YORK UNIVERSITÉ UNIVERSITY

Graduate Calendar

Mathematics and Statistics

2024-2025

CONTENTS

GRADUATE PROGRAM CONTACT

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ORIENTATION FOR INCOMING GRADUATE STUDENTS

(TENTATIVE) September 11, 2024

Faculty of Graduate Studies regulations, important dates, and deadlines:
http://gradstudies.yorku.ca

Graduate Program in Mathematics and Statistics: https://www.yorku.ca/science/mathstats/graduate-programs/

Introduction

York University offers the following graduate programs in mathematics and statistics which lead to Master of Arts, Master of Science, or Doctor of Philosophy degrees:

1. The MA program with specialization in applied mathematics, pure mathematics, probability, theoretical statistics, applied statistics, or data science.
2. The MSc program in applied & industrial mathematics.
3. The doctoral program in applied mathematics, pure mathematics, or statistics.

Students who are enrolled in the MA program can also apply for a graduate diploma in financial engineering.

This calendar describes these programs and provides details of entrance and degree requirements. It also provides information about financial support available to graduate students, as well as outlines of graduate courses to be offered in Summer 2024, Fall 2024, Winter 2025, and Summer 2025.

Summary of Graduate Programs

The MA Program

This program is suitable for those students who wish to undertake graduate study in mathematics or statistics. To be admitted, students must hold an honours degree in mathematics or statistics, or have an equivalent background.

Students can take courses in a wide variety of fields. Courses in areas such as algebra, analysis, topology, differential equations, numerical methods, applications of logic and set theory, probability, operations research, mathematical modelling and applied statistics are offered regularly.

The program provides solid preparation for admission to a PhD program at York or other North American universities. It is also a suitable program for students who wish to expand their knowledge of mathematics or statistics beyond what they have learned at the undergraduate level, but may not desire to continue beyond the master's level.

The program is available on a full-time or part-time basis. Full-time students with a good background can usually complete their degree in three terms (i.e., fall, winter and summer terms). Full-time students who are not able to complete the degree requirements within three terms can continue to do so, but their status changes to part-time, with a maximum of three additional terms to complete the degree requirement.

The MSc Program in Applied & Industrial Mathematics

The MSc in applied & industrial mathematics has been designed as a two-year program including a thesis. Students are required to take a certain set of core courses and the practicum. In the practicum, students will model physical problems that involve interpretations of experimental data, mathematical formulation of problems, analyses of the mathematical problems, and interpretations of the results. The program will culminate in a thesis. For more information, contact the program coordinator: Jianhong Wu (wujh@yorku.ca).

The Graduate Diploma in Financial Engineering

This program is a collaborative program established through the cooperation of the Schulich School of Business and the Department of Mathematics & Statistics. This diploma is awarded concurrently with a master's degree in mathematics & statistics. Financial engineering is one of the fastest growing areas of applied mathematics. The Financial Engineering Diploma program allows students to acquire both the theoretical knowledge and specialized skills needed to develop new financial instruments. Students who successfully complete this program find careers in the financial sector. For more information, contact diploma coordinator Michael Chen (chensy@yorku.ca).

The PhD Program

Students in the PhD program take advanced level courses and write a dissertation containing original research results. Members of the program have expertise in a wide variety of areas in mathematics, statistics and related disciplines. A detailed listing of the faculty and their fields of interest available at:

https://www.yorku.ca/science/mathstats/faculty-and-instructors/

To be admitted as a PhD student, an applicant must have a master's degree in mathematics or statistics, or must have completed at least one year of comparable studies.

Program Regulations

General Admission Requirements

To be considered for admission to the graduate program in mathematics and statistics, an applicant must be a graduate of a recognized university, or have equivalent qualifications. The average of a previous degree is normally calculated based on relevant grades over the last two years of study. In practice, applicants who are admitted usually have a higher average than the stated minimum requirement for each degree in this calendar, especially in their mathematics and statistics courses.

Applicants are required to demonstrate competence in English if they come from a country/institution where English is not the main language. A minimum score of 80 (TOEFL IBT) or 6.5 (IELTS Academic Module) is required.

Applicants are not required to take the Graduate Record Examinations (GRE).

The MA Program

1) *Admission Requirements*

See the section on General Admission Requirements. To be considered for admission in the MA program, the student must have a minimum average of B- (minimum score of 70 out of 100). Most successful applicants have a standing of at least B+ (minimum score of 77 out of 100). In addition to having sufficiently high standing, students are expected to have completed certain core courses in mathematics or statistics as undergraduates.

2) *Degree Requirements*

Students must complete: the core course requirement; and select one of the options of course-based program, combination of course and survey paper, or thesis. Based on the chosen option, the student may also need to complete the seminar requirement (6004 0.0). These options are detailed in the degree-specific MA checklists found at:

https://www.yorku.ca/science/mathstats/resources/

3) *Core Courses Requirements*

Each student is required to take one of the following sets of courses, to be chosen with the approval of the graduate program director. For any option chosen, no more than one-third of courses can be integrated, and all students must include among their courses one of the following sets. In addition to the lists below, please see the MA program worksheets, which present the same information in another format.

i) Pure Mathematics Stream

- Applied Algebra (Math 6121 3.0)
- Algebra II (Math 6122 3.0)
- Functional Analysis I (Math 6461 3.0)
- and one of the following
  - Measure Theory (Math 6280 3.0)
  - Complex Analysis (Math 6300 3.0)
  - Introduction to Harmonic Analysis (Math 6420 3.0)
  - Functional Analysis II (Math 6462 3.0)
  - Topology I (Math 6540 3.0)
  - Algebraic Topology I (Math 6550 3.0)
  - Probability Theory (Math 6605 3.0)

ii) Applied Mathematics Stream

Four courses chosen from

- Applied Algebra (Math 6121 3.0)
- Ordinary Differential Equations (Math 6340 3.0)
- Partial Differential Equations (Math 6350 3.0)
- Stochastic Processes (Math 6602 3.0)
- Probability Models (Math 6604 3.0)
- Advanced Numerical Methods (Math 6651 3.0)
- Numerical Solutions to Differential Equations (Math 6652 3.0)
- Modern Optimization (Math 6904 3.0)
- Stochastic Calculus in Finance (Math 6910 3.0)
- Numerical Methods in Finance (Math 6911 3.0)
- Harmonic Analysis and Image Processing (Math 6920 3.0)

- Mathematical Modelling (Math 6931 3.0)
- Mathematical Epidemiology (Math 6936 3.0)
- Stochastic Programming (MATH 6902 3.0)
- Machine Learning in Finance (MATH 6912 3.0)
- Computational Methods in Mathematical Biology (Math 6671 3.0)

iii) Probability Stream

- Stochastic Calculus in Finance (Math 6910 3.0)
- one of
  - Probability Theory (Math 6605 3.0)
  - Measure Theory (Math 6280 3.0)
- one of
  - Stochastic Processes (Math 6602 3.0)
  - Probability Models (Math 6604 3.0)
- and one of
  - Mathematical Statistics (Math 6620 3.0)
  - Applied Statistics I (Math 6630 3.0)
  - Numerical Methods in Finance (Math 6911 3.0)

iv) Theoretical Statistics Stream

- Mathematical Statistics (6620 3.0)
- Generalized Linear Models (6622 3.0)
- Applied Statistics I (6630 3.0)
- and one of
  - Advanced Mathematical Statistics (6621 3.0)
  - Probability Theory (6605 3.0)

v) Applied Statistics Stream

- Mathematical Statistics (6620 3.0)
- Generalized Linear Models (6622 3.0)
- Applied Statistics I (6630 3.0)
- Practicum in Statistical Consulting (6627 3.0)
- and one of
  - Applied Statistics II (6631 3.0)
  - Introduction to Bayesian Statistics (6635 3.0)
  - Survival Analysis (6641 3.0)
  - Applied Longitudinal Data Analysis (Math 6642 3.0)

vi) Data Science Stream

- Mathematical Statistics (6620 3.0)
- Generalized Linear Models (6622 3.0)
- Applied Statistics I (6630 3.0)
- Data Science (6650 3.0)
- and one of
  - Data Mining (6636 3.0)
  - Statistical Learning (6644 3.0)

Thesis, Survey Paper or Additional Course Requirements

Each student must choose one of the following requirements:

a) Write a master's thesis under the supervision of an approved faculty member, give an oral presentation to the program (30 minute presentation with one-and-half hours of question and answer period), and defend it before an examining committee. In addition to Faculty regulations regarding thesis examination, the candidate must give two talks in a student colloquium (20-minute presentations followed by question and answer period), one outlining work in progress and one presenting the final results. These talks are given prior to the final thesis defense.

b) Submit a survey paper (Math 6001 0.0) written under a faculty advisor and give an oral presentation (a 50-minute presentation with a half-hour question and answer period), and take six credits of additional course work. A digital copy (in PDF format) of the final version of the survey paper, with the confirmation of the faculty advisor, must be submitted to the program (gradmath@yorku.ca) within one week after the oral presentation.

c) Take twelve additional credits of course work for options (i)-(iv) and nine additional credits of course work for option (vi).

The courses selected to meet the above requirements must be graduate-level Math courses with first digit 6 (referred to as 6000-level courses). Students may, with permission from the graduate program director, use courses in other graduate programs such as computer science, physics and astronomy or economics to meet the requirements. Permission forms are available at:

https://www.yorku.ca/gradstudies/students/current-students/registration-enrolment/fgs-forms/

Note on course credits: no more than one third of the credits counted towards the MA degree requirements can come from integrated courses. Students will also not take or receive credit for an integrated course at the graduate level if they previously took the undergraduate version at York or elsewhere.

Note: Thesis proposals (including bibliography) must be submitted to the graduate program (gradmath@yorku.ca) for approval of the graduate program director and submission to the Faculty of Graduate Studies before the research project begins, and certainly no less than three months prior to the expected date for the oral examination of the completed thesis. All thesis proposals must be submitted along with the Thesis and Dissertation Proposal form (TD1) available at:

https://www.yorku.ca/gradstudies/wp-content/uploads/sites/184/2021/12/td1.pdf

The student is responsible to follow-up with the graduate program assistant to ensure that the proposal and TD1 form reaches the Dean of Graduate Studies by the above timeline.

The student's thesis proposal shall consist of a listing of the supervisory committee, a detailed description of the thesis, and a bibliography.

The supervisor/supervisory committee form (to be submitted along with the TD1 form) is available at:

https://www.yorku.ca/gradstudies/students/current-students/registration-enrolment/fgs-forms/

The guidelines for the preparation and examination of thesis and dissertation are available at:

https://www.yorku.ca/gradstudies/students/current-students/thesis-and-dissertation/

York University is committed to the highest standards of integrity in research. All projects involving the use of human subjects, animal and biohazard materials are subject to review by the appropriate university committee. York University has formulated policies for the conduct of research involving all three of these areas. Graduate student research involving human participants which takes place as part of a graduate course or Major Research Project (MRP) is reviewed and approved at the graduate program level. Master's theses and dissertations are reviewed by the Faculty of Graduate Studies and the Office of Research Ethics, and all such research proposals and informed consent documents must be approved by York University's Human Research Participants Committee (HPRC) before students may proceed with their research.

Graduate students writing theses, in which research involving human participants occurs shall familiarize themselves with York University's policies about the use of human participants. All research involving human participants is governed by the senate policy on Research Involving Human Participants. Details regarding the ethics review procedures for thesis/dissertation research involving human participants is available on the Faculty of Graduate Studies research ethics web page:

https://gradstudies.yorku.ca/current-students/thesis-dissertation/research-ethics/

The graduate program director will recommend the membership of the examining committee to the Faculty of Graduate Studies. The "Recommendation for Oral Exam" form available at:

https://www.yorku.ca/gradstudies/interdisdev/wp-content/uploads/sites/342/2021/08/Recommendation-for-Oral-Examination%E2%80%AFform.pdf

This form must be completed and submitted to the graduate program (gradmath@yorku.ca) for approval by the graduate program director and submission to the Faculty of Graduate Studies no less than 15 working days before the date set for the oral defense. This deadline is strictly enforced by the Faculty of Graduate Studies.

At the final defense, the student will give an oral presentation (30-minute presentation and one-and-half hours question and answer period) to defend the thesis before the examining committee.

In addition to faculty regulations regarding thesis examination, the candidate gives two talks in a student colloquium (20-minute presentations followed by question and answer period), one outlining work in progress and one presenting the final results. These presentation are given prior to the final defense. All members of the supervisory committee must be present at both talks.

It is the responsibility of both the supervisor and student to ensure that all degree requirements are met.

Seminar Requirement

In addition to the above, students who choose option (i)-(iv) or (vi) as their core course requirement must fulfill the seminar requirement (Math 6004 0.0). Students who choose option (v) are exempt as they do the Practicum in Statistical Consulting (Math 6627 3.0) in place of the seminar. To fulfill the seminar requirement, students must present two one-hour seminars. For each seminar, the topic is chosen in conjunction with a faculty member (different supervisor for each talk), who will then grade the talk on a pass-fail basis. Topics can be chosen from any branch of mathematics, but should not be taken directly from the student's course work, survey paper or thesis, although they can be related to such material. The two talks can be from different areas of mathematics or the same area, but the second talk should not just be a continuation of the first. Talks must be separated by at least one week, must be announced to the department at least 5 days before the talk is given, and must have at least 3 members of the York university community present in addition to the supervisor. In addition to giving the talks, students must attend six talks (e.g., seminar by other students). Documented evidence of attendance for each of the six talks is required.

Students may substitute another half-course for the seminar (MATH 6004) if they are pursuing their MA by Survey Paper (Math 6001) or by Thesis.

Additional Information on Survey Paper and Seminar for MA Program

i) *What is expected from students in survey paper*?

Students are expected to identify a faculty member who agrees to supervise them for a survey paper. A final report of the survey paper, approved by the supervisor, must be submitted digitally (in PDF format) to the graduate program (gradmath@yorku.ca) along with the confirmation of the faculty supervisor.

ii) *How to find a supervisor*?

While the program will make efforts to provide the necessary support, students are responsible for finding their own supervisor for seminar and/or survey paper.

iii) *How are grades reported*?

The grade for survey paper is pass or fail, and must be submitted by the following dates:

- Fall Term: January 15 (3.0 or 6.0 credit course)
- Fall/Winter and Winter Term: May 15 (3.0 or 6.0 credit course)
- Summer Term: September 15 (3.0 or 6.0 credit course)

iv) *How to confirm attendance in a seminar*?

The host (generally a faculty member) must sign the attendance form found at:

https://www.yorku.ca/science/mathstats/wp-content/uploads/sites/62/2021/04/Seminar_Attendance.pdf

This form must be submitted within a week of the seminar to the graduate program (gradmath@yorku.ca).

v) *What is acceptable as a seminar*?

Students can attend seminars by other students or faculty members, colloquia, DSO of PhD students, and thesis or dissertation defence.

Note: MA students who are taking Math 6001 (Survey Paper) or Math 6004 (Seminar) should enrol in the term of completion.

For graduation, MA students are required to complete the MA Checklists relevant to their stream. The checklists are available at:

https://www.yorku.ca/science/mathstats/resources/

Important Notes

Full-time MA students must register and pay fees for a minimum of three terms.

If MA program is not completed with 3 semesters of full-time study, the status of an MA student will be automatically part-time for any additional terms. Part-time students are not eligible for funding. Note that registration in

Financial Engineering Diploma **will not** extend the period of full-time study in the MA program.

Part-time MA students must register and pay fees for a minimum of 6 terms.

Full-time students may not be absent from the campus without the permission of the program director for more than four weeks of any term in which they are registered.

The MSc Program in Applied & Industrial Mathematics

i) *Admission Requirements*

An honours degree in mathematics (or equivalent background) with a minimum average of B (minimum score of 73 out of 100) may qualify the student for admission as a candidate to the program leading to the MSc degree in applied & industrial mathematics. Students whose first language is not English must demonstrate an acceptable command of English. A minimum score of 80 (TOEFL IBT) or 6.5 (IELTS Academic Module) is required.

ii) *Degree Requirements*

Students must complete Advanced Numerical Methods (Math 6651 3.0), Mathematical Modelling (Math 6931 3.0), Practicum in Industrial and Applied Mathematics (Math 6937 3.0), another 3-credit 6000-level course appropriate to the student's program of study approved by the student's supervisory committee, and a thesis (see below) which must be defended before an examining committee in accordance with the regulations of the Faculty of Graduate Studies.

Note: The student's thesis proposal (including bibliography) must be forwarded for approval to the Dean of Graduate Studies no less than 3 months prior to the expected date for the oral examination of the completed thesis. All thesis proposals must be submitted along with the Thesis/Dissertation Research Submission form (TD1) available at:

https://www.yorku.ca/gradstudies/wp-content/uploads/sites/184/2021/12/td1.pdf

This form must be submitted to the graduate program (gradmath@yorku.ca), for approval by the graduate program director and submission the Faculty of Graduate Studies. The student should follow up with the graduate assistant to ensure that the proposal and TD1 form reaches the Faculty of Graduate Studies by the above timeline.

The student's thesis proposal shall consist of a listing of the supervisory committee, a detailed description of the thesis, and a bibliography.

The supervisor/supervisory committee form (to be submitted along with the TD1 form) is available at:

https://www.yorku.ca/gradstudies/students/current-students/registration-enrolment/fgs-forms/

The guidelines for the preparation and examination of thesis and dissertation are available at:

https://www.yorku.ca/gradstudies/students/current-students/thesis-and-dissertation/

Departmental guidelines are available at:

https://www.yorku.ca/science/mathstats/wp-content/uploads/sites/62/2020/10/Guidelines-for-Supervision-of-Graduate-Students-1.pdf

York University is committed to the highest standards of integrity in research. All projects involving the use of human subjects, animal and biohazard materials are subject to review by the appropriate university committee. York University has formulated policies for the conduct of research involving all three of these areas. Graduate student research involving human participants which takes place as part of a graduate course or Major Research Project (MRP) is reviewed and approved at the graduate program level. Master's theses and dissertations are reviewed by the Faculty of Graduate Studies and the Office of Research Ethics, and all such research proposals and informed consent documents must be approved by York University's Human Research Participants Committee (HPRC) before students may proceed with their research.

Graduate students writing theses in which research involving human participants occurs shall familiarize themselves with York University's policies about the use of human participants. All research involving human participants is governed by the senate policy on Research Involving Human Participants. Details regarding the ethics review procedures for thesis/dissertation research involving human participants is available on the Faculty of Graduate Studies research ethics web page:

http://gradstudies.yorku.ca/current-students/thesis-dissertation/research-ethics/

The graduate program director will recommend the membership of the examining committee to the Faculty of Graduate Studies. The “Recommendation for Oral Exam” form available at:

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This form must be completed and submitted to the graduate program (gradmath@yorku.ca) for approval by the graduate program director and submission to the Faculty of Graduate Studies no less than 15 working days before the date set for the oral defense. This deadline is strictly enforced by the Faculty of Graduate Studies.

At the final defense, the student will give an oral presentation to the program (30-minute presentation and one-and-half hours question and answer period), and defend it before an examining committee.

In addition to faculty regulations regarding thesis examination, the thesis candidate gives two talks in a student colloquium (20-minute presentations followed by question and answer period), one outlining work in progress and one presenting the final results. These presentations are completed prior to the final defense. All members of the supervisory committee must be present at both talks.

Full-time students will complete degree requirements by the end of the 2nd year (6 terms). Part-time students will complete the degree requirements by the end of 12 terms. Full-time students who cannot complete the degree within 6 semester can continue to complete the requirements for a maximum of three additional semester with part-time status.

It is the responsibility of both the supervisor and student to ensure that all degree requirements are met.

Note on course credits: a student will not receive credit for more than 2 half integrated courses towards the master’s degree. Students may not take or receive credit for an integrated course at the graduate level if they previously took it at York or elsewhere at the undergraduate level.

Important Notes

Full-time MSc students must register and pay fees for a minimum of 6 terms.

If MSc program is not completed with 6 semesters of full-time study, the status of an MSc student will be automatically part-time for any additional terms. Part-time students are not eligible for funding.

Part-time MSc students must register and pay fees for a minimum of 12 terms.

Full-time students may not be absent from the campus without the permission of the program director for more than four weeks of any term in which they are registered.

The Graduate Diploma in Financial Engineering (Type 2 - Concurrent)

i) *Admission Requirements*

The Graduate Diploma in Financial Engineering is completed in conjunction with the master’s or doctoral program in mathematics and statistics. Students must first apply and be accepted to the MA, MSc, or doctoral program in mathematics and Statistics.

Applicants may indicate their interest in pursuing the Graduate Diploma in Financial Engineering at the same time they apply to the MA, MSc or doctoral program in mathematics and statistics, or they may submit a separate application for the diploma during the first term in which they are registered in the master’s or doctoral program. For further information and application process please visit:

https://www.yorku.ca/science/mathstats/graduate-programs/

ii) *Diploma Requirements*

The requirements for the Graduate Diploma in Financial Engineering may be completed in conjunction with the master’s program requirements.

The diploma requirements are as follows:

a) Successful completion of the following courses:

- MATH 6910 3.0, Stochastic Calculus in Finance
- MATH 6912 3.0, Machine Learning in Finance
- SB FINE 6200 3.0, Investments
- SB FINE 6800 3.0, Options, Futures, and Other Derivative Securities
- SB FNEN 6820 3.0, Advanced Derivative Securities
- SB FNEN 6850 3.0, Fixed Income Securities

- FNEN 6840 3.0 Enterprise-Wide Financial Risk Management

Note: MATH 6910, MATH 6912, and OMIS 6000, may be used to satisfy the MA by Coursework or MA by Survey Paper (Math 6001) program requirements.

Note: Students with little or no background in finance may find it beneficial to take ECON 5030, Econometrics of Financial Markets, as background for the finance courses listed above.

b) In addition to the course requirements, diploma students must complete one of the following: (i) subject to availability, an internship of at least 10 weeks duration in a financial institution, or (ii) a research project.

Note: Students in the MA program by Survey Paper (Math 6001) option who decide to fulfill the above requirement through completion of a research project may request that the diploma research project also be used toward fulfilment of the MA survey paper requirement. Such requests must be made in writing to the financial engineering coordinator, accompanied by the confirmation from the student's faculty advisor that the diploma research project is of acceptable quality to meet the MA degree requirements by Survey Paper. Such requests will be considered by the financial engineering coordinator only if the diploma research project contains substantial mathematics content, equivalent to that expected of students in the MA degree by Survey Paper option.

c) Diploma seminar requirement: Students who did not complete MATH 6627 3.0, Practicum in Statistical Consulting, as part of their mathematics and statistics degree program requirements are required to give a talk on their internship or research project to fulfill the diploma seminar requirement. These students should enrol in MATH 6004, Seminar course, in order to receive a grade. The talk must be announced to the department at least 5 days before the talk is given, and must have at least 3 members of the York university community present in addition to the supervisor. In addition to giving the talk, students must attend six talks of other students in the department. Documented evidence of attendance at six such talks is required (similar to the requirements of MA degree).

Diploma Length

Students typically require four consecutive terms to complete both the coursework for Mathematics & Statistics degree program and Type 2 Graduate Diploma in Financial Engineering, and then go on to complete the internship or research project, normally in one term.

Additional inquiries may be communicated with the diploma program coordinator Michael Chen (chensy@yorku.ca).

The PhD Program

The Department of Mathematics and Statistics offers PhD programs in applied mathematics, pure mathematics, and statistics.

i) *Admissions Requirements*

To be considered for admission in PhD programs, students must have completed an acceptable master's degree or must have completed one year of comparable work, with a minimum B+ average (minimum score of 77 out of 100). The admission process is very selective and not all students meeting this requirement will be admitted. A complete application file is required for the applicant to be considered.

Applicants should obtain at least two letters of recommendation by academics who know them well. Applications are considered by the PhD Committee, which ranks the applicants and makes recommendations to the graduate program director. The director will then make a recommendation to the Faculty of Graduate Studies for admission.

Current master's students who wish to apply for admission to the PhD program must submit an on-line application and supporting documentation. Internal promotion from master's to PhD program may be possible at the discretion of the graduate program director.

ii) *Degree Requirements*

Five major components make up the degree requirements for the PhD in mathematics and statistics. These are (1) coursework; (2) comprehensive exams; (3) dissertation subject oral; (4) dissertation proposal; and (5) dissertation oral exam (proceeded by the dissertation colloquium). Students can complete these degree requirements in 4 years.

Course Requirements

Students must successfully complete 12 credits at the graduate level. The courses must be chosen with the approval of the program director. Up to 12 additional credits may be required based on the recommendation of the supervisor, and at the discretion of the PhD committee and the graduate program director. Determination of such additional credits, if needed, will be made during the first semester of the PhD program and communicated with the students.

Note: A PhD student may submit a petition under the following circumstances.

i) A required course has already been completed through a previous degree. The petition may request replacement of another 6000-level course to satisfy the requirements of the PhD program with the completion of a minimum of 12 credits.

ii) The contents of additional credits recommended by the program have been covered in previous courses successfully completed by the student. The petition may request to waive such additional credits.

A petition must be submitted within the first semester of the PhD program, and must be supplemented with detailed syllabus for each course. The graduate program director may require a letter of course equivalency for approval of the petition.

Note on course credits: Students will not take or receive credit for an integrated course at the graduate level if they previously took it at York or elsewhere at the undergraduate level.

Comprehensive Examinations

Students will declare a specialization in one of the areas of pure mathematics, applied mathematics, or statistics, and write comprehensive examinations in subjects which are appropriate to the chosen specialization. In addition, statistics students will complete a statistical consulting requirement.

A doctoral candidate must satisfy their comprehensive examination requirements by completing the exams in the first year of study. Students need not enrol in the courses nor attend lectures in order to write the comprehensive exams. However, it is responsibility of the student to follow the syllabi of courses to prepare for the exams. The comprehensive exams in PhD programs include:

(1) Complex Analysis (MATH 6300)
(2) Measure Theory (MATH 6280)
(3) Functional Analysis (MATH 6461)
(4) Applied Algebra (MATH 6121)
(5) Algebra II (MATH 6122)
(6) Commutative Algebra (MATH 6130)
(7) General Topology (MATH 6540)
(8) Algebraic Topology (MATH 6550)
(9) Ordinary Differential Equations (MATH 6340)
(10) Partial Differential Equations (MATH 6350)
(11) Number Theory (MATH 6110 or MATH 6115)
(12) Probability Theory (MATH 6605)
(13) Category Theory (MATH 6180)
(14) Differential Geometry (MATH 6530)
(15) Set Theory (MATH 6040)
(16) Advanced Numerical Methods (MATH 6651)
(17) Numerical Solutions to Differential Equations (MATH 6652)
(18) Mathematical Modelling (MATH 6931)
(19) Mathematical Statistics (MATH 6620)
(20) Advanced Mathematical Statistics (MATH 6621)
(21) Generalized Linear Models (MATH 6622)
(22) Applied Statistics I (MATH 6630)

Note: While not all courses will be offered annually, course offerings will be responsive to students' need. Under special circumstances, exams may be taken in a year in which the courses is not offered.

PhD students must declare themselves to be in one of these three streams: applied mathematics, pure mathematics, or statistics streams. Based on degree requirements, students will decide which comprehensive exams to complete with the approval of their supervisor and the graduate program director.

Pure mathematics students must complete at least one exam from (1) to (3), one exam from (4) to (6), one exam from (7) to (11), plus one additional exam which can be selected from any comprehensive exams listed above.

Applied mathematics students must complete exam (18), at least one exam from (9) or (10), at least one exam from (16) or (17), plus one additional exam which can be selected from any comprehensive exams listed above.

Statistics students must complete exams (19) to (22).

Part-time students will have to pass at least 6 credits per year, and will have to complete the comprehensive exams by the end of their second year of enrolment.

Students are required to consult with the program director to make their course and exam selections. In certain extreme cases of difficulty due to scheduling, the PhD Committee will designate certain other courses as substitutes, arrange for reading courses, or modify the timing requirements. Comprehensive exams will be closed book in-class exams. Students who are not enrolled in a course but elect to take a comprehensive exam should contact the instructor regarding the time and place of the exam. All comprehensive exams are submitted to the PhD Committee for evaluation.

The details of Policies and Procedures for Milestone Examinations in the PhD Program are available at:

https://www.yorku.ca/science/mathstats/wp-content/uploads/sites/62/2022/12/CompExam-MATH-STAT-002-4.pdf

Current master's students who plan to apply for admission to the PhD program may wish to take some of the comprehensive exams. The grades (PASS or FAIL) will be counted if the students are admitted to the PhD program.

Note: A student who fails any given comprehensive exam more than once, or fails more than a total of 3 comprehensive exams, will be withdrawn from the program.

Practicum Requirement for Statistics Stream

The purpose of the practicum is to prepare students for the transition from statistics theory to the application of statistics through consulting and collaboration. MATH 6627 3.0 or an equivalent consulting course from another university, approved by the graduate program director, is required for all PhD students in Statistics. The course must be taken and passed within the first 6 semesters of the PhD program prior to Dissertation Subject Oral (see section below).

Dissertation Subject Oral

Students in the doctoral program must demonstrate depth of knowledge in their field of specialization. The candidate must pass an oral examination (Dissertation Subject Oral), which may occur within the second year of study and before the end of 6th semester. In preparation for this examination, the student shall, in consultation with the supervisor and tentative supervisory committee, decide on a dissertation subject and a syllabus of materials. The syllabus of materials shall consist of those theoretical results, techniques, and examples in the area which are deemed most likely by the tentative supervisory committee to be useful in research on the dissertation subject.

The tentative supervisory committee must approve the dissertation subject and agree that a command of the syllabus of materials will enable the student to pursue original research in that subject. A date for the examination will be set by the supervisor and the tentative supervisory committee in consultation with the student.

The Dissertation Subject Oral shall consist of a 30-minute oral presentation of the dissertation subject and a question period, up to one hour in length. All members of the student's supervisory committee must be present. Members of the graduate program may attend the examination and may ask questions on the presentation or on the syllabus of materials. The Dissertation Subject Oral should be announced to the department and the syllabus made available to the supervisory committee members in advance. For more details related to Dissertation Subject Oral, please see Policies and Procedures for Milestone Examinations in the PhD Program:

https://www.yorku.ca/science/mathstats/wp-content/uploads/sites/62/2022/12/CompExam-MATH-STAT-002-4.pdf

At the end of the question period, the tentative supervisory committee shall judge the examination as successful (Pass) or unsuccessful (Fail). In the latter case, the student may try again after additional study. If a student decides to change the dissertation subject, then an examination in the new subject will be required.

Upon the successful completion of the examination, the tentative supervisory committee will recommend approval of the student's research proposal. The student's dissertation proposal (including bibliography) must be submitted to the graduate program (gradmath@yorku.ca) along with the Thesis/Dissertation Research form (TD1) available at:

https://www.yorku.ca/gradstudies/wp-content/uploads/sites/184/2021/12/td1.pdf

This form, once approved by the graduate program director, will be submitted to the Faculty of Graduate Studies.

Important Note: dissertation proposal and form TD1 must be submitted at the beginning of the thesis research, immediately after the DSO. The oral examination/defense cannot be held until at least 6 months after this form is approved by FGS.

Students should follow up with the graduate program assistant to ensure that the proposal and TD1 form reaches the Faculty of Graduate Studies, and is approved by the above timeline.

York University is committed to the highest standards of integrity in research. All projects involving the use of human subjects, animal and biohazard materials are subject to review by the appropriate university committee. York University has formulated policies for the conduct of research involving all three of these areas. Graduate student research involving human participants which takes place as part of a graduate course or Major Research Project (MRP) is reviewed and approved at the graduate program level. Master's theses and dissertations are reviewed by the Faculty of Graduate Studies and the Office of Research Ethics, and all such research proposals and informed consent documents must be approved by York University's Human Research Participants Committee (HPRC) before students may proceed with their research.

Graduate students writing dissertations in which research involving human participants occurs shall familiarize themselves with York University's policies about the use of human participants. All research involving human participants is governed by the senate policy on Research Involving Human Participants. Details regarding the ethics review procedures for thesis/dissertation research involving human participants is available on the Faculty of Graduate Studies research ethics web page:

http://gradstudies.yorku.ca/current-students/thesis-dissertation/research-ethics/

The student's dissertation proposal shall consist of a listing of the student's supervisory committee, a detailed description of the dissertation, and a bibliography.

Guidelines for the preparation and examination of dissertations are available at:

https://www.yorku.ca/gradstudies/students/current-students/thesis-and-dissertation/

Departmental guidelines are available at:

https://www.yorku.ca/science/mathstats/wp-content/uploads/sites/62/2020/10/Guidelines-for-Supervision-of-Graduate-Students-1.pdf

Dissertation Evaluation

- *Dissertation Colloquium*

Upon completion of work on the dissertation, the supervisory committee, in consultation with the student, will set a date (at least 25 working days prior to the oral exam) for a preliminary examination thereof (dissertation colloquium).

The examination will consist of an oral presentation of the dissertation, of at most one hour duration, and a question period, up to one hour in length. Members of the graduate program in mathematics and statistics may attend the examination and may ask questions related to the student's dissertation. At the end of the question period the supervisory committee shall judge the examination. In the case of failure, a detailed rationale must be given to the student. This examination can be repeated, but only after an interval of at least one month. Supervisory committee members must be present during the repeat colloquium.

- *Dissertation Oral Examination*

An oral examination (30 minute presentation and 2 hour question and answer period) on the student's dissertation will be conducted according to the Faculty of Graduate Studies regulations. See "Guidelines for Preparation and Examination of Theses and Dissertations" for details. The graduate program director will recommend the membership of the examining committee to the Faculty of Graduate Studies. The completed "Recommendation for Oral Exam" form available at:

https://www.yorku.ca/gradstudies/wp-content/uploads/sites/184/2023/02/oral-exam-doctoral-14-2-23.pdf

This form must be submitted to the graduate program(gradmath@yorku.ca) for approval by the graduate program director and submission to the Faculty of Graduate Studies no less than 20 working days before the date set for the oral examination. This deadline is strictly enforced by the Faculty of Graduate Studies.

Faculty members and graduate students may attend the oral examination. They may, at the discretion of the chair of the examining committee, participate in the questioning, but only members of the examining committee may be present for the evaluation and for the vote at the conclusion of the examination.

Progress Report

All students enrolled in a PhD program are required to complete an annual research progress report detailing the achievements of the previous year and the objectives for the next year. Permission to continue to register in the program depends on a satisfactory report.

Deadlines for Meeting Requirements

Students are expected to finish the comprehensive exam requirements in the first year of their PhD studies. The Dissertation Subject Oral may be taken within the second year of study, but must be within the first 6 semesters. Students who are in the statistics stream should also finish the practicum requirement in the second year of study. The dissertation itself should be completed within two years of the Dissertation Subject Oral, although one additional year may be allowed by permission from the graduate program direction based on the support from the supervisor.

Supervisory Committees

Upon admission to the doctoral program, each student will be assigned a tentative supervisor from the graduate program. The student will decide on a study plan in consultation with the tentative supervisor, which will be confirmed during the first year of the program.

Dissertation Supervisory Committee

When a student has successfully written the comprehensive examinations, the supervisor in consultation with the student, will appoint a supervisory committee to be approved by the graduate program director. The student will decide on continuing the program of study in consultation with the supervisory committee. A dissertation supervisory committee shall be recommended by the graduate program director to the Faculty of Graduate Studies after the student has successfully taken the Dissertation Subject Oral, in accordance with the faculty regulations.

A supervisor must be recommended by the graduate program director for approval by the Faculty of Graduate Studies no later than the end of the 5th term of study. Students will not be allowed to register in the 7th term of study unless a supervisor has been identified and approved.

A supervisory committee must be recommended by the graduate program director for approval by the Faculty of Graduate Studies no later than the end of the 8th term of study. Students will not be allowed to register in the 9th term of study unless a supervisory committee has been approved.

The supervisor and supervisory committee form is available at:

https://www.yorku.ca/gradstudies/wp-content/uploads/sites/184/2021/03/supervisor-committee-approval.pdf

Dissertation Examining Committee

A dissertation examining committee will be appointed according to the Faculty of Graduate Studies regulations (www.gradstudies.yorku.ca). It is the responsibility of the supervisor and student to ensure that all degree requirements are met.

Acceptable Grades for Graduate Students

Faculty of Graduate Studies regulations regarding acceptable grades are available at:

https://gradstudies.yorku.ca/current-students/regulations/courses-grading/

Registration and Balance of Degree Fees

http://gradstudies.yorku.ca/current-students/regulations/fees/

Important Notes

Full-time doctoral students must register and pay fees for a minimum of 6 terms. Part-time doctoral students must register and pay fees for a minimum of 12 terms. Part-time students are not eligible for funding.

Students who successfully complete a master’s or PhD program in less time than the program length, will, prior to convocation be responsible for payment of a balance of degree fee. For the calculation of balance of fees, one full term is equivalent to two part-time terms.

Full-time students may not be absent from the campus without the permission of the program director for more than four weeks of any term in which they are registered.

Key timelines in the PhD program

- **Petition for credit transfer (if not used for obtaining another degree):** must be within the first semester
- **Comprehensive exams:** must be completed within the first 3 semesters
- **Supervisor:** must be recommended and approved before the end of 5th semester
- **Supervisory committee:** must be recommended and approved before the end of 8th semester
- **Dissertation Subject Oral:** must be completed before the end of 6th semester
- **Thesis proposal and TD1**: must be competed before the end of the 9th semester
- **Colloquium:** must be within the semester of Dissertation Oral Examination, and at least 25 days prior to the oral examination

Financial Support

Most full-time students are offered some financial support in the form of a teaching assistantship (TA) and/or a research assistantship (RA). Full-time MA students who are offered financial support will receive this support in year one of full-time studies. Full-time MSc students who are offered financial support will receive this support in year one and year two of full-time studies. Full-time PhD students who are offered financial support will continue to receive this support for four years provided their studies are proceeding in a satisfactory manner.

In addition to York support, students are urged to seek financial support from external sources. Part-time students are not eligible for financial support from York.

External Scholarships

Students with high averages are strongly encouraged to apply for external scholarships. These include NSERC and OGS scholarships. For NSERC scholarships, the student must be a citizen or permanent residence of Canada. The OGS is open to all students, including international (visa) students.

York Graduate Scholarships

A limited number of entrance scholarships are awarded to outstanding full-time students. These are valid for the first year of study only at the master's or doctoral level and are not renewable.

York Recruitments Awards

A limited number of recruitment awards may be available for outstanding full-time students. These awards are intended to bring high calibre students to the graduate program at York; they are valid for the first year of MA, MSc, and PhD programs only and are not renewable.

Bursaries

Full-time registered graduate students who are paying full-time fees and have financial need may apply to the Faculty of Graduate Studies for a bursary.

Type of Support at Admission

Type of Support	Degree Program		
	MA	**MSc**	**PhD**
TA	0.75/year	0.75/year	1/year
TA top-up to	0.875/year	0.875/year	—
RA	—	Yes	Yes
YGF	Yes	Yes	Yes
YGS	—	Limited (requires minimum A GPA)	
Recruitment Award	Limited (requires minimum A GPA)		

Intellectual Property Policy

The Faculty of Graduate Studies recognizes the mission of the university to seek, preserve, and disseminate knowledge and to conduct research in a fair, open, and morally responsible manner.

In such regard, the Faculty of Graduate Studies believes that intellectual property rights are divided among several interests, and that the rights and obligations of various claimants should be specified, fairly regulated, and that disputes arising may be mediated. All parties students and faculty are expected to behave in an ethically appropriate manner beyond their immediate graduate student/supervisory relationship, to encompass intellectual property rights, dissemination of research data, and in making decisions on authorship and publication of joint research.

Because of the varied cultural aspects and practices that differ among the graduate programs, each program is responsible for enacting and enforcing this policy of appropriate ethical practices on intellectual property rights, in compliance with the Faculty Policy on Intellectual Property for Graduate Programs. Programs which choose not to enact their own specific policy are bound by the Faculty Policy on Intellectual Property for Graduate Programs, which can be found here:

https://www.yorku.ca/gradstudies/students/current-students/thesis-and-dissertation/intellectual-property/

Application of the Faculty of Graduate Studies Intellectual Property Policy

The purpose of this section is to allow programs to enact a variant policy, to take into account normative practices and procedures of a discipline that may not be adequately described in the Faculty Policy on Intellectual Property for Graduate Programs. Programs will have an obligation to inform their students and faculty of the existence of the program policy, and especially of the nature of any special conditions, or of the Faculty Policy on Intellectual Property for Graduate Programs, if a program does not elect to formulate their own policy.

In the production of a program policy, no program may impose unreasonable or unusual conditions on any student or faculty member as a condition of admission to, or participation or teaching in a program. Furthermore, no individual agreement between a faculty member and a graduate student will impose unreasonable or unusual conditions on the student.

To ensure that the unequal power and influence of the faculty member in the supervisor/student relationship does not overwhelm the student, the Executive Committee of the graduate program will review all individual agreements to ensure that this condition is respected. The policy of each program must ensure that the Executive Committee of the Graduate Program may annul any individual agreement, and/or ask for redrafting of an agreement, where they consider that this condition has not been respected.

The program policy will be entitled 'Intellectual Property Policy of the Graduate Program in Mathematics and Statistics', and must be submitted to the Faculty of Graduate Studies for approval by the Executive Committee and Council within three months after approval of the Faculty Policy on Intellectual Property for Graduate Programs.

The Faculty Policy for Graduate Programs on Intellectual Property Relationships between Graduate Students and Their Supervisors

The following clauses, concerning authorship, publication and individual agreements, relating to graduate students and their supervisors, are to serve as the Faculty Policy on Intellectual Property for Graduate Programs who wish to devise their own policy, principles and practices. Clauses 1 through 15, either in their entirety or reworded, must be included in all graduate programs' policies. If clauses are reworded, the programs must ensure that the spirit of the Faculty wording is encompassed. The clauses may be augmented if the programs so wish. All program policies, which will be expected to have an appropriate preamble, are subject to the approval of the Faculty of Graduate Studies Executive Committee and Council.

Authorship

- Authorship can only be credited to those who make substantial intellectual contributions to a piece of work. Accepting the addition of an author who has not made a significant intellectual contribution to the piece of work is not ethical for authors.

- Authors accept not only credit but also responsibility for their work and, in particular, for ensuring that the work conforms to appropriate standards of Academic Honesty.
- Generally, the order of authors' names in a publication should reflect the substance of their relative contributions to the work, with priority going to those who made the greatest or most significant contribution. Supervisors should discuss the issue of authorship, and what factors may determine the final order of authorship, normally before commencing the work.
- Where the major substance or data of a co-authored publication is based on a portion of a graduate student's work, the student will normally be the first author. The supervisor, or joint authors should be prepared to offer a rationale in cases where the student is not listed as the first author. Where the work has been written up in a dissertation or thesis or paper before the research is published, the publication will normally cite the dissertation, thesis, or paper on which it is based.
- Anyone otherwise entitled to be acknowledged as a co-author may forfeit that right if they leave the project before substantially completing it. In such cases their contribution to the work shall nonetheless be acknowledged in an appropriate manner by the author(s), for example in the acknowledgements section of the publication.
- Providing financial support for a student's dissertation, thesis, or research paper is not, in itself, sufficient to warrant authorship. Only where intellectual input is provided beyond financial support, should co-authorship be considered.
- Supplying minor editorial work for a student's dissertation, thesis, or research paper is not, in itself, sufficient to warrant co-authorship.
- If a student is employed as a Research Assistant in circumstances where the work done in the course of that employment is not intended to and does not in fact become part of work done for the degree requirements, then the student may not normally claim co-authorship and does not own the data, except through a prior agreement that is consistent with the general principles above.
- If a student is employed as a Research Assistant in circumstances where the work done in the course of that employment becomes part of the thesis/dissertation/ research paper, the student may, at a minimum, claim co-ownership of the data but as the author of the thesis/ dissertation/ research paper owns the overall copyright.

Publication

- The university has an important duty, grounded in the public interest, to seek, preserve and disseminate knowledge. Therefore, authors should attempt to publish their work in a timely fashion. In cases where work must be kept confidential and unpublished for a time, the period of delay should normally be no more than one year from the date of acceptance of a thesis or dissertation, and should in no circumstances extend beyond two years from that date.
- Publications by graduate students and faculty must give full and proper acknowledgment to the contribution of other students or faculty, or others to their work, notwithstanding that such contribution may not warrant authorship. Such contributions should be substantial, in accordance with the particular discipline, and may include items such as original ideas that led directly to the research work, or requested commentary that resulted in significant changes to the research.
- Normally, all co-authors or co-owners of the data need to concur in publishing or presenting the work. Co-authors should agree to the time or place of presentation or publication of their jointly authored work prior to the presentation or publication, but such agreement should not be unreasonably withheld. The inability of the author(s) to contact another co-author prior to presentation at a meeting or seminar should not prevent work from being publicly disseminated, provided they make reasonable efforts to contact all contributors to obtain prior agreement.
- To verify research materials or data, there must be provisions for access. Supervisors and sponsors may, with agreement of the

student, retain the original materials provided. Under such circumstances students shall normally be presented on request with complete and usable copies of those materials.

- Where there has been significant substantive and intellectual contribution by the supervisor to the research, the intellectual property emanating thereof shall normally be the joint property of graduate students and their supervisor or sponsor for the masters or doctoral project in which the materials were created. When the physical research materials embody intellectual property, the student should have reasonable access to this material. Agreements concerning research materials and data should be made, where possible, before the commencement of research.
- Students shall not use in their dissertations, theses or papers data or results generated by someone else without first obtaining permission from those who own the materials.

Individual agreements

- Students and faculty may enter into individual agreements that modify their intellectual property rights. If they do so, the provisions of clauses below must be observed.
- Individual agreements should specify any financial relations and associated rights and obligations, provisions for ownership and control of original data and research materials, authorship, publication, and presentation.
- All individual agreements must explicitly state that they are subject to applicable Collective Agreements and all University regulations in force at the time.
- All individual agreements must be completed within four months of a student starting a significant portion of the research for a thesis or dissertation, or within four months of the student joining a laboratory. In the case for students joining a specific laboratory to undertake research with a specific supervisor, the supervisor should indicate prior to the arrival of the student the nature of any agreement expected to be entered into between the supervisor and the student.
- All individual agreements will be reviewed by the Executive Committee of the graduate program to ensure that the agreement does not impose any unreasonable or unusual conditions on the student. The Executive Committee of the graduate program may annul any individual agreement or ask for redrafting where this condition has not been respected.

Education and Information

Education is a most powerful tool to promote appropriate ethical behaviour in the graduate student/supervisor relationship, especially concerning intellectual property rights, dissemination of research data, authorship, and publication of joint research. Moreover, a suitable educational session to inform graduate students of their rights and obligations concerning intellectual property and associated aspects would go a long way to ensuring that potential conflicts are eliminated before intervention is required. Therefore, graduate programs should present an educational and information session to incoming graduate students on such matters as part of their orientation. To assist in this task, graduate programs should use the section of the report of the Task Force on Intellectual Property entitled "Intellectual Property and the Graduate Student at York", and ensure that copies of this section are provided to all new faculty and incoming graduate students. Furthermore, the graduate programs would find an educational session useful to continually update faculty members on what documentation may or should be included in appropriate individual agreements. To ensure that the educational session is held, graduate programs are required to include in their intellectual property policy the following statement:

That graduate program in Mathematics and Statistics will normally hold an information session on ethical aspects of research including intellectual property rights, and related issues, during the orientation session for new incoming graduate students. All new students and faculty will be provided with copies of the most recent edition of the document entitled "Intellectual Property and the Graduate Student at York."

Dispute Resolution

In such a complex area, disputes may arise even among people of good will, for example, out of conflicting understandings of fact, or interpretations of the law, faculty or program regulations, or individual agreements.

The primary role of the Faculty of Graduate Studies should be to provide general directives and principles governing the graduate student/ supervisory relationship, to educate and inform parties about their rights and appropriate behaviour, and to assist parties in mediating disputes. The latter imply that the parties can probably come to a voluntary and informed agreement between themselves. Generally, the imposition of resolutions by a Faculty or by arbitrators is far less satisfactory. Therefore, the following mediative process is suggested as a means of resolving disputes.

In disputes arising out of Program Policies or Individual Agreements, parties should initiate a complaint in writing, and bring it to the attention of the program director of the program in which the student is enrolled, with a copy to the Dean of the Faculty of Graduate Studies.

The program director should arrange an informal meeting of the parties to discuss the substance of the dispute, the possibility of negotiating an agreement at the program level, and to determine the necessity of approaching the Faculty for assistance. At the meeting, the parties shall be informed that they may at their own expense, seek legal remedy. At any point, if any party chooses to proceed in law, the mediative role of the program or faculty shall end.

If the parties choose to proceed to mediation, a mediator acceptable to the parties, preferably from outside the graduate program will be used, unless all parties agree to mediation by the Program Director. In cases where the nature of the dispute involves a requirement for technical knowledge of the matter, the Program Director may form a hearing committee consisting of herself/himself and necessary experts in the subject matter who preferably come from outside the graduate program. In assisting the parties in mediation, the program director or mediator must have regard to the fact that students and faculty generally stand in a relation of unequal power, and thus ensure that any agreement reached is consistent with the general principles of the report of the Task Force on intellectual Property.

If the dispute cannot be settled by mediation within the program, and on request of the parties, the Dean of the Faculty of Graduate Studies or his or her representative shall review the initial attempt at mediation, and if warranted may proceed with a new attempt at mediation, subject to the same conditions as stated above. In matters outside of ownership of intellectual property, the Faculty may direct how a settlement should be reached.

For further information and updates please visit:

https://www.yorku.ca/gradstudies/wp-content/uploads/sites/184/2021/06/intellectual-property.pdf

Course Outlines S2023, F2023, W2024

MATH 6004 0.0 S/F/W
Seminar

This course provides students with a chance to work independently and to present the results of their work to other students. Each student gives two one-hour seminars on topics arranged with two different faculty members. The topics may be related to other courses the student is taking, but should not be covered in those courses. They may be in the same field or two different fields. Students are expected to submit a written report prior to presenting each seminar. The seminars are graded separately and the course is graded on a pass/fail basis. Students in the course are expected to attend all seminars.

Main Source
Determined by the supervisor.

Course Director
Supervisors, one per Seminar

MATH 6121 3.0 F2024
Applied Algebra

Advanced group Theory and representation theory:

Group, morphism, subgroup, G-sets (and G[1]morphisms), Isomorphisms Theorems and quotient groups. Jordan-Holder Theorem, Sylow Theorem, structure of finitely generated abelian groups;

Representation of finite groups and characters (over C);

Preliminary notions in ring: definitions, Unique factorization domains, Euclidian domain, Principal ideal domain, Polynomial rings, Grobner basis, Chinese Remainder Theorem.

Main Source
Thomas W. Hungerford, Algebra, Graduate Texts in Mathematics 73

W. Fulton and J. Harris, Representation Theory, A first course, Graduate Texts in Mathematics 129

Course Director
Yun Gao, Ross S624

MATH 6122 3.0 W2025
Algebra II

TBD

Main Source
TBD

Course Director
Alexander Nenashev

MATH 6280 3.0 W2025
Measure Theory

A measure on a collection of subsets (or events) of a set is a function with certain desirable properties that describes the size (or probability) of each element of the collection. Given a measure it is possible to define an integral of specific functions against the measure thereby generalizing the Riemann integral. Both measures and this integration theory are essential concepts in probability theory and functional analysis.

In this course, we will begin by definition the notion of a measure and developing methods for constructing measures. Subsequently, we will study specific functions, known as measurable functions, and prove results such as Lusin's Theorem and Egorff's Theorem. Measurable functions will permit an integration theory and the study of many additional topics, such as Fatou's Lemma, the Dominated Convergence Theorem, Fubini's Theorem, Hahn and Jordan decompositions, the Lebesgue Differentiation Theorem, the Fundamental Theorems of Calculus, the Radon-Nikodym Theorem, the Lebesgue Decomposition Theorem, and L^p-spaces.

Main Source
Course Notes

Real Analysis, by Royden and Fitzpatrick, 4th edition (optional).

Course Director
Paul Skoufranis, Ross S625

MATH 6300 3.0 S2025
Complex Analysis

This course will cover topics in complex differentiability, power series, Cauchy-Riemann equations, Cauchy integral theorem, harmonic functions, contour integration and residues, meromorphic functions and Weierstrass products. We will cover fundamental theorems by Liouville, Jensen, Morera, Rouché, Hurwitz, Montel and Riemann. If time permits, we will also discuss applications to special functions (Riemann zeta function and elliptic functions) and to asymptotic analysis.

Main Source

L.V. Ahlfors. Complex analysis. International Series in Pure and Applied Mathematics. McGraw-Hill Book Co., New York, third edition, 1978.

Course Director

Alexey Kuznetsov, Ross N628

MATH 6340 3.0 W2025
Ordinary Differential Equations

This course will cover general properties of differential equations: existence, uniqueness and continuity theorems; linear systems and stability; Floquet theory; local theory of nonlinear systems; qualitative theory, Lyapunov stability, limit sets and attractors; linearization and invariant manifolds, Hartman-Grobman theorem; planar systems and Poincaré-Bendixon theory, phase plane analysis; periodic solutions and their stability, limit cycles and Poincaré map; normal form theory; bifurcation theory; nonlinear dynamics and applications in biology, physics and finance.

Main Source

Lawrence Perko, Differential Equations and Dynamical Systems, 3rd Edition, Springer.

Lecture notes of selected topics will be provided.

Course Director

Huaiping Zhu, Ross N618

MATH 6350 3.0 F2024
Partial Differential Equations

This is a first course in the modern theory of partial differential equations at the graduate level. We begin the course with Fourier analysis and tempered distributions on Euclidean spaces. Then we introduce the calculus of pseudo-differential operators in order to study the distribution solutions and weak solutions of Poisson equations driven by elliptic pseudo-differential operators. Sobolev spaces are constructed to measure the global regularity of distribution solutions and weak solutions of partial differential equations governed by elliptic pseudo-differential operators on Euclidean spaces.

Main Source

M. W. Wong, An Introduction to Pseudo-Differential Operators, Third Edition, World Scientific, 2014.

Course Director

Man Wah Wong, Ross N626

MATH 6373 3.0 S2024
Computational Dynamical Systems

This course will introduce basic concepts and techniques of bifurcation theory for discrete and continuous dynamical systems. These include topological equivalence and structural stability of dynamical systems, local bifurcations of equilibria and periodic orbits, normal forms, and global bifurcations. Most of the computational tasks in the course can be carried out with MATLAB and MAPLE. The goal of this course will be to introduce the computational skills and tools to compute the behavior of differential equations as parameters varies, to explore the bifurcations and complex dynamics. Dynamical models in biology will be explored as examples.

Main Source

TT Yuri Kuznetsov, Elements of Applied Bifurcation Theory, Springer-Verlag.
Lawrence Perko, Equations and Dynamical Systems. Springer.
Lecture notes of selected topics will be provided.

Course Director

Huaiping Zhu, Ross N618

MATH 6378 3.0 S2024
Applied Delay Differential Equations

TBD

Main Source

TBD

Course Director

Jianhong Wu, Ross N609

MATH 6461 3.0 W2025
Functional Analysis I

Functional analysis is the study of infinite-dimensional topological vector spaces over the real and complex fields and continuous linear operators between such spaces, combining the methods of linear algebra, analysis, measure theory, and topology. This course covers the following topics.

1. Banach Spaces
2. Hahn-Banach Theorem
3. Classical examples of Banach spaces and duality
4. Applications of the Baire category theorem
5. Topological vector spaces and weak topologies
6. Geometric Hahn Banach theorems and Krein-Milman theorem
7. Riesz representation theorem
8. Stone-Weierstrass theorem
9. Spectral theorem for compact operators

Main Source

No particular textbook will be followed strictly. The instructor will gradually make his own notes available. We will borrow elements from:

- J. B. Conway, A Course in Functional Analysis
- G. B. Folland, Real Analysis
- G. Köthe, Topological Vectors Spaces I
- B. Simons, Convexity: an analytic approach

A few other useful sources are:

- P. Skoufranis' Lecture Notes
- W. Rudin, Functional Analysis
- G.K. Pedersen, Analysis Now
- R.J. Zimmer, Essential results of functional analysis
- C.D. Aliprantis, K. Border, Infinite Dimensional Analysis: A Hitchhiker's Guide

Course Director

Pavlos Motakis, Ross S618

MATH 6540 3.0 F2024
Topology I

A topological space is a set along with a collection of subsets that formalize a notion of a nearness between points and subsets. Topology provides a framework to study continuity in the broadest setting applicable across many areas of mathematics, especially Functional Analysis. We will begin from the basic fundamental concepts and then focus on compact spaces, metrization, separation axioms, connectedness, product spaces, convergence, and other topics.

Main Source

Munkres, James R.; Topology, second edition. Prentice Hall (2000)

Willard, S.; General Topology, Dover.

Course Director

Paul Szeptycki, Ross N634

MATH 6602/4430 3.0 F2024
Stochastic Processes

TBD

Main Source

TBD

Course Director

Jorg Grigull, LSB 427D

MATH 6605 3.0 W2025
Probability Theory

This course examines the essentials of probability theory from the rigorous mathematical viewpoint. Topics include basic measure theory, the weak and strong laws of large numbers, the Borel-Cantelli lemma, zero-one laws, the law of the iterated logarithm, convergence in probability and weak convergence, characteristic functions, the central limit theorem, conditional probability and expectation, and martingales.

Prerequisite

An undergraduate course in probability.

Main Source

Jeffrey Rosenthal, A First Look at Rigorous Probability Theory, 2nd edition

Course Director

Neal Madras, Ross S616

MATH 6620 3.0 F2024
Mathematical Statistics

The topics for the course include fundamentals of statistical inference, various methods of estimation, and principles of hypothesis testing. Special topics will be added if time permits. The course begins with an introduction to rigorous probability theory.

Main Source

Jun Shao, Mathematical Statistics 2003; Springer.

Course Director

Hanna Jankowski, DB 2038

MATH 6621 3.0 W2025
Advanced Mathematical Statistics

This course will cover a broad range of limit theorems useful in mathematical statistics, along with methods of proof and techniques of application. It will begin with a variety of tools and foundations basic to asymptotic theory in statistics. Then, the asymptotic properties of the following statistics are considered: (a) The usual statistics computed from a sample; (b) The statistics concocted as transformations of vectors of more basic statistics; (c) statistics arising in classical parametric inference and contingency table analysis; (d) U-statistics. As time and interest permit, further related topics may also be covered.

Main Source

Mathematical Statistics, 2nd edition by Shao, J., 2003 Publisher; Springer

Course Director

Yuehua Wu, DB 2036

MATH 6622 3.0 W2025
Generalized Linear Models

Generalized Linear Models (GLMs) are an extension to linear models where the response variable is not continuous. These models are commonly used for analysis where the response variables are binary, categorical, proportions, or counts. GLMs play a crucial role in statistics and can be widely applied in industry, government, and banks as well as other areas. Tentative topics will include: review of linear models; formulation of GLMs; link functions; iterative least squares algorithms; deviance and asymptotic theory; model selection; residuals and quasi-likelihood; generalized linear mixed models.

Main Source

A.J. Dobson and A.G. Barnett (2008), An Introduction to Generalized Linear Models (third edition), Chapman and Hall/CRC Press.

Course Director

Wei Liu, Ross N601B

MATH 6627 3.0 W2025
Practicum in Statistical Consulting

This course helps students develop skills required for statistical consulting. Students will develop their practical data analysis skills, communication skills, and practical aspects of various statistical

topics. Students will learn strategies for presenting statistical findings verbally and in written

format. Students will learn strategies for working cooperatively with other researchers and

institutions. The course provides hands-on training in statistical consulting.

Main Source

Lecture Notes

Statistical Consulting – Cabrera & McDougall

Course Director

Kelly Ramsay, Ross S511A

MATH 6630 3.0 F2024
Applied Statistics I

The course will include the following topics in applied statistics: Maximum likelihood estimation using numeric methods including continuous and discrete; Optimization; Methods for missing data including the EM algorithm; Monte Carlo simulation methods; Markov Chain Monte Carlo methods; Bootstrap and Jackknife methods

Main Source

G. Givens and J. Hoeting (2013) Computational Statistics, 2nd ed., Wiley (Chapters 1-4, 6, 7, 9). Lecture notes will be provided

Course Director

George Monette, DB 2042

MATH 6633/4130B 3.0 F2024
Time Series Analysis

This course provides a systematic presentation of many statistical techniques for the analysis of time series data. Core topics include time dependence and randomness, trend, seasonality and error, stationary processes, ARMA (Autoregressive moving average) and ARIMA (Autoregressive integrated moving average) processes. Throughout the course, we will use statistical software R for data analysis.

Main Source

R.H. Shumway, S.D. Stoffer, Time Series Analysis and Its Applications With R Examples, 4th edition, Springer.

Course Director

Kaiqiong Zhao, Ross S514

MATH 6641 3.0 W2025
Survival Analysis

We will begin with the basics of survival analysis including censoring and truncation. Then we will proceed to discuss various nonparametric methods such as the Kaplan-Meier and Nelson-Aalen estimators. Next we will discuss semi-parametric models including proportional hazards models as well as accelerated failure-time models. R will be used extensively in this course. We will go into both the theoretical and practical aspects of survival analysis.

Main Source

1. Kalbfleisch and Prentice, The Statistical Analysis of Failure Time Data, Second Edition

2. Klein and Moeschberger, Survival Analysis: Techniques for Censored and Truncated Data, Second Edition

Course Director

TBD

MATH 6642 3.0 S2025
Applied Longitudinal Data Analysis

(pending enrolment)

Longitudinal data are very common in practice, in which outcomes are repeated measurements over time on the same subjects. The mixed model is suitable for the analysis of longitudinal data. This course provides a detailed overview of mixed models for the analysis of longitudinal data. The main topics include exploring longitudinal data, marginal models, linear mixed effects models, and generalized linear mixed models. If time permits, missing values in longitudinal data will be included as well. The course will be focused on the theoretical development and the statistical methodology as well as how to apply these approaches to analyze longitudinal data.

Main Source

G. Fitzmaurice, N. Laird, J. Ware, Applied Longitudinal Analysis (second edition).

Course Director

Wei Liu, Ross N601B

MATH 6643 3.0 S2024
Applications of Mixed Models

Mixed models are widely applied to analyze longitudinal data, in which outcomes are repeated measurements over time on the same subjects. This course provides a detailed overview of mixed models for the analysis of longitudinal data. The main topics include exploring longitudinal data, marginal models, linear/nonlinear mixed effects models, and generalized linear mixed models. If time permits, missing problems in longitudinal data will be discussed as well.

Main Source

P. Diggle, P. Heagerty, K. Liang, S.Zeger (2002). Analysis of Longitudinal Data (second edition).

Oxford University Press.

L. Fahrmeir, G. Tutz, (2000). Multivariate Statistical Modeling Based on Generalized Linear Models.

Springer-Verlag, New York.

Course Director

Wei Liu, Ross N601B

MATH 6644 3.0 W2025
Statistical Learning

TBD

Main Source

TBD

Course Director

Steven Wang, Ross N625

MATH 6650 3.0 F2024
Introduction to Statistical Data Science

This course provides a general introduction to Data Science. It gives an answer to “What is Data Science” and “What is/isn't a Data Science project". We will go through the main steps of a Data Science project explaining the theoretical and/or practical aspects, by using different Statistical and technological tools. It gives a general idea of data exploration, statistical analysis, machine learning, data visualization, among other steps present in the Data Science cycle. The main part of the course is in Python. Students (in groups) will deliver a data science project as a result of their learning.

Main Source
Lecture notes will be provided

Course Director
Jairo Diaz-Rodriguez, Ross N637

MATH 6651/4141 3.0 F2024
Advanced Numerical Methods

Topics in this course include: Numerical methods for solving ordinary differential equations including initial-value problems and boundary-value problems; Optimization problems: golden method, simplex method, steepest descents, conjugate gradient methods including nonlinear conjugate gradient methods; Approximation theory: least squares, orthogonal polynomials, Chebyshev approximation, Fourier approximation and Fast Fourier Transforms, and Pade approximation.

Main Source
Lecture notes will be provided

Course Director
Dong Liang, Petrie 225

MATH 6652 3.0 W2025
Numerical Solutions to Differential Equations

This course will include introduction to the MATLAB computing language with application to numerical integration and linear algebra; overview of numerical methods for ordinary differential equations including Runge-Kutta methods and application to dynamical systems; review of partial differential equations; well-posed boundary-value problems; finite difference approximations of derivatives. Parabolic equations: reduction to dimensionless form; solution by explicit and implicit methods, including the Crank-Nicholson method. It also includes elliptic equations: review of Jacobi and Gauss Seidel method; successive over-relaxation method; and Alternating Direction Implicit Method, as well as hyperbolic equations: linear and nonlinear wave equations; explicit, implicit and multistep methods. Convergence and stability of solution methods will be covered.

Main Source
Lecture notes will be provided.

Morton, K.W. and Mayers, D.F. Numerical Solution of Partial Differential Equations: An Introduction, Cambridge University Press.

Course Director
Miles Couchman, Ross N617

MATH 6902 3.0 F2024
Stochastic Programming

Uncertainty has always been an essential part of decisions on planning, scheduling, investment, policies, public health interventions, etc. Stochastic programming is one of the most capable model for such important decisions. In this course, we study its mathematical foundation, modelling issues, practice, tools, and significant applications. Programming skills in Python and knowledge in constrained and unconstrained optimization are expected.

Main Source
John R. Birge and François Louveaux, Introduction to stochastic programming, Springer, 2011

Course Director
Michael Chen, DB 2034

MATH 6910 3.0 F2024
Stochastic Calculus in Finance

This course will introduce the basic ideas and methods of stochastic calculus and apply these methods to financial models, particularly the pricing and hedging of derivative securities. We start by introducing the concepts of arbitrage and risk-neutral pricing in a discrete-time setting, then move to more sophisticated continuous-time models. Along the way we cover the following mathematical topics: Brownian motion, Stochastic integrals, Ito's formula, Martingales and Girsanov transformations. We will also cover interest-rate models and more advanced topics, if time permits.

Main Source
S. Shreve, Stochastic Calculus for Finance II: Continuous Time Models, Springer 2010

Course Director
Jingyi Cao, DB 2031

MATH 6910 3.0 W2025
Stochastic Calculus in Finance

This course will introduce the basic ideas and methods of stochastic calculus and apply these methods to financial models, particularly the pricing and hedging of derivative securities. We start by introducing the concepts of arbitrage and risk-neutral pricing in a discrete-time setting, then move to more sophisticated continuous-time models. Along the way we cover the following mathematical topics: Brownian motion, Stochastic integral, Ito's formula, Martingales and Girsanov's transformations. We will also cover interest-rate models and more advanced topics, if time permits.

Note: The Winter 2025 section of this course is being exclusively offered for Schulich Business students and aiming at non math-majoring students. Graduate students in Mathematics and Statistics should enrolled in the Fall 2024 section of MATH 6910 (and NOT in Winter 2025).

Main Source
S. Shreve, Stochastic Calculus for Finance II: Continuous Time Models, Springer-Verlag, 2010

Course Director
Hyejin Ku, DB 2025

MATH 6911 3.0 W2025
Numerical Methods in Finance

This course deals mainly with finite difference methods and Monte Carlo techniques and their applications in Mathematical Finance. More specifically, we will cover (i) stability and convergence for explicit, implicit and Crank-Nicolson finite difference schemes for solving the heat equation; (ii) finite difference schemes for solving PDEs in local volatility model; (iii) pricing European options and computing implied volatility surface in local volatility model; (iv) Monte Carlo techniques and variance reduction methods: conditional Monte Carlo, importance sampling, control variate method; (v) discrete time delta hedging in Black-Scholes model; (vi) computing Greeks using Monte Carlo techniques; (vii) pricing American options in binomial and Black-Scholes models. If time permits, we will also discuss Longstaff-Schwartz method for pricing American options.

Main Source
Lecture notes will be provided

Course Director
Alexey Kuznetsov, Ross N628

MATH 6912 3.0 W2025
Machine Learning in Finance

Machine learning (ML), a branch of artificial intelligence, is the science of programming computers to improve their performance by learning from data. Dramatic progress has been made in the last decade, driving machine learning into the integration of our daily life, technology, business services and finance. This course views the technical elements of machine learning, provides fundamental understanding of various machine learning models and algorithms, and explores their application in finance industry.

Students will learn how to implement commonly used ML algorithms in Python programming. Students in the course are assumed to know already or are expected to learn by themselves the following materials:

Scipy Lectures: https://scipy-lectures.org/

Skip the following sections:

1.2.5.3 and followings in 1.2

1.3.3 and followings in 1.3

1.4.4.5 and followings in 1.4 except 1.4.4.11

1.5 and followings in chapter 1 except 1.5.5

everything of chapter 2

everything of chapter 3

Main Source
John C. Hull, Machine Learning in Business: An Introduction to the World of Data Science, Independently published (May 26 2021), 979-8508489441

Course Director
Hongmei Zhu, Petrie 214

MATH 6931 3.0 F2024
Mathematical Modelling

This course will explore the principles of mathematical modelling and develop models

motivated by various case studies in natural sciences and other fields. The course will include a quick review of relevant topics (differential equations; linear algebra, units and scaling); principles of modelling (concepts, design and structure, compartmentalization); dynamical systems (continuous and discrete models; stability analysis, bifurcations, simulation methods, and phase illustrations); deterministic and stochastic models (probability, Monte-Carlo methods; Markov Chain processes); case studies (population models of growth, interacting species, epidemics, pathogen-host interactions, evolution); coding and computational experiments (simulating stochastic and deterministic methods using Matlab).

Main Source

Moghadas SM, Jaberi-Douraki M, Mathematical Modelling: A Graduate Textbook, Wiley 2018

Course Director

Seyed Moghadas, Ross S619

MATH 6936 3.0 W2025
Mathematical Epidemiology

Mathematical epidemiology is a field of study that uses mathematical models to understand the spread of infectious diseases among individuals at population level (epidemiology) and the immune-pathogenesis cellular level (within-host dynamics) and to evaluate the effectiveness of control measures.

The goal of this course is to familiarize students with the basic methods and approaches to build and analyze mathematical models of infectious diseases. It explores the mathematical foundations and computational methodologies used to understand the spread, dynamics, and control of infectious diseases within populations and within-host dynamics of pathogens. It is intended to start from a beginner level and accelerate to research level.

Through this course, students will gain insights into how to formulate mathematical models for transmission dynamics of infectious disease, immuno-epidemic models and within-host cellular level dynamics of parasite, viruses and other pathogen; choose an appropriate model type for a particular question; Identify research questions that can be addressed with math modeling methods; Understand how to interpret model results and limitations/pitfalls; use programming languages (Python, MATLAB, e.t.c.,) to numerically simulate infectious disease models; Interpret and critique mathematical models published in the scientific literature; Discuss the practical applications of math modeling, and the role of modeling in public health policy.

Topics to be covered are:

- The historical aspects of mathematical epidemiology, General ideas about the modeling process in general and modelling infectious disease processes.
- Basic epidemic and endemic compartmental models using deterministic differential equations,
- Extensions to Models with control strategies.
- Techniques for computing reproduction number; and different stability analysis approaches.
- Stochastic models in epidemiology.
- Discrete model in epidemiology,
- The classical model of in-host, infectious disease dynamics; Extensions to the basic in-host model; Stochastic models in immunology.
- Fitting epidemiological models to data,
- AI/ML applied to predicting infectious diseases (Optional – if time permits).

Prerequisites Basic understanding of calculus, differential equations, probability theory, and programming. No prior knowledge of epidemiology is required, but an interest in biology, statistics, and public health is beneficial.

Main Source

Martcheva, Maia. An introduction to mathematical epidemiology. Vol. 61. New York: Springer, 2015.

Blower, Sally. "Modelling infectious diseases in humans and animals." The Lancet Infectious Diseases 8.7 (2008): 415.

Course Director

Woldegebriel Assefa Woldegerima, Ross S614

MATH 6937 3.0 S2025
Practicum in Industrial and Applied Mathematics

This practicum course will be based on interdisciplinary and real-life application problems. Each time, a problem will be presented to students in class. The students are required to use the methods they have been learning from Math 6931 (Mathematical Modelling) to derive a reasonable mathematical model, to analyze and solve the model both analytically and numerically. Students will be encouraged to work in groups. Evaluation will be based on individual reports and group presentations.

Main Source

Lecture notes will be provided, consisting of selected book chapters, published papers, and online information relevant to the interdisciplinary and real-life application problems.

Course Director

Jianhong Wu, Ross N609

List of Graduate Courses S2023, F2023, W2024

Summer 2024			
Course #	**Course Title**	**Day and time**	**Instructor**
MATH 6373	Computational Dynamical Systems	Mon-Wed, 11:30-14:30	Huaiping Zhu
MATH 6378	Applied Delay Differential Equations	Mon-Wed, 14:30-17:30	Jianhong Wu
MATH 6643	Applications of Mixed Models	Tue-Thu, 10:00-13:00	Wei Liu

Fall 2024			
Course #	**Course Title**	**Day and time**	**Instructor**
MATH 6121	Applied Algebra	Tue-Thu, 10:00-11:30	Yun Gao
MATH 6350	Partial Differential Equations	Tue-Thu, 13:00-14:30	Man Wah Wong
MATH 6461	Functional Analysis I	Tues-Thurs, 14:30-16:00	Pavlos Motakis
MATH 6540	Topology I	Mon-Wed, 13:00-14:30	Paul Szeptycki
MATH 6602/4430	Stochastic Processes	Wed-Fri, 11:30-13:00	Jorg Grigull
MATH 6620	Mathematical Statistics	Mon-Wed, 10:00-11:30	Hanna Jankowski
MATH 6630	Applied Statistics I	Mon-Wed, 14:30-16:00	George Monette
MATH 6633/4130B	Time Series Analysis	Tue-Thu, 13:00-14:30	Kaiqiong Zhao
MATH 6650	Introduction to Statistical Data Science	Mon-Wed, 16:00-17:30	Jairo Diaz-Rodriguez
MATH 6651/4141	Advanced Numerical Methods	Tue-Thu, 14:30-16:00	Dong Liang
MATH 6902	Stochastic Programming	Tues-Thurs 11:30-13:00	Michael Chen
MATH 6910	Stochastic Calculus in Finance	Fri, 14:30-17:30	Jingyi Cao
MATH 6931	Mathematical Modelling	Mon-Wed, 13:00-14:30	Seyed Moghadas

Winter 2025			
Course #	**Course Title**	**Day and time**	**Instructor**
MATH 6122	Algebra II	Tue-Thu, 14:30-16:00	Alexander Nenashev
MATH 6280	Measure Theory	Tue-Thu, 10:00-11:30	Paul Skoufranis
MATH 6340	Ordinary Differential Equations	Wed, 14:30-17:30	Huaiping Zhu
MATH 6605	Probability Theory	Tue-Thu, 13:00-14:30	Neal Madras
MATH 6621	Advanced Mathematical Statistics	Tue-Thu, 14:30-16:00	Yuehua Wu
MATH 6622	Generalized Linear Models	Tue-Thu, 11:30-13:00	Wei Liu
MATH 6627	Practicum in Statistical Consulting	Mon-Wed, 10:00-11:30	Kelly Ramsay
MATH 6641/4130	Survival Analysis	Mon-Wed, 14:30-16:00	**TBD**
MATH 6644	Statistical Learning	Mon-Wed 13:00-14:30	Steven Wang
MATH 6652	Numerical Solutions to Differential Equations	Mon-Wed, 13:00-14:30	Miles Couchman
MATH 6910	Stochastic Calculus in Finance	Thu, 14:30-17:30	Hyejin Ku
MATH 6911	Numerical Methods in Finance	Tue-Thu, 10:00-11:30	Alexey Kuznetsov
MATH 6912	Machine Learning in Finance	Mon-Wed, 16:00-17:30	Hongmei Zhu
MATH 6936	Mathematical Epidemiology	Mon-Wed, 10:00-11:30	Woldegebriel Assefa Woldegerima
MATH 6937	Practicum in Industrial and Applied Mathematics	Tue, 14:30-17:30	Jianhong Wu

Summer 2025			
Course #	**Course Title**	**Day and time**	**Instructor**
MATH 6300	Complex Analysis	TBD	Alexey Kuznetsov
MATH 6642	Applied Longitudinal Data Analysis	Tue-Thu, 11:30-14:30	Wei Liu

Change from V1.0: Time for Math 6911 was incorrectly listed.