Mathematics & Its Application Major (Quantitative Biology)

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Models for comparison:

▼ Mathematics & Its Applications Specialist (Physical Science) (Science Program)

Completion Requirements:
(13.5-14.5 FCE, including at least 1.0 FCE at the 400 level)

Core Courses:

First Year:
(CSC108H1,CSC148H1)/CSC150H1; MAT137Y1/MAT157Y1, MAT223H1/MAT240H1
Second Year:
MAT224H1/MAT247H1, MAT237Y1/MAT257Y1, MAT246H1 (waived for students taking MAT157Y1), MAT244H1/MAT267H1;STA257H1
Note:
Second and Higher Years:
1. At least 0.5 FCE with a significant emphasis on ethics and social responsibility: ENV333H1/ ETH201H1/ ETH210H1/ ETH220H1/ HPS200H1/ IMC200H1/ JPH441H1/ PHL265H1/ PHL273H1/ PHL275H1/ PHL281H1 or another H course approved by the Department. Note: Students may use the CR/NCR option with this H course and have it count toward the program. Students in the VIC program may also use VIC172.

Higher Years:
MAT301H1, MAT334H1
NOTE:
1. Students planning to take specific fourth year courses should ensure that they have the necessary second and third year prerequisites.

Physical Sciences Concentration:

1. PHY151H1, PHY152H1; AST221H1
2. Three of: AST222H1; PHY250H1, PHY252H1, PHY254H1, PHY256H1
3. APM346H1/MAT351Y1
4. Three of: AST320H1, AST325H1; MAT337H1, MAT363H1/MAT367H1; PHY350H1, PHY354H1, PHY356H1, PHY357H1, PHY358H1
5. Two of: APM421H1, APM426H1, APM441H1, APM446H1; PHY407H1, PHY408H1, PHY456H1

▾ Mathematics Major (Science Program)

Completion Requirements:
(7.5 full courses or their equivalent. These must include at least 2.5 full course equivalent (FCE) at the 300+ level. Of those 2.5 FCE, at least 0.5 FCE must be at the 400 level).

First Year:
(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1, MAT223H1/MAT240H1
Second Year:
MAT224H1/ MAT247H1, MAT235Y1/ MAT237Y1/MAT257Y1, MAT244H1, MAT246H1

NOTE:
1. MAT224H1 may be taken in first year

Second and Higher Years:
1. At least 0.5 FCE with a significant emphasis on ethics and social responsibility: ETH210H1/ ETH220H1/ HPS200H1/ JPH441H1/ PHL265H1/ PHL273H1/ PHL275H1/ PHL281H1 or another H course approved by the Department. Note: Students may use the CR/NCR option with this H course and have it count toward the program.

Higher Years:
1. MAT301H1, MAT309H1/MAT315H1, MAT334H1
2. Additional 0.5 FCE at the 200+ level from: ACT240H1/ACT230H1; APM236H1; MAT309H1/MAT315H1/MAT335H1/ MAT337H1; STA247H1/ STA257H1
3. Additional 0.5 FCE at the 300+level from: APM346H1, APM462H1; MAT309H1, MAT315H1, MAT332H1/MAT344H1, MAT335H1, MAT337H1, MAT363H1, MAT475H1; HPS390H1, HPS391H1; PSL432H1
4. MAT401H1/MAT402H1 or any other MAT/APM 400-level course

NOTES:

1. Students using MAT157Y1 towards the first year program requirements must replace the exclusion course MAT246H1 with a different H level MAT/APM course at the 200+ level.

2. In the major program, higher level courses within the same topic are acceptable substitutions. With a judicious choice of courses, usually including introductory computer science, students can fulfill the requirements for a double major in mathematics and one of several other disciplines.

3. Students planning to take specific fourth year courses should ensure that they have the necessary second and third year prerequisites.

4. Students interested in becoming K-12 teachers should consider applying to the combined degree program --- a six-year program that leads to an Honours Bachelor of Science (H B Sc) from the University of Toronto and a Master of Teaching (M T) from the Ontario Institute for Studies in Education (OISE). The HBSc part of this program involves completing a Math Major, a Minor in Education and Society (offered by Victoria College) and a Minor in an area that would lead to a second "teachable" subject. Please see the Victoria College website for more information.

Possible further courses:
▾ JMB170Y1 - Biology, Models, and Mathematics

Hours: 48L/24T
Applications of mathematics to biological problems in physiology, genetics, evolution, growth, population dynamics, cell biology, ecology, and behaviour. Mathematical topics include: power functions and regression; exponential and logistic functions; binomial theorem and probability; calculus, including derivatives, max/min, integration, areas, integration by parts, substitution; differential equations, including linear constant coefficient systems; dynamic programming; Markov processes; and chaos. This course is intended for students in Life Sciences.

Corequisite: BIO120H1
Distribution Requirements: Science
Breadth Requirements: The Physical and Mathematical Universes (5)

(presently not offered)

▾ APM236H1 - Applications of Linear Programming

Hours: 36L
Introduction to linear programming including a rapid review of linear algebra (row reduction, matrix inversion, linear independence), the simplex method with applications, the duality theorem, complementary slackness, the dual simplex method and the revised simplex method.

Prerequisite: MAT221H1/MAT223H1/MAT240H1 (Note: no waivers of prerequisites will be granted)
Distribution Requirements: Science
Breadth Requirements: The Physical and Mathematical Universes (5)

MAT244H1 - Introduction to Ordinary Differential Equations

Hours: 36L

First order ordinary differential equations: Direction fields, integrating factors, separable equations, homogeneous equations, exact equations, autonomous equations, modeling. Existence and uniqueness theorem. Higher order equations: Constant coefficient equations, reduction of order, Wronskian, method of undetermined coefficients, variation of parameters. Solutions by series and integrals. First order linear systems, fundamental matrices. Non-linear equations, phase plane, stability. Applications in life and physical sciences and economics.

Prerequisite: (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1, MAT223H1/MAT240H1
Corequisite: MAT235Y1/MAT237Y1/MAT257Y1
Exclusion: MAT267H1, MAT212H5, MAT258Y5
Distribution Requirements: Science
Breadth Requirements: The Physical and Mathematical Universes (5)

MAT245H1 - Mathematical Methods in Data Science

Hours: 36L/24P

An introduction to the mathematical methods behind scientific techniques developed for extracting information from large data sets. Elementary probability density functions, conditional expectation, inverse problems, regularization, dimension reduction, gradient methods, singular value decomposition and its applications, stability, diffusion maps. Examples from applications in data science and big data.

Prerequisite: MAT137Y1/MAT157Y1, MAT223H1/MAT240H1, MAT224H1/MAT247H1
Corequisite: MAT237Y1/MAT257Y1
Distribution Requirements: Science
Breadth Requirements: The Physical and Mathematical Universes (5)

MAT332H1 - Introduction to Graph Theory

Hours: 36L

This course will explore the following topics: Graphs, subgraphs, isomorphism, trees, connectivity, Euler and Hamiltonian properties, matchings, vertex and edge colourings, planarity, network flows and strongly regular graphs. Participants will be encouraged to use these topics and execute applications to such problems as timetabling, tournament scheduling, experimental design and finite geometries.

Prerequisite: MAT224H1/MAT247H1
Corequisite: Recommended Corequisite: MAT301H1/MAT347Y1
Distribution Requirements: Science
Breadth Requirements: The Physical and Mathematical Universes (5)

MAT344H1 - Introduction to Combinatorics

Hours: 36L

Basic counting principles, generating functions, permutations with restrictions. Fundamentals of graph theory with algorithms; applications (including network flows). Combinatorial structures including block designs and finite geometries.

Prerequisite: MAT223H1/MAT240H1
Distribution Requirements: Science
Breadth Requirements: The Physical and Mathematical Universes (5)

APM461H1 - Combinatorial Methods

Hours: 36L

A selection of topics from such areas as graph theory, combinatorial algorithms, enumeration, construction of combinatorial identities.

Prerequisite: MAT224H1/MAT247H1, MAT137Y1/MAT157Y1, MAT301H1/MAT347Y1
Recommended Preparation: MAT344H1
Distribution Requirements: Science
Breadth Requirements: The Physical and Mathematical Universes (5)