectation. Brownian motion, Gaussian processes, martingales. Wiener and Itô integrals with respect to Brownian motion. Itô formula. Stochastic differential equations. Applications to financial mathematics, the Black-Scholes formula. This course is equivalent to STAT 5604 at Carleton University
Course Component: Lecture

MAT 5174 Network Performance (3 units)

The course will focus on advanced techniques in performance evaluation of large complex networks. Topics may include classical queueing theory and simulation analysis; models of packet networks; loss and delay systems; blocking probabilities. This course is equivalent to STAT 5704 at Carleton University.
Course Component: Lecture
Prerequisite: Some familiarity with probability and stochastic processes and queueing, or permission of the instructor.

MAT 5175 Robust Statistical Inference (3 units)

This course is equivalent to STAT 5506 at Carleton University.
Course Component: Lecture

MAT 5180 Numerical Analysis for Differential Equations (3 units)

Floating pointing arithmetic; numerical solution of ordinary differential equations; finite difference methods for partial differential equations; stability, consistency and convergence: von Neumann analysis, Courant-Friedrichs-Lewy condition, Lax theorem; finite element methods: boundary value problems and elliptic partial differential equations; spectral and Pseudo-spectral methods. This course is equivalent to MATH 5806 at Carleton University.
Course Component: Lecture

MAT 5181 Data Mining I (3 units)

Visualization and knowledge discovery in massive datasets; unsupervised learning: clustering algorithms; dimension reduction; supervised learning: pattern recognition, smoothing techniques, classification. Computer software will be used. This course is equivalent to STAT 5703 at Carleton University.
Course Component: Lecture

MAT 5182 Modern Applied and Computational Statistics (3 units)

Resampling and computer intensive methods: bootstrap, jackknife with applications to bias estimation, variance estimation, confidence intervals, and regression analysis. Smoothing methods in curve estimation; statistical classification and pattern recognition: error counting methods, optimal classifiers, bootstrap estimates of the bias of the misclassification error. This course is equivalent to STAT 5702 at Carleton University.

Course Component: Lecture

MAT 5185 Asymptotic Methods of Applied Mathematics (3 units)

Asymptotic series: properties, matching, application to linear and nonlinear differential equations. Asymptotic expansion of integrals: elementary methods, methods of Laplace, Stationary Phase and Steepest Descent, Watson's Lemma, Riemann-Lebesgue Lemma. Perturbation methods: regular and singular perturbation for differential equations, multiple scale analysis, boundary layer theory, WKB theory. This course is equivalent to MATH 5408 at Carleton University.

Course Component: Lecture

MAT 5187 Topics in Applied Mathematics (3 units)

This course is equivalent to MATH 5403 at Carleton University.

Course Component: Lecture

MAT 5190 Mathematical Statistics I (3 units)

Statistical decision theory; likelihood functions; sufficiency; factorization theorem; exponential families; UMVU estimators; Fisher's information; Cramer-Rao lower bound; maximum likelihood and moment estimation; invariant and robust point estimation; asymptotic properties; Bayesian point estimation. This course is equivalent to STAT 5600 at Carleton University.

Course Component: Lecture

Prerequisites: MAT 3172, MAT 3375. The courses MAT 5190, MAT 5375 cannot be combined for credits.

MAT 5191 Mathematical Statistics II (3 units)

Confidence intervals and pivotals; Bayesian intervals; optimal tests and Neyman-Pearson theory; likelihood ratio and score tests; significance tests; goodness-of-fit tests; large sample theory and applications to maximum likelihood and robust estimation. This course is equivalent to STAT 5501 at Carleton University.

Course Component: Lecture

Prerequisite: MAT 5190.

MAT 5192 Sampling Theory and Methods (3 units)

Unequal probability sampling with and without replacement; unified theory of standard errors; prediction approach; ratio and regression estimation; stratification and optimal designs; multistage cluster sampling; double sampling; domains of study; post-stratification; non-response; measurement errors. Related topics. This course is equivalent to STAT 5502 at Carleton University.

Course Component: Lecture

MAT 5193 Linear Models (3 units)

Theory of non-full-rank linear models: estimable functions, best linear unbiased estimators, hypothesis testing, confidence regions; multi-way classification; analysis of covariance; variance component models: maximum likelihood estimation, MINQUE, ANOVA methods. Miscellaneous topics. This course is equivalent to STAT 5503 at Carleton University.

Course Component: Lecture

Prerequisite: MAT 4175 (MATH 4500) or MAT 5190 (STAT 5600).

MAT 5194 Stochastic Processes and Times Series Analysis (3 units)

This course is equivalent to STAT 5504 at Carleton University.

Course Component: Lecture

MAT 5195 Design of Experiments (3 units)

Overview of linear model theory; orthogonality; randomized block and split plot designs; Latin square designs; randomization theory; incomplete block designs; factorial experiments; confounding and fractional replication; response surface methodology. Miscellaneous topics. This course is equivalent to STAT 5505 at Carleton University.

Course Component: Lecture

Prerequisites: MAT 3375 and MAT 3376 or MAT 5190 (STAT 3505 and STAT 4500 or STAT 5600).

MAT 5196 Multivariate Analysis (3 units)

This course is equivalent to STAT 5509 at Carleton University.

Course Component: Lecture

MAT 5197 Stochastic Optimization (3 units)

Topics chosen from stochastic dynamic programming, Markov decision processes, search theory, optimal stopping. This course is equivalent to STAT 5601 at Carleton University.

Course Component: Lecture

Prerequisite: STAT 3506 or MAT 4371.

MAT 5198 Stochastic Models (3 units)

Markov systems, stochastic networks, queuing networks, spatial processes, approximation methods in stochastic processes and queuing theory. Applications to the modelling and analysis of computer-communications systems and other distributed networks. This course is equivalent to MATH 5701 at Carleton University.

Course Component: Lecture

MAT 5199 Nonparametric Statistics (3 units)

Classical nonparametric techniques; nonparametric density estimation; nonparametric regression analysis: kernel estimators, orthogonal series estimators, smoothing splines; estimation of statistical functionals; nonparametric bootstrap; jackknife; elements of highdimensional statistical inference; multiple testing and false discovery. Statistical software will be used. This course is equivalent to STAT 5516 at Carleton University

Course Component: Lecture

Prerequisite : MAT 5375 or MAT 5190.

MAT 5301 Topics in Combinatorial Mathematics (3 units)

This course is equivalent to MATH 5609 at Carleton University.

Course Component: Lecture

MAT 5303 Linear Optimization (3 units)

This course is equivalent to MATH 5801 at Carleton University.

Course Component: Lecture

MAT 5304 Nonlinear Optimization (3 units)

This course is equivalent to MATH 5803 at Carleton University.

Course Component: Lecture

MAT 5307 Topics in Operations Research (3 units)

This course is equivalent to MATH 5804 at Carleton University.

Course Component: Lecture

MAT 5308 Topics in Algorithm Design (3 units)

This course is equivalent to MATH 5805 at Carleton University.

Course Component: Lecture

MAT 5309 Harmonic Analysis on Groups (3 units)
This course is equivalent to MATH 6002 at Carleton University.
Course Component: Lecture

MAT 5312 Topics in Topology (3 units)
This course is equivalent to MATH 6201 at Carleton University.
Course Component: Lecture

MAT 5313 Topics in Probability and Statistics (3 units)
This course is equivalent to MATH 6507 at Carleton University.
Course Component: Lecture

MAT 5314 Topics in Probability and Statistics (3 units)
This course is equivalent to STAT 6508 at Carleton University.
Course Component: Lecture

MAT 5315 Advanced Design of Surveys (3 units)
Course Component: Lecture

MAT 5317 Analysis of Categorical Data (3 units)
Analysis of one-way and two-way tables of nominal date; multi-dimensional contingency tables, log-linear models; tests of symmetry, marginal homogeneity in square tables; incomplete tables; tables with ordered categories; fixed margins, logistic models with binary response; measures of association and agreement; biological applications. This course is equivalent to STAT 5602 at Carleton University.
Course Component: Lecture

MAT 5318 Reliability and Survival Analysis (3 units)
This course is equivalent to STAT 5603 at Carleton University.
Course Component: Lecture

MAT 5319 Topics in Probability and Statistics (3 units)
This course is equivalent to MATH 6507 at Carleton University.
Course Component: Lecture

MAT 5324 Game Theory (3 units)
This course is equivalent to MATH 5607 at Carleton University.
Course Component: Lecture

MAT 5326 Topics in Analysis (3 units)
This course is equivalent to MATH 6008 at Carleton University.
Course Component: Lecture

MAT 5327 Topics in Algebra (3 units)
This course is equivalent to MATH 6101 at Carleton University.
Course Component: Lecture

MAT 5341 Quantum Computing (3 units)
Space of quantum bits; entanglement. Observables in quantum mechanics. Density matrix and Schmidt decomposition. Quantum cryptography. Classical and quantum logic gates. Quantum Fourier transform. Shor's quantum algorithm for factorization of integers. This course is equivalent to MATH 5821 at Carleton University.
Course Component: Lecture

MAT 5343 Mathematical Aspects of Wavelets and Digital Signal Processing (3 units)
Lossless compression methods. Discrete Fourier transform and Fourier-based compression methods. JPEG and MPEG. Wavelet analysis. Digital filters and discrete wavelet transform. Daubechies wavelets. Wavelet compression. This course is equivalent to MATH 5822 at Carleton University.
Course Component: Lecture
Prerequisites: Linear algebra and Fourier series

MAT 5361 Topics in Mathematical Logic (3 units)
This course is equivalent to MATH 6806 at Carleton University.
Course Component: Lecture

MAT 5375 Introduction to Mathematical Statistics (3 units)
Limit theorems; sampling distributions; parametric estimation; concepts of sufficiency and efficiency; Neyman-Pearson paradigm, likelihood ratio tests; parametric and non-parametric methods for two-sample comparisons; notions of experimental design, categorical data analysis, the general linear model, decision theory and Bayesian inference. This course is essential for students in applied statistics. This course is equivalent to STAT 5610 at Carleton University.
Course Component: Lecture
The courses MAT 5190, MAT 5375 cannot be combined for credits.

MAT 5505 Mathématiques discrètes appliquées I : Théorie des graphes (3 crédits)
Chemins et cycles, arbres, connexité, parcours euleriens et cycles hamiltoniens, coloration des arêtes, ensembles indépendants et cliques, coloration des sommets, graphes planaires, graphes orientés. Sujets choisis parmi les thèmes suivants : théorie algébrique des graphes, théorie topologique des graphes, graphes aléatoires. Ce cours est équivalent à MATH 5818 à la Carleton University.
Volet : Cours magistral

MAT 5506 Optimisation combinatoire (3 crédits)
Théorie des flots et thèmes voisins. On traitera parmi d'autres les sujets suivants : chemins minimaux, arbres générateurs de coût minimal, flots de coût maximal, flots de coût minimal. Couplage optimal dans les graphes bipartis. Ce cours est équivalent à MATH 5808 à la Carleton University.
Volet : Cours magistral

MAT 5507 Mathématiques discrètes appliquées II : Énumération combinatoire (3 crédits)
Fonctions génératrices ordinaires et exponentielles; formules de produit; permutations; partitions; arborescences; indice de cycle; méthode WZ. Inversion de Lagrange; analyse des singularités des fonctions génératrices et leur comportement asymptotique. Sujets choisis parmi les thèmes suivants : graphes aléatoires, structures combinatoires aléatoires, fonctions hypergéométriques. Ce cours est équivalent à MATH 5819 à la Carleton University.
Volet : Cours magistral

MAT 5522 Algèbres de banach (3 crédits)
Ce cours est équivalent à MATH 5003 à la Carleton University.
Volet : Cours magistral

MAT 5525 Analyse réelle I (3 crédits)
Mesure et intégration, mesure de Lebesgue et intégration sur R, théorème de Fubini, théorème de Lebesgue-Radon-Nikodym, continuité absolue et dérivation, espaces Lp. Chapitres choisis comme par exemple la théorie de Stone-Daniell. Ce cours est équivalent à MATH 5007 à la Carleton University.
Volet : Cours magistral
Préalables : MAT 3520 (MATH 3001).

MAT 5526 Analyse réelle II (3 crédits)

Espaces de Banach et de Hilbert, opérateurs linéaires bornés, espaces duals. Chapitres choisis parmi les suivants : topologies faibles, théorème d'Alaoglu, opérateurs compacts, calcul différentiel dans les espaces de Banach, théorèmes de représentation de Riesz. Ce cours est équivalent à MATH 5008 à la Carleton University.
Volet : Cours magistral
Prerequisite for MAT 5526

MAT 5531 Équations différentielles ordinaires I (3 crédits)

Ce cours est équivalent à MATH 5405 à la Carleton University.
Volet : Cours magistral

MAT 5533 Équations aux dérivées partielles I (3 crédits)

Ce cours est équivalent à MATH 5406 à la Carleton University.
Volet : Cours magistral
Prerequisite: An intermediate level course on Ordinary Differential Equations such as MAT 3130 Dynamical Systems or equivalent, or the permission of the School or Department.

MAT 5534 Équations différentielles : Chapitres choisis (3 crédits)

Ce cours est équivalent à MATH 5407 à la Carleton University.
Volet : Cours magistral

MAT 5541 Algèbre I: Anneaux et modules (3 crédits)

Modules et anneaux noethériens et artiniens. Ensembles algébriques, leurs idéaux, théorème de base de Hilbert, idéaux radicaux, Hilbert Nullstellensatz. Localisation des anneaux et des modules. Produit tensoriel des modules et des algèbres. Anneaux et modules semi-simples, le lemme de Schur, le théorème de densité de Jacobson, le théorème d'Artin-Wedderburn. Suites exactes courtes, modules libres, modules projectifs, modules injectifs, modules plats. Ce cours est équivalent à MATH 5107 à la Carleton University.
Volet : Cours magistral

MAT 5542 Algèbre II: Groupes et la théorie de Galois (3 crédits)

Actions de groupes, formule des classes, théorèmes de Sylow, séries centrales, de composition et dérivées, théorème de Jordan-Holder, extensions de corps et polynômes minimaux, fermeture algébrique, extensions séparables, intégralité, groupes de Galois, théorème fondamental de la théorie de Galois, corps finis, extensions cyclotomiques, théorème fondamental de l'algèbre, extensions transcendantes. Ce cours est équivalent à MATH 5109 à la Carleton University.
Volet : Cours magistral

MAT 5543 Algèbre de lie (3 crédits)

Ce cours est équivalent à MATH 5104 à la Carleton University.
Volet : Cours magistral

MAT 5544 Algèbre commutative (3 crédits)

Spectre premier d'un anneau commutatif (comme espace topologique); localisation des anneaux et des modules; produit tensoriel des modules et algèbres; théorème des zéros de Hilbert et conséquences pour les algèbres de type fini sur un corps; dimension de Krull d'un anneau; dépendance intégrale, théorèmes de « going-up » et « going-down »; lemme de normalisation de Noether et théorie de la dimension dans les algèbres de type fini sur un corps; anneaux noethériens et théorème « de la base » de Hilbert; introduction aux variétés algébriques affines et à leurs morphismes.
Volet : Cours magistral

MAT 5545 Théorie des groupes (3 crédits)

Ce cours est équivalent à MATH 5106 à la Carleton University.
Volet : Cours magistral

MAT 5547 Algèbre homologique et théorie des catégories (3 crédits)

Ce cours est équivalent à MATH 5108 à la Carleton University.
Volet : Cours magistral

MAT 5548 Représentation de groupes et applications (3 crédits)

Volet : Cours magistral

MAT 5549 Géométrie algébrique (3 crédits)

Quelques notions d'algèbre commutative, théorème des zéros de Hilbert, ensembles algébriques, topologie de Zariski. Variétés affines et projectives sur un corps algébriquement clos. Fonctions régulières et applications rationnelles. Sujets choisis parmi : la relation entre les variétés algébriques complexes et les variétés analytiques complexes; genres; diviseurs; fibrés en droites; Théorèmes de Riemann-Roch et de Bézout.
Volet : Cours magistral
Prerequisite: MAT 3143

MAT 5551 Topologie I (3 crédits)

Espaces topologiques; topologie produit et topologie quotient; axiomes de dénombrabilité et axiomes de séparation; espaces compacts, connexes; homotopie, groupe fondamental; convergence des filtres et des suites généralisées. Ce cours est équivalent à MATH 5205 à la Carleton University.
Volet : Cours magistral
Prerequisite: MAT 3153 (MATH 3001).

MAT 5552 Topologie II (3 crédits)

Revêtements, homologie (axiomes d'Eilenberg-Steenrod), applications, construction d'une théorie de l'homologie. Ce cours est équivalent à MATH 5206 à la Carleton University.
Volet : Cours magistral
Prerequisites: MAT 3143 and MAT 5151 (MATH 3100 and MATH 5205).

MAT 5555 Variétés différentielles (3 crédits)

Ce cours est équivalent à MATH 5208 à la Carleton University.
Volet : Cours magistral

MAT 5558 Groupes de Lie I (3 crédits)

Ce cours est équivalent à MATH 6104 à la Carleton University.
Volet : Cours magistral

MAT 5565 Théorie des automates I (3 crédits)

Ce cours est équivalent à MATH 5605 à la Carleton University.
Volet : Cours magistral

MAT 5567 Langages formels et analyse syntactique (3 crédits)

Ce cours est équivalent à MATH/COMP 5807 à la Carleton University.
Volet : Cours magistral

MAT 5570 Théorie des probabilités I (3 crédits)

Espaces de probabilité et mesures de probabilité, sigma-algèbres, variables aléatoires et répartitions, l'espérance mathématique définie comme une intégrale de Lebesgue, formule de changement de variable, lois des grands nombres, inégalités intégrales, théorèmes de convergence, intégrabilité uniforme, mesure produit, théorème de Fubini, indépendance et sujets liés à l'indépendance, lemmes de Borel-Cantelli, inégalités maximales, modes de convergence, théorème central limite, fonctions caractéristiques. Ce cours est équivalent à STAT 5708 à la Carleton University.
Volet : Cours magistral
Préalables : MAT 3520, MAT 3572 (MATH 3001, MATH 3500).

MAT 5571 Théorie des probabilités II (3 crédits)

Lois des grands nombres, fonctions caractéristiques, théorème-limite central, probabilité et espérance conditionnelles, propriétés élémentaires et théorèmes de convergence des martingales, introduction au mouvement brownien. Ce cours est équivalent à MATH 5709 à la Carleton University.
Volet : Cours magistral
Prerequisite: MAT 5170 (STAT 5708).

MAT 5580 Analyse numérique I pour les équations différentielles (3 crédits)

Arithmétique des nombres à virgule flottante; solution numérique des équations différentielles ordinaires; méthode des différences finies pour les équations aux dérivées partielles; stabilité, consistance et convergence : analyse de von Neumann, condition de Courant-Friedrichs-Lewy, théorème de Lax; méthode des éléments finis : problèmes aux limites et équations aux dérivées partielles elliptiques; méthodes Spectrale et Pseudo-Spectrale.
Volet : Cours magistral

MAT 5590 Statistique mathématiques I (3 crédits)

Théorie de la décision statistique; fonctions de vraisemblance; suffisance; théorème de factorisation; familles exponentielles; Estimateurs UMVU; Fonction d'information de Fisher; Limite inférieure de Cramer-Rao; maximum de vraisemblance et estimation du moment; estimation ponctuelle invariante et robuste; propriétés asymptotiques; Estimation ponctuelle bayésienne. Ce cours est équivalent au cours STAT 5600 à l'Université Carleton.
Volet : Cours magistral
Préalables : MAT 3172, MAT 3375. Les cours MAT 5775, MAT 5190 ne peuvent être combinés pour l'obtention de crédits.

MAT 5591 Statistique mathématiques II (3 crédits)

Intervalles de confiance et pivots; Intervalles bayésiens; tests optimaux et théorie de Neyman-Pearson; tests de vraisemblance et de Rao score; tests de signification; tests d'adéquation; théorie basée sur de grands échantillons et applications au maximum de vraisemblance et estimation robuste. Ce cours est équivalent à STAT 5501 à la Carleton University.
Volet : Cours magistral
Préalable : MAT 5590.

MAT 5593 Modèles linéaires (3 crédits)

Théorie des modèles linéaires des rangs non-exhaustifs : fonctions estimables, meilleurs estimateurs linéaires sans biais, vérification des hypothèses, régions de confiance; classification multidimensionnelle; analyse de la covariance; modèles de composantes de variance; méthode du maximum de vraisemblance; méthode MINQUE, ANOVA; sujets divers. Ce cours est équivalent à STAT 5503 à la Carleton University.
Volet : Cours magistral
Prerequisite for MAT 5593

MAT 5595 Plan d'expériences (3 crédits)

Aperçu de la théorie du modèle linéaire; orthogonalité; blocs complets avec randomisation totale, plans split plot; plans de carré latin; théorie du caractère aléatoire; plans de blocs incomplets; expériences factorielles; la théorie de la randomisation; les effets confondus et la replication fractionelle; méthodologie de la surface de réponse; sujets divers.
Volet : Cours magistral

MAT 5596 Analyse multivariée (3 crédits)

Cours visant à donner à l'étudiant la possibilité d'entreprendre de la recherche mathématique dans le contexte d'un projet en collaboration avec un organisme parrain des secteurs public ou privé. Inclut des séminaires sur des sujets pertinents au projet de l'étudiant. Note finale de S (satisfaisant) ou NS (non satisfaisant) décidée par le professeur responsable du cours en consultation avec le superviseur du stage, fondée sur le contenu mathématique et sur la présentation orale et écrite des résultats. Ce cours est équivalent à STAT 5509 à la Carleton University.
Volet : Cours magistral
Préalable : Permission de l'Institut.

MAT 5597 Optimisation stochastique (3 crédits)

Ce cours est équivalent à STAT 5601 à la Carleton University.
Volet : Cours magistral
Prerequisite: STAT 3506 or MAT 4371.

MAT 5598 Modèles stochastiques (3 crédits)

Ce cours est équivalent à MATH 5701 à la Carleton University.
Volet : Cours magistral

MAT 5709 Analyse harmonique sur les groupes (3 crédits)

Ce cours est équivalent à MATH 6002 à la Carleton University.
Volet : Cours magistral

MAT 5712 Topologie : Chapitres choisis (3 crédits)

Ce cours est équivalent à MATH 6201 à la Carleton University.
Volet : Cours magistral

MAT 5713 Topics in Probability and Statistics (3 crédits)

Ce cours est équivalent à MATH 6507 à la Carleton University.
Volet : Cours magistral

MAT 5714 Théories problèmes et statistique (3 crédits)

Ce cours est équivalent à MATH 6508 à la Carleton University.
Volet : Cours magistral

MAT 5715 Planification des sondages (3 crédits)

Volet : Cours magistral

MAT 5726 Analyse : Chapitres choisis (3 crédits)

Ce cours est équivalent à MATH 6008 à la Carleton University.
Volet : Cours magistral

MAT 5727 Algèbre - chapitres choisis (3 crédits)

Ce cours est équivalent à MATH 6101 à la Carleton University.
Volet : Cours magistral

MAT 5761 Logique mathématique : Chapitres choisis (3 crédits)

Ce cours est équivalent à MATH 6806 à la Carleton University.
Volet : Cours magistral

MAT 5775 Introduction à la statistique mathématique (3 crédits)

L'inférence statistique; distributions des statistiques classiques et les théorèmes central limites qui s'y rapportent; estimation paramétrique; statistique suffisante; estimateur efficace; paradigme Neyman-Pearson, tests de rapport de vraisemblance; méthodes paramétrique et non paramétrique pour la comparaison de deux échantillons; planification des expériences, analyse des données catégoriques, modèles linéaires généralisés, théorie de la décision et inférence Baysienne. Ce cours est essentiel au étudiant(e)s en statistique appliquée. Ce cours est équivalent au cours STAT 5610 à l'Université Carleton.
Volet : Cours magistral
Les cours MAT 5775, MAT 5590 ne peuvent être combinés pour l'obtention de crédits.

MAT 5990 Séminaire / Seminar (3 crédits / 3 units)

Ce cours est équivalent à MATH 5900 à la Carleton University. / This course is equivalent to MATH 5900 at Carleton University.
Volet / Course Component: Cours magistral / Lecture

MAT 5990T Séminaire / Seminar (3 crédits / 3 units)

Volet / Course Component: Cours magistral / Lecture

MAT 5991 Travaux dirigés / Directed Studies (3 crédits / 3 units)

Ce cours est équivalent à MATH 5901 à la Carleton University. / This course is equivalent to MATH 5901 at Carleton University.
Volet / Course Component: Recherche / Research

MAT 5992 Seminar in Biostatistics (3 crédits / 3 units)

Students work in teams on the analysis of experimental data or experimental plans. The participation of experimenters in these teams is encouraged. Student teams present their results in the seminar, and prepare a brief written report on their work.
Volet / Course Component: Cours magistral / Lecture

MAT 5996 Stage de recherche / Research Internship (3 crédits / 3 units)

Cours visant à donner à l'étudiant la possibilité d'entreprendre de la recherche mathématique dans le contexte d'un projet en collaboration avec un organisme parrain des secteurs public ou privé. Inclut des séminaires sur des sujets pertinents au projet de l'étudiant. Note finale S (satisfaisant) ou NS (non satisfaisant), à décider par le professeur responsable du cours en consultation avec le superviseur du stage, fondée sur le contenu mathématique et sur la présentation orale et écrite des résultats. / Project-oriented course affording students the opportunity to undertake research in applied mathematics as a cooperative project with governmental or industrial sponsors. Project work and seminars on related topics. Grade S (Satisfactory) or NS (Not satisfactory) to be assigned based upon the mathematical content as well as upon the oral and written presentation of results, and to be determined by the professor in charge of the course in consultation with the internship supervisor.
Volet / Course Component: Cours magistral / Lecture

MAT 6991 Travaux dirigés / Directed Studies (3 crédits / 3 units)

Ce cours est équivalent à MATH 6901 à la Carleton University. / This course is equivalent to MATH 6901 at Carleton University.
Volet / Course Component: Recherche / Research

MAT 6997 Projet en mathématiques et statistique / Project in Mathematics and Statistics (6 crédits / 6 units)

Projet en mathématiques et statistique dirigé par un professeur approuvé par le directeur des études supérieures et donnant lieu à la rédaction d'un rapport approfondi (30-40 pages approx). Noté S (satisfaisant) ou NS (non satisfaisant) par le directeur du projet et un autre professeur nommé par le directeur des études supérieures en mathématiques et statistique. Le projet est normalement complété en une session. Ce cours est équivalent à MATH 5910 à la Carleton University. / Project in mathematics and statistics supervised by a professor approved by the director of graduate studies and leading to the writing of an in-depth report (approx. 30-40 pages). Graded S (Satisfactory) or NS (Not satisfactory) by the supervisor and by another professor appointed by the director of graduate studies in mathematics and statistics. The project will normally be completed in one session. This course is equivalent to MATH 5910 at Carleton University.
Volet / Course Component: Recherche / Research
Permission of the Department is required.

MAT 9900 Examen de synthèse: Analyse réelle I / Comprehensive Exam: Real Analysis 1

Cet examen porte sur le contenu du cours MAT 5525. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT 5525 et MAT 5526 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5125. This exam is the final exam of the course and is graded by the professors who teach MAT 5125 and MAT 5126 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9901 Examen de synthèse: Analyse réelle II / Comprehensive Exam: Real Analysis II

Cet examen porte sur le contenu du cours MAT 5526. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT 5525 et MAT 5526 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5126. This exam is the final exam of the course and is graded by the professors who teach MAT 5125 and MAT 5126 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9902 Examen de synthèse: Algèbre I / Comprehensive Exam: Algebra I

Cet examen porte sur le contenu du cours MAT 5541. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT 5541 et MAT 5542 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5141. This exam is the final exam of the course and is graded by the professors who teach MAT 5141 and MAT 5142 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9903 Examen de synthèse: Algèbre II / Comprehensive Exam: Algebra II

Cet examen porte sur le contenu du cours MAT 5542. Cet examen est l'examen final de ce cours et est corrigé par les professeurs qui enseignent MAT 5541 et MAT 5542 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5142. This exam is the final exam of the course and is graded by the professors who teach MAT 5141 and MAT 5142 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9904 Examen de synthèse: Topologie I / Comprehensive Exam: Topology I

Cet examen porte sur le contenu du cours MAT 5551. Cet examenn est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT 5551 et MAT 5552 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant) / This exam covers the content of the course MAT 5151. This exam is the final exam of the course and is graded by the professors who teach MAT 5151 and MAT 5152 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9905 Examen de synthèse: Topologie II / Comprehensive Exam: Topology II

Cet examen porte sur le contenu du cours MAT 5552. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT 5551 et MAT 5552 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5152. This exam is the final exam of the course and is graded by the professors who teach MAT 5151 and MAT 5152 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9906 Examen de synthèse: Équations différentielles I / Comprehensive Exam: Differential Equations I

Cet examen porte sur le contenu du cours MAT 5531. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT 5531 et MAT 5533 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5131. This exam is the final exam of the course and is graded by the professors who teach MAT 5131 and MAT 5133 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9907 Examen de synthèse: Équations différentielles II / Comprehensive Exam: Differential Equations II

Cet examen porte sur le contenu du cours MAT5533. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT 5531 et MAT 5533 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5133. This exam is the final exam of the course and is graded by the professors who teach MAT 5131 and MAT 5133 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9908 Examen de synthèse: Mathématiques discrètes I / Comprehensive Exam: Discrete Mathematics I

Cet examen porte sur le contenuu du cours MAT5505. Cet examen est l'examen final sur cours et est corrigé par les professeurs qui enseignent MAT 5505 et MAT5507 dans l'année acedémique. Noté S (satisfaisant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5105. This exam is the final exam of the course and is graded by the professors who teach MAT 5105 and MAT 5107 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9909 Examen de synthèse: Mathématiques discrètes II / Comprehensive Exam: Discrete Mathematics II

Cet examen porte sur le contenu du cours MAT5507. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT5505 et MAT5507 dans l'année académique. Noté S (Satisfaisant) et NS (non satisfaisant). / This exam covers the content of the course MAT 5107. This exam is the final exam of the course and is graded by the professors who teach MAT 5105 and MAT 5107 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9910 Examen de synthèse: Théories des probabilités I / Comprehensive Exam: Probability Theory I

Cet examen porte sur le contenu du cours MAT5570. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT 5570 et MAT5571 dans l'année académique. Noté S (satisfaiant) et NS (non satisfaisant). / This exam covers the content of the course MAT 5170. This exam is the final exam of the course and is graded by the professors who teach MAT 5170 and MAT 5171 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9911 Examen de synthèse: Théories des probabilités II / Comprehensive Exam: Probability Theory II

Cet examen porte sur le contenu du sours MAT5571. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT5570 et MAT5571 dans l'année académique. Noté S (satisfansant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5171. This exam is the final exam of the course and is graded by the professors who teach MAT 5170 and MAT 5171 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9912 Examen de synthèse: Statistique mathématiques I / Comprehensive Exam: Mathematical Statistics I

cet examen porte sur le contenu du cours MAT5590. Cet examen est l'examen final du cours et est corrigé par les professerus qui enseignent MAT5590 et MAT5591 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant).. / This exam covers the content of the course MAT 5190. This exam is the final exam of the course and is graded by the professors who teach MAT 5190 and MAT 5191 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9913 Examen de synthèse: Statistique et mathématiques II / Comprehensive Exam: Mathematical Statistics II

Cet examen porte sur le contenu du cours MAT5591. Cet examen est l'examen final du cours et est corrigé par les professeurs qui enseignent MAT5590 et MAT5591 dans l'année académique. Noté S (satisfaisant) ou NS (non satisfaisant). / This exam covers the content of the course MAT 5191. This exam is the final exam of the course and is graded by the professors who teach MAT 5190 and MAT 5191 in the academic year. Graded S (satisfactory) or NS (not satisfactory).
Volet / Course Component: Recherche / Research

MAT 9998 Examen de synthèse avancé / Advanced Comprehensive Examination

Le syllabus pour l'examen de synthèse avancé est déterminé par le comité consultatif de thèse (CCT). Le syllabus devrait être fournni à l'étudiant au moins six mois avant la date de l'examen. Le syllabus doit contenir la forme, le contenu et les attentes pour l'examen de synthèse avancé. L'examen de synthèse avancé peut être écrit ou/et oral. Noté S (satisfaisant) ou NS (non satisfaisant). / The syllabus of the advanced comprehensive examination is prescribe by the thesis advisory committee (TAC). The syllabus should be given to the student at least six months before the date of the examination. The syllabus must provide the form, contents and expectations for the advanced comprehensive examination. The advanced comprehensive examination can be written and/or oral. Graded S (satisfactory) or NS (non satisfactory).
Volet / Course Component: Recherche / Research