Sciences Curriculum Committee
Friday, February 2, 2018
Science Curriculum Committee
Full Review Proposals By Unit
1 New Course:

ANT431H1: The Real Planet of the Apes

Contact Hours:
  Lecture: 12 / Practical: 12

Description:
Through fossil labs and lectures, we look back over 30 to 5 million years ago when apes roamed from Spain to China and Germany to Southern Africa. The fossil record of these apes, our ancestors, reveals how we evolved our large brains, dexterous hands, extended growth period and incredible intelligence. We encounter many surprises along the way, such as apes living with pandas in Hungary, animals with a mix of monkey, ape and pig traits and apes the size of polar bears. Of the more than 100 species of fossil apes known, only one gave rise to us.

Prerequisites:
  ANT203Y1

Corequisites:

Exclusions:

Recommended Preparation:
  ANT335Y1 or ANT330Y1

Breadth Requirements:
  Living Things and Their Environment (4)

Distribution Requirements:
  Science

Competencies:
  Communication: notably; Critical and Creative Thinking: extensively; Information Literacy: notably
  Quantitative Reasoning: notably; Social and Ethical Responsibility: notably

Experiential Learning:
  Research: extensively; Other: extensively;
  Nature of "Other" Experiential Learning: Distinctive Practicals or Laboratories

Rationale:
The course complements courses on human evolution. It covers the period during our evolutionary history before humans appeared, when apes were ubiquitous throughout the Old World. It reinforces and develops skills in comparative anatomy, shape and pattern analysis and integration of large, complex databases. It also addresses fundamental questions of our evolutionary context, the emergent equality of all humans and our historic and current place within life on earth.

Consultation:
  Approved by the departmental undergraduate curriculum committee which has student representatives on it

Resources:
  Fossil casts in department
  Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:
  None
<table>
<thead>
<tr>
<th>Programs of Study for Which This Course Might be Suitable:</th>
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<tbody>
<tr>
<td>Estimated Enrolment:</td>
</tr>
<tr>
<td>25</td>
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<tr>
<td>Instructor:</td>
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<tr>
<td>Prof David Begun</td>
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</table>
1 Minor Program Modification:

Planetary Science Specialist

Completion Requirements:

One 300+-level FCE must be included in the program.

(14 full courses or equivalent, including at least one 400+series course)

First Year:
(CHM135H1, CHM138H1, CHM136H1, CHM139H1)/(CHM151Y1); (MAT135H1, MAT136H1)/MAT137Y1;
(PHY131H1, PHY132H1)/(PHY151H1, PHY152H1) (MAT137Y1 and PHY151H1, PHY152H1 preferred)
First or Second Year:
MAT223H1/MAT240H1
Second or Third Year:
AST221H1, AST222H1; (CHM222H1, CHM223H1)/(CHM225Y1)/(PHY252H1, PHY256H1); CHM238Y1; ESS221H1
GLG206H1, ESS261H1, ESS262H1 GLG216H1/GLG207H1; MAT235Y1/MAT237Y1 (MAT237Y1 preferred);
MAT244H1/MAT267H1; PHY250H1, PHY254H1
Third and/or Fourth Years:
1. PHY395H1
   JPE395H1
2. At least three of AST325H1, CHM327H1, CHM338H1; ESS231H1 GLG318H1; GLG440H1, GLG465H1;
   PHY354H1, PHY407H1, PHY408H1
3. One additional 300+series course; consult with appropriate Undergraduate Secretary for course selection
Fourth Year:
PLN420H1, PLN425H1

Description of Proposed Changes:

POST needed updating to reflect changes in Departments of Chemistry, Geography, Earth Sciences and Physics.

Rationale:

Impact:

Consultation:

Resource Implications:

3 Course Modifications:

AST101H1: The Sun and Its Neighbours

Exclusions:

AST121H1, AST221H1. Also excluded are CIV100H1, CIV101H1, CIV102H1, any 100- or higher-series CHM/PHY courses taken previously or concurrently(with the exception of PHY100H1, PHY101H1, PHY201H1, PHY202H1, PHY205H1, PHY207H1, CHM101H1)

Rationale:

We have updated the exclusions list to reflect changes in Faculty of Engineering and Department of Physics.
### AST201H1: Stars and Galaxies

**Exclusions:**
- AST121H1, AST210H1, AST221H1, AST222H1. Also excluded are CIV100H1, CIV101H1, CIV102H1 and any 100- or higher-series CHM or PHY courses taken previously or concurrently (with the exception of PHY100H1, PHY101H1, PHY201H1, PHY202H1, PHY205H1, PHY207H1, CHM101H1).

**Rationale:**
We have updated exclusions to reflect changes in Faculty of Engineering and Department of Physics.

### AST221H1: Stars and Planets

**Prerequisites:**
- PHY132H1/PHY152H1; MAT136H1 PHY152H/MAT137Y1/MAT157Y1 PHY180H

**Rationale:**

**Consultation:**

**Resources:**
1 Course Modification:

**BCH428H1: Genomics of microbial communities in human health and beyond**

<table>
<thead>
<tr>
<th>Prerequisites:</th>
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<tbody>
<tr>
<td>BCH210H1/BCH242Y1; BCH311H1/MGY311Y1; CSB349H1; MGY377H1/MGY360HH/CSB349H1 BCH350H1.</td>
</tr>
</tbody>
</table>

| Rationale: |
| Resources: |
| Consultation: |
6 Minor Program Modifications:

Biological Chemistry Specialist

Description:

Previous:
New:

Consult Professor G. A. Woolley, Department of Chemistry.

Biological Chemistry examines Nature at the molecular level by using a combination of synthetic, inorganic, analytical and physical chemistry as well as the tools of molecular biology and biochemistry. This program provides the setting to understand the chemical reactions and interactions that occur in biological processes, as well as how chemical strategies can be used to control these systems. This program includes sufficient flexibility to allow focus in areas such as bioinorganic, bioorganic, biophysical or medicinal chemistry. Students graduating from this program will be prepared for career paths in the biotechnology, biomedical and pharmaceutical sectors, as well as for research and teaching in related areas of chemistry and biology. This program is accredited by the Canadian Society for Chemistry.

Enrolment Requirements:

This is a limited enrolment program. All students who request the program and obtain at least the specified mark(s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment website at http://www.artsci.utoronto.ca/current/program for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%.

Completion Requirements:

Consult Professor G. A. Woolley, Department of Chemistry.

Biological Chemistry examines Nature at the molecular level by using a combination of synthetic, inorganic, analytical and physical chemistry as well as the tools of molecular biology and biochemistry. This program provides the setting to understand the chemical reactions and interactions that occur in biological processes, as well as how chemical strategies can be used to control these systems. This program includes sufficient flexibility to allow focus in areas such as bioinorganic, bioorganic, biophysical or medicinal chemistry. Students graduating from this program will be prepared for career paths in the biotechnology, biomedical and pharmaceutical sectors, as well as for research and teaching in related areas of chemistry and biology. This program is accredited by the Canadian Society for Chemistry.

This is a limited enrolment program: All students who request the program and obtain at least the specified mark(s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment web site at http://www.artsci.utoronto.ca/current/program for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%:

(14 full courses or their equivalent, including at least three 400-series courses)

First Year: BIO120H1, BIO130H1; CHM151Y1 (strongly recommended)/(CHM135H1/CHM139H1, CHM136H1/
Chemistry (FAS), Department of

CHM138H1); (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

First or Second Year: (PHY131H1, PHY132H1)/(PHY151H1, PHY152H1)

Second and Higher Years:

1. BCH210H1; BIO230H1/BIO250Y1; CHM217H1, (CHM220H1/CHM222H1, CHM221H1/CHM223H1)/CHM225Y1, CHM238Y1, (CHM249H1 strongly recommended)/CHM247H1
2. CHM347H1, CHM348H1, CHM379H1;
3. At least 1.0 credit from the following: CHM317H1, CHM327H1, CHM338H1, CHM343H1, CHM410H1, CHM499Y1
4. Further 300/400-series courses in BCH or CHM, including CHM437H1, CHM447H1, and CHM479H1 to make a total of 14 full courses. CSB450H1 is also acceptable.

Description of Proposed Changes:
MAT157Y1 is being added as an additional choice of first year Math courses.

Rationale:
Adding MAT157Y1 to the list of first year Math course choices would allow student more options to meet degree requirements.

Impact:

Consultation:
This addition is made in consultation with and with the approval of the Math Department.

Resource Implications:

Chemistry Major

Enrolment Requirements:

 Previous:
New:

Consult Associate Chair, Undergraduate Studies, Department of Chemistry.

This is a limited enrolment program. All students who request the program and obtain at least the specified mark (s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment website at http://www.artsci.utoronto.ca/current/program for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%.

Completion Requirements:

Consult Associate Chair, Undergraduate Studies, Department of Chemistry.

This is a limited enrolment program. All students who request the program and obtain at least the specified mark (s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment web site at http://www.artsci.utoronto.ca/current/program for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%.
Chemistry (FAS), Department of

(8 full courses or their equivalent, including at least one CHM half course equivalent at the 400-level)

First Year: (CHM151Y1 strongly recommended)/(CHM135H1/CHM139H1, CHM136H1/CHM138H1); (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

Second Year: At least two of CHM217H1, CHM220H1/CHM222H1/CHM225Y1, CHM238Y1, (CHM249H1 strongly recommended)/CHM247H1

Third Year: At least two of CHM317H1, CHM327H1, CHM338H1, CHM343H1, CHM348H1, CHM379H1

Fourth Year: Further 200/300/400-level CHM courses to make a total of seven CHM full course equivalents (CHM299Y1, CHM396Y0, CHM397H0, CHM398H0, CHM398Y0, CHM399Y1 excluded)

Description of Proposed Changes:
MAT157Y1 is being added as an additional choice of first year Math courses.

Rationale:
Adding MAT157Y1 to the list of first year Math course choices would allow student more options to meet degree requirements.

Impact:

Consultation:
This addition is made in consultation with and with the approval of the Math Department.

Resource Implications:

Chemistry Specialist

Description:

Previous:

New:
Consult Associate Chair, Undergraduate Studies, Department of Chemistry.

The Chemistry Specialist Program provides a broad coverage of the core areas of chemistry together with appropriate courses in mathematics and physics during the first three years, and allows students to follow a particular area of interest or a more general program in fourth year. The program is suitable for professional work in any area of chemistry and for entry into graduate school to continue work in any of the sub-fields of chemistry, provided that appropriate options are chosen in fourth year. This program is accredited by the Canadian Society for Chemistry.

Enrolment Requirements:

Previous:

New:
This is a limited enrolment program. All students who request the program and obtain at least the specified mark (s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment website at http://www.artsci.utoronto.ca/current/program for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%

Completion Requirements:
The Chemistry Specialist Program provides a broad coverage of the core areas of chemistry together with appropriate courses in mathematics and physics during the first three years; and allows students to follow a particular area of interest or a more general program in fourth year. The program is suitable for professional work in any area of chemistry and for entry into graduate school to continue work in any of the sub-fields of chemistry, provided that appropriate options are chosen in fourth year. This program is accredited by the Canadian Society for Chemistry.

This is a limited enrolment program. All students who request the program and obtain at least the specified mark(s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment web site at http://www.artsci.utoronto.ca/current/program for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%.

(14 full courses or their equivalent, including at least three 400-series courses)

First Year: (CHM151Y1 strongly recommended)/(CHM135H1/CHM139H1, CHM136H1/CHM138H1); (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1; (PHY131H1, PHY132H1)/(PHY151H1, PHY152H1)

Second Year: CHM217H1, (CHM220H1/CHM222H1, CHM221H1/CHM223H1)/CHM225Y1, CHM238Y1, CHM249H1; MAT235Y1/MAT237Y1

Third and Fourth Years:

1. BCH210H1, CHM326H1/CHM328H1, CHM327H1
2. Further 300/400-level full course equivalents in CHM/MAT/another science, including at least three of CHM317H1, CHM338H1, CHM343H1, CHM379H1, CHM410H1, CHM499Y1 and at least three 400-level CHM full course equivalents to make a total of 14 full courses.

Description of Proposed Changes:

MAT157Y1 is being added as an additional choice of first year Math courses.

Rationale:

Adding MAT157Y to the list of first year Math course choices would allow student more options to meet degree requirements.

Impact:

Consultation:

This addition is made in consultation with and with the approval of the Math Department.

Resource Implications:

Environmental Chemistry Specialist

Description:

Previous:

New:

Consult Professor J. Murphy, Department of Chemistry (416-946-0260 or jmurphy@chem.utoronto.ca)

Jointly sponsored by the School of the Environment and the Department of Chemistry, this program focuses on analytical theory, instrumentation and methodological aspects of organic and inorganic contaminants in soil, water, air and biological tissues.
Enrolment Requirements:

Previous:

New:

This is a limited enrolment program. All students who request the program and obtain at least the specified mark (s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment website at http://www.artsci.utoronto.ca/current/program for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%.

Completion Requirements:

Consult Professor J. Murphy; Department of Chemistry (416-946-0260 or jmurphy@chem.utoronto.ca)

Jointly sponsored by the School of the Environment and the Department of Chemistry; this program focuses on analytical theory; instrumentation and methodological aspects of organic and inorganic contaminants in soil; water; air and biological tissues.

This is a limited enrolment program. All students who request the program and obtain at least the specified mark (s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment web site at http://www.artsci.utoronto.ca/current/program for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%.

(14 full courses or their equivalent, including at least one 400-series course)

First Year: (BIO120H1, BIO130H1/BIO220H1); CHM151Y1 (strongly recommended)/(CHM135H1/CHM139H1, CHM136H1/CHM138H1); (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

First or Second Year: (PHY131H1, PHY132H1)/(PHY151H1, PHY152H1)

Second and Higher Years:

1. CHM217H1, (CHM220H1/CHM222H1, CHM221H1/CHM223H1)/CHM225Y1, CHM238Y1, CHM247H1/CHM249H1; (CHM210H1, GGR203H1/GGR314H1); STA220H1/GGR270H1

2. CHM310H1, CHM410H1, CHM415H1; ENV234H1, (ENV221H1, ENV222H1), ENV334H1/ENV341H1/ENV346H1

3. One additional FCE from 300/400-series CHM courses

4. ENV421H1/CHM499Y1/CHM398H0 (in areas relevant to the program with prior approval by the Department)

5. Further courses from any 300/400 series courses with DR=SCI, BR=4 or BR=5 such that the total FCE for the specialist is 14.

Description of Proposed Changes:

MAT157Y1 is being added as an additional choice of first year Math courses.

Rationale:

Adding MAT157Y1 to the list of first year Math course choices would allow student more options to meet degree requirements.

Impact:

Consultation:
This addition is made in consultation with and with the approval of the Math Department.

Resource Implications:

Materials Science Specialist

Description:

Previous:

New:

Consult Professor Dwight Seferos, Department of Chemistry.

This program draws both on the basic sciences of chemistry and physics, and on the more applied areas such as metallurgy or ceramics. Courses dealing with these latter fields are offered through the Department of Materials Science in the Faculty of Applied Science and Engineering. This would be an appropriate program for students with career interests in solid state, polymer or composite materials industries, or for graduate work in either chemistry or materials science, with an appropriate choice of options. Students may follow the Materials Chemistry path by taking research course CHM 499Y1 or the Materials Science and Engineering path by taking research course MSE 498Y1.

Admission Requirements:

Previous:

New:

Enrolment Requirements:

This is a limited enrolment program. All students who request the program and obtain at least the specified mark(s) in the required courses will be eligible to enrol. Consult see the Arts & Science Program Enrolment web site for application procedures.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%.

Completion Requirements:

Consult Associate Chair, Undergraduate Studies; Department of Chemistry:

This program draws both on the basic sciences of chemistry and physics, and on the more applied areas such as metallurgy or ceramics. Courses dealing with these latter fields are offered through the Department of Materials Science in the Faculty of Applied Science and Engineering. This would be an appropriate program for students with career interests in solid state, polymer or composite materials industries, or for graduate work in either chemistry or materials science, with an appropriate choice of options. Students may follow the Materials Chemistry path by taking research course CHM 499Y1 or the Materials Science and Engineering path by taking research course MSE 498Y1.

(14 full courses or their equivalent, including at least one 400-series course)

First Year: (BIO120H1, BIO130H1/BIO220H1); CHM151Y1 (strongly recommended)/(CHM135H1/CHM139H1, CHM136H1/CHM138H1); (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

First or Second Year: (PHY131H1, PHY132H1)/(PHY151H1, PHY152H1)

Second Year and Higher Years:

1. MSE101H1
2. (CHM220H1/CHM222H1, CHM221H1/CHM223H1, MSE202H1/CHM225Y1, CHM238Y1, CHM247H1/CHM249H1)
3. MSE219H1, MSE318H1, MSE335H1
4. CHM325H1, CHM327H1, CHM338H1, CHM343H1/CHM348H1, CHM426H1, CHM434H1
5. At least three of the following one of which must be a 400-series: MSE302H1, MSE316H1, MSE343H1, MSE344H1, MSE415H1, MSE351H1
6. At least two of the following: MSE340H1, MSE422H1, MSE440H1, MSE442H1, MSE459H1, MSE451H1, MSE458H1, MSE459H1, MSE461H1
5. Materials Chemistry path: CHM499Y1/Introduction to Chemistry Research
Materials Science and Engineering path: MSE498Y1 Design & Research Project

Description of Proposed Changes:
This program needs updating in order to reflect a current and more practical set of courses from both the Department of Materials Science and Engineering and the Department of Chemistry.

The program requirements have been updated to reflect changes to course offerings in CHM and MSE and to introduce additional flexibility into the program for upper level students. Specifically, the proposed modification:

1) update the physical chemistry requirement to reflect the current course offerings in the two Departments. Both the existing calendar entry [(CHM220H1/CHM222H1,CHM221H1/CHM223H1)/CHM225Y1] and proposed modifications [CHM220H/CHM222H and CHM223H/MSE202H1] require that students in this program complete two semesters of physical chemistry. However, the explicit CHM221H1 option is now removed because this course was re-numbered to CHM223H1. The CHM225Y1 option is removed because the year-long course has been discontinued and was replaced with CHM222H, CHM223H. MSE202 (“Thermodynamics I”) is now also added as an option for the second semester of physical chemistry.

2) Changes MSE318H (Phase Transformations) from an optional to a required course.

3) Changes the MSE 300- and 400-level course choices in order to introduce flexibility into the program and reflect changes in the fields of materials science and chemistry.

The old requirements of
5. At least two of the following: MSE316H1, MSE318H1, (MSE342H1, MSE343H1), MSE351H1
6. At least two of the following: MSE430H1, MSE440H1, MSE459H1, MSE451H1, MSE461H1

Will be replaced with
5. At least three of the following, one of which must be a 400-series: MSE302H1, MSE316H1, MSE343H1, CHM434H1, CHM446H1, MSE415H1, MSE430H1, MSE432H1, MSE440H1, MSE442H1, MSE451H1, MSE458H1, MSE459H1, MSE461H1

The expanded list reflects the broader set of topics from which materials scientists may need to draw. This expanded list is MSE302H1 (Thermodynamics 2; statistical thermodynamics), MSE316H1 (Mechanical Behavior of Material; includes metals, ceramics and plastics), MSE343H1 (Biomaterials), CHM434H1 (Polymer Chemistry; an introduction to plastics from a molecular perspective, concepts include synthesis, characterization and properties), CHM446H1 (Organic Materials Chemistry; a course that is focused on the design of molecules for application in materials science such as energy, electronics, sensors and drug delivery), MSE415H1 (Environmental Degradation of Materials), MSE430H1 (Electronic Materials; Materials parameters and electronic properties of semiconductors are discussed as basic factors in the engineering of semiconductor devices, MSE432H1 (Macromolecular Materials Engineering; broad overview course begins with an introduction to polymer synthesis, followed by discussion of molecular structure, microstructure and material macrostructure of polymers leading to an understanding of polymer properties and performance.), MSE440H1 (Biomaterial Processing and Properties; biomaterials for formation of surgical implants and dental restorations include selected metals, polymers, ceramics, and composites), MSE442H1 (Surgical and Dental Implant Design; Case studies will be used to illustrate approaches for selection of biomaterials for fabrication of implants for specific applications in medicine and dentistry), MSE451H1 (Advanced Physical Properties of Structural Nanomaterials; the physical properties of bulk nanostructured materials.), MSE458H1 (Nanotechnology in Alternate Energy Systems; candidates for use in corrosion, catalysis and energy conversion devices), MSE459H1 (Synthesis of Nanostructured Materials; Various synthesis techniques to produce nanostructured materials), MSE461H1 (Engineered Ceramics; physical, electrical, magnetic, and thermomechanical properties exhibited by advanced technical ceramics)
### Rationale:
These changes are proposed in order to enhance the student experience, by providing new options for students studying this rapidly expanding and progressing field and by offering increased flexibility to upper year students enrolled in the program. CHM 446H1 is a new course on materials chemistry, and CHM 434H1 and MSE461H1 have been added to provide the students with more flexible options. Both CHM and MSE faculty agree that the curriculum in all of these courses is appropriate to the specialization.

### Impact:
The Materials Science Specialist student experience will be enhanced upon adoption of the proposed changes. Courses newly included in the program choices reflect both the growing importance of a molecular view of materials science and how chemistry is the foundation for this view. Students will also benefit from having more options for their 4th year, thus avoiding conflicts and providing greater flexibility. In previous years, students raised concerns about not having enough flexibility in the 3rd and 4th year courses. This change should alleviate those concerns. All courses have been reviewed by both CHM and MSE faculty.

### Consultation:
The modifications proposed here are driven by feedback and discussion with upper-level students. Students enrolled in the Materials Chemistry Program initiated the conversations that resulted in these proposed modifications. In particular, upper level students expressed their desire that more flexibility be introduced into the program to enhance the student experience.

In response, representatives from MSE and CHM met on April 17, 2017 to review the program with an eye to increasing program flexibility and reflecting the current state of this field. After discussion, MSE and CHM representatives agreed on the set of courses described in this proposal.

### Resource Implications:
The requirements can be met through existing resources.

### Synthetic & Catalytic Chemistry Specialist

#### Description:
Previous:

New:

Consult Professor R. Batey, Department of Chemistry.

This program focuses on the fundamentals and practical aspects of modern synthetic organic and inorganic chemistry, and the understanding and applications of catalytic reactions. Students will become exposed to extensive green chemistry approaches from both experimental and theoretical perspectives. The program provides preparation for career paths as synthetic / discovery chemists, in the pharmaceutical, biotechnology, biomedical, crop protection, materials and related sectors, or for academic research and teaching positions. This program is accredited by the Canadian Society for Chemistry.

#### Enrolment Requirements:
Previous:

New:

This is a limited enrolment program. All students who request the program and obtain at least the specified mark (s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment website at [http://www.artsci.utoronto.ca/current/program](http://www.artsci.utoronto.ca/current/program) for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%.

#### Completion Requirements:

[Consult Professor R. Batey, Department of Chemistry](mailto:ConsultProfessor.R.Batey@utoronto.ca)
This program focuses on the fundamentals and practical aspects of modern synthetic organic and inorganic chemistry, and the understanding and applications of catalytic reactions. Students will become exposed to extensive green chemistry approaches from both experimental and theoretical perspectives. The program provides preparation for career paths as synthetic/discovery chemists, in the pharmaceutical, biotechnology, biomedical, crop protection, materials and related sectors; or for academic research and teaching positions. This program is accredited by the Canadian Society for Chemistry.

This is a limited enrolment program. All students who request the program and obtain at least the specified mark (s) in the required courses will be eligible to enrol. Consult the Arts & Science Program Enrolment web site at http://www.artsci.utoronto.ca/current/program for details.

Courses for admission: CHM135H1/CHM139H1 and CHM136H1/CHM138H1 or CHM151Y1 with a minimum mark of 63%.

(14 full courses or their equivalent)

First Year: (CHM151Y1 strongly recommended)/(CHM135H1/CHM139H1, CHM136H1/CHM138H1); (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1; (PHY131H1, PHY132H1)/(PHY151H1, PHY152H1)

Second and Higher Years:

1. BCH210H1, CHM217H1, (CHM220H1/CHM222H1, CHM221H1/CHM223H1)/CHM225Y1, CHM238Y1, (CHM249H1 strongly recommended)/CHM247H1; MAT235Y1/MAT237Y1
2. CHM317H1, CHM338H1, CHM342H1, CHM343H1, CHM347H1, CHM348H1:
3. CHM432H1, CHM440H1, CHM441H1, CHM443H1:
4. CHM499Y1 and/or CHM398H0 in areas relevant to the program with prior approval by the Department:
5. Further 300/400-series courses in CHM, including CHM325H1, CHM328H1, CHM379H1, CHM416H1, CHM434H1, CHM437H1, CHM447H1 and CHM479H1 to make a total of 14 full courses.

Description of Proposed Changes:
MAT157Y1 is being added as an additional choice of first year Math courses.

Rationale:
Adding MAT157Y1 to the list of first year Math course choices would allow student more options to meet degree requirements.

Impact:

Consultation:
This addition is made in consultation with and with the approval of the Math Department.

Resource Implications:
4 Minor Program Modifications:

Computer Science Major

Enrolment Requirements:

This is a limited enrolment program (Type 2L) that can only accommodate a certain number of students. Eligibility is based on the following criteria:

A. Completion of at least 4.0 FCEs including CSC148H1 (with a minimum grade of 70%) and CSC165H1/CSC240H1 (with a minimum grade of 70%), AND

B. An average of the grades in CSC148H1/CSC207H1 and CSC165H1/CSC236H1/CSC240H1 that meets the department's annual cutoff. Also, CSC240H1 grades will be adjusted to account for the course's greater difficulty. Note Finally, note that the cutoff changes from year to year, depending on the current capacity of the program and the pool of applicants. For more information, including historical data, please visit http://web.cs.toronto.edu/program/ugrad/admission.htm.

Note that students admitted to the program after second or third year will be required to pay retroactive deregulated program fees.

Completion Requirements:

(8.0 full course equivalents [FCEs], including at least 0.5 FCE at the 400-level)

First year (2.5 FCEs):
1. (CSC108H1, CSC148H1)/CSC150H1, CSC165H1/CSC240H1; (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

Second year (2.5 FCEs):
2. CSC207H1, CSC236H1/(MAT135H1 CSC240H1, CSC258H1, MAT136H1) CSC263H1/CSC265H1; STA247H1/STA255H1/STA257H1

Notes:
a. Students with a strong background in an object-oriented language such as Python, Java or C++ may omit CSC108H1 and proceed directly with CSC148H1. [There is no need to replace the missing half-credit for program completion; however, please base your course choice on what you are ready to take, not on “saving” a half-credit].
b. CSC240H1 is an accelerated and enriched version of CSC165H1 plus CSC236H1, intended for students with a strong mathematical background, or who develop an interest after taking CSC165H1. If you take CSC240H without CSC165H1, there is no need to replace the missing half-credit for program completion; but please see Note (a) 1.
c. Consult the Undergraduate Office for advice about choosing among CSC108H1 and CSC148H1, and between CSC165H1 and CSC240H1.

Second year (2.5 FCEs):
2. CSC207H1, CSC236H1/CSC240H1, CSC258H1, CSC263H1/CSC265H1; STA247H1/STA255H1/STA257H1

Later years (3.0 FCEs):
3. 3.0 FCEs from the following:
Computer Science (FAS), Department of

- Any 200-/300-/400-level CSC course;
- \texttt{BCB410H1}, \texttt{BCB420H1}, \texttt{BCB330Y1}/\texttt{430Y1};
- \texttt{ECE385H1}, \texttt{ECE489H1};
- \texttt{MAT221H1}/\texttt{MAT223H1}/\texttt{MAT240H1}, \texttt{MAT235Y1}/\texttt{MAT237Y1}/\texttt{MAT257Y1}, any 300-/400-level MAT course except \texttt{MAT329Y1}, \texttt{MAT390H1}, \texttt{MAT391H1}

with at least 0.5 FCE from a 400-level CSC/BCB course, at least 1.0 additional FCE from 300-/400-level CSC/BCB/ECE courses, and at least 0.5 additional FCE from a 300-/400-level course.

No more than more than 1.0 FCE from \texttt{CSC490H1}, \texttt{CSC491H1}, \texttt{CSC494H1}, \texttt{CSC495H1}, \texttt{BCB330Y1}/\texttt{430Y1} may be used to fulfill program requirements.

The choices in 3 must satisfy the requirement for an integrative, inquiry-based activity by including one of the following half-courses: \texttt{CSC301H1}, \texttt{CSC318H1}, \texttt{CSC404H1}, \texttt{CSC411H1}, \texttt{CSC418H1}, \texttt{CSC420H1}, \texttt{CSC428H1}, \texttt{CSC454H1}, \texttt{CSC485H1}, \texttt{CSC490H1}, \texttt{CSC491H1}, \texttt{CSC494H1}, \texttt{CSC495H1}. This requirement may also be met by participating in the PEY (Professional Experience Year) program.

\textbf{Description of Proposed Changes:}

\textbf{Enrolment:} In calculation of student average, removed \texttt{CSC207H1} as alternative to \texttt{CSC148H1} and removed \texttt{CSC236H1} as alternative to \texttt{CSC165H1}/\texttt{CSC240H1}.

\textbf{Completion (already going through divisional review on CM):} bookkeeping – removed old course \texttt{CSC150H1}.

\textbf{Rationale:}

We find that many students who do not meet the admission cutoff on the basis of \texttt{CSC148H1} and \texttt{CSC165H1} continue to take courses as if they were in the program (sometimes with difficulty because of the lack of priority during enrolment), yet do no better in \texttt{CSC207H1} and/or \texttt{CSC236H1} than in their first year courses. These students find themselves having committed two full years of time and energy towards a program that they will not be admitted to (sometimes more), rather than thinking about alternatives right after first year.

Students are currently admitted on the basis of their average grade in [\texttt{CSC148H1} or \texttt{CSC207H1}, whichever is higher] and [\texttt{CSC165H1} or \texttt{CSC236H1} or \texttt{CSC240H1}, whichever is higher]. The proposed change removes \texttt{CSC207H1} and \texttt{CSC236H1} from the courses that students can use for admission purposes, leaving only \texttt{CSC148H1} and \texttt{CSC165H1}/\texttt{CSC240H1}.

\textbf{Impact:}

Students who do not meet the program admission cutoff will be required to repeat \texttt{CSC148H1} and/or \texttt{CSC165H1}/\texttt{CSC240H1}, which will drive home early the message that they may not get admitted and need to make other plans right away.

\textbf{Consultation:}

The proposal was discussed at length during two separate meetings of the Department of Computer Science’s Undergraduate Committee (which includes two undergraduate student representatives). Concerns were raised regarding the fate of students who perform well in their first year courses while still falling short of the cutoff (e.g., an average of 82 between \texttt{CSC148H1} and \texttt{CSC165H1} would have been insufficient for students who are not in the first year Computer Science admission stream in 2017). We reached a decision that the number of students going on to \texttt{CSC207H1} and/or \texttt{CSC236H1} and failing to gain admission was greater than the number of students who performed well in their first year courses and would be inconvenienced by having to re-take them. Also, those students who re-take first year courses where there is no real need still have the option to do so at the same time as they progress to second year courses – assistants in our undergraduate office would be informed to advise students of this possibility only for those students who are clearly ready and to warn others of the risk of pursuing their original plan too doggedly if there was a reasonable chance they may not get admitted.

\textbf{Resource Implications:}

N/A
Computer Science Minor

Enrolment Requirements:

This is a limited enrolment program (Type 2L) that can only accommodate a certain number of students. Eligibility is based on the following criteria:

A. Completion of at least 4.0 FCEs including CSC148H1 (with a minimum grade of 70%) and CSC165H1/CSC240H1 (with a minimum grade of 70%), AND

B. An average of the grades in CSC148H1/CSC207H1 and CSC165H1/CSC236H1/CSC240H1 that meets the department's annual cutoff. When more than one course has been completed from a list of alternatives, the higher grades will be used. Also, CSC240H1 grades will be adjusted to account for the course's greater difficulty. Note finally, note that the cutoff changes from year to year, depending on the current capacity of the program and the pool of applicants. For more information, including historical data, please visit http://web.cs.toronto.edu/program/ugrad/admission.htm.

Completion Requirements:

(4.0 full course equivalents [FCEs])

1. (CSC108H1, CSC148H1)/CSC150H1, CSC165H1/CSC240H1

2. CSC207H1, CSC236H1/CSC240H1

Notes:

a. Students with a strong background in Java or C++ may omit CSC108H1 and proceed directly with CSC148H1:

b. CSC240H1 is an accelerated and enriched version of CSC165H1 plus CSC236H1, intended for students with a strong mathematical background, or who develop an interest after taking CSC165H1:

c. Consult the Undergraduate Office for advice about choosing among CSC108H1 and CSC148H1, and between CSC165H1 and CSC240H1.

2. CSC207H1, CSC236H1/CSC240H1

(Total of above requirements: 2.5 FCEs. If you take fewer than 2.5 FCEs, you must take more than 1.5 FCEs from the next list, so that the total is 4.0 FCEs.)

3. 1.5 FCEs from the following list, of which at least 1.0 FCE must be at the 300-/400-level:

- CSC: any 200-/300-/400-level

Note:
Computer Science (FAS), Department of

•  Computer Science Minors are limited to three 300-/400-level CSC/ECE half-courses

Description of Proposed Changes:

Enrolment: In calculation of student average, removed CSC207H1 as alternative to CSC148H1 and removed CSC236H1 as alternative to CSC165H1/CSC240H1.
Completion (already going through divisional review on CM): bookkeeping – removed old course CSC150H1.

Rationale:

We find that many students who do not meet the admission cutoff on the basis of CSC148H1 and CSC165H1 continue to take courses as if they were in the program (sometimes with difficulty because of the lack of priority during enrolment), yet do no better in CSC207H1 and/or CSC236H1 than in their first year courses. These students find themselves having committed two full years of time and energy towards a program that they will not be admitted to (sometimes more), rather than thinking about alternatives right after first year.

Students are currently admitted on the basis of their average grade in [CSC148H1 or CSC207H1, whichever is higher] and [CSC165H1 or CSC236H1 or CSC240H1, whichever is higher]. The proposed change removes CSC207H1 and CSC236H1 from the courses that students can use for admission purposes, leaving only CSC148H1 and CSC165H1/CSC240H1.

Impact:

Students who do not meet the program admission cutoff will be required to repeat CSC148H1 and/or CSC165H1/CSC240H1, which will drive home early the message that they may not get admitted and need to make other plans right away.

Consultation:

The proposal was discussed at length during two separate meetings of the Department of Computer Science’s Undergraduate Committee (which includes two undergraduate student representatives). Concerns were raised regarding the fate of students who perform well in their first year courses while still falling short of the cutoff (e.g., an average of 82 between CSC148H1 and CSC165H1 would have been insufficient for students who are not in the first year Computer Science admission stream in 2017). We reached a decision that the number of students going on to CSC207H1 and/or CSC236H1 and failing to gain admission was greater than the number of students who performed well in their first year courses and would be inconvenienced by having to re-take them. Also, those students who re-take first year courses where there is no real need still have the option to do so at the same time as they progress to second year courses – assistants in our undergraduate office would be informed to advise students of this possibility only for those students who are clearly ready and to warn others of the risk of pursuing their original plan too doggedly if there was a reasonable chance they may not get admitted.

Resource Implications:

N/A

Computer Science Specialist

Enrolment Requirements:

This is a limited enrolment program(Type 2L) that can only accommodate a certain number of students. Eligibility is based on the following criteria:

A.  Completion of at least 4.0 FCEs including CSC148H1 (with a minimum grade of 70%) and CSC165H1/CSC240H1 (with a minimum grade of 70%) ; AND
B.

- An average of the grades in CSC148H1/CSC207H1 and CSC165H1/CSC236H1/CSC240H1 that meets the department's annual cutoff: When more than one course has been completed from a list of alternatives, the higher grades will be used. Also: CSC240H1 grades will be adjusted to account for the course's greater difficulty. Note Finally: note that the cutoff changes from year to year, depending on the current capacity of the program and the pool of applicants. For more information, including historical data, please visit [http://web.cs.toronto.edu/program/ugrad/admission.htm](http://web.cs.toronto.edu/program/ugrad/admission.htm).

Note that students admitted to the program after second or third year will be required to pay retroactive deregulated program fees.

**Completion Requirements:**

(12.0 full course equivalents [FCEs], including at least 1.5 FCEs at the 400-level)

**First year (2.5 FCEs):**

1. (CSC108H1, CSC148H1)/CSC150H1, CSC165H1/CSC240H1; (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

**Second year (3.5 FCEs):**

2. CSC207H1, CSC209H1, CSC236H1/(MAT135H1 CSC240H1, CSC258H1, MAT136H1) CSC263H1/CSC265H1; MAT221H1/MAT223H1/MAT240H1; STA247H1/STA255H1/STA257H1

**Notes:**

a. 1: Students with a strong background in an object-oriented language such as Python, Java or C++ may omit CSC108H1 and proceed directly with CSC148H1. There is no need to replace the missing half-credit for program completion; however, please base your course choice on what you are ready to take, not on “saving” a half-credit.

b. 2: CSC240H1 is an accelerated and enriched version of CSC165H1 plus CSC236H1, intended for students with a strong mathematical background, or who develop an interest after taking CSC165H1. If you take CSC240H1 without CSC165H1, there is no need to replace the missing half-credit for program completion; but please see Note (a) 1: 2.

c. 3: Consult the Undergraduate Office for advice about choosing among CSC108H1 and CSC148H1, and between CSC165H1 and CSC240H1.

**Second year (3.5 FCEs):**

2. CSC207H1, CSC209H1, CSC236H1/CSC240H1, CSC258H1, CSC263H1/CSC265H1; MAT221H1/MAT223H1/MAT240H1; STA247H1/STA255H1/STA257H1

**Later years (6.0 FCEs):**

3. CSC369H1, CSC373H1/CSC375H1

4. 5.0 FCEs from the following:

- Any 300-/400-level CSC course;
- BCB410H1, BCB420H1, BCB330Y1/BCB430Y1;
- ECE385H1, ECE489H1;
Computer Science (FAS), Department of

- MAT224H1, MAT235Y1/MAT237Y1/MAT257Y1, any 300-/400-level MAT course except MAT329Y1, MAT390H1, MAT391H1;
- STA248H1/STA261H1, any 300-/400-level STA course

with at most 2.0 FCEs from MAT or STA courses, and at least 1.5 FCEs from 400-level CSC, BCB, or ECE courses.

No more than 1.0 FCE from CSC490H1, CSC491H1, CSC494H1, CSC495H1, BCB330Y1/BCB430Y1 may be used to fulfill program requirements.

The choices in 4 must satisfy the requirement for an integrative, inquiry-based activity by including one of the following half-courses: CSC301H1, CSC318H1, CSC404H1, CSC411H1, CSC418H1, CSC420H1, CSC428H1, CSC454H1, CSC485H1, CSC490H1, CSC491H1, CSC494H1, CSC495H1. This requirement may also be met by participating in the PEY (Professional Experience Year) program.

### Choosing courses

This program offers considerable freedom to choose courses at the 300-/400-level, and you are free to make those choices on your own. We are eager to offer guidance, however, and both our Undergraduate Office and individual faculty members are a rich source of advice.

<table>
<thead>
<tr>
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</tr>
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</table>
Focus In Web And Internet Technologies

Completion Requirements:

Required courses:

1. STA248H1/STA261H1, CSC309H1, CSC343H1, CSC358H1, CSC458H1, CSC411H1
2. 0.5 FCE from the following: CSC310H1, CSC443H1, CSC469H1

Suggested Related Courses:

1. Courses offered at UTM: CSC347H5, CSC423H5, CSC427H5
2. ECE568H1
3. ENV281H1, ENV381H1

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

2 New Courses:

COG260H1: Data, Computation, and the Mind

Contact Hours:

\[
\text{Lecture: 24} \quad / \quad \text{Practical: 12}
\]

Description:

How does the human mind work? We explore this question by analyzing a range of data concerning such topics as human rationality and irrationality, human memory, how objects are represented in the mind, and the relation of language and cognition. This class provides critical thinking and practical computational skills that will allow students to work with data in cognitive science and related disciplines.

Prerequisites:

CSC108H1

Corequisites:

COG250Y1

Exclusions:
Computer Science (FAS), Department of

Recommended Preparation:  

Breadth Requirements:  
Society and its Institutions (3)

Distribution Requirements:  
Social Science

Competencies:  
  Communication: notably; Critical and Creative Thinking: extensively; Information Literacy: notably  
  Quantitative Reasoning: extensively; Social and Ethical Responsibility: slightly

Experiential Learning:  
  Research: notably; Other: none

Rationale:  
An important skill for cognitive science students to acquire is the ability to relate human behavioral data (from experimental or observational studies), and/or brain imaging data, to theories and models about the representations and mechanisms that underlie various aspects of cognition. Advances in data science are key to making these links in theoretically-motivated and methodologically-justified ways. This course will develop in students these disciplinary-specific skills (which have wide applicability in various fields, such as organizational behaviour, human-computer interaction design, various medical fields, etc.), as well as transferable skills such as data analysis techniques and computational design and implementation methods.

Consultation:  
Psychology and Computer Science

Resources:  
TA support in the amount of 80 hours, following the standard practice in courses in CSC (2 hr/student), that are comparable in format to the present course.  
Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:  
No direct overlap with existing courses.

Programs of Study for Which This Course Might be Suitable:  
COG Major (Science – ASMAJ1446)

Estimated Enrolment:  
40

Instructor:  
Prof. Yang Xu

COG343H1: Issues on Cognitive Science III: Computational Cognition

Contact Hours:  
  Lecture: 24 / Practical: 12

Description:  
An examination of core topics in cognitive science building on introductions in COG250Y1. Typical topics include: computational models of cognition and learning, natural language processing, computer intelligence.

Prerequisites:  
CSC148H1, STA220H1/PSY201H1

Corequisites:  
24
Computer Science (FAS), Department of

COG250Y1

Exclusions:

Recommended Preparation:

Breadth Requirements:
The Physical and Mathematical Universes (5)

Distribution Requirements:
Science

Competencies:

Communication: notably; Critical and Creative Thinking: extensively; Information Literacy: notably
Quantitative Reasoning: extensively; Social and Ethical Responsibility: slightly

Experiential Learning:
Research: notably; Other: none

Rationale:
This is course will expand our third-year course series (COG341H1/COG342H1), which represent a philosophical and psychological perspective on cognitive science to include a computational cognition perspective.

Consultation:
Psychology and Computer Science

Resources:
TA support in the amount of 80 hours, following the standard practice in courses in CSC (2 hr/student), that are comparable in format to the present course.

Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:
No direct overlap with existing courses.

Programs of Study for Which This Course Might be Suitable:
COG Major (Science – ASMAJ1446)

Estimated Enrolment:
40

Instructor:
Prof. Suzanne Stevenson

1 Course Modification:

CSC412H1: Probabilistic Learning and Reasoning

Prerequisites:
CSC411H1/STA314H1

Rationale:

Consultation:

Resources:
5 Minor Program Modifications:

Earth and Environmental Systems Major

**Description:**

**Previous:**

**New:**

In the Earth and Environmental Systems Major, students use multidisciplinary approaches to studying the large-scale interactions between the Earth and planetary systems over a broad spectrum of time-scales, addressing deep timescales of millions to billions of years as well as processes taking place in today’s and in future worlds. Courses take an integrative approach to understanding interactions between the solid Earth, the biosphere, the atmosphere and the hydrosphere, addressing how these interactions have developed over geological, historical, and recent time periods. Themes of the program include Earth surface processes (e.g., evolution of landforms and sedimentary basins), paleoclimatology (e.g., drivers of Earth’s natural climate variability), biogeochemistry, Quaternary science (understanding the ice ages) and global environmental change. This program provides broad context over time and space to better understand and provide solutions for the current issues of climate change, resource consumption and global pollution weighing heavily on people and societies. Students are advised to check course prerequisites, to review the clusters of courses listed for the geoscience major program, and to consult the Earth Sciences Undergraduate Handbook for logical course progressions. For further questions, please contact the Student Affairs Coordinator (Scott Moore, Department of Earth Sciences, 22 Russell St. Earth Sciences Center, Room 1062 email: ugrad@es.utoronto.ca).

Keywords: Geoscience, Geology, Earth Sciences, Earth History, Evolution, Chemistry, Physics, Biology

**Completion Requirements:**

(8 full courses or their equivalent including at least 2.0 FCE at 300+ series with at least 0.5 FCE at 400 level series.)

1. 2.0 FCE foundation science courses: 2.0 FCE selected from JEG100H1 (ESS102H1), BIO120H1, BIO130H1, CHM135H1 (CHM139H1), CHM136H1 (CHM138H1), PHY131H1, PHY132H1, MAT135H1, ENV237H1/ENV238H1

2. 3.0 FCE core courses:

- 1.0 FCE at 200 level: ESS261H1, ESS262H1 (NOTE: ESS261H and ESS262H may be taken in either order.)
- 1.0 FCE at 300 level: ESS345H1, ESS361H1/ESS362H1/GGR305H1
- 0.5 FCE field course: ESS410H1/ESS450H1/GGR390H1
- 0.5 FCE capstone course: ESS461H1/ESS462H1/ESS463H1/ESS464H1

3. 3.0 FCE elective courses:

In addition to the above core courses, you need to take 3 FCE electives. This requirement can be satisfied by any of the Earth Sciences Courses listed in categories A to F below on this page. The following clusters of courses are neither mutually exclusive nor meant to limit choice but intended to show logical course complements. These are not POS requirements; rather the clusters are presented to aid students in course selection according to their interests.

a) Earth Surface Processes

ESS241H1, ESS311H1, ESS331H1, ESS445H1, GGR201H1, GGR205H1, GGR272H1

b) Paleoclimate
Earth Sciences (FAS), Department of

ESS331H1, ESS361H1, ESS362H1, ESS461H1, ESS464H1, ENV234H1, GGR305H1

c) Biogeochemistry
ENV233H1, ESS311H1, ESS312H1, ESS362H1, ESS410H1, ESS462H1

d) Global Environmental Change
ESS362H1, ESS462H1, ESS463H1, GGR203H1, GGR314H1, PHY392H1

e) Quarternary Science
ANT314H1, ANT315H1, ANT409H1, ANT419H1, ESS461H1

f) Other Relevant Courses
JGA305H1, ESS450H1, GGR337H1, ENV337H1, JEE337H1, JSC301H1, ESS399Y0, ESS491H1/ESS492Y1

Description of Proposed Changes:
We propose that students in the Earth and Environmental Systems Major be able to substitute ENV237/ENV238 for one of their first year physics credits.

Rationale:
ENV237/238 provides a more earth science flavored physics education than the general first year physics courses. This is particularly true for the ES students with an interest in earth surface processes.

Impact:
Students will have greater flexibility in scheduling, and improved choices to tailor their courses to their interests.

Consultation:
We estimate that only a handful of students will take advantage of this new choice (the combined enrollment for both programs is less than 15 students/year). We consulted with all involved units (School of the Environment & Physics) and see no resource implications.

Resource Implications:

Environmental Geosciences Specialist (Science Program)

Description:
The Environmental Geosciences specialist program explains the interconnectedness within the Earth system (biosphere, hydrosphere, atmosphere, and geosphere), measures and models processes related to groundwater and biochemical activities, and assesses the effects of human activities on our geological surroundings.

Jointly sponsored by the School for the Environment and the Department of Earth Sciences. Topics include earth materials, sedimentary geology, aqueous geochemistry, hydrogeology and biogeochemistry. For more information, please contact the Department of Earth Sciences, undergradchair@es.utoronto.ca. Students should note that under the Professional Geoscientists Act of 2000, individuals practicing Environmental Geoscience in Ontario require education that fulfills APGO knowledge requirements (see note below) or a P.Eng.

Enrolment Requirements:

Previous:

New:
Completion Requirements:

(12 full courses or their equivalent which includes fulfillment of the Faculty’s Distribution requirement, including at least one FCE from 400-series courses)

1st year required courses (2 FCE): CHM151Y1/(CHM135H1, CHM136H1), MAT135H1, PHY131H1/PHY151H1

1st year elective courses: 1 FCE from MAT136H1, PHY132H1/PHY152H1, ENV237H1/ENV238H1, BIO120H1, CSC108H1/ESS345H1, JEG100H1

2nd year required courses (2 FCE): ESS241H1, ENV233H1, ESS223H1, ESS262H1, GGR201H1

2nd year elective courses: 1 FCE from ESS221H1, ESS222H1, ESS261H1, STA220H1/GGR270H1, CHM210H1, MAT221H1/MAT223H1; up to 0.5 FCE of this requirement can be satisfied by taking one of the following ethics courses: IMC200H1/PHL273H1/PHL275H1/ABS201Y1

3rd and 4th year required courses (2 FCE): ESS311H1, ESS312H1, ESS410H1, ESS461H1

3rd and 4th year elective courses: 4 FCE from JGA305H1, ESS234H1/EVS330H1, ESS331H1, ESS361H1, ESS362H1, GGR337H1, GGR390H1, ENV333H1, ESS431H1, ESS441H1, ESS445H1, ESS450H1, ESS462H1, ESS463H1, ESS464H1, ESS490H1, ESS491H1/ESS492Y1

If you plan to become APGO certified, we suggest you consider the following courses to fulfill minimum qualifications. This list comprises courses which are required for the specialist as well as suggested courses; together they fulfill groups 1A, 1B, 2A and 2B of the APGO requirements and add up to 13.5 FCE:

Group 1A: CHM135H1, MAT135H1, PHY131H1

Group 1B: BIO120H1, MAT136H1, CHM136H1, PHY132H1, STA220H1, CSC108H1/ESS345H1

Group 2A: ESS221H1, ESS241H1, ESS234H1/EVS330H1, ESS331H1

Group 2B: ENV233H1, ESS312H1, GGR201H1, GGR337H1, JGA305H1

Group 2C: 4.5 FCE of 200/300/400 level ESS or other allowable courses

All students, regardless of their career aspirations, are encouraged to talk to the undergraduate chair about their selection of electives.

Description of Proposed Changes:

We propose that students in the Environmental Geosciences Specialist be able to substitute ENV237/ENV238 for one of their first year physics credits.

Rationale:

ENV237/238 provides a more earth science flavored physics education than the general first year physics courses. This is particularly true for the ES students with an interest in earth surface processes.

Impact:

Students will have greater flexibility in scheduling, and improved choices to tailor their courses to their interests.

Consultation:

We estimate that only a handful of students will take advantage of this new choice (the combined enrollment for both programs is less than 15 students/year). We consulted with all involved units (School of the Environment & Physics) and see no resource implications.

Resource Implications:
Geology Specialist

Description:
Previous:
New:

This program gives the deepest level of education within the field of geology and is geared towards preparing students for a career in the energy and mineral resources sector or as a government-employed geologist. The program meets the requirements for gaining membership in the Association of Professional Geoscientist of Ontario (APGO) and similar organizations countrywide. The specialist program involves heavy course load in classical geology subjects, such as mineralogy and petrology, sedimentology, structural geology, paleontology, mineral resources and geologic field mapping. Students are advised to be aware of course prerequisites, check clusters of courses listed for the Geology Specialist program, and consult the Earth Sciences Undergraduate Handbook for logical course progressions. For further questions, please consult with the Student Affairs Coordinator (Scott Moore, Department of Earth Sciences, 22 Russell St. Earth Sciences Center, Room 1062 email: ugrad@es.utoronto.ca).

Keywords: Geology, Petrology, Energy and Mineral Resources

Completion Requirements:

Please consult the undergraduate handbook for detailed information on this program.

(14 full courses or their equivalent)

5.0 FCE foundation courses:
CHM151Y1/CHM135H1, CHM136H1 (CHM138H1, CHM139H1); MAT135H1 & MAT136H1; (PHY131H1, PHY132H1)/(PHY151H1, PHY152H1); BIO120H1/MAT221H1/MAT223H1; STA220H1/GGR270H1; GGR201H1; CSC108H1/ESS345H1; recommended: ESS262H1/ESS102H1/or JEG100H1

6.0 FCE core courses:
ENV233H1, ESS221H1, ESS222H1, ESS241H1, ESS261H1, JGA305H1, ESS311H1, ESS312H1, ESS322H1, ESS331H1, ESS441H1, ESS431H1 (previously ESS332)

1.0 FCE field courses:
ESS234H1/ESS330H1, ESS324H1/ESS420H1

2.0 FCE electives chosen from:
ENV234H1, ESS381H1, ESS410H1, ESS423H1, ESS425H1, ESS445H1, ESS461H1, ESS481H1, ESS420H1/ESS490H1, ESS491H1/ESS492Y1, ESS362H1

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:
# Geophysics Specialist

**Description:**

**Previous:**

**New:**

The Geophysics specialist program allows students to model physical processes in and on Earth and other planets and to apply non-invasive methods of imaging the subsurface, often in 4D (i.e., space and time); targets may range from archaeological investigations to groundwater imaging and mineral exploration, but also include modeling of mountain-building processes and the exploration of planetary surfaces instead. Students are advised to be aware of course prerequisites, and consult the Earth Sciences Undergraduate Handbook. For further questions, please consult with the Student Affairs Coordinator (Scott Moore, Department of Earth Sciences, 22 Russell St. Earth Sciences Center, Room 1062 email: ugrad@es.utoronto.ca).

## Completion Requirements:

Consult Departments of Geology and Physics

(13.5 to 14 full courses or their equivalent with at least one course at the 400-level)

9.0 FCEs core courses:

- **100-level:** PHY131H1/PHY151H1, PHY132H1/PHY152H1; (MAT135H1, MAT136H1)/MAT137Y1
- **200-level:** PHY250H1, PHY254H1; MAT235Y1/MAT237Y1; ESS221H1, ESS241H1
- **300-level:** JPE395H1, PHY395H1; JGA305H1
- **400-level:** PHY408H1, PHY493H1, PHY495H1, ESS452H1; ESS441H1, ESS445H1, ESS450H1

0.5 to 1.0 FCEs ethics course chosen from the following list: JPH441H1, ENV333H1, IMC200H1, PHL273H1, PHL275H1, INS201Y1

4.0 to 4.5 additional FCEs chosen from Groups A, B, and/or C:

**Group A** -- courses required and relevant for professional registration (APGO):

- CHM135H1; ESS345H1/CSC108H1; STA220H1/GGR270H1; MAT223H1, MAT244H1; APM346H1; ESS331H1

**Group B** -- emphasis on physics (suitable for graduate school preparation in a physics program):

- PHY252H1, PHY350H1, PHY354H1, PHY392H1, PHY454H1, PHY495H1

**Group C** -- other relevant courses:

- PHY224H1, MAT224H1, MAT335H1, APM346H1, ESS211H1, ESS222H1, ESS311H1, ESS312H1, ESS431H1, ESS434H1/ESS330H1, ESS410H1, ESS490H1, ESS491H1/ESS492Y1; ESS492H1

## Description of Proposed Changes:

**Rationale:**

**Impact:**

**Consultation:**
Geoscience Major

Description:

Previous: [description]

New: [description]

The study of Earth Sciences integrates many of the classical sciences like chemistry and physics and applies their principles to a diverse range of processes. The major program aims to give students exposure to the traditional geoscience curriculum (Mineralogy, Petrology, Geological structures and Maps, Field Techniques etc.). Students wishing for a more customized degree, should explore the Earth and Environmental Systems Major. Students are advised to be aware of course prerequisites, check clusters of courses listed for the geoscience major program, and consult the Earth Sciences Undergraduate Handbook for logical course progressions. For further questions, please consult with the Student Affairs Coordinator (Scott Moore, Department of Earth Sciences, 22 Russell St. Earth Sciences Center, Room 1062 email: ugrad@es.utoronto.ca).

Keywords: Geology, Paleontology, Earth History, Evolution

Completion Requirements:

(8 full courses or their equivalent including at least 2.0 FCE at 300+ series with at least 0.5 FCE at 400 level series.)

2.0 to 2.5 FCE chosen from BIO120H1; CHM135H1, CHM136H1 (CHM138H1, CHM139H1); MAT135H1, MAT136H1, MAT137Y1; PHY131H1, PHY132H1; JEG100H1 (ESS102H1); ENV234H1

2.5 FCE core courses: ESS221H1, ESS222H1, ESS241H1, ESS261H1, ESS331H1

0.5 FCE field course: ESS234H1/ESS330H1/ESS410H1/ESS450H1

2.5 to 3.0 FCE chosen from 300/400 level ESS courses/JGA305H1; note course progressions and prerequisites.

We suggest students consider the following logical course clusters in their higher years:
(a) Earth/planetary materials and mineral resources: ENV233H1, ESS322H1, ESS431H1 (ESS332H1), ESS423H1
(b) tectonics: JGA305H1, ESS345H1, ESS441H1, ESS445H1
(c) environmental biogeochemistry: ENV233H1, ESS311H1, ESS312H1, ESS410H1, ESS461H1
(d) geoarchaeology: JGA305H1, ESS461H1

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

4 New Courses:
## ESS234H0: Introduction to Geological Field Methods

### Contact Hours:

### Description:

### Prerequisites:

### Corequisites:

### Exclusions:

ESS330H0

### Recommended Preparation:

### Breadth Requirements:

### Distribution Requirements:

### Competencies:

- Communication: none
- Critical and Creative Thinking: none
- Information Literacy: none
- Quantitative Reasoning: none
- Social and Ethical Responsibility: none

### Experiential Learning:

- Research: none
- Other: none

### Rationale:

ESS330 is meant to be taken in the 2nd year of study. ESS234H0 aligns the course numbering to the pedagogical intent. We also replace the course title with a more generic term in case the location of the field camp changes.

### Consultation:

Undergraduate Affairs Committee

### Resources:

### Overlap with Existing Courses:

### Programs of Study for Which This Course Might be Suitable:

### Estimated Enrolment:

### Instructor:

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## ESS234H1: Introduction to Geological Field Methods

### Impact on Programs:

- This proposal triggers modifications in the unit's program(s)

### Contact Hours:

### Description:
Earth Sciences (FAS), Department of

A two-week field course in early May or late August. Students are introduced to field geology and to basic field measurement, mapping, and documentation techniques (for example in the Espanola - Manitoulin Island area, west of Sudbury). Students are responsible for the cost of board and lodging and transport to and from the field area. Not eligible for CR/NCR option. Note: Enrollment is handled by the department. For registration deadlines, additional fees associated with the field course, course dates, and special registration requirements, please consult the departmental announcements or inquire with ugrad@es.utoronto.ca.

| Prerequisites: | ESS222H1, ESS241H1 |
| Corequisites: | |
| Exclusions: | ESS330H1, GLG340H1 |
| Recommended Preparation: | |
| Breadth Requirements: | The Physical and Mathematical Universes (5) |
| Distribution Requirements: | Science |

**Competencies:**
- *Communication*: none; *Critical and Creative Thinking*: none; *Information Literacy*: none
- *Quantitative Reasoning*: none; *Social and Ethical Responsibility*: none

**Experiential Learning:**
- *Research*: none; *Other*: none

**Rationale:**
ESS330 is meant to be taken in the 2nd year of study. Here we align the course numbering to the pedagogical intent. We also replace the course title with a more generic term in case the location of the field camp changes.

**Consultation:**
Undergraduate Affairs Committee

**Resources:**

**Overlap with Existing Courses:**

**Programs of Study for Which This Course Might be Suitable:**

**Estimated Enrolment:**

**Instructor:**

**ESS324H0: Advanced Geological Field Methods**

**Contact Hours:**

**Description:**
<table>
<thead>
<tr>
<th>Prerequisites:</th>
<th>ESS234H1/ESS330H1</th>
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<tr>
<td>Corequisites:</td>
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<tr>
<td>Exclusions:</td>
<td>ESS420H0</td>
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<tr>
<td>Recommended Preparation:</td>
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<td>Breadth Requirements:</td>
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<tr>
<td>Distribution Requirements:</td>
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<tr>
<td>Competencies:</td>
<td></td>
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</tbody>
</table>
  * Communication: none  
  * Critical and Creative Thinking: none  
  * Information Literacy: none  
  * Quantitative Reasoning: none  
  * Social and Ethical Responsibility: none |
| Experiential Learning: |  
  * Research: none  
  * Other: none |
| Rationale: | ESS420 is meant to be taken in the 3rd year of study. ESS324H0 aligns the course numbering to the pedagogical intent. We also replace the course title with a more generic term in case the location of the field camp changes. |
| Consultation: | Undergraduate Affairs Committee |
| Resources: | |
| Overlap with Existing Courses: | |
| Programs of Study for Which This Course Might be Suitable: | |
| Estimated Enrolment: | |
| Instructor: | |

**ESS324H1: Advanced Geological Field Methods**

**Impact on Programs:**  
This proposal triggers modifications in the unit's program(s)

**Contact Hours:**

**Description:**  
A two-week advanced geological mapping project in a challenging field environment. Students learn to compile existing geoscience data, create a geological map and prepare a professional final report on their activities and findings. Not eligible for CR/NCR option. For registration deadlines, additional fees associated with the field course, course dates, and special registration requirements, please consult the departmental announcements or inquire with
Prerequisites:
ESS322H1, ESS234H1/ESS330H1

Corequisites:

Exclusions:
ESS420H1, GLG445H1

Recommended Preparation:

Breadth Requirements:
The Physical and Mathematical Universes (5)

Distribution Requirements:
Science

Competencies:
Communication: none; Critical and Creative Thinking: none; Information Literacy: none
Quantitative Reasoning: none; Social and Ethical Responsibility: none

Experiential Learning:
Research: none; Other: none

Rationale:
ESS420H1 is meant to be taken in the 3rd year of study. The creation of ESS324H1 aligns the course numbering to the pedagogical intent. We also replace the course title with a more generic term in case the location of the field camp changes.

Consultation:
Undergraduate Affairs Committee

Resources:

Overlap with Existing Courses:

Programs of Study for Which This Course Might be Suitable:

Estimated Enrolment:

Instructor:

1 Course Modification:

ESS261H1: Earth System Evolution

Recommended Preparation:
Previous: BIO120H1
New:

Rationale:
# Earth Sciences (FAS), Department of

<table>
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<th>Consultation:</th>
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<td>Resources:</td>
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## 4 Retired Courses:

**ESS330H0: Intr Geol Field Meth**

**Rationale:**
ESS330 is meant to be taken in the 2nd year of study. The creation of ESS234H0 aligns the course numbering to the pedagogical intent.

**Consultation:**
Undergraduate Affairs Committee

**ESS330H1: Introduction to Geologic Field Methods**

**Rationale:**
ESS330H1 is meant to be taken in the 2nd year of study. The introduction of ESS234H1 aligns the course numbering to the pedagogical intent.

**Consultation:**
Undergraduate Affairs Committee

**ESS420H0: Advanced Field Methods**

**Rationale:**
ESS420 is meant to be taken in the 3rd year of study. The creation of ESS324H0 aligns the course numbering to the pedagogical intent.

**Consultation:**
Undergraduate Affairs Committee

**ESS420H1: Advanced Geological Field Methods**

**Rationale:**
ESS420H1 is meant to be taken in the 3rd year of study. The creation of ESS324H1 aligns the course numbering to the pedagogical intent.

**Consultation:**
Undergraduate Affairs Committee
5 Minor Program Modifications:

**Biodiversity and Conservation Biology Major**

**Completion Requirements:**

(8 FCEs including at least 2.0 FCEs at 300+ series with at least 0.5 FCE at the 400 level series)

First Year (1.0 ±5 FCEs): BIO120H1; tMAT135H1; MAT136H1/MAT137Y1/MAT221H1/MAT223H1

Higher Years:

1. 2.0 FCEs: BIO220H1 (ecology and evolutionary biology); EEB225H1 (recommended)/STA220H1/STA257H1/STA288H1/GGR270H1/PSY201H1 (statistics); EEB255H1 (conservation biology); ENV234H1 (environmental biology; cannot be substituted with EEB375H1)

2. 1.5 FCEs in organismal biology (with at least 0.5 FCE from Group 1 and 0.5 FCE from Group 2) from:
   - Group 1 (plant or microbial): BIO251H1; EEB268H1, EEB330H1, EEB331H1, EEB340H1; FOR305H1
   - Group 2 (animal): EEB263H1, EEB266H1, EEB267H1, EEB380H1, EEB382H1, EEB384H1, EEB386H1, EEB388H1

3. 0.5 FCE in core evolution: EEB318H1, EEB323H1, EEB362H1

4. 0.5 FCE in core ecology from: EEB319H1, EEB321H1, EEB328H1

5. 0.5 FCE: EEB365H1 (applied conservation biology)

6. 1.5 ±0 FCE from: BIO130H1, BIO251H1; EEB263H1, EEB266H1, EEB267H1, EEB268H1, EEB313H1, EEB318H1, EEB319H1, EEB321H1, EEB322H1, EEB323H1, EEB324H1, EEB325H1, EEB328H1, EEB330H1, EEB331H1, EEB340H1, EEB362H1, EEB380H1, EEB382H1, EEB384H1, EEB386H1, EEB388H1, EEB390H1, EEB397Y1, EEB398H0, EEB399Y0, EEB428H1, EEB430H1, EEB433H1, EEB440H1, EEB455H1, EEB459H1, EEB497H1, EEB498Y1, EEB499Y1; EHJ352H1; ENV334H1, ENV432H1; FOR200H1, FOR201H1, FOR307H1, FOR413H1; GGR272H1, GGR324H1; JHE353H1, JHE355H1; NUS

7. 0.5 FCE at 400 series from: EEB465H1, EEB466H1; field course: EEB403H0, EEB403H1, EEB405H0, EEB405H1, EEB406H0, EEB406H1, EEB407H0, EEB407H1, EEB410H0, EEB410H1; seminar, EEB495H1; EEB497H1, research project: EEB497H1; EEB498Y1/EEB499Y1 (recommended research subject in biodiversity and/or conservation biology) and concurrent research issues course EEB488H1 (0.5 FCE)

NOTE: BIO260H1/HMB265H1 (genetics) is recommended. Note that both BIO260H1 and HMB265H1 require BIO130H1 and BIO230H1; BIO230H1 requires both CHM135H1 and CHM136H1

Students interested in law, economics, policy, or environmental studies may choose to pair their Biodiversity and Conservation Biology Major with another Major such as Economics, Environmental Ethics, or Environmental Studies (all three are Arts programs), or Science programs (e.g., School of the Environment programs).

**Description of Proposed Changes:**

New optional courses have been added from Math, Geography, and Forestry, primarily for students who already have them before enrolling in an Ecology and Evolutionary program. Note that any EEB student wishing to enrol in these courses would need to ensure the prerequisites were satisfied, and after priority enrolment was finished.

**Rationale:**

**Impact:**
Consultation:
Discussions have been held with relevant departments around adding the new optional courses, noting EEB students would not have priority access.

Resource Implications:

Ecology & Evolutionary Biology Major

Completion Requirements:

(8 FCEs full courses or their equivalent including at least 2.0 FCEs at 300+ series with at least 0.5 FCE at the 400 series level)

First Year (2.0 FCEs): BIO120H1; BIO130H1; (CHM135H1 (formerly CHM139H1), CHM136H1 (formerly CHM138H1))/CHM151Y1

Higher Years:
1. 2.0 FCEs: BIO220H1; BIO230H1; BIO260H1/HMB265H1; EEB225H1/STA220H1/STA257H1/STA288H1/GGR270H1/PSY201H1
2. 1.0 FCEs from: BIO251H1, BIO270H1/PSL300H1, BIO271H1/PSL301H1, EEB263H1, EEB266H1, EEB267H1, EEB268H1, ENV234H1
3. 0.5 FCE in core ecology and evolution from: EEB318H1, EEB319H1, EEB321H1, EEB322H1, EEB328H1, EEB362H1
4. 1.5 2.0 FCEs from: EEB313H1, EEB318H1, EEB319H1, EEB321H1, EEB322H1, EEB323H1, EEB324H1, EEB325H1, EEB328H1, EEB330H1, EEB331H1, EEB362H1, EEB365H1, EEB375H1, EEB380H1, EEB382H1, EEB384H1, EEB386H1, EEB388H1, EEB390H1, EEB397Y1, EEB398H0, EEB398Y0, EEB399Y1, EEB399Y0, EEB428H1, EEB430H1, EEB433H1, EEB440H1, EEB455H1, EEB459H1, EEB465H1, EEB466H1; EHJ352H1; ENV432H1; NUS201H0, NUS301H0, NUS302H0, NUS303H0, NUS304H0, NUS401H0 *
5. 0.5 FCE from: EEB202H1, EEB204H1, EEB206H1, EEB214H1, EEB215H1); ENV234H1, ENV334H1, ENV432H1; EHJ352H1, JHE353H1, JHE355H1; JMB170Y/MAT135H1/MAT136H1/MAT135Y/MAT137Y/MAT221H1/MAT223H1/MAT157Y; MGY340H1; NUS301H0, NUS302H0, NUS303H0, NUS304H0, NUS401H0 *
6. 0.5 FCE at the 400-series from: field course, EEB403H0, EEB403H1, EEB405H0, EEB405H1, EEB406H0, EEB406H1, EEB407H0, EEB407H1, EEB410H0, EEB410H1; seminar EEB495H1, EEB496H1; independent research project course, EEB497H1, EEB498Y1/EEB499Y1 (concurrent with research issues course EEB488H1); advanced lecture/discussion course, EEB428H1, EEB430H1, EEB433H1, EEB440H1, EEB455H1, EEB459H1, EEB465H1, EEB466H1; ENV432H1

Description of Proposed Changes:

Rationale:

Impact:
Ecology and Evolutionary Biology Specialist

Completion Requirements:

(12 FCEs including at least 4.0 FCEs at the 300+ series level, 1.0 of which must be at the 400 series level)

First Year (3.0 FCEs): BIO120H1; BIO130H1; (CHM135H1, CHM136H1)/CHM151Y1; (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

1. 2.0 FCEs: BIO220H1 (ecology and evolutionary biology); BIO230H1 (molecular and cell biology); BIO260H1/HMB265H1 (genetics); BIO251H1/BIO270H1/PSL300H1/ENV234H1 (plant or animal form and function/environmental biology); Please note: ENV234H1 (environmental biology) cannot be substituted with EEB375H1.

2. 0.5 FCE in statistics from: EEB225H1 (recommended)/STA220H1/STA257H1/GGR270H1/PSY201H1

3. 0.5 FCE in core evolution from: EEB318H1, EEB323H1, EEB362H1

4. 0.5 FCE in core ecology from: EEB319H1, EEB321H1 (both are recommended), EEB328H1

5. 0.5 FCE in organismal biology from: EEB263H1, EEB266H1, EEB267H1, EEB268H1, EEB330H1, EEB331H1, EEB340H1, EEB380H1, EEB382H1, EEB384H1, EEB388H1

6. 1.0 FCE at 300+ series, from: EEB313H1, EEB318H1, EEB319H1, EEB321H1, EEB322H1, EEB323H1, EEB324H1, EEB325H1, EEB328H1, EEB330H1, EEB331H1, EEB340H1, EEB356H1, EEB362H1, EEB365H1, EEB380H1, EEB382H1, EEB384H1, EEB386H1, EEB388H1, EEB390H1, EEB398H0, EEB399Y0, EEB428H1, EEB430H1, EEB433H1, EEB440H1, EEB455H1, EEB459H1, EEB460H1, EEB465H1, EEB466H1, EEB492H1/EEB492Y1, EEB495H1, EEB496H1; EHJ352H1; ENV334H1, ENV432H1; ENV395Y1; NUS201H0, NUS301H0, NUS302H0, NUS303H0, NUS304H0, NUS401H0 *

* More information about NUS courses and programs can be found on the Biology Calendar section

Sub-total = 8.0 FCEs

7. 1.0 to 2.5 FCEs in at least two of the three following categories: (1) one field course (0.5 FCE) from EEB403H0, EEB405H1, EEB406H0, EEB406H1, EEB407H0, EEB407H1, EEB410H0, EEB410H1; (2) one seminar (0.5 FCE) from EEB495H1, EEB496H1; and/or (3) one independent research project course (1.0 FCE) from EEB497H1 EEB498Y1/EEB498Y1 EEB499Y1 and concurrent research issues course EEB488H1 (0.5 FCE).

Sub-total = 9.0 or 10.5 FCEs (depending on options chosen in #7)

8. Select the remaining FCEs for a total of 12.0 FCEs (at least 1.0 must be 300+ series if 1.0 FCE is completed in #7 above) from: BIO251H1, BIO270H1/PSL300H1, BIO271H1/PSL301H1; all EEB courses (excluding EEB202H1, EEB206H1, EEB208H1, EEB214H1, EEB215H1); EHJ352H1; ENV234H1, ENV334H1, ENV432H1, JHE355H1, JHE355H1; and no more than 1.0 FCE from the following (note that some courses may require prerequisites that are not listed within this program): ANT336H1, ANT333Y1, ANT335Y1, ANT338H1, ANT430H1, ANT436H1; CSB328H1, CSB340H1, CSB349H1, CSB350H1, CSB352H1, CSB353H1, CSB343H1, CSB341H1, CSB452H1, CSB458H1, CSB472H1, CSB474H1; ENV346H1; FOR200H1, FOR201H1, FOR301H1, FOR306H1, FOR307H1, FOR413H1, FOR416H1, FOR417H1, FOR418H1; GGR201H1, GGR203H1, GGR205H1, GGR206H1, GGR272H1, GGR273H1, GGR305H1, GGR307H1, GGR308H1; MAT221H1; MGY340H1; NUS; PSY100H1, PSY260H1, PSY270H1, PSY280H1, PSY290H1, PSY305H1, PSY390H1, PSY397H1, PSY474H1, PSY492H1, PSY497H1 (note that many PSY courses have limited enrolment)
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Total = 12 FCEs

NOTE: Students may wish to concentrate in ecology, evolutionary biology, or behaviour. Recommended EEB, EHJ and JHE courses for these concentrations are as follows:

Ecology: EEB255H1, EEB319H1, EEB321H1, EEB328H1, EEB365H1, EEB428H1, EEB433H1, EEB440H1, EEB465H1, EEB495H1; ENV432H1
Evolutionary Biology: EEB323H1, EEB324H1, EEB325H1, EEB362H1, EEB390H1, EEB440H1, EEB459H1, EEB460H1, EEB466H1; EHJ352H1; JHE353H1, JHE355H1
Behaviour: EEB322H1, EEB455H1, EEB496H1

Description of Proposed Changes:

New optional courses have been added from Anthropology and Psychology, primarily for students who already have them before enrolling in an Ecology and Evolutionary program. Note that any EEB student wishing to enrol in these courses would need to ensure the prerequisites were satisfied, and after priority enrolment was finished.

Rationale:

Impact:

Consultation:

Discussions have been held with relevant departments around adding the new optional courses, noting EEB students would not have priority access.

Resource Implications:

Environmental Biology Major

Completion Requirements:

(8 FCEs including at least 2.0 FCEs at 300+ series with at least 0.5 FCE at the 400 level series)

First Year (2.0 3.0 FCEs): BIO120H1; (CHM135H1 (formerly CHM139H1), CHM136H1 (formerly CHM138H1)/CHM151Y1; (MAT135H1; MAT136H1/MAT136H1 MAT135Y1/MAT137Y1/MAT221H1/MAT223H1 or; PHY131H1/PHY151H1 or BIO130H1

1. 2.0 FCEs: BIO220H1 (ecology and evolutionary biology); ENV234H1 (cannot be substituted with EEB375H1 for this requirement), ENV334H1 (environmental biology); EEB225H1 (recommended)/STA220H1/STA257H1/STA288H1/GGR270H1/PSY201H1 (statistics)

2. 0.5 FCE in biological diversity and function from: BIO251H1, BIO270H1; EEB266H1, EEB267H1, EEB268H1, EEB340H1; BIO260H1/HMB265H1 (note that both require BIO130H1 and BIO230H1)

3. 0.5 FCE in physical environment from: CHM210H1 ; ENV233H1, ENV237H1, ENV238H1; ESS261H1, ESS262H1; GGR201H1, GGR203H1, GGR205H1, GGR206H1; PHY131H1, PHY132H1, PHY151H1, PHY152H1

4. 1.0 0.5 in core ecology from: EEB319H1, EEB321H1, EEB322H1, EEB324H1, EEB328H1

5. 1.5 0.5 FCE from: EEB313H1, EEB319H1, EEB321H1, EEB322H1, EEB323H1, EEB324H1, EEB325H1, EEB328H1, EEB365H1, EEB375H1, EEB386H1, EEB403H0, EEB403H1, EEB405H0, EEB405H1, EEB406H0, EEB406H1, EEB407H0, EEB407H1, EEB410H0, EEB410H1, EEB428H1, EEB430H1, EEB433H1, EEB497H1, EEB498Y1, EEB499Y1; ENV316H1, ENV337H1, ENV432H1, ENV452H1; ESS311H1, ESS361H1, ESS362H1, ESS462H1, ESS463H1, ESS464H1; FOR305H1, FOR307H1, FOR418H1; GGR305H1, GGR307H1, GGR308H1;
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ESS311H1; JFG470H1; ENV316H1

6. 0.5 FCE at the 400-series from: field course EEB403H0, EEB403H1, EEB405H0, EEB405H1, EEB406H0, EEB406H1, EEB407H0, EEB407H1, EEB410H0, EEB410H1/FOR418H1; seminar/lecture course EEB428H1, EEB430H1, EEB433H1, EEB495H1, ENV432H1, ENV452H1; ESS462H1, ESS463H1, ESS464H1; JFG470H1; EEB497H1, independent research project course EEB497H1; EEB498Y1 (concurrent with research issues course EEB488H1), EEB499Y1.

This program can be combined with other Environmental programs (see School of the Environment), as well as Science (e.g., Chemistry, Earth Sciences) and Social Science (e.g., Economics) programs.

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

Environmental Biology Minor

Completion Requirements:

(4 FCEs; must include at least one full-course equivalent at the 300+ series)

1. 1.5 FCEs: BIO120H1; BIO220H1; ENV234H1 (cannot be substituted with EEB375H1)

2. 0.5 FCE in organismal biology: EEB266H1, EEB267H1, EEB268H1

3. 2.0 FCEs (at least 1.0 FCEs at 300+ series)

A. core ecology and evolution (no more than 1.0 FCEs) from: EEB318H1; BIO251H1, EEB319H1, EEB321H1, EEB322H1, EEB324H1; EEB255H1, EEB328H1

B. biological diversity (no more than 0.5 FCE): EEB263H1, EEB266H1, EEB267H1, EEB268H1; EEB318H1; EEB319H1; EEB321H1; EEB323H1; EEB324H1; EEB328H1; EEB331H1; EEB362H1; EEB340H1; EEB365H1; EEB380H1; EEB382H1; EEB384H1; EEB386H1; EEB388H1

C. field courses: EEB433H1; ENV434H1 (recommended); ENV432H1; NUS; no more than 0.5 FCE; one field course from EEB403H0, EEB403H1, EEB405H0, EEB405H1, EEB406H0, EEB406H1, EEB407H0, EEB407H1, EEB410H0, EEB410H1

D. no more than 1.0 FCEs from: BIO251H1, EEB255H1, EEB362H1, EEB365H1, EEB428H1, EEB433H1; ENV334H1 (recommended), ENV432H1; NUS

Description of Proposed Changes:
1 New Course:

EEB313H1: Quantitative Methods in R for Biology

Contact Hours:
- Lecture: 24  /  Practical: 24

Description:
The quantitative analysis and management of biological data is crucial in modern life sciences disciplines. Students will develop skills with R as applied to problems in ecology and evolutionary biology to learn reproducible approaches for data management, data manipulation, visualization, modelling, statistical analysis, and simulation for solving biological problems.

Prerequisites:
- BIO220H1, EEB225H1/STA288H1/STA220H1

Corequisites:

Exclusions:
- STA130H1, PSY305H1

Recommended Preparation:
- CSC108H1/CSC120H1/CSC121H1

Breadth Requirements:
The Physical and Mathematical Universes (5)

Distribution Requirements:
- Science

Competencies:
- Communication: notably; Critical and Creative Thinking: notably; Information Literacy: extensively
- Quantitative Reasoning: extensively; Social and Ethical Responsibility: none

Experiential Learning:
- Research: notably; Other: none

Rationale:
Ecological and evolutionary processes are complex because they involve a combination of both nonlinear dynamics (e.g. infectious disease oscillations, alternate stable states of coral reefs) and stochastic processes (e.g. mutation, environmental disturbances) that are often hierarchically structured physiologically, demographically, or spatially. This complexity demands that modern biological scientists are computationally literate so as to implement and analyze
models of biological processes as well as manage and analyze big datasets that are hierarchically structured and non-gaussian, which is becoming the norm in diverse areas in medicine, academia, NGO, government and industry settings. This course aims to bring a practical approach to understanding how to properly manage, trouble-shoot, visualize, and conduct robust analyses of biological models and data, by using models that are fundamental to ecology and evolution as well as biological data that are hierarchical and non-normal. It offers a primarily hands-on computer lab experience with the R software environment, which dovetails with training in other courses offered by the EEB and Statistics departments. The course introduces best practices for reproducible workflows with RStudio/RMarkdown and Git/GitHub, appropriate use of data frames, data wrangling and visualization (e.g. dplyr, ggplot), and implementation of analytical and probabilistic modelling in R. The course builds on the basic statistical principles from a prerequisite introductory course in statistics and how to apply them to concepts introduced in prerequisite introductory biology. Students will also conduct project work to give them inquiry-based learning activities.

Consultation: We consulted among EEB faculty for the value of this course, for which consensus was reached. We also consulted with Cell & Systems Biology and confirmed with them that there was little overlap with CSB352H1/472H1 so no exclusion was warranted. Finally, we consulted with Statistics and determined that STA130H1 should be considered an exclusion to EEB313H1.

Resources: Computer lab

Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses: Statistics offers several interesting related courses: STA302H1 (Methods of Data Analysis) deals with statistical data analysis with a focus on regression, STA303H1 (Methods of Data Analysis II) that focuses on more complicated regression models, STA305H1 (Design of Scientific Studies) involves the statistically appropriate layout of experiments. Each of these courses requires 1.5 to 2.0 FCE of prerequisite STA courses, making them inaccessible to most life science students. The goals of EEB313H1 are distinct in that it aims to develop student skills in the R computing environment with biological topics in ecology and evolutionary biology, with special emphasis on data visualization, data wrangling, and reproducible workflows (e.g. with Git).

Cell & Systems Biology and Biochemistry both offer courses in bioinformatics (CSB352H1, CSB472H1, BCB410H1) that focus on genomic analysis, rather than more general data management and probabilistic modeling. The 400-level courses also require many prerequisites and small class sizes that make them inaccessible to many students, especially those in programs not administered by CSB or BCH. The BCB410 course requires many computer science prerequisites, unlike EEB313. Moreover, both of the CSB courses are highly oversubscribed, thus making related course offerings that provide practical quantitative skills crucial for undergraduate training.

Programs of Study for Which This Course Might be Suitable: proposed Quantitative Biology Major, EEB Specialist and Major, Biology Specialist and Major, Biodiversity and Conservation Biology Major, Environmental Science Major, Environmental Biology Major, Cell & Molecular Biology Specialist and Major

Estimated Enrolment: 30

Instructor: Prof. Martin Krkosek

1 Course Modification:

EEB430H1: Theoretical Ecology

Title: Modeling in Theoretical Ecology and Evolution

Contact Hours: Previous: Lecture: 24 / Practical: 24
New: **Lecture:** 24 / **Practical:** 12

**Description:**

Study of *Theoretical* ecology and evolution uses models to explain biological phenomena including *such as* the maintenance of biodiversity, population growth, competition, eco-evolutionary dynamics, *trait and molecular evolution*, epidemiology, spatial ecology, and *species* extinction. Students will learn to develop and *analyse* ecological models, assess and apply analytical, simulation and statistical models for analysis *to analyse* and *interpret* data interpretation. *(Not offered in 2016–17)*

**Prerequisites:**

BIO220H1, EEB225H1, MAT136H1/MAT137Y1/MAT223H1, and at least one of EEB319H1/EEB321H1/EEB322H1/ EEB323H1

**Rationale:**

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**Consultation:**

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**Resources:**

- CQuest computer lab

**Budget Implications:** The academic unit will provide the resources required for this course from existing budget.
4 Minor Program Modifications:

Economics & Mathematics Specialist

Enrolment Requirements:

The Economics & Mathematics Specialist program is a limited enrolment program. All students who request the program and obtain at least the specified marks in the required courses will be eligible to enrol.

Students interested in the Economics & Mathematics Specialist program apply and enter from either the Economics Major or Mathematics Major program, after having completed the Year 2 requirements of the program as described below. Note that course substitutions may not be used to enter this program.

Entry Requirements (from the Economics or Mathematics Major program):

- A minimum of 70% in ECO206Y1, and
- A minimum of 70% in ECO208Y1, and
- A minimum of 60% in MAT137Y1/MAT157Y1.

Note: In order to meet the pre-requisites for the specialist-oriented second-year courses (ECO206Y1, ECO208Y1, and ECO227Y1), students must obtain a mark of at least 70% in ECO100Y1, and earn a minimum of 60% in (MAT135H1, MAT136H1) or 55% in MAT137Y1/MAT157Y1.

Completion Requirements:

Program Course Requirements: 13 full courses or their equivalent

First Year (2.0 FCE):

1. ECO100Y1/(ECO101H1, + ECO102H1);
2. MAT137Y1/MAT157Y1

Second Year and Higher (Core Courses, 8.5 FCE):

1. ECO206Y1, ECO208Y1, ECO220Y1/ECO227Y1/(STA257H1, STA261H1)
2. CSC108H1/CSC148H1
3. MAT223H1/MAT240H1, MAT224H1/MAT247H1, MAT237Y1/MAT257Y1, MAT246H1, MAT244H1/MAT267H1
4. ECO325H1, ECO326H1, ECO375H1
5. MAT336H1/MAT337H1/MAT357H1, APM462H1

Third Year and Higher (Elective Courses, 2.5 FCE):

1. 0.5 300+ ECO course
2. 1.0 400-level ECO course
3. 1.0 300-level or higher MAT (or APM) courses (in addition to APM462H1).
Notes:

1. Students must meet all prerequisites for upper-year math and economics courses, and should choose their sequencing of courses accordingly.
2. MAT223H1/MAT240H1 may be taken in First Year.
3. ECO475H1 is strongly recommended.
4. STA302H1/STA303H1 are not accepted in lieu of ECO375H1.
5. Students with MAT157Y1 cannot take MAT246H1 (it is an exclusion). Such students can instead substitute any 300-level MAT or APM course to meet the MAT246H1 requirement.

Description of Proposed Changes:
MAT244H1/MAT267H1 are removed as not being relevant to the program, as is MAT336H1. CSC108H1/CSC148H1 since students will benefit from programming language and data structures.

Rationale:
Changes are proposed to bring the program into modern-day workplace and graduate studies.

Impact:
This will expand students' skill base and enable them to go on into the workplace with up to date skills and/or graduate school. There are 19 students currently in this program and will have little impact on CSC resources.

Consultation:
Consultation was done with Professor F. Pitt of the Computer Science Department.

Resource Implications:

Economics Major

Enrolment Requirements:

(The enrolment requirements below are effective for students who are:

- applying to programs in April 2018
- planning to take ECO101H1 and ECO102H1 in Summer 2017 in order to apply to an Economics program in July 2017 (during the second round of program enrolment) for September 2017 admission:

Students who are applying to an Economics program in April 2017 (during the first round of program enrolment) for June 2017 admission should consult the 2016-17 Calendar.)

This is a limited enrolment program. Students who request the program and obtain at least the specified mark(s) in the required course(s) will be eligible to enrol.

Required courses and grades for program enrolment:

(ECO101H1 with a final mark of at least 63% and ECO102H1 with a final mark of at least 63%, or ECO105Y1 with a final mark of at least 80%), AND
MAT133Y1 with a final mark of at least 63%, or
(MAT135H1 with a final mark of at least 60% and MAT136H1 with a final mark of at least 60%), or
MAT137Y1 with a final mark of at least 55%, or
MAT157Y1 with a final mark of at least 55%.)
Completion Requirements:

Program Course Requirements: 7 full courses or their equivalent

First Year (2.0 FCE):
1. ECO101H1+ECO102H1/ECO100Y1/ECO105Y1;
2. MAT133Y1/(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

Second Year (Core courses, 3.0 FCE):
1. ECO200Y1/ECO204Y1/ECO206Y1,
2. ECO202Y1/ECO208Y1/ECO209Y1,
3. ECO220Y1/ECO227Y1/(STA237H1 STA220H1, STA238H1 STA255H1)/(STA257H1, STA261H1)

Third and Higher Years (ECO Electives, 2.0 FCE):
1. 1.5 FCE 300+ series ECO courses
2. At least 0.5 FCE 400 level ECO course

Notes:
1. Eligibility for all Economics programs is based, in part, on attaining a minimum grade in ECO101H1 plus ECO102H1 or ECO105Y1 (which are exclusions to each other). Students are reminded that they may only repeat a course once as per Faculty regulations. For admission to a program requiring ECO101H1 plus ECO102H1 or ECO105Y1, this means that students have a combined total of at most two tries at ECO101H1 plus ECO102H1, ECO105Y1 or any comparable course (e.g., at UTSC or UTM). No third try will be considered in order to meet the minimum grade requirement for admission to a program.
2. Students in the Major program considering graduate studies in Economics are advised to take the more mathematical stream courses (ECO206Y1, ECO208Y1), and also some or all of the 300-level advanced micro, macro, and econometrics sequence (ECO325H1, ECO316H1/ECO326H1, and ECO375H1).
3. Students considering graduate studies in Economics are also encouraged to take more than the minimum amount and level of math. Students should especially consider MAT221H1/MAT223H1/MAT240H1 (Linear Algebra), MAT235Y1/MAT237Y1 (Multivariate Calculus), MAT246H1 (Abstract Mathematics), or even consider doing a Minor program in Mathematics.
4. Students should pay careful attention to the courses they choose to meet the 200-level statistics requirements. The accepted combinations are precisely as stated. In particular, STA237H1+STA238H1 STA220H1+STA255H1 and STA257H1+STA261H1 are distinct packages of courses, and the elements cannot be combined any other way.
5. Students combining other programs with Economics need to confirm that their chosen statistics courses meet the requirements of both programs. Besides the combinations noted in descriptions of the ECO programs, the only other accepted combinations for ECO Major program, and course prerequisite conditions, are precisely: STA247H1+STA248H1; and PSY201H1+STA255H1.
6. Students in the Major program in Economics cannot be enrolled in the Minor program in Environmental Economics.

Description of Proposed Changes:
STA237H1 and STA238H1 are new courses proposed by the Statistics Department and replace the former STA220H1 and STA255H1 as acceptable program requirements for this program.

ECO316H1 (as an alternative to ECO326H1) is added to the notes as an acceptable preparation for students applying to graduate school.
Economics (FAS), Department of

Rationale:

Impact:

Consultation:

Resource Implications:

Economics Specialist

Enrolment Requirements:

The Economics Specialist program is a limited enrolment program. All students who request the program and obtain at least the specified marks in the required courses will be eligible to enroll.

Students interested in the Specialist program apply and enter from the Major program, after having completed the Year 2 requirements of the program as described below. Note that course substitutions may not be used to enter this program.

Entry Requirements (from the Major program):

A minimum of 70% in each course in the trio of intermediate courses:

- ECO206Y1 (70%), and
- ECO208Y1 (70%), and
- ECO220Y1 (70%)/ECO227Y1 (70%)/(STA257H1 (70%), STA261H1 (70%)).

Note: In order to meet the pre-requisites for the specialist-oriented second-year courses (ECO206Y1; ECO208Y1; and ECO227Y1), students must obtain a mark of at least 70% in ECO100Y1/ECO101H1 (70%) + ECO102H1 (70%); and earn a minimum of 60% in (MAT135H1; MAT136H1) or 55% in MAT137Y1.

Completion Requirements:

Program Course Requirements: 12 full courses or their equivalent

First Year (2.0 FCE):

1. ECO100Y1/(ECO101H1, + ECO102H1);
2. (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

Note: MAT133Y1 is not a suitable substitute for (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1.

Second Year (Core Courses, 3.0 FCE):

- ECO206Y1, ECO208Y1, ECO220Y1/ECO227Y1/(STA257H1, STA261H1)
Economics (FAS), Department of

**Third Year (Core Courses, 1.5 FCE):**

- ECO325H1, ECO326H1, ECO375H1

**Third Year and Higher (ECO Electives, 5.5 FCE):**

1. 4.5 FCE 300-level ECO or higher
2. 1.0 FCE 400-level ECO

**Notes:**

1. ECO210H1 is highly recommended, especially for students interested in graduate studies. Students may count ECO210H1 towards the Specialist program in lieu of a 0.5 300-level ECO elective.
2. While 200-level or higher math or statistics courses may complement the Economics Specialist courses, they **cannot** be used as substitutes for economics courses in this program.
3. Students are nevertheless encouraged to take more math if they plan on pursuing graduate studies. Students should especially consider MAT221H1/MAT223H1/MAT240H1 (Linear Algebra), MAT235Y1/MAT237Y1 (Multivariate Calculus), MAT246H1 (Abstract Mathematics), or even consider doing a Minor program in Mathematics.
4. ECO475H1 is strongly recommended.
5. STA302H1/STA303H1 are not accepted in lieu of ECO375H1.
6. (STA220H1, STA255H1) are not accepted in lieu of ECO220Y1/ECO227Y1/(STA257H1, STA261H1).
7. **CSC108H1/CSC148H1** (introductory programming) is strongly recommended for students interested in graduate studies.

**Description of Proposed Changes:**

The note is removed after the Entry Requirements.

**Rationale:**

The note is redundant and can be confusing to students. Students will know that they can't take gain entrance to the program without these requirements and those required courses have their prerequisites listed, it isn't necessary to state them in the note. This also makes it consistency across programs since there is no note on the Economics and Mathematics Specialist program.

**Impact:**

This change has no impact on entry to the program.

**Consultation:**

**Resource Implications:**

**Financial Economics Specialist**

**Enrolment Requirements:**

This is a limited enrolment program. Students enrolled in this program cannot simultaneously be enrolled in any other Economics specialist, joint specialist, major or minor program in Economics, or in Economic History or in the B.Com program.

This is a Type 2L limited program and so meeting the minimum course marks specified above will not necessarily guarantee admission.
Students interested in the Specialist program apply and enter from the Major program, after having completed the Year 2 requirements of the program as described below.

**Entry Requirements (from the Major program):**

A minimum of 80% in each course in the trio of intermediate courses:

- ECO206Y1 (80%), and
- ECO208Y1 (80%), and
- ECO227Y1 (80%)/(STA257H1 (80%), STA261H1 (80%)).

**Note:** In order to meet the pre-requisites for the specialist-oriented second-year courses (ECO206Y1, ECO208Y1, and ECO227Y1); students must obtain a mark of at least 70% in ECO100Y1/(ECO101H1 (70%) + ECO102H1 (70%)); and earn a minimum of 60% in (MAT135H1, MAT136H1) or 55% in MAT137Y1.

**Completion Requirements:**

**Program Course Requirements: 13 full courses or their equivalent**

**First Year (2.0 FCE):**

1. ECO100Y1/(ECO101H1, + ECO102H1);
2. (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

**Note:** MAT133Y1 is not a suitable substitute for (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1.

**Second Year (Core Courses, 3.0 FCE):**

- ECO206Y1, ECO208Y1, ECO227Y1/(STA257H1, STA261H1)

**Third Year (Core Courses, 2.5 FCE):**

1. ECO325H1, ECO326H1, ECO375H1
2. ECO358H1, ECO359H1

**Third Year and Higher (Electives, 5.5 FCE, at least 1.0 at the 400-level):**

1. 1.0 FCE from ECO349H1, ECO356H1, **ECO440H5 ECO357H1**, ECO456H1, ECO461H1/ECO460H5, ECO462H1/ECO434H5, ECO463H1/ECO463H5, ECO464H1, ECO465H1, ECO475H1
2. 4.5 additional 300+ ECO credits

**Notes:**
1. Some required courses at upper-year levels may be offered only on the St. George or on the University of Toronto Mississauga campus in any given year. Students registered in this program at either campus may have to attend lectures on the other campus in such cases.

2. MAT221H1/MAT223H1/MAT240H1 is recommended as preparation for ECO375H1. Students taking one of these MAT courses can have it count in lieu of a 0.5 300-level ECO credit required for this program.

3. (MAT235Y1/MAT237Y1)/ECO210H1 is strongly recommended for this program. Students taking one of these courses can have it count in lieu of 0.5 300-level credit required for this program.

4. ECO475H1 is strongly recommended

5. STA302H1/STA303H1 are not accepted in lieu of ECO375H1

6. (STA220H1, STA255H1; STA237H1, STA238H1) are not accepted in lieu of ECO220Y1/ECO227Y1/(STA257H1, STA261H1).

7. CSC108H1/CSC148H1 (introductory programming) is strongly recommended for students interested in graduate studies.

Description of Proposed Changes:

Removal of the Note after Entry Requirements.
Addition of a UTM course that is a viable option within this program.

Rationale:
The note is redundant and can be confusing to students. Students will know that they can't take gain entrance to the program without these requirements and those required courses have their prerequisites listed, it isn't necessary to state them in the note. This also makes it consistency across programs since there is no note on the Economics and Mathematics Specialist program.

The UTM course, ECO 440H5 adds to the students' selection of courses.

Impact:
This has no impact on the program.

Consultation:

Resource Implications:

45 Course Modifications:

ECO220Y1: Quantitative Methods in Economics

Description:

Numerical and graphical data description; data collection and sampling; probability; sampling distributions; statistical inference; hypothesis testing and estimation; simple and multiple regression analysis (extensive coverage). Learn how to analyze data and how to correctly interpret and explain results. Applications include research papers in economics.

Prerequisites:

ECO100Y1(67%)/(ECO101H1 ECO101H (63%), ECO102H1 ECO102H (63%))/ECO105Y1 (80%) ; MAT133Y1/(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

Exclusions:

ECO227Y1, GGR270H1, PSY201H1, PSY202H1, SOC300H1; STA107H, STA220H1, STA221H1, STA247H1, STA248H1; STA250H1, STA257H1, STA261H1

Rationale:

Two new statistics courses, STA237H1 and STA238H1 have been added to the exclusion list. Older statistics courses have been removed, and ECO 227Y is also removed since the content is very different from ECO 220Y.
ECO227Y1: Quantitative Methods in Economics

Prerequisites:
ECO100Y1(70%)/(ECO101H1 ECO101H (70%), ECO102H1 ECO102H (70%)); MAT133Y1 (63%)/(MAT135H1 (60%), MAT136H1 (60%))/MAT137Y1 (55%)/MAT157Y1 (55%)

Exclusions:
ECO220Y1, GGR270H1, PSY201H1; PSY202H1, SOC300H1; STA107H, STA247H1, STA248H1; STA250H1, STA255H1, STA257H1, STA261H1

Rationale:
Out of date exclusions are removed, and the exclusion to ECO 220Y is removed since they are completely different courses.

consultation:

Resources:

ECO305H1: Economics of Accounting

Prerequisites:
ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1)

Rationale:
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

consultation:

Resources:

ECO306H1: American Economic History

Description:
A survey of American economic history from the ante-bellum period to the present. Potential topics include the rapid growth of the American economy in the late 19th and early 20th century; causes of the onset of the Great Depression; the economic impact of slavery and its aftermath; health and demographic trends; and 20th century trends in inequality.

Prerequisites:
ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1)

Rationale:
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

consultation:
ECO310H1: Empirical Industrial Organization

Description:

The quantitative analysis of firms' strategies in real-world industries, using tools from applied microeconomics and statistics. Topics include studies of monopoly, oligopoly, imperfect competition, and the estimation of demand and cost functions that underpin these markets.

Prerequisites:

ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1/(STA237H1, STA220H1, STA238H1, STA255H1)/(STA257H1, STA261H1)

Rationale:

Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

ECO313H1: Environmental Economics and Policies

Prerequisites:

ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1/(STA237H1, STA220H1, STA238H1, STA255H1)/(STA257H1, STA261H1)

Rationale:

Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

ECO324H1: Economic Development

Prerequisites:

ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1/(STA237H1, STA220H1, STA238H1, STA255H1)/(STA257H1, STA261H1)

Exclusions:

ECO324Y1, ECO324Y5

Rationale:

Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:
### ECO325H1: Advanced Economic Theory - Macro

**Prerequisites:**
ECO208Y1/ECO202Y1 (70%)/ECO209Y1 (70%), ECO220Y1 (70%)/ECO227Y1/(STA237H1 STA220H1 (70%), STA238H1 STA255H1 (70%))/(STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Remove 70% minimum on ECO 209Y1 more accurately reflects the level of that course, in line with ECO 208Y1.

**Consultation:**

**Resources:**

### ECO326H1: Advanced Economic Theory - Micro

**Title:**
Advanced Microeconomics Economic Theory - Game Theory Micro

**Prerequisites:**
ECO200Y1 (70%)/ECO204Y1 (70%)/ECO206Y1, ECO220Y1 (70%)/ECO227Y1/(STA237H1 STA220H1 (70%), STA238H1 STA255H1 (70%))/(STA257H1, STA261H1)

**Rationale:**
The title change better reflects course content.
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.
Remove 70% minimum on ECO 204Y1 more accurately reflects the level of that course, in line with ECO 206Y1.

**Consultation:**

**Resources:**

### ECO331H1: Behavioural and Experimental Economics

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**Consultation:**

**Resources:**

### ECO332H1: Economics of the Family

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1)
### Rationale:
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

### Consultation:

### Resources:

#### ECO334H1: Political Economy: Voters, Information and Media

<table>
<thead>
<tr>
<th>Title:</th>
<th>The Political Economy of Voters, Information and Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites:</td>
<td>ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 /</td>
</tr>
<tr>
<td>Rationale:</td>
<td>Title change to more clearly reflect course syllabus. Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs than STA220H1 + STA255H1.</td>
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<tr>
<td>Consultation:</td>
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<tr>
<td>Resources:</td>
<td>Budget Implications: The academic unit will provide the resources required for this course from existing budget.</td>
</tr>
</tbody>
</table>

#### ECO336H1: Public Economics

| Prerequisites: | ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 /|STA237H1, STA220H1, STA238H1, STA255H1|/ (STA257H1, STA261H1) |
| Rationale: | Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs. |
| Consultation: | |
| Resources: | |

#### ECO337H1: Public Economics (for Commerce)

| Prerequisites: | ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 /|STA237H1, STA220H1, STA238H1, STA255H1|/ (STA257H1, STA261H1) |
| Rationale: | Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs. |
| Consultation: | |
| Resources: | |
ECO338H1: Economics of Careers

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 / (STA237H1, STA220H1, STA238H1, STA255H1) / (STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**Consultation:**

**Resources:**

ECO339H1: Labour Economics: Employment, Wages and Public Policy

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 / (STA237H1, STA220H1, STA238H1, STA255H1) / (STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**Consultation:**

**Resources:**

ECO340H1: Labour Economics: The Distribution of Earnings

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 / (STA237H1, STA220H1, STA238H1, STA255H1) / (STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**Consultation:**

**Resources:**

ECO349H1: Money, Banking and Financial Markets

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1, ECO202Y1/ECO208Y1/ECO209Y1, ECO220Y1/ECO227Y1 / (STA237H1, STA220H1, STA238H1, STA255H1) / (STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**Consultation:**

**Resources:**
**ECO358H1: Financial Economics I**

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1 /STA237H1 STA220H1, STA238H1 STA255H1/ (STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**Consultation:**

**Resources:**

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**ECO362H1: Economic Growth**

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1, ECO202Y1/ECO208Y1/ECO209Y1, ECO220Y1/ECO227Y1 /STA237H1 STA220H1, STA238H1 STA255H1/ (STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**Consultation:**

**Resources:**

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**ECO364H1: International Trade Theory**

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1 /STA237H1 STA220H1, STA238H1 STA255H1/ (STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**Consultation:**

**Resources:**

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**ECO368H1: Economics of Conflict**

**Prerequisites:**
ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1 /STA237H1 STA220H1, STA238H1 STA255H1/ (STA257H1, STA261H1) Note: Students with ECO100Y1 (67%)/(ECO101H1 ECO101H (63%)) + ECO102H1 ECO102H (63%)/ECO105Y1 (80%), plus a full-year of quantitative methods/statistics (e.g., POL242Y1), and who are enrolled in the International Relations or Peace, Conflict and Justice Major or Specialist programs may take this course with Permission of the Instructor.

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.
ECO369H1: Health Economics

Prerequisites:  
ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1 / (STA237H1 STA220H1, STA238H1 STA255H1) /
(STA257H1, STA261H1)

Rationale:  
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:  

Resources:  

ECO372H1: Applied Regression Analysis and Empirical Papers

Prerequisites:  
ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 / (STA237H1 STA220H1, STA238H1 STA255H1) /
(STA257H1, STA261H1)

Rationale:  
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:  

Resources:  

ECO374H1: Applied Econometrics (for Commerce)

Title:  
Previous: Applied Econometrics (for Commerce)  
New: Forecasting and Time Series Econometrics

Prerequisites:  
ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1 / (STA237H1 STA220H1, STA238H1 STA255H1) /
(STA257H1, STA261H1)

Exclusions:  
Previous: ECO375H1, ECO327Y5  
New:  

Rationale:  
This course is separate and distinct from ECO 375H1, with little or no overlap, so the exclusion is removed. The title change reflects more closely course content and there will be a section restricted to Commerce students and a section for Arts and Science students.

The two new STA237H1 and STA238H1 also align more closely with Economics programs and are now included as prerequisites in the list.

Consultation:  

Resources:  

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ECO375H1: Applied Econometrics I

Prerequisites:
ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1 (70%)/(STA237H1 (70%), STA238H1(70%))/ ECO227Y1/ (STA257H1, STA261H1)

Exclusions:
ECO374H1, ECO327Y5, ECO375H5

Rationale:
ECO 375H1 and ECO 374H1 are no longer exclusions as they are two separate distinct courses with little to no overlap.

The two new STA237H1 and STA238H1 also align more closely with Economics programs and are now included as prerequisites in the list.

Consultation:

Resources:

ECO380H1: Markets, Competition, and Strategy

Prerequisites:
ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 /(STA237H1, STA238H1, STA255H1)/ (STA257H1, STA261H1)

Rationale:
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

ECO381H1: Personnel Economics

Prerequisites:
ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 /(STA237H1, STA238H1, STA255H1)/ (STA257H1, STA261H1)

Rationale:
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

ECO401H1: Topics in Economic Policy

Prerequisites:
ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1 /(STA237H1, STA220H1, STA238H1, STA255H1)/ (STA257H1, STA261H1) ; At least one FCE in ECO at the 300 level or higher.
### Economics (FAS), Department of

**Rationale:**

Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

### ECO402H1: Topics in Health Economics

**Prerequisites:**

ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1 / (STA237H1 STA220H1, STA238H1 STA255H1) / (STA257H1, STA261H1); At least one FCE in ECO at the 300 level or higher.

**Rationale:**

Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

### ECO403H1: Topics in Development Economics and Policy

**Description:**

This course covers a variety of topics pertaining to economic development and associated policies. Depending on the course instructor, the focus may be on theories and policies related to poverty alleviation, human capital formation, financial markets, international trade, governance or economic growth.

**Prerequisites:**

ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1 / (STA237H1 STA220H1, STA238H1 STA255H1) / (STA257H1, STA261H1); At least one FCE in ECO at the 300 level or higher.

**Rationale:**

Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

### ECO404H1: Topics in Managerial Economics

**Prerequisites:**

ECO200Y1(75%)/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1 / (STA237H1 STA220H1, STA238H1 STA255H1) / (STA257H1, STA261H1); ECO372H1/ECO374H1/ECO375H1; At least one FCE in ECO at the 300 level or higher.

**Rationale:**

Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**It was determined that a higher level of statistics/econometrics was needed for this 400 level course.**
<table>
<thead>
<tr>
<th>Course Title</th>
<th>Prerequisites</th>
<th>Rationale</th>
<th>Consultation</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECO406H1: Developmental Macroeconomics</strong></td>
<td><strong>Prerequisites:</strong> ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1); At least one FCE in ECO at the 300 level or higher.</td>
<td>Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.</td>
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<tr>
<td><strong>ECO407H1: Competing Views in Macroeconomic Theory and Policy</strong></td>
<td><strong>Prerequisites:</strong> ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1); At least one FCE in ECO at the 300 level or higher.</td>
<td>Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.</td>
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<tr>
<td><strong>ECO408H1: The Economics of Life: A Historical Perspective (Formerly ECO308H1)</strong></td>
<td><strong>Prerequisites:</strong> ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1); At least one FCE in ECO at the 300 level or higher.</td>
<td>Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.</td>
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<tr>
<td><strong>ECO409H1: Topics in Money, Banking, and Finance</strong></td>
<td><strong>Prerequisites:</strong> ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1 ECO209Y1; ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1); At least one FCE in ECO at the 300 level or higher.</td>
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</table>
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

**ECO410H1: Mergers and Competition Policy**

**Prerequisites:**
- ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1), at least 1.0 ECO FCE at the 300+ level or higher

**Rationale:**
- Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

**ECO414H1: Energy and Regulation**

**Prerequisites:**
- ECO200Y1/ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1) or permission of the instructor

**Rationale:**
- Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

**ECO417H1: Economic Development Policy: Community Engaged Learning**

**Prerequisites:**
- ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1)

**Rationale:**
- Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

**ECO419H1: International Macroeconomics**

**Prerequisites:**
- ECO200Y1/ECO204Y1/ECO206Y1, ECO202Y1/ECO208Y1/ECO209Y1, ECO220Y1/ECO227Y1 /(STA237H1 STA220H1, STA238H1 STA255H1)/ (STA257H1, STA261H1) permission of instructor
Economics (FAS), Department of

Rationale:
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

ECO423H1: Economics and Biosocial Data

Prerequisites:
ECO200Y1/ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1/(STA237H1 STA220H1, STA238H1 STA255H1)/(STA257H1, STA261H1); at least 1.0 ECO FCE at the 300+ level; or permission of the instructor.

Rationale:
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:

ECO425H1: Business Cycles

Description:
This course builds on material covered in ECO208Y1. Students will learn how to use business cycle models to better understand key empirical features of the macroeconomy. Topics covered include the financial crisis, monetary policy, fiscal policy, theories of unemployment, and the effects of innovation on economic fluctuations, the Great Depression and the Financial Crisis.

Prerequisites:
ECO200Y1 ECO200Y1/ECO204Y1 204Y/ECO206Y1 206Y, ECO202Y1 ECO202Y1/ECO208Y1 208Y/ECO209Y1 209Y, ECO220Y1 ECO220Y/ECO227Y1 227Y/(STA237H1 STA220H1, STA238H1 STA255H1)/(STA257H1 STA257H, STA261H1) STA261H; at least 1.0 ECO FCE at the 300+ level

Corequisites:
ECO374H1/ECO375H1

Exclusions:
Previous: ECO438H1
New:

Rationale:
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

Consultation:

Resources:
### ECO435H1: The Economics of Modern China

**Prerequisites:**
ECO200Y1(70%)/ECO204Y1 (70%)/ ECO206Y1 (70%); ECO220Y1/ECO227Y1/(STA237H1 STA220H1, STA228H1 STA255H1)/(STA257H1, STA261H1)

**Rationale:**
Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.

**Consultation:**

**Resources:**

### ECO463H1: Financial Market Microstructure

**Title:**
Financial Market Innovation Microstructure

**Description:**

**Previous:**
Security prices evolve through a large number of bilateral trades, performed by people that have specific, well-regulated and institutionalized roles. Market microstructure is the subfield of financial economics that studies the price formation process. Using the lens of theoretical economic models, this course reviews insights concerning the strategic trading behaviour of individual market participants, and models are brought market data. The course further studies how public and private information, market regulation, and trading arrangements, such as limit order books or dark pools, affect behavior. < / p>

**New:**
A research-oriented course that explores the impact of technological developments on the industrial organization of financial markets. Topics include the impact of the automated financial products and procedures (e.g., algorithmic trading and robo-advising) on the price formation process, the economic impact of new tools and technologies (e.g., blockchain, digital currencies, and predictive analytics such as machine learning), the emergence of alternative financing methods such as crowdfunding and peer-to-peer lending. < / p>

**Prerequisites:**
ECO200Y1 ECO358H1 (70%)/ECO204Y1 RSM330H1 (60%)/ECO206Y1 (60% 70%), (ECO374H1 (70%)/ECO375H1 (70%))/CSC321H1/CSC411H1

**Recommended Preparation:**

**Previous:**
New: ECO358H1/RSM330H1/RSM332H1

**Rationale:**
The change in title more clearly reflects ways in which modern financing occurs, and the course description is now more fine-tuned to the course content, describing up-to-date technological advances and innovation. It is an excellent course in the Specialist in Financial Economics programs at both St. George and UTM, from which students often apply to the Master in Financial Economics program at St. George.

**Consultation:**

**Resources:**

**Budget Implications:** The academic unit will provide the resources required for this course from existing budget.
**ECO499H1: Honours Essay in Applied Microeconomics**

<table>
<thead>
<tr>
<th>Prerequisites:</th>
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<tbody>
<tr>
<td>ECO200Y1/ECO204Y1/ECO206Y1; ECO202Y1/ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1 / (STA237H1, STA220H1, STA238H1, STA255H1) / (STA257H1, STA261H1) ; ECO372H1/ECO374H1/ECO375H1; 3.0 GPA in economics courses; approval of the associate chair, undergraduate</td>
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<table>
<thead>
<tr>
<th>Rationale:</th>
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<tbody>
<tr>
<td>Two new statistics courses (STA237H1 and STA238H1) replace STA220H1 + STA255H1 in the prerequisite list, and are more aligned with Economics courses and programs.</td>
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<tr>
<th>Consultation:</th>
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<tr>
<th>Resources:</th>
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2 Minor Program Modifications:

Environmental Science Major

Completion Requirements:

(8.0 7.5 full courses or their equivalent)

First Year (1.5 FCEs): BIO120H1; 0.5 FCE from CHM136H1/CHM138H1/CHM135H1 (recommended)/CHM139H1/CHM151Y1; 0.5 FCE from MAT135H1/MAT137Y1/MAT157Y1/JMB170Y1

Second Year (2.5 FCEs):
1. ENV221H1
2. ENV234H1
3. One of CHM210H1 or ESS262H1 ENV233H1
4. ENV237H1/ENV238H1*
ENV238H1 is for students who have previously taken PHY131H1/PHY132H1/PHY151H1/PHY152H1
5. STA220H1/STA288H1/EEB225H1/GGR270H1 or other science courses providing training in statistics as approved by the Academic Associate Director.

NOTE: students interested in taking EEB Field Courses (Group B) in third/fourth year are encouraged to take BIO220H in second/third year.

Third Year (1.5 FCE):
1. The other of CHM210H1 or ESS262H1 not taken in second year
2. + ENV337H1/JEE337H1
3 2. ENV316H1

Third/Fourth Year (2.0 FCEs):
1. 2.0 FCE from courses in Group A, B, and C, with no more than 0.5 FCE from Group C. At least 0.5 FCE must be at the 300+-level

Group A: Environmental Science
BIO220H1*/CHM210H1/CHM310H1/CHM410H1/CHM415H1/EEB319H1/EEB321H1/EEB328H1/EEB365H1/ EEB428H1/EEB430H1/EEB433H1/EEB440H1/EEB465H1/ENV334H1/ENV341H1/ENV346H1/ENV430H1/ ENV432H1/ESS261H1/ESS311H1/ESS312H1/ESS461H1/ESS463H1/ENV301H1/GGR301H1/GGR308H1/GGR314H1/GGR347H1/ GGR348H1/GGR409H1/JGA305H1/PCL362H1/PHY392H1**/PHY492H1**

Notes :*BIO220H1 is required for all upper-year 300+ EEB series courses, with no exceptions.** PHY392H1 and PHY492H1 include relevant environmental content, but prerequisites for these courses cannot be used towards Group A requirements.

Group B: Environmental Science-related Field Courses
ANT330Y1/ARH306Y1/EEB403H1/EEB405H1/EEB406H1/EEB407H1/EEB410H1/ENV336H1/ENV395Y0/ ENV396Y0/ESS330H1/ESS410H1/ESS450H1/GGR390H1

Note :*BIO220H1 is required for all upper-year 300+ EEB series courses, with no exceptions.

Group C: Environmental Policy & Society (no more than 0.5 FCE from Group C)
ENV222H1/ENV261H1/ENV281H1/ENV282H1/ENV307H1/ENV320H1/ENV322H1/ENV333H1/ ENV335H1/ENV347H1/ENV361H1/ENV362H1/ENV381H1/ENV382H1/ENV422H1/ENV461H1/ ENV462H1/FOR302H1
Fourth Year (0.5 FCE):
1. 0.5 FCE from the following: ENV432H1 */ENV440H1/ENV452H1*  
   *Note that ENV432H1 requires one of EEB319H1/EEB321H1/EEB365H1/ENV334H1 as a prerequisite, and ENV452H1 requires includes ENV334H1 as one of ENV316H1/ENV334H1/ENV337H1 as a prerequisite its prerequisites.

Students combining the Environmental Science Major with a second BSc or BA Major, and who are also interested in obtaining a basic understanding of the social/political/policy aspects of environment, can add the Environmental Studies Minor. Some of the courses taken for the Environmental Science Major may be double counted for this Minor. Please contact the Undergraduate Student Advisor (see above) to learn more about this option.

**Description of Proposed Changes:**

ENV233H1 is being retired, and since it was jointly offered by Chemistry and Earth Sciences, it is being replaced by an Environmental Chemistry course - CHM210H1 - and an Earth Sciences course - ESS262H1.

**Rationale:**

The core second year courses for the Environmental Science major provide a basic introduction to students about what each science discipline that offers one of these courses brings to understanding and addressing environmental issues.

**Impact:**

Students will have to take an extra half course for the major, but this only brings the total FCE to 8, which is typical for a BSc major.

**Consultation:**

There was extensive consultation among Chemistry, Earth Sciences and the School of the Environment about this change.

**Resource Implications:**

None

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**Environmental Science Minor**

**Completion Requirements:**

**First Year (1.5 FCE):**

1. BIO120H1; 0.5 FCE from CHM136H1/CHM138H1/CHM135H1 (recommended)/CHM139H1/CHM151Y1; 0.5 FCE from MAT135H1/MAT137Y1/MAT157Y1/JMB170Y1

**Higher Years (2.5 FCEs):**
2. ENV221H1  
3. 1.0 FCE from CHM210H1 ENV234H1, ENV234H1 ENV233H1, ENV237H1/ENV238H1*, ESS262H1  
4. ENV337H1/JEE337H1  
5. 0.5 FCE from courses in Group A or B**

**Notes**

*ENV238H1 is for students who have previously taken PHY131H1/PHY132H1/PHY151H1/PHY152H1

** Students should verify the prerequisites for the courses listed under the groups below in advance of their course selection.

BIO220H1 is required for all upper-year EEB 300+-series courses (Group A and B) and there are no exceptions.

**Group A: Environmental Science**

CHM310H1/CHM410H1/CHM415H1/EEB319H1/EEB321H1/EEB328H1/EEB365H1/EEB428H1/EEB430H1/EEB433H1/EEB440H1/EEB465H1/ENV334H1/ENV341H1/ENV346H1/ENV430H1/ENV432H1/ESS261H1/ESS311H1/ESS312H1/ESS461H1/ESS463H1/GGR301H1/GGR308H1/GGR314H1/GGR347H1/GGR348H1/
Notes: *PHY392H1 and PHY492H1 include relevant environmental content, but prerequisites for these courses cannot be used towards Group A requirements.

**Group B: Environmental Science-related Field Courses**

ANT330Y1/ARH306Y1/EEB403H1/EEB405H1/EEB406H1/EEB407H1/EEB410H1/ENV316H1/ENV336H1/ENV395Y0/ENV396Y0/ESS330H1/ESS410H1/ESS450H1/GGR390H1

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**Description of Proposed Changes:**

ENV233H1 is being retired, and since it was jointly offered by Chemistry and Earth Sciences, it is being replaced by an Environmental Chemistry course - CHM210H1 - and an Earth Sciences course - ESS262H1.

**Rationale:**

ENV233H1 is being retired, and since it was jointly offered by Chemistry and Earth Sciences, it is being replaced by an Environmental Chemistry course - CHM210H1 - and an Earth Sciences course - ESS262H1.

**Impact:**

**Consultation:**

There was extensive consultation among Chemistry, Earth Sciences and the School of the Environment about this change.

**Resource Implications:**

None

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**1 New Course:**

**ENV396H0: Special Topics Field Course**

**Contact Hours:**

**Description:**

This course examines Australia’s environmental, wildlife and conservation issues from an interdisciplinary perspective. In consideration of these issues, Australia’s unique flora and fauna are examined through lectures and fieldwork in the various climatically varied regions of Australia that are visited throughout the course.

**Prerequisites:**

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**

ENV200H1 or equivalent; or BIO120H1 or equivalent

**Breadth Requirements:**

**Distribution Requirements:**
Environment (FAS), School of

Competencies:

- **Communication**: slightly; **Critical and Creative Thinking**: notably; **Information Literacy**: notably
- **Quantitative Reasoning**: slightly; **Social and Ethical Responsibility**: notably

Experiential Learning:

- **Research**: extensively; **Other**: none

Rationale:

This is a half-course version of the existing ENV396Y0 Summer Abroad course. The ENV396H0 course is being introduced because the current content/course load of the ENV396Y0 is not sufficient to justify it being a full course. ENV396Y0 will be left in the calendar, and at some future date may be offered if the course content/course load justifies having it as a full course. This field course is offered in Australia, with instructors from the University of New South Wales.

Consultation:

Consultation about this change was held between the School of the Environment and the Summer Abroad program at Woodsworth.

Resources:

None

Overlap with Existing Courses:

Programs of Study for Which This Course Might be Suitable:

Estimated Enrolment:

Instructor:

3 Course Modifications:

ENV200H1: Assessing Global Change: Science and the Environment (formerly ENV200Y1)

Exclusions:

- BIO120H1, BIO150Y1 (applies only to students in Arts & Science); **ENV200Y1, EEB208H1 ENV200Y1**

Rationale:

ENV200H1 is listed as an exclusion for EEB208H1, so for consistency, EBB208H1 should be listed as an exclusion for ENV200H1.

Consultation:

None

Resources:

None.

ENV316H1: Laboratory and Field Methods in Environmental Science

Prerequisites:

- ENV234H1, ENV233H1, ENV237H1/ENV238H1, one of CHM210H1/ESS262H1, one of STA220H1/STA288H1/EEB225H1/GGR270H1

Rationale:
ENV233H1 is being discontinued, and the instructors have found that a stats course is important preparation for the course, so the prerequisites for the course are being changed accordingly. A stats course is required for the Environmental Science program, for which this course is a required course.

**Consultation:**

**Resources:**

None

### ENV337H1: Human Interactions with the Environment

**Prerequisites:**

(two of ENV233H1, ENV234H1, ENV237H1/ENV238H1) or (two of CHM210H1, ENV234H1, ENV237H1/ENV238H1, ESS262H1) or (GGR201H1 + GGR203H1) or (ENV233H1 + ESS261H1) or (ESS261H1 + ESS262H1) or (CHM210H1 + CHM217H1) or (ENV221H1/ENV222H1/ENV234H1 + BIO220H1 + BIO230H1/BIO255H1) or permission of Academic Associate Director

**Rationale:**

**Consultation:**

**Resources:**
3 Minor Program Modifications:

**Forest Conservation Minor**

<table>
<thead>
<tr>
<th>Completion Requirements:</th>
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<tbody>
<tr>
<td>(4 full courses or their equivalent)</td>
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</tr>
<tr>
<td>First Year: 1.0 FCE from ANT100Y1; ECO101H1, ECO102H1, ECO105Y1 <strong>ECO100Y1</strong>; ENV200H1; <strong>GGR100H1</strong>; GGR101H1, JEG100H1</td>
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<tr>
<td>Higher Years: 3.0 FCEs from FOR200H1, FOR201H1, FOR300H1, FOR301H1, FOR302H1, FOR303H1, FOR305H1, FOR306H1, FOR307H1, FOR310H1, FOR400Y1, FOR401H1</td>
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</table>

**Description of Proposed Changes:**
Adjusting for course changes in other departments: ECO100Y1 has been divided up into ECO101H1 and ECO102H1. Adding in JEG100H1 which is a new course with similar components to the GGR100H1 and ESS102H1.

**Rationale:**
Adjusting for course changes in other departments: ECO100Y1 has been divided up into ECO101H1 and ECO102H1. Adding in JEG100H1 which is a new course with similar components to the GGR100H1 and ESS102H1.

**Impact:**

**Consultation:**

**Resource Implications:**

**Forest Conservation Science Minor**

<table>
<thead>
<tr>
<th>Completion Requirements:</th>
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<tbody>
<tr>
<td>(4 full courses or their equivalent, including at least 1.0 300-series course and 1.0 400-series course)</td>
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<tr>
<td>First Year: 1.0 FCE from BIO120H1; ECO101H1 <strong>GGR100H1, ECO102H1</strong>; GGR101H1; <strong>CHM135H1, CHM138H1</strong>, CHM136H1 <strong>CHM139H1</strong></td>
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<tr>
<td>Second Year: FOR200H1, FOR201H1</td>
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</tr>
<tr>
<td>Third Year: 1.0 FCE from FOR300H1, FOR301H1, FOR302H1, FOR303H1, FOR305H1, FOR306H1, FOR307H1, FOR310H1</td>
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<tr>
<td>Fourth Year: FOR400Y1</td>
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</table>

**Description of Proposed Changes:**
Adjusting for course changes in other departments: CHM138H1 and CHM139H1 are now CHM135H1 and CHM136H1; ECO100Y1 has been divided up into ECO101H1 and ECO102H1.

**Rationale:**
Adjusting for course changes in other departments: CHM138H1 and CHM139H1 are now CHM135H1 and CHM136H1; ECO100Y1 has been divided up into ECO101H1 and ECO102H1.

**Impact:**

**Consultation:**

**Resource Implications:**

### Forest Conservation Science Specialist

#### Completion Requirements:

(12 full courses or their equivalent, including at least 3.5 300-series courses and 2.0 400-series courses; other equivalent and approved courses offered by other Faculties, University of Toronto Mississauga or University of Toronto Scarborough may be eligible for inclusion.)

**First Year:**
BIO120H1; plus 2.5 first year Science FCEs (GGR100H1; GGR101H1; CHM135H1 CHM138H1, CHM136H1 CHM139H1 recommended)

**Second Year:**
1. ENV234H1; FOR200H1, FOR201H1
2. 1.0 FCE from ECO220Y1, ECO227Y1; GGR270H1, GGR271H1; STA220H1, STA221H1
3. 1.0 FCE from BIO220H1, BIO251H1, BIO260H1; GGR205H1, GGR206H1; GGR272H1, GGR273H1; PHL273H1; ENV221H1, ENV222H1; ENV234H1, ENV237H1; ENV238H1

**Third Year:**
1. FOR301H1, FOR305H1; 1.0 FCE from FOR300H1, FOR302H1, FOR303H1, FOR306H1, FOR307H1, FOR310H1; ENV334H1
2. 0.5 FCE from EEB319H1, EEB321H1, EEB323H1, EEB328H1; CSB340H1
3. 1.0 FCE from EEB324H1, EEB365H1, EEB386H1, EEB388H1; GGR303H1; GGR305H1, GGR314H1; ENV320H1, ENV322H1, ENV323H1

**Fourth Year:**
1. FOR400Y1, FOR401H1
2. 0.5 FCE from FOR403H1, FOR405H1, FOR410H1, FOR413H1, FOR416H1, FOR417H1, FOR418H1, FOR419H1, FOR420H1, FOR423H1; GGR403H1; ENV347H1; JFG470H1, JFG475H1; EEB403H1, EEB406H1, EEB407H1

**Description of Proposed Changes:**
Adjusting for course changes in other departments: CHM138H1 and CHM139H1 are now CHM135H1 and CHM136H1. All other removed courses are no longer on offer by their respective departments

**Rationale:**
Adjusting for course changes in other departments: CHM138H1 and CHM139H1 are now CHM135H1 and CHM136H1. All other removed courses are no longer on offer by their respective departments

**Impact:**

**Consultation:**

**Resource Implications:**
2 Minor Program Modifications:

Physical and Environmental Geography Major

Enrolment Requirements:

Admission is based on one of the following:

- 0.5 GGR FCE's at the 100 or 200 level with a final mark of 67% or 63%
- 1.0 GGR FCE's at the 100 and/or 200 level with a final mark of 67% or 63%

Jointly-offered GGR courses will also be considered (e.g. JEG, JGI, JGE). This is a limited enrolment program that can only accommodate a limited number of students. Achieving these marks does not necessarily guarantee admission to the program in any given year.

Completion Requirements:

- **Introductory Courses**: Any 4 half courses or the equivalent (2.0 FCEs) from GGR100H1/JEG100H1, MAT133Y1/MAT135H1/MAT136H1/MAT137Y1/MAT157Y1, MAT223H1/MAT240H1, MAT224H1/MAT247H1, PHY131H1/PHY151H1, PHY132H1/PHY152H1, CHM138H1/CHM136H1, CHM139H1/CHM135H1, CHM151Y1, BIO120H1, BIO130H1, at least two of which must be Math or Phys half courses.

- **Core Courses**: Any 3 courses (1.5 FCE) from GGR201H1, GGR205H1, GGR206H1

- **Regional Geography Course**: Any course (0.5 FCE) from GGR101H1, GGR240H1, GGR246H1, GGR254H1, GGR341H1, GGR342H1, GGR343H1

- **Methods Courses**: All (1.5 FCE) of GGR270H1, GGR272H1, GGR390H1

- **Applications**: Any 4 courses (2.0 FCEs) from GGR273H1, GGR301H1, GGR305H1, GGR307H1, GGR308H1, GGR310H1/FOR310H1, GGR314H1, GGR337H1, GGR373H1, GGR347H1, GGR348H1, GGR416H1, GGR493Y1 (based on internship), any GGR course from the list for Core Courses and Fourth Year Courses requirement B or F not already used; any one half course from Group I (below). No more than one from GGR273H1, GGR373H1.

- **Fourth Year Course**: Any course (0.5 FCE) from GGR401H1, GGR405H1, GGR413H1, GGR414H1, GGR491Y1, GGR493Y1 (0.5 FCE can be used based on internship), GGR498H1

**Total FCEs: 8.0**

Description of Proposed Changes:

We are lowering entry grade requirements for all our specialist and major programs.

For majors, we are lowering the entry grade requirement from 73% in 0.5 GGR FCE to 67%. We are lowering the entry grade requirement from 67% in 1.0 GGR FCE to 63%.

Rationale:

Historically, the Physical & Environmental Geography entry requirements have been the same as those for our Social Science programs (Human Geography, Environmental Geography). We have proposals put forward to lower the entry requirements for those programs to bring them in line with those for other social science programs in FAS. We would like to lower the entry requirements for our science programs to keep in step with the other programs in Geography.
### Impact:

The change will allow more students to be eligible for our programs. It will provide greater opportunities for students with mediocre grades and in good standing to enroll in our programs. It should not have an impact on course enrollment significantly. Many students from other programs take our courses. We may end up with a higher percentage of students in Geography programs in our courses.

### Consultation:

- Undergraduate Committee – faculty & students
- St George Council - faculty & students
- School of the Environment

### Resource Implications:

None

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### Physical and Environmental Geography Specialist

#### Enrolment Requirements:

Admission will be determined by one of the following:

- 0.5 FCE's at the 100 or 200 level with a final mark of **75%** or 1.0 GGR FCE's at the 100 and/or 200 level with a final mark of **70%** in each course.

Jointly-offered GGR courses will also be considered (e.g. JEG, JGI, JGE). This is a limited enrolment program that can only accommodate a limited number of students. Achieving these marks does not necessarily guarantee admission to the program in any given year.

#### Description of Proposed Changes:

We are lowering entry grade requirements for all our specialist and major programs. For specialists, we are lowering the entry grade requirement from **77%** in 0.5 GGR FCE to **75%**. The entry grade requirement in 1.0 GGR FCE remains the same at **70%**.

#### Rationale:

Historically, the Physical & Environmental Geography entry requirements have been the same as those for our Social Science programs (Human Geography, Environmental Geography). We have proposals put forward to lower the entry requirements for those programs to bring them in line with those for other social science programs in FAS. We would like to lower the entry requirements for our science programs to keep in step with the other programs in Geography.

#### Impact:

The change will allow more students to be eligible for our programs. It will provide greater opportunities for students with mediocre grades and in good standing to enroll in our programs. It should not have an impact on course enrollment significantly. Many students from other programs take our courses. We may end up with a higher percentage of students in Geography programs in our courses.

#### Consultation:

- Undergraduate Committee – faculty & students
- St George Council - faculty & students
- School of the Environment

#### Resource Implications:

None

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### 1 New Course:
# GGR388H1: Special Topics in Physical & Environmental Geography

<table>
<thead>
<tr>
<th>Contact Hours:</th>
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<tr>
<td>Lecture: 24</td>
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<tr>
<th>Description:</th>
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<tr>
<td>Content in any given year varies by instructor. Students must meet the prerequisites set by the department (see the Geography website for details in May). Can be used towards Physical &amp; Environmental Geography and Environmental Geography programs.</td>
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<th>Prerequisites:</th>
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<th>Corequisites:</th>
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<th>Exclusions:</th>
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<th>Recommended Preparation:</th>
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<th>Breadth Requirements:</th>
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<tr>
<td>The Physical and Mathematical Universes (5)</td>
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<tr>
<th>Distribution Requirements:</th>
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<tbody>
<tr>
<td>Science</td>
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<tr>
<th>Competencies:</th>
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<tbody>
<tr>
<td>Communication: none; Critical and Creative Thinking: none; Information Literacy: none</td>
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<tr>
<td>Quantitative Reasoning: none; Social and Ethical Responsibility: none</td>
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<tr>
<th>Experiential Learning:</th>
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<tbody>
<tr>
<td>Research: none; Other: none</td>
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<thead>
<tr>
<th>Rationale:</th>
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<tbody>
<tr>
<td>In the last few years we have experienced an issue with our 3rd-year Special Topics course GGR300H1. We have only one such course and this had posed a problem when we have offered more than one Special Topics course in any one year. It produces administrative and scheduling difficulties for the Undergraduate Student Advisor, and confusion for students as it is not clear which Special Topics courses can be used for specific programs.</td>
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<tr>
<th>Resources:</th>
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<tr>
<td>Budget Implications: The academic unit will provide the resources required for this course from existing budget.</td>
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<tr>
<th>Overlap with Existing Courses:</th>
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Consultation:

Budget Implications: The academic unit will provide the resources required for this course from existing budget.
Programs of Study for Which This Course Might be Suitable:
- Physical & Environmental Geography - Specialist, Major, Minor
- Environmental Geography - Specialist, Major, Minor

Estimated Enrolment:
- 60

Instructor:

3 Retired Courses:

GGR300H1: Special Topics in Geography I

Rationale:
We are replacing this single special topics course with a set of 5 special topics courses that are program specific (GGR385H1, GGR386H1, GGR387H1, GGR388H1, GGR389H1).

JFG470H1: Forest Management

Rationale:
Course has not been offered in 5 years. Instructor from Forestry has retired.

Consultation:
Faculty of Forestry

JFG475H1: Forest Fire Management Systems

Rationale:
Course has not been offered in 5 years. Instructor from Forestry has retired.

Consultation:
Faculty of Forestry
6 Minor Program Modifications:

Fundamental Genetics and its Applications Major

Completion Requirements:

Required Courses (8.0 FCE, including at least 0.5 FCE at the 400-level)

Chemical and Physical Foundations of Biological Systems

1. (CHM135H1, CHM136H1)/(CHM138H1, CHM139H1)/CHM151Y1
   Transfer credits will be accepted in lieu of the chemistry requirements only if they carry a direct exclusion or equivalency to a pre-approved chemistry course

2. MAT135H1/PHY131H1/PHY151H1/CSC120H1/CSC148H1
3. BCH210H1

Biological Foundations of Living Systems

4. BIO120H1, BIO130H1
5. BIO220H1
6. BIO230H1/BIO255H1

Courses in Fundamental Genetics

7. HMB265H1/BIO260H1
8. HMB321H1

9. 0.5 FCE from: HMB360H1/HMB421H1/HMB435H1/HMB437H1/HMB474H1/BCH311H1/BCH425H1/BCH426H1/BCH440H1/BCH445H1/BCH448H1/CSB328H1/CSB331H1/CSB340H1/CSB349H1/CSB351Y1/CSB353H1/CSB428H1/CSB429H1/EEB318H1/EEB323H1/EEB365H1/EHJ352H1/MGY314H1/MGY315H1/MGY340H1/MGY428H1/MGY452H1/MGY470H1/MGY471H1/PSL350H1

Courses in Applied Genetics

10. HMB201H1
11. HMB301H1/BCH311H1/ECO369H1/PSL350H1

12. 0.5 FCE from: HMB301H1/HMB401H1/HMB431H1/HMB436H1/HMB441H1/HMB489H1/BCH311H1/BCH340H1/BCH350H1/BCH441H1/BCH447H1/CSB352H1/CSB458H1/CSB459H1/CSB472H1/CSB473H1/CSB474H1/EEB325H1/EEB459H1/EEB460H1/NFS487H1/PHL384H1/PSL350H1/PSL404H1/PSY390H1

Data Analysis and Research-Based Courses

13. 0.5 FCE in statistics: HMB325H1/EEB225H1/STA220H1/STA288H1

14. 0.5 FCE from a research-based or lab course: HMB311H1/HMB314H1/MGY315H1/HMB342H1/HMB360H1/HMB496Y1/*HMB499Y1/*HST373H1/MGY314H1/MGY377H1/MGY378H1

*A research project from a different unit may be accepted with prior written approval from Human Biology if the course is not counting toward a different program.

Fundamental Genetics and its Applications Major Notes:
Human Biology Program

1. Courses can only count toward one requirement, even if listed as options to multiple requisites of the program.
2. Not all courses listed have priority enrolment for Fundamental Genetics and its Applications majors. Students are responsible for checking priority of courses and meeting course prerequisites for courses they wish to take.
3. The Fundamental Genetics and its Applications major cannot be paired with any other Human Biology Program managed major program.

Description of Proposed Changes:
Adding BCH311H1/PSL350H1 to the requisite line that requires 0.5 FCE in 300-applied genetics courses (REQ 11), as well as REQ line 12.

Rationale:
The rationale is that these three courses many students take and feedback received is that they were able to take the cellular molecular biology in these three courses and apply it effectively to further studies in applied genetics. Program wishes to acknowledge this and add alternatives to HMB301H1- which focuses on biotechnology business which some students have expressed a lack of desire of taking as it does not help with further studies in applied genetics. This change is simply to give students more options, should they choose to take the option.

Impact:
There should be minimal impact as many students in this program already take one of these three courses.

Consultation:
Consultation with HMB Faculty. Consulted with Martha Harris in June 2017 about this change.

Resource Implications:
N/A

Fundamental Genetics and its Applications Specialist

Enrolment Requirements:

(Effective for students enrolling in programs in April 2018: For students intending to enroll starting April 2017: please consult the 2016-17 Calendar.)

This specialist is a Type 3 limited enrolment program. Admissions will be based on the following criteria, however achieving the minimum grades listed does not guarantee admission to the Fundamental Genetics and its Applications specialist program in any given year.

Applying with less than 8 FCEs:

• Completion of BIO130H1 with a minimum grade of 65
• Completion of CHM135H1 and completion of CHM136H1 with a minimum grade of 55 (or CHM151Y1 with a minimum grade of 55).
  Transfer credits will be accepted in lieu of the chemistry requirements only if they carry a direct exclusion or equivalency to a pre-approved chemistry course. Please carefully check your Transfer Credit Assessments.
• Completion of 4.0 FCE

Applying with 8 or more FCEs completed:

• Completion of BIO220H1 with a minimum grade of 65
• Completion of BIO230H1/BIO255H1 with a minimum grade of 65
• Completion of HMB265H1/BIO260H1
• Completion of BCH210H1
# Human Biology Program

Students may apply for this major program during Round 1 and Round 2 of Type 3 Enrolment after they have earned 4.0 FCE. Students applying for admissions to the program utilizing transfer credits will be considered on a case-by-case basis. Students entering from CEGEP or from another university should contact hmb.undergrad@utoronto.ca after their transfer credit assessment has been complete for program enrolment assessment. For more information about Type 3 enrolment, visit the [Faculty of Arts & Science Subject Program Enrolment Instructions website](#).

## Completion Requirements:

### Required Courses (12.0 FCE, including at least 1.0 FCE at the 400 level)

#### Chemical and Physical Foundations of Biological Systems

1. (CHM135H1, CHM136H1)/(CHM138H1, CHM139H1)/CHM151Y1
   
   *Transfer credits will be accepted in lieu of the chemistry requirements only if they carry a direct exclusion or equivalency to a pre-approved chemistry course*

2. MAT135H1/PHY131H1/PHY151H1/CSC120H1/CSC148H1
3. BCH210H1

#### Biological Foundations of Living Systems

4. BIO120H1, BIO130H1
5. BIO220H1
6. BIO230H1/BIO255H1

#### Courses in Fundamental Genetics

7. HMB265H1/BIO260H1
8. HMB321H1


#### Courses in Applied Genetics

10. HMB201H1
11. HMB301H1/BCH311H1/ECO369H1/PSL350H1

12. 1.5 FCE from: HMB301H1/HMB401H1/HMB431H1/HMB436H1/HMB441H1/HMB489H1/BCH311H1/BCH340H1/BCH441H1/BCH447H1/CSB352H1/CSB458H1/CSB459H1/CSB472H1/CSB473H1/CSB474H1/EEOB325H1/EEOB425H1/CSB448H1/CSB449H1/CSB450H1/CSB455H1/CSB472H1/CSB473H1/CSB474H1/EEOB425H1/CSB448H1/CSB449H1/CSB450H1/CSB455H1

#### Data Analysis and Research-Based Courses

13. 0.5 FCE in statistics: HMB325H1/EEOB225H1/STA220H1/STA288H1
14. 0.5 FCE from bioethics: HMB306H1/HMB406H1/PHL281H1
15. 0.5 FCE from upper-year lab course: HMB311H1/HMB314H1/PSL350H1
16. 0.5 FCE from research based courses: HMB342H1/HMB360H1/HST373H1/MGY314H1/MGY315H1
17. 1.0 FCE from research project course: HMB496Y1*/HMB499Y1*

*A research project from a different unit may be accepted with prior written approval from Human Biology if the course is not counting toward a different program.*

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**Fundamental Genetics and its Applications Specialists Notes:**
### Description of Proposed Changes:

Adding BCH311H1/PSL350H1 to the requisite line that requires 0.5 FCE in 300-applied genetics courses.

### Rationale:

The rationale is that these three courses many students take and feedback received is that they were able to take the cellular molecular biology in these three courses and apply it effectively to further studies in applied genetics. Program wishes to acknowledge this and add alternatives to HMB301H1 - which focuses on biotechnology business which some students have expressed a lack of desire of taking as it does not help with further studies in applied genetics. This change is simply to give students more options, should they choose to take the option.

### Impact:

There should be minimal impact as many students in this program already take one of these three courses.

### Consultation:

Consultation with HMB Faculty. Consulted with Martha Harris in June 2017 about this change.

### Resource Implications:

N/A

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### Global Health Major

#### Completion Requirements:

#### Required Courses (8.0 FCE, including at least 0.5 FCE at the 400-level)

**Chemical and Physical Foundations of Biological Systems**

1. (CHM135H1, CHM136H1)/(CHM138H1, CHM139H1)/CHM151Y1  *Transfer credits will be accepted in lieu of the chemistry requirements only if they carry a direct exclusion or equivalency to a pre-approved chemistry course.*
2. MAT135H1/PHY131H1/PHY151H1

**Biological Foundations of Living Systems**

3. BO120H1, BIO130H1
4. BIO230H1/BIO255H1
5. HMB265H1/BIO260H1
6. PSL300H1, PSL301H1
7. 1.0 FCE from: HMB302H1/HMB322H1/ANA300Y1/ANA301H1/BCH311H1/CSB351Y1/IMM340H1/IMM350H1/MGY377H1/MGY378H1/PSL350H1

**Global Health Concentration Courses**

8. 0.5 FCE from: PHS100H1/PSY100H1/ABS201Y1/ANT100Y1/SOC101Y1/SOC100H1/ECO100Y1/ECO101H1  *Transfer credits from AP and IB psychology are not accepted.*
9. HMB203H1

10. 0.5 FCE from courses on the biological dimensions of Global Health: HAJ453H1/HMB323H1/HMB342H1/HMB433H1/HMB436H1/HMB437H1/HMB440H1/HMB443H1/HMB462H1/HMB473H1/HMB474H1/HMB496Y */HMB499Y1 */CSB351Y1/EHB325H1/EHB325H1/HST373H1/MGY350H1/MGY377H1/MGY378H1/MIJ485H1

11. 0.5 FCE from courses on the social and ecological dimensions of Global Health: HMB303H1/HMB306H1/
Data Analysis Courses

12. 0.5 FCE in statistics: HMB325H1/STA220H1/STA288H1/PSY201H1

*A research project from a different unit may be accepted with prior written approval from Human Biology if the course is not counting toward a different program.

Global Health Major Notes:
1. Courses can only count toward one requirement, even if listed as options to multiple requisites of the program
2. Not all courses listed have priority enrolment for Global Health majors. Students are responsible for checking priority of courses and meeting course prerequisites for courses they wish to take.
3. The Global Health major cannot be paired with any other Human Biology Program managed major program.

Description of Proposed Changes:
Adding BCH311H1/PSL350H1 to the requisite line that requires 1.0 FCE in cellular molecular structure or function courses at the 300-level.

Rationale:
These three courses are useful courses to take, and many students already take them. It will allow students to ensure they have an in-depth understanding of cellular-molecular biology and prerequisite should they choose to take a 400-level course in another unit to satisfy their 400-level course requirement for their HMB Program.

Impact:
Should have little to no impact as the three courses added are already courses many of our students take.

Consultation:
Consultation with HMB Faculty. Consulted with Martha Harris re: adding these three courses to the genetics program, but after that discussion, HMB Faculty discussed it would be useful as an option in all programs (save for neuroscience)

Resource Implications:
N/A

Global Health Specialist

Completion Requirements:

Required Courses (13.5 FCE, including at least 1.0 FCE at the 400-level)

Chemical and Physical Foundations of Biological Systems

1. (CHM135H1, CHM136H1)/(CHM138H1, CHM139H1)/CHM151Y1
   Transfer credits will be accepted in lieu of the chemistry requirements only if they carry a direct exclusion or equivalency to a pre-approved chemistry course.
2. MAT135H1/PHY131H1/PHY151H1
3. BCH210H1

Biological Foundations of Living Systems
4. BIO120H1, BIO130H1  
5. BIO220H1  
6. BIO230H1/BIO255H1  
7. HMB265H1/BIO260H1  
8. PSL300H1, PSL301H1  
9. 1.0 FCE from HMB302H1/HMB322H1/ANA300Y1/ANA301H1/BCH311H1/CSB351Y1/IMM340H1/IMM350H1/MGY377H1/MGY378H1/PSL350H1

**Global Health Concentration Courses**

10. HMB203H1  
11. HMB323H1

12. 0.5 FCE from: PHS100H1/GGR112H1/PSY100H1/ABS201Y1/ANT100Y1/SOC101Y1/ECO100Y1/ECO101H1/SOC102H1/SOC100H1 *Transfer credits from AP and IB psychology are not accepted.*

13. 0.5 FCE from Epidemiology Courses: HMB342H1/HST373H1

14. 2.0 FCE from courses on the biological dimensions of Global Health: HAJ453H1/HMB323H1/HMB433H1/HMB436H1/HMB437H1/HMB440H1/HMB443H1/HMB462H1/HMB473H1/HMB474H1/HMB496Y */HMB499Y1 */JEH455H1/CSB351Y1/EEB325H1/EEJ352H1/MGY350H1/MGY377H1/MGY378H1/MIJ485H1

15. 1.0 FCE from courses on the social and ecological dimensions of Global Health: HMB303H1/HMB306H1/ABS240Y1/ABS250Y1/ABS350H1/ABS355H1/ANT345H1/ANT348H1/ANT358H1/ANT458H1/ANT460H1/ECO314H1/ECO324H1/ECO333H1/ECO334H1/ECO342H1/ECO369H1/ECO402H1/EEB428H1/ENV341H1/ENV430H1/ENV432H1/GGR433H1/GGR434H1/HST410H1/HST440H1/HST464H1/JNH350H1/NEW352H1/NEW353H1/NEW453H1/NFS490H1/PHS300H1/PSY320H1/PSY321H1

**Data Analysis and Research-Based Courses**

16. 0.5 FCE in statistics: HMB325H1/STA220H1/STA288H1/PSY201H1/HMB325H1  
17. 0.5 FCE in bioethics: HMB306H1/HMB406H1/PHL281H1  
18. 1.0 FCE from: HMB496Y1 */HMB499Y1*

*A research project from a different unit may be accepted with prior written approval from Human Biology if the course is not counting toward a different program.*

**Global Health Specialists Notes:**

1. Courses can only count toward one requirement, even if listed as options to multiple requisites of the program  
2. Not all courses listed have priority enrolment for Global Health specialists. Students are responsible for checking priority of courses and meeting course prerequisites for courses they wish to take.

**Description of Proposed Changes:**

Adding three in-depth cellular molecular biology courses as an option on a requisite line with multiple options, in response to faculty feedback on course recommended preparation/ideal pre-requisites and are three courses many students take anyway.

**Rationale:**

These three courses are useful courses to take, and many students already take them. It will allow students to ensure they have an in-depth understanding of cellular-molecular biology and per-requisite should they choose to take a 400-level course in another unit to satisfy
Human Biology Program

their 400-level course requirement for their HMB Program.

Impact:

Consultation:
Consultation with HMB Faculty. Consulted with Martha Harris re: adding these three courses to the genetics program, but after that discussion, HMB Faculty discussed it would be useful as an option in all programs (save for neuroscience). Emails to these three units (PSL, BCH, CSB) have been sent to confirm this change is alright but seeing as they are large courses students take anyway we trust there will be no issue.

Resource Implications:

Health & Disease Major

Completion Requirements:

Required Courses (8.0 7.5 FCE, including at least 0.5 FCE at the 400-level)

Chemical and Physical Foundations of Biological Systems

1. (CHM135H1, CHM136H1)/(CHM138H1, CHM139H1)/CHM151Y1 Transfer credits will be accepted in lieu of the chemistry requirements only if they carry a direct exclusion or equivalency to a pre-approved chemistry course
2. MAT135H1/PHY131H1/PHY151H1
3. BCH210H1

Biological Foundations of Living Systems

4. BIO120H1, BIO130H1
5. BIO220H1, BIO230H1/BIO255H1
6. HMB265H1/BIO260H1
7. PSL300H1, PSL301H1

Health & Disease Concentration Courses

8. HMB202H1
9. HMB302H1/HMB322H1

10. 0.5 FCE from: HAJ453H1/HMB401H1/HMB402H1/HMB422H1/HMB432H1/HMB434H1/HMB436H1/HMB437H1/HMB440H1/HMB441H1/HMB443H1/HMB452H1/HMB462H1/HMB470H1/HMB471H1/HMB472H1/HMB473H1/HMB474H1/EHJ352H1/JEH455H1/ANA300Y1/ANA301H1/BCH311H1/CSB345H1/EEB325H1/LMP301H1/LMP363H1/LMP403H1/LMP406H1/NFS485H1/NFS486H1/PCL362H1/PSL350H1/PSL404H1/PSL421H1/PSL425H1

Data Analysis and Research-Based Courses in Advanced Research, Laboratory, or Cellular Molecular Topics

11. 0.5 FCE in statistics: HMB325H1/STA220H1/STA288H1/PSY201H1
12. 0.5 FCE from an upper-year lab or research-based course: HMB312H1/HMB314H1/HMB323H1/HMB342H1/HST373H1/HMB496Y1 */HMB499Y1*/BCH311H1/PSL350H1
**Human Biology Program**

*A research project from a different unit may be accepted with prior written approval from Human Biology if the course is not counting toward a different program.*

**Health & Disease Major Notes:**

1. Courses can only count toward one requirement, even if listed as options to multiple requisites of the program.
2. Not all courses listed have priority enrolment for Health & Disease majors. Students are responsible for checking priority of courses and meeting course prerequisites for courses they wish to take.
3. The Health & Disease major cannot be paired with any other Human Biology Program managed major program.

**Description of Proposed Changes:**

Adding BCH311H1/CSB349H1/PSL350H1 to the requisite line that requires a research or lab course. The name of the line is being slightly altered to acknowledge these are not labs or research based, however, feedback indicates that they are better preparation for some life science students than epidemiology, and we want to encourage our students to take these courses, should they be interested, and also have them count toward the program in some way.

**Rationale:**

These three courses are useful courses to take, and many students already take them. It will allow students to ensure they have an in-depth understanding of cellular-molecular biology and per-requisite should they choose to take a 400-level course in another unit to satisfy their 400-level course requirement for their HMB Program.

**Impact:**

Should have little to no impact as the three courses added are already courses many of our students take.

**Consultation:**

Consultation with HMB Faculty. Consulted with Martha Harris re: adding these three courses to the genetics program, but after that discussion, HMB Faculty discussed it would be useful as an option in all programs (save for neuroscience)

**Resource Implications:**

n/a

**Human Biology Major**

**Completion Requirements:**

**Required Courses (8.0 FCE, including at least 0.5 FCE at the 400-level)**

**Chemical and Physical Foundations of Biological Systems**

1. (CHM135H1, CHM136H1)/(CHM138H1, CHM139H1)/CHM151Y1 *Transfer credits will be accepted in lieu of the chemistry requirements only if they carry a direct exclusion or equivalency to a pre-approved chemistry course*
2. MAT135H1/PHY131H1/PHY151H1
3. BCH210H1

**Biological Foundations of Living Systems**

4. BIO120H1, BIO130H1
5. HMB204H1
6. BIO230H1/BIO255H1, BIO220H1
7. HMB265H1/BIO260H1
8. PSL300H1, PSL301H1
Human Biology Program

9. 1.0 FCE from: HMB302H1/ANA300Y1/ANA301H1/BCH311H1/CSB351Y1/IMM340H1/IMM350H1/MGY377H1/MGY378H1/PSL350H1

10. 1.0 FCE from: HMB302H1/HMB303H1/HMB310H1/HMB311H1/HMB312H1/HMB314H1/HMB322H1/HMB323H1/HMB342H1/HMB360H1/EHJ352H1/HMB402H1/HMB406H1/HMB422H1/HMB432H1/HMB434H1/HMB437H1/HMB440H1/HMB441H1/HMB443H1/HMB452H1/HMB462H1/HMB470H1/HMB471H1/HMB473H1/HMB474H1/HMB496Y1/IMM340H1/IMM350H1/IMM430H1/LMP363H1/LMP402H1/LMP403H1/LMP406H1/MJ485H1/MGY377H1/MGY378H1/MGY470H1/NFS284H1/NFS382H1/NFS400H1/NFS485H1/NFS486H1/NFS487H1/NFS489H1/NFS490H1/PCL362H1/PCL473H1/PSL420H1/PSL421H1/PSY371H1/PSY372H1/PSY399H1/PSY440H1/PSY460H1/PSY470H1/PSY471H1/PSY494H1

* A research project from a different unit may be accepted with prior written approval from Human Biology if the course is not counting toward a different program.

Human Biology Major Notes:
1. Courses can only count toward one requirement, even if listed as options to multiple requisites of the program.
2. Not all courses listed have priority enrolment for Human Biology majors. Students are responsible for checking priority of courses and meeting course prerequisites for courses they wish to take.
3. The Human Biology major cannot be paired with any other Human Biology Program managed major program.

Description of Proposed Changes:
Adding BCH311H1/PSL350H1 to the requisite line that requires 1.0 FCE in cellular molecular structure or function courses at the 300-level.

Rationale:
These three courses are useful courses to take, and many students already take them. It will allow students to ensure they have an in-depth understanding of cellular-molecular biology and per- requisite should they choose to take a 400-level course in another unit to satisfy their 400-level course requirement for their HMB Program.

Impact:
Should have little to no impact as the three courses added are already courses many of our students take.

Consultation:
Consultation with HMB Faculty. Consulted with Martha Harris re: adding these three courses to the genetics program, but after that discussion, HMB Faculty discussed it would be useful as an option in all programs (save for neuroscience)

Resource Implications:
2 Course Modifications:

**LMP410H1: Pathobiology of Neurodegenerative Disease**

**Description:**

Molecular basis of neurodegenerative diseases of the central and peripheral nervous systems. Emphasis on the **Relevant neuroanatomy and molecular pathobiology** of neurodegenerative diseases, current research developments and guidance with writing of research proposals on the **CNS**. Mid-term and final exams will practice assembly of a succinct **Current research proposal** and query **topics in** neurodegenerative disease material taught in course **diseases**.

**Prerequisites:**  
BCH311H1 (BIO240H1, BIO241H1)/BIO255Y1/(PSL300H1, PSL301H1)/PSL302Y1

**Rationale:**

Consultation:

Resources:

**LMP436H1: Microbial Pathogenesis**

**Prerequisites:**  
BCH210H1/BCH242Y1, (IMM340H1, IMM350H1)/(IMM341H1, IMM351H1)

**Rationale:**

Consultation:

Resources:
4 Minor Program Modifications:

**Accounting Specialist: Financial Reporting and Control**

<table>
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<tr>
<th>Enrolment Requirements:</th>
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<td><strong>Previous:</strong></td>
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<td><strong>New:</strong></td>
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**Completion Requirements:**

(14.0-15.5 full courses or their equivalent out of 20 courses, for a BCom)

First Year:

1. (ECO101H1, ECO102H1)/ECO100Y1, RSM100H1/MGT100H1/RSM100Y1
2. MAT133Y1/(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1
3. Students who began in September 2016 and after are strongly encouraged to take RSM219H1, RSM230H1 and RSM250H1 in their first year of study
4. Students are encouraged to take one course towards the Breadth Requirement in First Year

Second and Higher Years:

5. ECO204Y1/ECO206Y1, ECO220Y1/ECO227Y1/(STA220H1, STA255H1)*/(STA237H1, STA238H1)/(STA257H1, STA261H1)
6. RSM219H1, RSM220H1, RSM221H1, RSM222H1
7. RSM323H1, RSM324H1, RSM332H1, RSM333H1

* For students who began their Year 2 studies of Rotman Commerce in Fall 2018 and after: STA220H1 and STA255H1 are considered equivalent to ECO220Y1 for the purposes of completing Rotman Commerce program requirements only. They are not considered equivalent by the Economics department. Therefore STA220H1 and STA255H1 will not count towards an ECO minor nor will it count as a pre-req for upper level ECO courses where ECO220Y1 is required. Please consult the Commerce department if you are considering STA220H1 and STA255H1.

Second and Higher Years for students who began studies in September 2016 and onwards:

8. 0.5 from: RSM260H1, RSM270H1, RSM392H1
9. RSM230H1, RSM250H1
10. Any 1.0 300+ ECO
11. Complete 1.0 in Applied Accounting**: RSM328H1, RSM425H1, RSM428H1
12. Complete 1.5 in Advanced Accounting**: RSM320H1, RSM321H1, RSM322H1, RSM327H1, RSM422H1, RSM423H1, RSM424H1, RSM427H1
13. RSM429H1

** at least 0.5 FCE of the courses chosen in #11 and #12 above must be at the 400-series level
Second and higher years for students who began studies prior to September 2016:

8. 1.0 from: RSM250H1, RSM260H1, RSM270H1, RSM392H1

9. Any 1.0 300+ ECO

10. Complete 1.0 in Applied Accounting**: RSM328H1, RSM425H1, RSM428H1

11. Complete 1.5 in Advanced Accounting**: RSM320H1, RSM321H1, RSM322H1, RSM327H1, RSM422H1, RSM423H1, RSM424H1, RSM427H1

12. RSM429H1

** at least 0.5 FCE of the courses chosen in #10 and #11 above must be at the 400-series level

Note: Students must take a minimum of 10.0 RSM and 10.0 non-RSM courses. MGT100H1 will be considered equivalent to RSM100H1 and count as 0.5 RSM courses towards the program requirement for Arts and Science transfer students. Students may enrol in only one Rotman Commerce Specialist.

Description of Proposed Changes:
Economics and Statistics have worked together to create the new paired courses STA237H and STA238H that will be the equivalent to ECO220Y. As they find students who take STA220H and STA255H aren’t as well prepared for 300+ level ECO courses which require ECO220Y as a pre-req they will no longer accept them as an equivalent. In Commerce, we will still allow students to take STA220H and 255H as an equivalent to ECO220Y for program requirements (although students will have to understand that it limits the number of upper-level ECO courses that they can choose from) and students considering that option should seek support from that Academic Advisor.

Rationale:
Some Commerce students prefer to pursue curriculum that are less reliant on data and statistics. Keeping STA220H and STA255H in as an equivalent to ECO220Y allows those who were planning on taking upper level ECO courses that don’t have ECO220Y as a pre-req to still complete all of their requirements. These students are strongly encouraged to meet with their academic advisor so they understand the limitations of their upper year ECO course options.

Impact:
This will maintain the current flexibility in our program for students whose strengths lie in qualitative material.

Consultation:
We have consulted with Economics about this and they are in agreement.

Resource Implications:

Accounting Specialist: Public Accounting

Completion Requirements:

(14.0-15.5 full courses or their equivalent out of 20 courses, for a BCom)

First Year:
1. (ECO101H1, ECO102H1)/ECO100Y1, RSM100H1/MGT100H1/RSM100Y1
2. MAT133Y1/(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1
3. Students who began in September 2016 and after are strongly encouraged to take RSM219H1, RSM230H1 and RSM250H1 in their first year of study.

4. Students are encouraged to take one course towards the Breadth Requirement in First Year.

Second and Higher Years:

5. ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1/(STA220H1, STA255H1) */(STA237H1, STA238H1)/(STA257H1, STA261H1)

6. RSM219H1, RSM220H1, RSM221H1, RSM222H1

7. RSM323H1, RSM324H1, RSM332H1, RSM333H1

* For students who began their Year 2 studies of Rotman Commerce in Fall 2018 and after: STA220H1 and STA255H1 are considered equivalent to ECO220Y1 for the purposes of completing Rotman Commerce program requirements only. They are not considered equivalent by the Economics department. Therefore STA220H1 and STA255H1 will not count towards an ECO minor nor will it count as a pre-req for upper level ECO courses where ECO220Y1 is required. Please consult the Commerce department if you are considering STA220H1 and STA255H1.

Second and Higher Years for students who began studies in September 2016 and onwards:

8. RSM225H1, RSM230H1, RSM250H1

9. RSM320H1, RSM321H1, RSM322H1

10. Any 1.0 300+ ECO

11. RSM422H1, RSM423H1, RSM424H1, RSM426H1, RSM427H1

Second and higher years for students who began studies prior to September 2016:

8. RSM225H1

9. 0.5 from RSM230H1, RSM250H1, RSM260H1, RSM270H1, RSM392H1

10. RSM320H1, RSM321H1, RSM322H1

11. Any 1.0 300+ ECO

12. RSM422H1, RSM423H1, RSM424H1, RSM426H1, RSM427H1

Note: Students must take a minimum of 10.0 RSM and 10.0 non-RSM courses. MGT100H1 will be considered equivalent to RSM100H1 and count as 0.5 RSM courses towards the program requirement for Arts and Science transfer students. ECO209Y1 and ECO374H1 are strongly recommended. Students may enrol in only one Rotman Commerce Specialist.

Description of Proposed Changes:

Economics and Statistics have worked together to create the new paired courses STA237H and STA238H that will be the equivalent to ECO220Y. As they find students who take STA220H and STA255H aren’t as well prepared for 300+ level ECO courses which require ECO220Y as a pre-req they will no longer accept them as an equivalent. In Commerce, we will still allow students to take STA220H and 255H as an equivalent to ECO220Y for program requirements (although students will have to understand that it limits the number of upper-level ECO courses that they can choose from) and students considering that option should seek support from that Academic Advisor.

Rationale:
Some Commerce students prefer to pursue curriculum that are less reliant on data and statistics. Keeping STA220H and STA255H in as an equivalent to ECO220Y allows those who were planning on taking upper level ECO courses that don’t have ECO220Y as a pre-req to still complete all of their requirements. These students are strongly encouraged to meet with their academic advisor so they understand the limitations of their upper year ECO course options.

**Impact:**
This will maintain the current flexibility in our program for students whose strengths lie in qualitative material.

**Consultation:**
We have consulted with Economics about this and they are in agreement.

**Resource Implications:**

---

**Finance and Economics Specialist**

**Completion Requirements:**

(14.0-14.5 full courses or their equivalent out of 20 courses, for a BCom)

**First Year:**

1. (ECO101H1, ECO102H1)/ECO100Y1, RSM100H1/MGT100H1/RSM100Y1

2. MAT133Y1/(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

3. Students who began in September 2016 and after are strongly encouraged to take RSM219H1, RSM230H1 and RSM250H1 in their first year of study

4. Students are encouraged to take one course towards the Breadth Requirement in First Year

**Higher Years for students who began studies in September 2016 and onwards:**

5. ECO204Y1/ECO206Y1; ECO208Y1/ECO209Y1; ECO220Y1/ECO227Y1/(STA220H1, STA255H1) *(STA237H1, STA238H1)/(STA257H1, STA261H1)

6. RSM219H1, RSM222H1, RSM230H1, RSM250H1

7. Complete 0.5 from: RSM260H1, RSM270H1, RSM392H1

8. RSM330H1, RSM332H1, RSM333H1

9. Any 2.5 300+ ECO

10. 1.0 from: RSM430H1, RSM432H1, RSM433H1, RSM434H1, RSM435H1, RSM437H1

11. 0.5 from: RSM295Y0/RSM395Y0, RSM437H1 (note: RSM437H1 may be counted towards requirement 10 OR 11 – not both), RSM462H1, RSM480H1, RSM490H1, RSM491H1

* For students who began their Year 2 studies of Rotman Commerce in Fall 2018 and after: STA220H1 and STA255H1 are considered equivalent to ECO220Y1 for the purposes of completing Rotman Commerce program requirements only. They are not considered equivalent by the Economics department. Therefore STA220H1 and STA255H1 will not count towards an ECO minor nor will it count as a pre-req for upper level ECO courses where ECO220Y1 is required. Please consult the Commerce department if you are considering STA220H1 and STA255H1.

**Higher years for students who began their studies prior to September 2016:**
Description of Proposed Changes:
Economics and Statistics have worked together to create the new paired courses STA237H and STA238H that will be the equivalent to ECO220Y. As they find students who take STA220H and STA255H aren’t as well prepared for 300+ level ECO courses which require ECO220Y as a pre-req they will no longer accept them as an equivalent. In Commerce, we will still allow students to take STA220H and 255H as an equivalent to ECO220Y for program requirements (although students will have to understand that it limits the number of upper-level ECO courses that they can choose from) and students considering that option should seek support from their Academic Advisor.

Rationale:
Some Commerce students prefer to pursue curriculum that are less reliant on data and statistics. Keeping STA220H and STA255H in as an equivalent to ECO220Y allows those who were planning on taking upper level ECO courses that don’t have ECO220Y as a pre-req to still complete all of their requirements. These students are strongly encouraged to meet with their academic advisor so they understand the limitations of their upper year ECO course options.

Impact:
This will maintain the current flexibility in our program for students whose strengths lie in qualitative material.

Consultation:
We have consulted with Economics about this and they are in agreement.

Resource Implications:

Management Specialist

Completion Requirements:

(12.0-12.5 full courses or their equivalent out of 20 courses, for a BCom)

First Year:
1. (ECO101H1, ECO102H1)/ECO100Y1, RSM100H1/MGT100H1/RSM100Y1
2. MAT133Y1/(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1
3. Students who began in September 2016 and after are strongly encouraged to take RSM219H1, RSM230H1 and RSM250H1 in their first year of study.

4. Students are encouraged to take one course towards the Breadth Requirement (above) in First Year.

Higher Years for students who began studies in September 2016 and onwards:

5. ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1/(STA220H1, STA255H1) */(STA237H1, STA238H1)/(STA257H1, STA261H1)

6. RSM219H1, RSM222H1, RSM230H1, RSM250H1, RSM260H1, RSM270H1

7. RSM332H1, RSM333H1, RSM392H1

8. Any 1.0 300+ ECO

9. 1.0 from: ECO324Y1 */ECO324H1, ECO357H1, ECO364H1, ECO365H1, ECO419H1, ECO435H1, ECO451H1, ECO457Y1 *, ECO459H1, RSM295Y0/RSM395Y0 *, RSM437H1, RSM462H1, RSM480H1, RSM490H1, RSM491H1 (excluding any courses that have already been used to satisfy requirement 8, as outlined above)

*For students who began their Year 2 studies of Rotman Commerce in Fall 2018 and after NOTE: STA220H1 and STA255H1 are considered equivalent to ECO220Y1 for the purposes of completing Rotman Commerce program requirements only. They are not considered equivalent by the Economics department. Therefore STA220H1 and STA255H1 will not count towards an ECO minor nor will it count as a pre-req for upper level ECO courses where ECO220Y1 is required. Please consult the Commerce department if you are considering STA220H1 and STA255H1.

** Y courses may count only as 0.50 FCEs towards this requirement.

10. Any 1.0 400-level RSM, in addition to any courses taken in requirement 9 above.

Higher years for students who began their studies prior to September 2016:

5. ECO204Y1/ECO206Y1; ECO220Y1/ECO227Y1/(STA220H1, STA255H1)/(STA257H1, STA261H1)

6. RSM219H1, RSM222H1, RSM230H1, RSM260H1, RSM270H1

7. RSM332H1, RSM333H1, RSM392H1

8. Any 1.0 300+ ECO

9. 1.0 from: ECO324Y1 */ECO324H1, ECO357H1, ECO364H1, ECO365H1, ECO419H1, ECO435H1, ECO451H1, ECO457Y1 *, ECO459H1, RSM295Y0/RSM395Y0 *, RSM437H1, RSM462H1, RSM480H1, RSM490H1, RSM491H1 (excluding any courses that have already been used to satisfy requirement 8, as outlined above)*NOTE: Y courses may count only as 0.50 FCEs towards this requirement.

6. Any 1.0 400-level RSM, in addition to any courses taken in requirement 9 above.

Note: Students must take a minimum of 10.0 RSM and 10.0 non-RSM courses. MGT100H1 will be considered equivalent to RSM100H1 and count as 0.5 RSM courses towards the program requirement for Arts and Science transfer students. Students may enrol in only one Rotman Commerce Specialist.

Description of Proposed Changes:

Economics and Statistics have worked together to create the new paired courses STA237H and STA238H that will be the equivalent to ECO220Y. As they find students who take STA220H and STA255H aren’t as well prepared for 300+ level ECO courses which require ECO220Y as a pre-req they will no longer accept them as an equivalent. In Commerce, we will still allow students to take STA220H and 255H as an equivalent to ECO220Y for program...
requirements (although students will have to understand that it limits the number of upper-level ECO courses that they can choose from) and students considering that option should seek support from that Academic Advisor.

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<thead>
<tr>
<th><strong>Rationale:</strong></th>
</tr>
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<th><strong>Resource Implications:</strong></th>
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</table>
2 Minor Program Modifications:

Mathematical Applications in Economics and Finance Specialist

Completion Requirements:

(12-12.5 FCE, including at least 1.5 FCE at the 400-level)

First Year:
ECO100Y1/(ECO101H1, + ECO102H1); MAT137Y1/MAT157Y1, MAT223H1, MAT224H1

(Please check the requirements for ECO206Y1 to ensure that you pass these first year courses with grades that allow registration in ECO206Y1)

Second Year:
ECO206Y1; MAT237Y1, MAT244H1, MAT246H1 (waived for students taking MAT157Y1 taking157Y1); STA257H1, STA261H1

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/PHL265H1/PLH273H1/PLH275H1/PLH281H1 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 VIC172Y1.

Third Year:
1. APM346H1; ECO358H1; ECO359H1; MAT337H1; STA302H1/ECO375H1; STA347H1
2. One of: MAT332H1, MAT344H1, MAT334H1, MAT475H1

Fourth Year:
APM462H1, APM466H1; STA457H1

NOTE:
1. Students planning to take specific fourth year courses should ensure that they have the necessary third year prerequisites.
2. Please note that STA457H1 lists STA302H1 one of the prerequisite so you are encouraged to plan ahead.

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:
Mathematics Minor

Completion Requirements:

(4.0 FCE)

1. (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1
2. MAT221H1 (80%+)/MAT223H1/MAT240H1, MAT235Y1/MAT237Y1/MAT257Y1, MAT224H1/MAT244H1/
   MAT246H1/APM236H1/MAT247H1
   Note: MAT221H1/MAT223H1 should be taken in first year
3. Additional 1.0 FCE at the 300+ level from APM/MAT/HPS390H1/HPS391H1/PSL432H1

NOTE:
1. In the minor program, higher level courses within the same topic are acceptable substitutions.
2. Students planning to take specific third and fourth year courses should ensure that they have the necessary first, second
   and third year prerequisites.
3. Please note that APM306Y1 accounts for 0.5 credits of Society and its Institution (BR 3) and 0.5 credits of The Physical
   and Mathematical Universes (BR5)
4. This course will only account for a half credit in BR5 for this program.

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

1 New Course:

MAT377H1: Mathematical Probability and Random Variables

Contact Hours:

Lecture: 36 / Tutorial: 12

Description:

This course introduces students to various topics in probability theory. Topics include basic concepts (such as
probability, random variables, expectations, conditional probability), examples of distributions and stochastic processes
and their properties, convergence results (such as the law of large numbers, central limit theorem, random series, etc.),
various inequalities, and examples of applications.

Prerequisites:

MAT157Y1, MAT247H1

Corequisites:
Exclusions:
   STA347H1

Recommended Preparation:

Breadth Requirements:
   The Physical and Mathematical Universes (5)

Distribution Requirements:

Competencies:
   Communication: slightly; Critical and Creative Thinking: extensively; Information Literacy: slightly
   Quantitative Reasoning: extensively; Social and Ethical Responsibility: none

Experiential Learning:
   Research: none; Other: none

Rationale:
   Probability theory is one of the most active areas of mathematics today, and specialist undergraduate students in mathematics, physics, and computer science, should be introduced to the field before they go to graduate school. Right now Mathematics Department does not offer any course in probability. Compared, for example, to STA347H1, the course will go more in depth while giving examples of applications of probabilistic ideas beyond statistics (for example, geometry and computer science) and incorporating modern ideas (such as concentration inequalities and random graphs, among many other possible topics).

   All other parameters are the same as standard 300-level course, such as Differential Geometry.

Consultation:

Resources:

Overlap with Existing Courses:

Programs of Study for Which This Course Might be Suitable:

Estimated Enrolment:

Instructor:

3 Course Modifications:

APM306Y1: Mathematics and Law

Description:

This course examines the relationship between legal reasoning and mathematical logic; provides a mathematical perspective on the legal treatment of interest and actuarial present value; critiques ethical issues; analyzes how search engine techniques on massive databases transform legal research and considers the impact of statistical analysis and game
theory on litigation strategies.

NOTE

This course counts as 0.5 FCE in BR3 and 0.5 FCE in BR5.

This course will only contribute 0.5 FCE to the Math Minor program.

Breadth Requirements:
The Physical and Mathematical Universes (5), Society Thought, Belief and Its Institutions (3) Behaviour (2)

Rationale:

Consultation:

Resources:

MAT347Y1: Groups, Rings and Fields

Prerequisites:
MAT257Y1/(85% in MAT247H1 and permission of the instructor)

Rationale:

Consultation:

Resources:

MAT351Y1: Partial Differential Equations

Prerequisites:
MAT257Y1/85% in MAT237Y1, MAT267H1

Corequisites:
Previous: MAT334H1/MAT354H1

Rationale:

Consultation:

Resources:
3 Minor Program Modifications:

Physics Major

Completion Requirements:

(8.0-7.5 FCE including at least 2.0 FCE at the 300+ level, with at least 0.5 FCE at the 400 level)

A Physics Major program is appropriate for students interested in a more flexible and diverse undergraduate physics program. A Physics Major may be tailored to be a natural counterpart to a second Major in mathematics, astronomy, computer science, environmental science, geology or the life sciences. Students should consult the Associate Chairs (Undergraduate Studies) of Physics and the respective departments for advice on course selections.

First Year: (2.0 FCE)

(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1, PHY131H1/PHY151H1, PHY132H1/PHY152H1

Second Year: (3.0 FCE)

1. MAT235Y1/MAT237Y1/MAT257Y1, MAT223H1/MAT240H1, PHY224H1

2. 1.0 FCE from PHY231H1, PHY331H1, PHY250H1, PHY252H1, PHY254H1, PHY256H1

Third Year: (2.5 FCE)

1. MAT244H1/MAT267H1, PHY324H1/PHY405H1/PHY407H1/PHY408H1

2. 1.5 FCE, including at least 0.5 FCE at the PHY400 level, from APM346H1/MAT334H1/MAT354H1; PHY-300 level courses/PHY-400 level courses/JPE395H1/JPE493H1, excluding JPH311H1, JPH441H1

Third or Fourth Year Notes: (0.5 FCE)

1. Ethics and Social Responsibility Requirement: The Physics course JPH441H1 meets this requirement as well as any of the following courses: ETH201H1/ETH210H1 /ETH220H1 /HPS200H1 /PHL265H1 /PHL273H1 /PHL275H1 /PHL281H1/IMC200H1 /VIC172H1 /ENV333H1 . See Note 2.

Notes:

1. Students in the Physics Major program who are is not designed primarily for students intending to pursue graduate studies in Physics. Such students should consult with the Physics Specialist or one of the Associate Chair (Undergraduate Studies) joint Specialist programs.

2. Requirement 1 in Third or Fourth Year represents 0.5 FCE Students are expected to take an Arts & Science course with a significant emphasis on "Ethics and Social Responsibility" satisfying this requirement may be substituted subject to approval from by the Associate Chair (Undergraduate Studies).
**Rationale:**
Tidied up the notes. Changed the wording to reflect the reality in Degree Explorer that the Ethics Requirement is required for graduation, not just suggested. This major has always been 8.0 FCE when you include this ethics requirement.

**Impact:**

**Consultation:**
All changes approved by Physics UGCC on November 24, 2017.

**Resource Implications:**

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### Physics Minor

**Completion Requirements:**

(4.0 FCE)

First Year: (1.0 FCE)
PHY131H1/PHY151H1, PHY132H1/PHY152H1

Second Year: (2.0 FCE)
1. PHY224H1
2. 1.5 FCE from PHY231H1, PHY250H1, PHY252H1, PHY254H1, PHY256H1

Third Year: (1.0 FCE)
1. PHY324H1/PHY405H1 /PHY407H1 /PHY408H1
2. 0.5 FCE from: APM346H1/MAT334H1/MAT354H1; PHY-300 level course/PHY-400 level course/JPE395H1/JPE493H1, excluding JPH311H1, JPH441H1

### Description of Proposed Changes:

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### Physics Specialist

**Completion Requirements:**
The Physics Specialist Program offers rigorous training in the full spectrum of core physics subfields, as well as their numerous important applications. Practical courses treat the experimental and computational aspects and complement the lecture courses. Physics concerns many of the most fundamental questions in our scientific understanding of the universe. What is the nature of matter and energy at the smallest scales? What are the physical processes that govern the Earth’s climate? What is the nature of light and how can it be controlled? How do the collective properties of solids emerge from those of individual atoms? How do biological processes organize themselves to maintain their survival? What is the structure and evolution of the Earth and the other planets? How can quantum information be used for computation? Physics seeks answers to these questions using a combination of theory, computation and precise experimental work, and the results find application across all of science.

Consult the Associate Chair (Undergraduate Studies), Department of Physics.

(13.5 FCE, including at least one full course at the 400 level)

First Year: (2.5 FCE)

(MAT135H1, MAT136H1)/MAT137Y1, MAT223H1/MAT240H1, PHY131H1/PHY151H1, PHY132H1/PHY152H1

(The courses MAT137Y1, MAT223H1, PHY151H1, PHY152H1 are recommended.)

Second Year: (4.0 FCE)

MAT237Y1/MAT257Y1/MAT235Y1, MAT244H1/MAT267H1, PHY224H1, PHY250H1, PHY252H1, PHY254H1, PHY256H1

(The courses MAT237Y1, MAT244H1 are recommended.)

Second or Third Year: (0.5 FCE)

PHY324H1

Third Year: (3.0 FCE)

1. APM346H1, MAT334H1/MAT354H1, PHY350H1, PHY354H1, PHY356H1

2. Additional 0.5FCE from PHY-300 level courses/PHY-400 level courses/JPE395H1/JPE493H1, excluding JPH311H1, JPH441H1

Third or Fourth Year: (3.5 FCE)

1. PHY424H1

2. 1.0 FCE from PHY450H1, PHY452H1, PHY454H1, PHY456H1, PHY460H1

3. PHY405H1/PHY407H1/PHY408H1/PHY426H1/PHY478H1. See Note 2.

4. 1.0 FCE, including at least 0.5 FCE at the PHY-400 level, from PHY-300 level courses/PHY-400 level courses/JPE395H1/JPE493H1, excluding JPH311H1, JPH441H1

5. Ethics and Social Responsibility Requirement: The Physics course JPH441H1 meets this requirement as well as any of the following courses: ETH201H1/ETH210H1/ETH220H1/HPS200H1/PHL265H1/PHL273H1/PHL275H1/PHL281H1/IMC200H1/VIC172H1/ENV333H1. See Note 3.

Notes:
1. Students are encouraged but not required to enrol in the independent study and project courses such as PHY371H1, PHY478H1, etc..

2. PHY479Y1 (Undergraduate Research Project) satisfies Requirement 3 in Third or Fourth Year and counts as 0.5 FCE at the PHY-400 level for Requirement 4 in Third or Fourth Year. Students may use MAT351Y1 APM351Y1 instead of APM346H1 for Requirement 1 in Third Year.

3. Requirement 5 in Third or Fourth Year represents 0.5 FCE with a significant emphasis on "Ethics and Social Responsibility". Students may use the CR/NCR option towards any of the courses listed in Requirement 5. Another Arts & Science course with a significant emphasis on “Ethics and Social Responsibility” may be substituted subject to approval from the Associate Chair (Undergraduate Studies).

4. The requirement for an integrative, inquiry-based activity is satisfied by the required course PHY424H1.

**Description of Proposed Changes:**
This proposal simply involves replacing a course that has been retired with the current version of the course offered by the same department (i.e., Department of Mathematics).

**Rationale:**

**Impact:**

**Consultation:**

**Resource Implications:**
2 Minor Program Modifications:

**Physiology Major**

<table>
<thead>
<tr>
<th>Enrolment Requirements:</th>
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<tbody>
<tr>
<td>This is a limited enrolment program that can only accommodate a limited number of students. Eligibility will be competitive and based on a student’s marks in the 3.0 FCE required first-year courses:</td>
</tr>
<tr>
<td>BIO120H1, BIO130H1, (CHM135H1, CHM136H1)/CHM151Y1, and 1.0 FCE from any of the following: MAT135H1, MAT136H1, MAT137Y1, MAT157Y1, PHY131H1, PHY132H1, PHY151H1, PHY152H1 with an average of at least 70% on these 3.0 full-course equivalents (FCEs) and a final mark of at least 60% in each course.</td>
</tr>
<tr>
<td>While it is difficult to predict what will be competitive course marks and average in a given year, based on previous years, the estimate is: course marks = mid 70s; average = mid 70s.</td>
</tr>
<tr>
<td>Achieving these estimated marks does not guarantee admission to the program in any given year.</td>
</tr>
<tr>
<td>Note: Students must apply to this program on the Arts &amp; Science Faculty Registrar’s Office website (see the Arts &amp; Science Program Enrolment website for application procedures).</td>
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<td>(8 full courses or their equivalent, including 0.5 FCE at the 400-level)</td>
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<tr>
<td><strong>First Year:</strong></td>
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<tr>
<td>1. 2 full course equivalent from (BIO120H1, BIO130H1)/BIO150Y1; (CHM135H1, CHM136H1)/CHM151Y</td>
</tr>
<tr>
<td>2. 1 full course equivalent from any of the following: MAT135H1, MAT136H1; MAT137Y1, MAT157Y1, PHY131H1, PHY132H1, PHY151H1, PHY152H1</td>
</tr>
<tr>
<td><strong>Second Year:</strong></td>
</tr>
<tr>
<td>2 full course equivalent from BCH210H1; BIO230H1/BIO255H1; PSL300H1, PSL301H1</td>
</tr>
<tr>
<td><strong>Higher Years:</strong></td>
</tr>
<tr>
<td>1. 1 full course equivalent from PSL372H1, PSL350H1/BCH311H1/Csb349H1</td>
</tr>
<tr>
<td>2. 1 full course equivalent from ANA300Y1, ANA301H1; CSB325H1, CSB330H1, CSB332H1/CJH332H1, CSB343H1, CSB345H1/CSB445H1, CSB346H1, CSB347H1; IMM340H1/IMM341H1, IMM350H1/IMM351H1; NFS284H1; PCL201H1, PCL285H1, PCL302H1; PSY201H1; PSY397H1; STA220H1</td>
</tr>
<tr>
<td>3. 1 full course equivalent from HMB430H1/HMB470H1/HMB472H1; PSL304H1, PSL305H1, PSL310H1, PSL374H1, PSL378H1/PSL379H1/PSL379H0/PSL398H0/PSL398H1, PSL399Y1, PSL380H1, PSL400-series courses</td>
</tr>
</tbody>
</table>

**Description of Proposed Changes:**

**Rationale:**

**Impact:**

**Consultation:**
Physiology Specialist

Completion Requirements:

Physiology Specialist program (14 full courses or their equivalent)

First Year: (4 full course equivalent from the following)
BIO120H1/PSL190H1, BIO130H1; (CHM135H1/CHM139H1), (CHM136H1/CHM138H1), (PHY131H1, PHY132H1)/(PHY151H1, PHY152H1)

First Year or upper years:
(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

Second Year:
1. 2.5 full course equivalents from BCH210H1; BIO230H1/BIO255H1; CHM220H1/CHM247H1/CHM249H1;
PRL300H1, PSL301H1
2. 1.5 full course equivalents from BIO220H1, BIO260H1/HMB265H1; MAT235Y1, PHY231H1, PSL299Y1/PSL399Y1;
   STA220H1/STA250H1

Third Year:
1. 3 full course equivalent from BCH370H1; PSL304H1, PSL305H1, PSL350H1/CSB349H1/BCH311H1, PSL372H1;
   PSL374H1
2. 1 full course equivalent from the following list: ANA300Y1, ANA301H1; BME498Y1; CSB325H1, CSB332H1/
   CJH332H1, CSB343H1, CSB345H1/CSB445H1, CSB346H1, CSB347H1; IMM340H1/IMM341H1, IMM350H1/
   IMM351H1; PCL201H1, PCL285H1, PCL302H1; PHY331H1, PSL310H1; PSL378H1/PSL379H1/PSL398H1;
   PSY397H1

Fourth Year: (at least 2 FCEs at 400-level)
1. PSL496Y/PSL497H1/PSL498Y1/PSL499H1
2. 1-1.5 full course equivalents from PSL400-series or HMB430H1/HMB470H1/HMB472H1

* These courses may be taken in the first year or subsequent years, and are not required for entrance into the
specialist program.

Description of Proposed Changes:

Rationale:

Impact:

Consultation:

Resource Implications:

5 Course Modifications:
PSL280H1: Introduction to Physiologic Adaptations of Marine Mammals

**Prerequisites:**
(BIO120H1, BIO130H1) or BIO150Y1, CHM136H1/CHM138H1/CHM151Y1 or permission of the course coordinator.

**Rationale:**

**Consultation:**

**Resources:**

PSL300H1: Human Physiology I

**Recommended Preparation:**
BIO130H1, CHM136H1 or BIO130H1; CHM138H1/CHM151Y1; and 1 FCE from any of the following: MAT135H1, MAT136H1, MAT135Y1, MAT137Y1, MAT157Y1, PHY131H1, PHY132H, PHY151H1, PHY152H1

**Rationale:**

**Consultation:**

**Resources:**

PSL301H1: Human Physiology II

**Recommended Preparation:**
BIO130H1, CHM136H1 or BIO130H1; CHM138H1/CHM151Y1; and 1 FCE from any of the following: MAT135H1, MAT136H1, MAT135Y1, MAT137Y1, MAT157Y1, PHY131H1, PHY132H, PHY151H1, PHY152H1

**Rationale:**

**Consultation:**

**Resources:**

PSL304H1: Topics in Cellular, Molecular and Organismic Physiology I

**Prerequisites:**
BCH210H1, PSL300H1, PSL301H1, MAT100-series; PHY100-series

**Rationale:**

**Consultation:**

**Resources:**
# PSL350H1: Mammalian Molecular Biology

<table>
<thead>
<tr>
<th>Prerequisites:</th>
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<tbody>
<tr>
<td>BIO230H1/BIO255H1, PSL300H1, BCH210H1</td>
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<th>Rationale:</th>
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<th>Resources:</th>
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4 Minor Program Modifications:

Psychology Major

Enrolment Requirements:

The Major is a Type 2L(Limited) program that can only accept a limited number of students. The quantity of applications received in a given year always far exceeds the number of spaces available in the program. Eligibility will be based on the following criteria, however, achieving the minimum marks listed does not guarantee admission to the Major in any given year. Please have a back-up plan/program in place, should you not be admitted.

Applying with fewer than 8 FCEs completed:

- PSY100H1 with a final mark of at least 75% (AP and IB Psychology are not accepted)
- A senior-level (Gr. 12) high school course in Calculus
- A senior-level (Gr. 12) high school course in Biology (effective for entry in Spring 2020)
- Completion of at least 4 FCEs

Effective for admission to the University starting in September 2018; a grade 12 science credit in biology, physics, or chemistry will be required (pending Faculty approval)

Applying with 8 or more FCEs completed:

- Completion of PSY100H1 (AP and IB Psychology are not accepted)
- A senior-level (Gr. 12) high school course in Calculus
- A senior-level (Gr. 12) high school course in Biology (effective for entry in Spring 2020)
- Completion of at least 8 FCEs
- PSY201H1 (or equivalent course in statistics), plus at least 1 FCE in PSY at the 200-level (taken from the PSY210H1 - PSY290H1 series) with an average of 73%* across all three courses. If more than two PSY 200-levels have been completed, we will take the two with the highest grades.

NOTE: For students entering Effective for admission to the University starting in September 2019 or later 2018, it is recommended to have a grade 12 science credit in biology, physics, or chemistry will be needed for admission to any Psychology program of study. required (pending Faculty approval)

*In past admission cycles, the average grade cut-off for the Major program ranged from approximately 80-84%. This may vary from year to year, and can even be higher.

Description of Proposed Changes:

Changing previous statement about requiring a grade 12 science credit for admission effective September 2018, we are now changing this statement to: "Effective for admission to the University starting in September 2019, a grade 12 Biology credit will be required". This was approved at a meeting with the Acting Chair of Psychology and the Admissions Committee on November 22nd, 2017.

Rationale:

Impact:

Consultation:
Psychology Minor

Enrolment Requirements:

The Minor is a Type 2(Limited) program that can only accept a limited number of students. The quantity of applications received in a given year always far exceeds the number of spaces available in the program. Eligibility will be based on the following criteria; however, achieving the minimum marks listed does not guarantee admission to the Minor in any given year. Please have a back-up plan/program in place, should you not be admitted.

Applying with fewer than 8 FCEs completed:

- PSY100H1 with a final mark of at least 73% (AP and IB Psychology are not accepted)
- A senior-level (Gr. 12) high school course in Calculus
- A senior-level (Gr. 12) high school course in Biology (effective for entry in Spring 2020)
- Completion of at least 4 FCEs

Applying with 8 or more FCEs completed:

- Completion of PSY100H1 (AP and IB Psychology are not accepted)
- A senior-level (Gr. 12) high school course in Calculus
- A senior-level (Gr. 12) high school course in Biology (effective for entry in Spring 2020)
- Completion of at least 8 FCEs
- PSY201H1 (or equivalent course in statistics), plus at least 1 FCE in PSY at the 200-level (taken from the PSY210H1 - PSY290H1 series) with an average of 70%* across all three courses. If more than two PSY 200-levels have been completed, we will take the two with the highest grades.

NOTE: For students entering Effective for admission to the University for starting in September 2019 or later 2018, it is recommended to have a grade 12 science credit in biology credit; physics; or chemistry will be required (pending Faculty approval)

*In past admission cycles, the average grade cut-off for the Minor program ranged from approximately 77-79%. This may vary from year to year, and can even be higher.

Description of Proposed Changes:

Changing previous statement about requiring a grade 12 science credit for admission effective September 2018, we are now changing this statement to: "Effective for admission to the University starting in September 2019, a grade 12 Biology credit will be required". This was approved at a meeting with the Acting Chair of Psychology and the Admissions Committee on November 22nd, 2017.

Rationale:

Impact:
Psychology Research Specialist - Thesis

Enrolment Requirements:

Students should apply at the end of their second year and begin the program in their third. Interested students should ideally apply for a PSY Major or Specialist(Non-thesis) at the end of their first year. All students accepted into or considering the Research Specialist program should enrol in a PSY lab course in their third year. In addition to applying in the spring via the Arts & Science website, students may also apply directly to the department in the fall of their third year and begin the program that January. The deadline for the second round of applications is usually in October. More information on the fall applications can be found at http://home.psych.utoronto.ca/undergraduate/info/rsp.htm.

The Research Specialist program is a Type 3 program and, therefore, enrolment is limited to no more than 15 students per year. Eligibility is highly competitive and based on the following criteria. **Please note that meeting the following minimum requirements does not guarantee admission.**

- PSY100H1 with a final mark of at least 80%  *(AP and IB Psychology are not accepted)*
- A senior-level (Gr. 12) high school course in Calculus
- A senior-level (Gr. 12) high school course in Biology  *(effective for entry in Spring 2020)*
- Completion of at least 8 FCEs
- Completion of PSY201H1 and PSY202H1 (or equivalent courses in statistics), with an overall average of at least 75%
- Minimum completion of an additional 2 FCEs at the 200-level in PSY (taken from the PSY210H1 - PSY290H1 series), with an overall average of at least 78% taken from the top four grades (this does not include PSY201H1 or PSY202H1)

**NOTE:** For students entering **Effective for admission to the University for starting in September 2019 or later 2018,** it is recommended to have a grade 12 **science credit in biology credit; physics, as it or chemistry will be needed for admission to any Psychology program of study. required (pending Faculty approval)**

Description of Proposed Changes:

Changing previous statement about requiring a grade 12 science credit for admission effective September 2018, we are now changing this statement to: "Effective for admission to the University starting in September 2019, a grade 12 Biology credit will be required". This was approved at a meeting with the Acting Chair of Psychology and the Admissions Committee on November 22nd, 2017.

Rationale:

Impact:

Consultation:

Resource Implications:
Psychology Specialist

Enrolment Requirements:

The Specialist is a Type 2L (Limited) program that can only accept a limited number of students. The quantity of applications received in a given year always far exceeds the number of spaces available in the program. Eligibility will be based on the following criteria, however, achieving the minimum marks listed does not guarantee admission to the Specialist in any given year. Please have a back-up plan/program in place, should you not be admitted.

Applying with fewer than 8 FCEs completed:

- PSY100H1 with a final mark of at least 80% *(AP and IB Psychology are not accepted)*
- A senior-level (Gr. 12) high school course in Calculus
- A senior-level (Gr. 12) high school course in Biology *(effective for entry in Spring 2020)*
- Completion of at least 4 FCEs

*Effective for admission to the University starting in September 2018; a grade 12 science credit in biology, physics, or chemistry will be required (pending Faculty approval)*

Applying with 8 or more FCEs completed:

- Completion of PSY100H1 *(AP and IB Psychology are not accepted)*
- A senior-level (Gr. 12) high school course in Calculus
- A senior-level (Gr. 12) high school course in Biology *(effective for entry in Spring 2020)*
- Completion of at least 8 FCEs
- PSY201H1 and PSY202H1 (or equivalent courses in statistics), plus at least 1 FCE in PSY at the 200-level (taken from the PSY210H1 - PSY290H1 series) with an average of 75%* across all four courses. If more than two PSY 200-levels have been completed, we will take the two with the highest grades.

*NOTE: For students entering Effective for admission to the University for starting in September 2019 or later 2018, it is recommended to have a grade 12 science credit in biology credit, physics, as it or chemistry will be needed for admission to any Psychology program of study. *(pending Faculty approval)*

*In past admission cycles, the average grade cut-off for the Specialist program ranged from approximately 83-86%. This may vary from year to year, and can even be higher.*

Description of Proposed Changes:

Changing previous statement about requiring a grade 12 science credit for admission effective September 2018, we are now changing this statement to: "Effective for admission to the University starting in September 2019, a grade 12 Biology credit will be required". This was approved at a meeting with the Acting Chair of Psychology and the Admissions Committee on November 22nd, 2017.

Rationale:

Impact:

Consultation:

Resource Implications:
# 1 Course Modification:

**PSY202H1: Statistics II**

<table>
<thead>
<tr>
<th>Exclusions:</th>
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<tbody>
<tr>
<td>ECO220Y1/ECO227Y1/STA221H1/SOC252H1/SOC300H1</td>
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<table>
<thead>
<tr>
<th>Rationale:</th>
</tr>
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<tbody>
<tr>
<td>Just adding SOC252H1 as an exclusion, as just became aware of this course.</td>
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<th>Consultation:</th>
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<th>Resources:</th>
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</table>
This is a limited enrolment program. All students who request the program and obtain at least the specified mark(s) in the required course(s) will be eligible to enrol. Courses required in either the major or specialist programs in actuarial science may not be taken as CR/NCR.

In order to enrol into the Actuarial Science Specialist program, the following courses must be completed: MAT137Y1 with a final mark of at least 65%, and ECO101H1 + ECO102H1 both with a final mark of at least 70%, and ACT240H1 and ACT245H1 and ACT247H1 with a final mark of at least 70% in each course. Students will usually enrol into the Actuarial Science Major program after completion of MAT137Y1 and ECO101H1 + ECO102H1, and then they will enrol into the Specialist program after the completion of ACT240H1, ACT245H1 and ACT247H1. Once these requirements are met by a student, the student will be eligible to enroll in the Actuarial Science Specialist Program. Note that the Mathematics Department enforces MAT223H1/MAT240H1 as a prerequisite for MAT237Y1.

Completion Requirements

(12.5 courses)
This program is designed to prepare a student for professional work as an actuary, and more generally in the financial risk management industry.

First Year:
1. ECO101H1 (70%), ECO102H1 (70%)
2. MAT137Y1 (65%)/MAT157Y1
3. MAT223H1/MAT240H1 (should be taken in first year, enforced as a prereq for MAT237Y1)
4. CSC108H1/CSC120H1/CSC121H1/CSC148H1
STA130H1 is strongly recommended.

Second Year:
1. ACT240H1 (70%), ACT245H1 (70%), ACT247H1 (70%)
2. MAT237Y1/MAT257Y1
3. STA257H1, STA261H1
4. MGT201H1

Higher Years:
ACT348H1, ACT349H1, ACT370H1, ACT451H1, ACT452H1, ACT455H1, ACT460H1, ACT466H1, STA302H1, STA347H1, STA457H1

NOTES:
In order to enroll in ANY 300- or 400-level ACT course, the minimum grade of C must be obtained in each
of ACT240H1, ACT245H1 and ACT247H1. The enrolment requirements and the prerequisites for all ACT courses will be strictly enforced.

Students who have an interest in pursuing studies in mathematical finance should consider taking MAT244H1, MAT336H1/MAT337H1 and APM346H1. Students in the Actuarial Science Specialist Program who have successfully completed ACT348H1 and ACT349H1 may request to enroll in the following RSM courses (provided the appropriate prerequisites and corequisites are met): RSM430H1, RSM433H1, RSM437H1. MAT246H1 is recommended (not required) for students in the Actuarial Science Specialist Program.

### Proposed Calendar Copy

#### Enrolment Requirements

This is a limited enrolment program. All students who request the program and obtain at least the specified mark(s) in the required course(s) will be eligible to enrol. Courses intended to count toward either the major or specialist programs in actuarial science may not be taken as CR/NCR.

In order to enrol into the Actuarial Science Specialist program, the following courses must be completed: MAT137Y1 with a final mark of at least 63%, and ACT240H1 and ACT245H1 and ACT247H1 with a final mark of at least 70% in each course. Students will usually enrol into the Actuarial Science Major program after completion of MAT137Y1, and then they will enrol into the Specialist program after the completion of ACT240H1, ACT245H1 and ACT247H1. Once these requirements are met by a student, the student will be eligible to enroll in the Actuarial Science Specialist Program. Note that the Mathematics Department enforces MAT223H1/MAT240H1 as a prerequisite for MAT237Y1.

#### Completion Requirements

(13 FCE courses)

This program is designed to prepare a student for professional work as an actuary, and more generally in the financial risk management industry.

First Year:
1. MAT137Y1 (63%)/MAT157Y1 (60%)
2. MAT223H1/MAT240H1 (should be taken in first year, enforced as a prereq for MAT237Y1)
3. ECO101H1, ECO102H1

To be completed before the end of Second Year:
1. STA130H1 (students should complete this course by the end of the Fall Semester of Second Year)
2. CSC108H1/CSC120H1/CSC121H1/CSC148H1

*Note: for students applying in Spring 2018 at the end of their second year, accommodation will be made for the STA130H1 requirement.*

Second Year:
1. ACT240H1 (70%), ACT245H1 (70%), ACT247H1 (70%)
2. MAT237Y1/MAT257Y1
3. STA257H1, STA261H1
4. MGT201H1

Higher Years:
1. A set of mandatory courses (3.5 FCEs): ACT348H1, ACT370H1, ACT451H1, ACT452H1, STA302H1, STA314H1, ACT350H1
2. 2 FCE to be selected from lists 1 and 2 (students can only use at a maximum 1 FCE from list 2, the practice oriented courses, to fulfill program requirements):
   (1) ACT349H1, ACT371H1, ACT455H1, ACT460H1, ACT466H1, STA457H1, STA414H1, and
   (2) ACT372H1, ACT470H1, ACT471H1, ACT473H1, ACT475H1.

**NOTES:**

112
In order to enroll in ANY 300- or 400-level ACT course, the minimum grade of C must be obtained in each of ACT240H1, ACT245H1 and ACT247H1. The enrolment requirements and the prerequisites for all ACT courses will be strictly enforced.

Students who have an interest in pursuing studies in mathematical finance should consider taking MAT244H1, MAT336H1/MAT337H1 and APM346H1. Students in the Actuarial Science Specialist Program who have successfully completed ACT348H1 and ACT349H1 may request to enroll in the following RSM courses (provided the appropriate prerequisites and corequisites are met): RSM430H1, RSM433H1, RSM437H1. MAT246H1 is recommended (not required) for students in the Actuarial Science Specialist Program.

Proposal Questions - General

Brief Description of the Proposed Changes (Provide a brief summary.)

We propose to add STA130H1 (intro to statistical reasoning) to the first year requirement, and change the higher year program from a mandatory set of courses to a combination of mandatory and elective courses (choosing from a prescribed list). The total number of required courses is increased by 1 FCE. These changes emerge from discussions in the Department of Statistics self-study and align the program with changes in the profession toward modern statistics and data science concepts.

Details of the Proposed Changes (Changes to program description, requirements, and program learning outcomes.)

1. Add STA130H1 (Intro to Statistical Reasoning) as a mandatory course to be completed before the end of the second year.
2. Higher year requirements: currently there are 5.5FCE required courses in higher years and all courses are mandatory. We propose to continue to require 5.5 FCE in the higher years, but with 3.5FCE from a list of mandatory courses and 2FCE from a list of elective courses. All the mandatory courses, except for STA314H1 and a new course to replace STA347H1 (see below), are currently mandatory. All the elective courses, except for STA414H1 (see below), are currently offered and some of them are currently mandatory.

Rationale (Explain why the changes have been proposed, providing any additional information that may be helpful for review, or of relevance for Curriculum Committees. This may include connections to the unit’s priorities, recent reviews or institutional planning, or alignment with other programs.)

Background: The actuarial profession is marching into the age of Big Data. Increasingly, employers in various actuarial fields are requiring new actuarial hires to have sophisticated knowledge in statistics and data science. To meet the new demands from the industry and the profession, the Society of Actuaries (SOA) - the education and credentialing body of North American actuaries - recently released its new curriculum effective from July 2018. One of the key additions to SOA’s new curriculum is a new exam in Statistics for Risk Modeling (SRM) which includes modern statistical and data science techniques. There will also be a new five-hour proctored project on predictive analytics, as a capstone requirement following the completion of the SRM exam. Casualty Actuarial Society (CAS), the credentialing body for actuaries working in the Property and Casualty fields, has also published their new curriculum for 2018 entailing similar changes in direction. The proposed changes to the existing actuarial science specialist program at UofT aim to stay current with new trends and demand from the profession and in line with SOA and CAS new curriculum.

These goals emerged in the recent self-study within the Department of Statistics, to adapt Actuarial Science programs in this direction. This report also noted the importance of better integration of actuarial science and data science and anticipated the current proposal: “From discussions with industry partners we have learned of a growing need in industry for actuaries who also have a strong background in data science. We are currently in the preliminary stages of developing an undergraduate program in our department that will be a combination of actuarial science and data science.”

Detailed rationale for each proposed change:
1. Add STA130H1 as a mandatory first-year course: STA130H1 is a new course offered by the Statistics program, first offered in 2016-17. This is an introductory course on statistical learning, including basic concepts in data science and an introduction to the program R (which is required for many STA courses in the second and higher years). STA130H1, along with the first-year CSC course (can be taken in the first or the second year of study), will become the prerequisites for another new course STA314H1, which will be offered for the first time in 2018-19. We
propose to add STA314H1 as a mandatory course for the specialist program (see rationale below), and therefore STA130H1 (i.e. its prerequisite) should be required as well.

2. Higher year requirements: currently there are 5.5FCE required courses in higher years and all courses are mandatory. We propose to continue to require 5.5 FCE in the higher years, but with 3.5FCE from a list of mandatory courses, covering fundamental topics in actuarial science, and 2FCE from a list of elective courses, divided into a set of advance theory courses and a set of practice-oriented courses. All the mandatory courses, except for STA314H1 and a new course to replace STA347H1 (see below), are currently mandatory. All the elective courses, except for STA414H1 (see below), are currently offered and some of them are currently mandatory.

   a. The rationale of this change is that the profession has become more diverse in the past decade and the amount of technical content and professional requirement has significantly increased, which has been reflected in the new curriculum from SOA and CAS. In order to provide necessary training to the new generation of actuaries and accommodate the growing body of technical content, we propose a list of 3.5FCE mandatory courses to cover the fundamental knowledge of key branches of actuarial science, and another 2FCE selected from a longer list of courses based on individual student’s academic and professional interests.

   b. The first sublist of elective courses are theoretical actuarial courses that provide more advanced knowledge in a particular branch of actuarial science (e.g. life contingency, financial mathematics, loss model, risk modeling and data science). The second sublist of elective courses are practice courses taught by seasoned professionals from the industry, which help students connect theories with applications in the real world. This list includes practice courses in all the key actuarial tracks – life & annuity, pension, property & casualty. In order not to dilute the technical and academic rigor of the specialist program, students can only use at a maximum 1FCE from the sub-list of practice courses to fulfill their program requirements (although they may take more practice courses beyond program requirements).

   c. Add STA314H1 as a mandatory higher-year required course: STA314H1 is a proposed new course by Statistics program to be first offered in 2018-19. This course will be a core course to cover much of the new modern statistical techniques and data science topics, which had been added to SOA and CAS new curriculum. This course is a key expansion of our core actuarial specialist curriculum at UofT. A follow-up course covering more advanced data science and machine learning topics, STA414H1, has been included in the higher-year elective list for actuarial students with serious academic interests in statistical modeling.

   d. Replace STA347H1 with a newly proposed ACT course (ACT350H1): STA347H1 has served as a statistical foundation and prerequisite for a few advanced fourth-year ACT courses (ACT455H1, ACY460H1, ACT466H1). However, this course was taught by the Statistics program for statistics students without customization to actuarial students. The new course will serve the same function as STA347H1, but will be designed and taught with a clear emphasis on the most relevant statistical theories (e.g. Markov Chain, stochastic processing, etc) that prepare students for the study in Advanced Life Contingencies and Property and Casualty Insurance courses (e.g. ACT455H1, ACT460H1, ACT466H1, ACT471H1).

**Impact** *(Specify the impact the changes will have on students, and on other units/programs. If courses listed in the program are offered by other units, include a letter of support from the head of that unit, speaking to enrolment controls and priority enrolment, if applicable.)*

There is no anticipated impact on other units. The most significant changes involve ACT and STA courses.

One of the key feedback we hear from students is that they have found the higher-level mandatory courses too rigid and “old-fashioned”, as they heavily focus on the traditional actuarial fields and methods. The proposed changes will enhance students’ learning experiences in Actuarial Science Specialist program by providing pathways that best suit individuals’ academic and professional goals and interests, especially as the profession itself is becoming more diverse. The newly added courses in modern statistics and data science will also better prepare students for the emerging demand of the profession and industry.

**Consultation** *(Describe consultation that has already been done with students, faculty, and other units.)*
Regarding adding STA130 and STA314 as required courses - Statistics program has been consulted on proposed changes to add STA courses to the actuarial science program. The Associate Chair of Statistics endorse those changes. In developing the proposed changes, we began consultation with the Office of the Dean and the Office of the Registrar in Summer 2017. These changes were reviewed and approved by the Committee on Admissions on January 17, 2018.

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<tr>
<th>Diversity</th>
<th>How does the proposed program or modification support diversity? E.g through curriculum design supporting different learners, accommodation, etc.</th>
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<tbody>
<tr>
<td>The changes do not affect Diversity.</td>
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<tr>
<th>Resource Implications</th>
<th>Provide a statement of the resource requirements for the program, and an indication of whether you can meet these requirements through your existing resources, or have received additional resources from the Dean.</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no anticipated impact on resource. We expect to meet these requirements through existing resources. We also anticipate limited impact on enrollment. Currently 120-150 students take the first actuarial science course in their second year, with 30-40% proceeding to enroll in the actuarial science programs (after meeting the course and grade requirements for three second-year courses). The course and grade requirements for the three crucial second-year courses remain the same and therefore we do not anticipate major changes in enrollment.</td>
<td></td>
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</table>

| Faculty and TA Support | |
|------------------------| |
| We expect to meet these requirements through existing resources. |

<table>
<thead>
<tr>
<th>Arts &amp; Science - Divisional Data:</th>
<th>For further definition of these objectives, see the Degree Objectives Guidelines (July 2008).</th>
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<tr>
<td>Academic Context</td>
<td>Outline the context that explains why the program is designed this way, e.g. relation of program to discipline, students’ interests, career paths, etc.</td>
</tr>
<tr>
<td>The actuarial profession is marching into the age of Big Data. Increasingly, employers in various actuarial fields are requiring new actuarial hires to have sophisticated knowledge in statistics and data science. To meet the new demands from the industry and the profession, the Society of Actuaries (SOA) - the education and credentialing body of North American actuaries - recently released its new curriculum which includes modern statistical and data science techniques and a new five-hour proctored project on predictive analytics as a capstone requirement. Casualty Actuarial Society (CAS), the credentialing body for actuaries working in the Property and Casualty fields, has also published their new curriculum for 2018 entailing similar changes in direction. The proposed changes to the existing actuarial science specialist program at UofT aim to stay current with new trends and demand from the profession and in line with SOA and CAS new curriculum.</td>
<td></td>
</tr>
<tr>
<td>A key change to the Actuarial Science Specialist to meet these needs is to add STA130H1 and STA314H1 as mandatory courses. They are core courses to cover much of the new modern statistical techniques and data science topics, which had been added to SOA and CAS new curriculum. Those courses are key expansions of our core actuarial specialist curriculum at UofT.</td>
<td></td>
</tr>
<tr>
<td>The profession has become more diverse in the past decade and the amount of technical content and professional requirement has significantly increased, which has been reflected in the new curriculum from SOA and CAS. The revised higher year structure, with 3.5 FCE in mandatory courses and 2 FCE in elective courses, is designed to provide necessary training to the new generation of actuaries and accommodate the growing body of technical content. The new mandatory + elective structure for higher year courses will also facilitate students’ diverse academic and professional interests, and provide more in-depth training for students who want to delve into particular career paths.</td>
<td></td>
</tr>
</tbody>
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1 Details for resource areas can include: estimated enrolment per academic year; new courses necessary to mount for the program; additional instructor requirements; teaching assistant requirements; laboratory equipment requirements; computing or library resource requirements.
**Learning Outcomes** *(Explain how the change affects the program learning outcomes, including disciplinary goals, relevant methodologies and skills acquired upon program completion.)*

UofT’s actuarial science specialist program is recognized as one of the most rigorous academic programs in Canada. In the past, the program (as well as the profession) has a focus on “long-term” coverages (life, annuities, pension). With the proposed changes, the program will achieve further balance between long-term and short-term coverages (property and casualty). More importantly, students will have better statistical foundation and be better at working with data. The proposed changes will ensure that students acquire knowledge in data science and modern statistical methods which can be extremely valuable in their future careers as actuaries and insurance professionals who deal with either long-term (life, annuity, pension) or short-term (property&casualty, health) actuarial data.

We also added “practice courses” to the elective list in the higher year (students can use up to 1FCE practice course to fulfill program requirement). Those courses are taught by seasoned professionals from the industry, which help students connect theories with applications in the real world. They provide hands-on knowledge in modeling as well as business and communication skills. Those practice courses were previously available to students as well, however, they were not recognized as course credits towards fulfilling Specialist program requirements. The proposed changes explicitly recognize the efforts of completing those courses, which may incentivize more Specialist students to take the courses.

**Depth of Knowledge** *(Explain how particular courses allow students to achieve depth of knowledge, relating to the proposed change.)*

The introduction of STA130H1 and STA314H1 as proposed mandatory courses contributes to depth of knowledge in statistical reasoning, data science and modern statistical techniques. STA414H1 has been included in the higher-year elective list for actuarial students with serious academic interests in statistical modeling. Introducing ACT350H1 to replace STA347H1 provides in-depth knowledge in stochastic processing and Markov Chain, which are especially useful for actuarial science students. The change to include practice courses as options in the higher year requirements.

**Competencies: For these five categories, describe how each competency is developed within the program to the degree relevant to the area/discipline. If the program does not address a particular competency, explain why that competency is not relevant to your area/discipline and how students in your program are expected to attain that competency within their overall degree program.**

**Critical and Creative Thinking**
Practice courses included in the proposed elective list for higher years encourage critical thinking through case-study, project-based pedagogy.

**Communication**
We added “practice courses” to the proposed elective list for the higher year (students can use up to 1FCE practice course to fulfill program requirement). Those courses are taught by seasoned professionals from the industry, which help students connect theories with applications in the real world. They provide hands-on knowledge in modeling as well as business and communication skills.

**Information Literacy**
The practice courses included in the proposed elective list have a focus on training students to better identify, evaluate and effectively use needed information and data to solve or respond to issues at hand, specifically in the fields of life insurance, property and casualty insurance and pension.

**Quantitative Reasoning**
The actuarial science specialist is a highly quantitative program including in-depth courses in mathematical statistics, probability theory, life contingency models, financial mathematics, loss model and credibility theory, stochastic processing, data science and machine learning, etc.

**Social and Ethical Responsibility**
ACT475, a practice course included in the proposed elective list, has a major pedagogical goal to enhance social and ethical responsibilities of future actuaries. Through readings, discussions, weekly comments and a final paper, students (aspiring actuaries) learn the social and economic implication of their future career.
Integrative, Inquiry-based Activity

Practice courses included in the proposed elective list for higher years encourage case-study, project-based learning, which integrate knowledge from foundational courses.

<table>
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<tr>
<th>UTQAP Process</th>
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<tbody>
<tr>
<td><strong>Steps</strong></td>
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<td>Consultation with Dean’s office (and VPAP)</td>
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<td>Faculty of Arts &amp; Science Council</td>
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<td>Consultation with Dean’s office (and VPAP)</td>
</tr>
<tr>
<td>Reported to the Provost and included in annual report to AP&amp;P</td>
</tr>
<tr>
<td>Ontario Quality Council – reported annually</td>
</tr>
</tbody>
</table>
This is a limited enrolment program. All students who request the program and obtain at least the specified mark(s) in the required course(s) will be eligible to enrol. Courses required in either the major or specialist programs in actuarial science may not be taken as CR/NCR.

Required courses: MAT137Y1 with a final mark of at least 65% and ECO101H1 + ECO102H1, both with a final mark of at least 70%. Note that the Mathematics Department enforces MAT223H1/MAT240H1 as a prerequisite for MAT237Y1.

Completion Requirements

(8.5 courses or their equivalent, including at least two full-course equivalents at the 300+-level, of which at least one is a the 400 level)
First Year:
1. MAT137Y1 (65%)/MAT157Y1
2. ECO101H1 (70%), ECO102H1 (70%)
3. MAT223H1/MAT240H1 (should be taken in first year, enforced prerequisite for MAT237Y)
   STA130H1 is strongly recommended.

Higher Years:
1. MGT201H1
2. ACT240H1, ACT245H1, ACT247H1, ACT348H1, ACT370H1
3. MAT237Y1/MAT257Y1
4. STA257H1, STA261H1
5. Two of: ACT349H1, ACT371H1, ACT372H1, ACT451H1, ACT452H1, ACT455H1, ACT460H1, ACT466H1, ACT470H1, ACT473H1, ACT475H1, STA302H1, STA347H1, STA457H1

NOTES:
1. In order to enroll in ANY 300- or 400-level ACT course, the minimum grade of C must be obtained in each of ACT240H1, ACT245H1 and ACT247H1. The enrolment requirements and the prerequisites for all ACT courses will be strictly enforced.
2. Students who have an interest in pursuing studies in mathematical finance should consider taking MAT244H1, MAT336H1/MAT337H1 and APM346H1.
Enrolment Requirements

This is a limited enrolment program. All students who request the program and obtain at least the specified mark(s) in the required course(s) will be eligible to enrol. Courses required in either the major or specialist programs in actuarial science may not be taken as CR/NCR.

Required courses: MAT137Y1 with a final mark of at least 63%. Note that the Mathematics Department enforces MAT223H1/MAT240H1 as a prerequisite for MAT237Y1.

Completion Requirements

(8.5 full courses or their equivalent)

First Year:
1. MAT137Y1 (63%)/MAT157Y1 (60%)
2. MAT223H1/MAT240H1 (should be taken in first year, enforced as a prereq for MAT237Y1)

To be completed before the end of Second Year:
1. STA130H1 (students should complete this course by the end of the Fall Semester of Second Year)
2. CSC108H1/CSC120H1/CSC121H1/CSC148H1

Higher Years:
1. ACT240H1, ACT245H1, ACT247H1, ACT348H1, ACT370H1
2. MAT237Y1/MAT257Y1
3. STA257H1, STA261H1
4. ACT451H1, ACT452H1, STA302H1

STA314H1 is strongly recommended.

NOTES:
1. In order to enroll in ANY 300- or 400-level ACT course, the minimum grade of C must be obtained in each of ACT240H1, ACT245H1 and ACT247H1. The enrolment requirements and the prerequisites for all ACT courses will be strictly enforced.
2. Students who have an interest in pursuing studies in mathematical finance should consider taking MAT244H1, MAT336H1/MAT337H1 and APM346H1.
3. Students interested in actuarial practices should consider taking ACT371H1, ACT372H1, ACT470H1, ACT471H1, ACT473H1, ACT475H1.

Proposal Questions - General

Brief Description of the Proposed Changes (Provide a brief summary.)

We propose to add STA130H1 (Intro to statistical reasoning) and a first-year computer science course to be required courses to be completed before the end of the second year, and changes to 1-st and 2nd year required courses. We propose to change the higher year program from a “choose-two-from-a-list” structure to a mandatory set of courses. The total number of required courses does not change. These changes emerge from discussions in the Department of Statistics self-study and align the program with changes in the profession toward data science concepts.
Details of the Proposed Changes (Changes to program description, requirements, and program learning outcomes.)

1. Add STA130H1 (intro to statistical reasoning) and a first-year CSC course as mandatory courses to be completed before the end of second year.
2. Higher year requirements: we propose to eliminate the current elective list and replace it with a mandatory list of three core courses.
3. Remove MGT201H1 as a required course
4. Remove ECO101H1 & ECO102H1 as required courses

Rationale (Explain why the changes have been proposed, providing any additional information that may be helpful for review, or of relevance for Curriculum Committees. This may include connections to the unit’s priorities, recent reviews or institutional planning, or alignment with other programs.)

The actuarial profession is marching into the age of Big Data. Increasingly, employers in various actuarial fields are requiring new actuarial hires to have sophisticated knowledge in statistics and data science. To meet the new demands from the industry and the profession, the Society of Actuaries (SOA) - the education and credentialing body of North American actuaries - recently released its new curriculum effective from July 2018. One of the key additions to SOA’s new curriculum is a new exam in Statistics for Risk Modeling (SRM) which includes modern statistical and data science techniques. There will also be a new five-hour proctored project on predictive analytics, as a capstone requirement following the completion of the SRM exam. Casualty Actuarial Society (CAS), the credentialing body for actuaries working in the Property and Casualty fields, has also published their new curriculum for 2018 entailing similar changes in direction. The proposed changes to the existing Actuarial Science Major program at UofT aim to stay current with new trends and demand from the profession and in line with SOA and CAS new curriculum.

These goals emerged in the recent self-study within the Department of Statistics, to adapt Actuarial Science programs in this direction. This report also noted the importance of better integration of actuarial science and data science and anticipated the current proposal: “From discussions with industry partners we have learned of a growing need in industry for actuaries who also have a strong background in data science. We are currently in the preliminary stages of developing an undergraduate program in our department that will be a combination of actuarial science and data science.”

Detailed rationale for each proposed change:

1. Add STA130H1 and first-year CSC course as mandatory first-year courses: STA130H1 is a new course offered by the Statistics program, first offered in 2016-17. This is an introductory course on statistical learning, including basic concepts in data science and an introduction to the program R (which is required for many STA courses in the second and higher years). STA130H1 and a first-year CSC course will become the prerequisites for another new course STA314H1, which will be offered for the first time in 2018-19. STA314H1 will be a strongly recommended higher-year course for the Major students, as it covers much of the new modern statistical techniques and data science topics, which had been added to SOA and CAS new curriculum. Due to limits on the number of required courses in a Major program, we cannot require STA314H1 for the Major program. Nevertheless, it will be a strongly recommended course especially for students who intend to prepare for accreditation. Its prerequisites - STA130H1 and a first-year CSC course are required - for their own merits and importance in the actuarial core curriculum, as well as in anticipation of students electing STA314H1 in their higher years.

2. Higher year requirements: we propose to eliminate the current elective list and replace it with a mandatory list of three core courses. These three courses, along with the currently required higher-year courses, cover the fundamental knowledge of key branches of actuarial science. We believe all students graduating with an actuarial Major should have studied those fundamentals (e.g. loss models, statistical regression models), in anticipation of further graduate-level or on-the-job trainings in a chosen actuarial field.

3. Remove MGT201H1 as a required course: With the shift to emphasise modern statistics and data science concepts in first year and higher year required courses, this introductory accounting course is not at the core of an undergraduate actuarial curriculum. However, MGT201H1 will be added to SOA’s Validation by Educational Experience (VEE) database for students to fulfill their credits for accounting. Remove ECO101H1+ECO102H1 as required courses: Macro and Micro-economics are useful background knowledge for actuarial students. However, they are not at the core of an actuarial curriculum. Given the growing number of actuarial core courses, we decided...
to remove the economics courses as program requirements, in order to prioritize data science concepts as a core direction identified in the department self-study as well as in the new professional curriculum.

<table>
<thead>
<tr>
<th>Impact (Specify the impact the changes will have on students, and on other units/programs. If courses listed in the program are offered by other units, include a letter of support from the head of that unit, speaking to enrolment controls and priority enrolment, if applicable.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is no anticipated impact on other units, with the only exception of potential impact on a first-year CSC course as it becomes required in the actuarial science major program. In the cases of ECO101H1, ECO102H1, and MGT201H1, since these courses are still used for the purpose of obtaining SOA’s Validation by Educational Experience (VEE) credits for Economics and Accounting, we don’t expect any significant change in enrollment in those two courses from actuarial students. Department advising will guide students planning to professionalize as actuaries. For students who enroll in the Major to explore actuarial curriculum, these changes, especially the mandatory core courses in the higher years, will provide them with a better idea of key branches of knowledge in actuarial science. They will be better prepared should they choose to professionalize in the future.</td>
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<tr>
<th>Consultation (Describe consultation that has already been done with students, faculty, and other units.)</th>
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<tbody>
<tr>
<td>Within the Department of Statistical Sciences, we have consulted with the Statistics program regarding adding STA130H1 as required and STA314H1 as highly recommended course, and the Associate Chair of Statistics endorses those changes. In developing the proposed changes, we began consultation with the Office of the Dean and the Office of the Registrar in Summer 2017. We have consulted with the Department of Economics regarding the proposed changes to remove ECO101H1 &amp; ECO102H1 from the Major program requirements. Since these courses are still used for the purpose of obtaining SOA’s Validation by Educational Experience (VEE), we expect students who opt for accreditation to continue to enroll in these courses. We also expect that students who opt for accreditation will also continue to enroll in MGT201H. We do not expect enrolment in these courses to be severely affected.</td>
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<tr>
<th>Diversity (How does the proposed program or modification support diversity? E.g through curriculum design supporting different learners, accommodation, etc.)</th>
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<tbody>
<tr>
<td>The proposed changes do not affect Diversity.</td>
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<th>Resource Implications (Provide a statement of the resource requirements for the program, and an indication of whether you can meet these requirements through your existing resources, or have received additional resources from the Dean.)</th>
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<td>The actuarial profession is marching into the age of Big Data. Increasingly, employers in various actuarial fields are requiring new actuarial hires to have sophisticated knowledge in statistics and data science. To meet the new demands from the industry and the profession, which includes modern statistical and data science techniques, the proposed changes aim to stay current with new trends and demand from the profession and in line with new curriculum from the Society Of Actuaries and Casualty Actuarial Society. The introduction of STA130H1 as a mandatory course and STA314H1 as a strongly recommended course accomplish these changes as they are core courses to cover much of the new modern statistical techniques and data science topics. Those courses are key expansions of our core actuarial specialist curriculum at UofT. Modifying requirements in the higher year program to a mandatory set of courses, covers the fundamental knowledge</td>
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</table>
of key branches of actuarial science. We believe all students graduating with an actuarial major should have studied those fundamentals, in anticipation of further graduate-level or on-the-job trainings in a chosen actuarial field. We would prefer to include more courses, but there is no space in the Major program. The mandatory set we chose are the most important ones to bring the program in line with the current academic context.

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Explain how the change affects the program learning outcomes, including disciplinary goals, relevant methodologies and skills acquired upon program completion.</th>
</tr>
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<tr>
<td>UofT’s actuarial science program is recognized as one of the most rigorous academic program in Canada. In the past, the program (as well as the profession) has a focus on “long-term” coverages (life, annuities, pension). With the proposed changes, the program will achieve further balance between long-term and short-term coverages (property and casualty). More importantly, students will have better statistical foundation and be better at working with data. They will acquire knowledges in data science and modern statistical methods which can be extremely valuable in their future careers. Changes to required courses in first and second year shift the learning outcomes away from more general background toward focused concepts in actuarial analysis. The shift to mandatory courses in the higher years, rather than a set of options with more flexible choice, will ensure all students graduating with an actuarial Major have studied foundational courses covering key knowledge in different branches of actuarial science, with an emphasis on loss models and data analysis. While some flexibility may be lost by replacing a list of elective courses with a set of mandatory courses, the program gains in the balance by ensuring consistency for our Major graduates outweigh the drawback.</td>
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<th>Depth of Knowledge</th>
<th>Explain how particular courses allow students to achieve depth of knowledge, relating to the proposed change.</th>
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<tbody>
<tr>
<td>The introduction of data science concepts as required through STA130H1 and as strongly recommended in STA314H1 promotes depth of knowledge through development of statistical reasoning, data science concepts, and modern statistical techniques. The reduction of flexibility in higher year requirements, with the change to require ACT451H1 and ACT452H1 instead of a long list of courses shifts development of depth of knowledge to topics in loss models, credibility theory, and simulation, which is key for future actuaries. At the same time we propose that all Major students be required to take STA302H1, which contributes to depth of knowledge in regression models, which is crucial for students choosing to work in “short-term” actuarial fields.</td>
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| Competencies: For these five categories, describe how each competency is developed within the program to the degree relevant to the area/discipline. If the program does not address a particular competency, explain why that competency is not relevant to your area/discipline and how students in your program are expected to attain that competency within their overall degree program. |
| Critical and Creative Thinking | Proposed changes to the Major are not expected to affect competency in Critical and Creative Thinking. Students have an opportunity to develop this in both the required courses and a variety of elective courses that continue to be available to them. |

| Communication | Proposed changes to the Major are not expected to affect competency in Communication. This is developed in all our practicum courses (ACT371H1, ACT372H1, ACT471H1, ACT470H1, ACT473H1, ACT475H1) which will continue to be available to Major students. The newly required course STA130 also has a strong communication component in its curriculum. |
## Information Literacy
Proposed changes to the Major are not expected to affect competency in information literacy. Identifying, evaluating and effectively using needed information and data to problem solve is a core component of actuarial curriculum.

## Quantitative Reasoning
The Actuarial Science Major is a highly quantitative program including in-depth courses in loss models and data science. The proposed changes develops existing competencies within a more streamlined higher year curriculum.

## Social and Ethical Responsibility
Our practicum courses (specifically ACT473H1, ACT475H1) address social and ethical responsibility and will continue to be available to Major students.

## Integrative, Inquiry-based Activity
Our practicum courses (ACT371H1, ACT372H1, ACT471H1, ACT470H1, ACT473H1, ACT475H1) all use case studies and inquiry-based learning activities as part of the pedagogy and they will continue to be available to Major students.

## UTQAP Process

<table>
<thead>
<tr>
<th>Steps</th>
<th>Approvals</th>
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<td>January 2018</td>
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<tr>
<td>Dean’s Office Sign-off</td>
<td>January 26, 2018</td>
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<tr>
<td>Undergraduate Curriculum Committee</td>
<td>February 2, 2018</td>
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<td>February 14, 2018</td>
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</table>
4 Minor Program Modifications:

Applied Statistics Specialist

Description:

Previous:
New:

Statistical methods have applications in almost all areas of science, engineering, business, government, and industry. The practising statistician is involved in such diverse projects as designing clinical trials to test a new drug, economic model-building to evaluate the costs of a guaranteed-income scheme, predicting the outcome of a national election, planning a survey of television viewing habits, and estimating animal populations.

Today’s consumer is bombarded with the results of so many quantitative studies using statistical methodology that it is necessary to know something about statistics in order to be properly critical. A basic knowledge of statistics should be an integral part of everyone’s general education.

Probability theory is used to analyse the changing balance among the age-groups in a population as the birth rate changes, the control force needed to keep an aircraft on course through gusts of wind, the chance that the demand for electricity by all the customers served by a substation will exceed its capacity. These are just three of many phenomena that can be analysed in terms of randomness and probability.

The course offerings are intended not only for specialists in the theory of the subject but also to serve the needs of the many other disciplines that use statistical methods, e.g. in sample survey design and experimental design. Students following the Specialist Program are encouraged to include courses in major fields of application in their overall program. The Major Program can be profitably combined with specialization in another discipline. Students in these programs may also qualify for the A. Stat. designation from the Statistical Society of Canada.

Both applied and theoretical courses are offered in Statistics and Probability. The foundation courses STA220H1, STA221H1, STA237H1, STA238H1, STA247H1, STA248H1, STA255H1, STA257H1, and STA261H1 are distinguished primarily by their mathematical demands, as indicated by the prerequisites. Students interested in the Biological or Social Sciences will generally find the most relevant courses of the more advanced offerings to be STA302H1, STA303H1, STA304H1, STA305H1 and STA429H1. The probability course STA347H1 will be of interest to those whose field of application includes stochastic models. Students interested in Data Science may want to consider the program of study in Data Science, offered jointly between the Departments of Statistical Science and Computer Science. The required courses in that program can be used as a guide to picking Statistics courses that are most relevant to Data Science.

Students in the Applied Statistics Specialist program must complete at least one disciplinary focus.

To enrol in one or more focuses, students must first be enrolled in the Applied Statistics Specialist program. Enrolment instructions can be found on the Arts & Science Current Students program enrolment website. Focuses can be chosen on ACORN after admission to the program.

Admission Requirements:

Previous:
New:

Enrolment Requirements:

Previous:
New:

This is a limited enrolment program (Type 2L) that can only accommodate a certain number of students. Eligibility is based on the following criteria:

For students entering the program after first year:
1. Completion of at least 4.0 FCEs including:

- STA130H1,
- CSC108H1/CSC120H1/CSC121H1/CSC148H1,
- MAT223H1/MAT240H1,
- (MAT135H1, MAT136H1) with a minimum grade of 75% or MAT137Y1 with a minimum grade of 65%

or MAT157Y1 with a minimum grade of 65%

AND

2. An average of the grades in STA130H1 and (MAT135H1, MAT136H1) /MAT137Y1/MAT157Y1 that meets the department's annual cutoff.

For students entering the program after 2nd year:

1. Completion of:

- CSC108H1/CSC120H1/CSC121H1/CSC148H1,
- MAT223H1/MAT240H1
- MAT235Y1/MAT237Y1/MAT257Y1
- (STA237H1, STA238H1) with a minimum grade of 75% or (STA247H1, STA248H1) with a minimum grade of 75%

or (STA257H1, STA261H1) with a minimum grade of 65%

AND

2. An average of the grades in (STA237H1, STA238H1) / (STA257H1, STA261H1) and MAT235Y1/MAT237Y1/MAT257Y1 that meets the department's annual cutoff

Completion Requirements:

(10.5-10.9 FCEs plus a disciplinary focus requiring 2.0-3.5 FCEs)

First year:
1. STA130H1, CSC108H1/CSC120H1/CSC121H1/CSC148H1, (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1.

(MAT137Y1/MAT157Y1 recommended)
2. Recommended: introductory course in disciplinary focus.

MAT223H1/MAT240H1 STA130H1 is also strongly recommended to be taken in first year and is required preparation for MAT237Y1.

Second year:
3. MAT223H1/MAT240H1, MAT235Y1/MAT237Y1/MAT257Y1, (STA237H1 STA220H1/STA221H1/ECO220Y1, STA238H1 STA255H1)/(STA247H1, STA248H1)/(STA257H1, STA261H1)

((STA257H1, STA261H1) recommended) MAT223H1/MAT240H1 can be taken in first year.

Upper years:
4. STA302H1, STA303H1, STA304H1/STA305H1, STA355H1, STA410H1, STA437H1, STA442H1, STA490Y1
5. 0.5 FCEs from STA 300+-level offerings (excluding STA310H5)
6. 1.0 FCEs from the following list:
Disciplinary Focuses

Students in the Applied Statistics Specialist program must complete at least one disciplinary focus.

To enrol in one or more focuses, students must first be enrolled in the Applied Statistics Specialist program. Enrolment instructions can be found on the Arts & Science Current Students program enrolment website. Focuses can be chosen on ACORN after admission to the program, which begins in July.

Health Studies: (2.0 FCE) HST209H1, HST211H1, HST373H1, HST330H1/HST411H1/HST464H1

Global Health: (2.5 FCE) BIO120H1, BIO130H1, HMB203H1, HMB323H1, HMB342H1/HMB433H1 (Recommended: HMB433H1)

Health and Disease: (3.0 FCE) BIO120H1, BIO130H1, HMB202H1, HMB265H1, HMB302H1, HMB321H1/HMB322H1/HMB422H1

Fundamental Genetics and its Applications: (3.0 FCE) BIO120H1, BIO130H1, HMB201H1, HMB265H1, HMB301H1, HMB321H1/HMB421H1/HMB441H1 (Recommended: HMB421H1)

Neuroscience: (3.5 FCE) BIO120H1, BIO130H1, PSY100H1, HMB200H1/HMB220H1, HMB265H1, HMB300H1, HMB420H1/HMB440H1 (Recommended: HMB420H1)

Social Psychology: (2.0 FCE) PSY100H1, PSY220H1, PSY322H1, PSY326H1/PSY321H1/PSY424H1/PSY426H1/PSY405H1/PSY406H1

Cognitive Psychology: (2.0 FCE) PSY100H1, PSY270H1, PSY493H1, PSY372H1/PSY342H1/PSY405H1/PSY406H1/PSY475H1

Sociolinguistics: (3.0 FCE) LIN100Y1; 2 of LIN228H1, LIN229H1, LIN232H1 or LIN241H1; LIN351H1 and LIN456H1

Psycholinguistics: (3.0 FCE) LIN100Y1; 2 of LIN228H1, LIN229H1, LIN232H1 or LIN241H1; 2 of JLP374H1, JLP315H1 or JLP471H1

Astronomy & Astrophysics: (2.5 or 3.0 FCE): (PHY131H1, PHY132H1)/(PHY151H1, PHY152H1); AST221H1, AST222H1; (PHY252H1, AST320H1)/AST325H1/AST326Y1

Sociology: (2.5 FCE) SOC100H1+SOC150H1 (minimum combined average grade of 65%); SOC204H1; 1.0 FCE from SOC303H1, SOC312H1, SOC336H1, SOC355H1, SOC363H1, SOC364H1.

Students interested in advanced study in Sociology should consider additional courses, in particular SOC201H1, SOC251H1, and SOC254H1

Ecology (3.0 FCE): BIO120H1, BIO220H1; 2.0 FCE from (with at least 0.5 FCE at the 400 level) EEB319H1/EEB321H1 32HH/EBB328H1 32HH/EEB365H1 365H/EEB428H1 428H/EEB433H1 433H/EEB440H1 440H or ENV234H1/ENV334H1 334H/ENV432H1 432H

Evolutionary Biology (3.5 FCE): BIO120H1, BIO130H1, BIO220H1; 1.5 FCE from HMB265H1/BIO260H1, EEB318H1, EEB323H1, EEB324H1, EEB325H1, EEB362H1, EHJ352H1; 0.5 FCE from EEB440H1, EEB455H1, EEB459H1, EEB460H1

Notes:

*BIO260H1 requires BIO230H1 as a prerequisite.
*Students in the Applied Statistics specialist focus in Evolutionary Biology can request that HMB waive the co-requisite of BIO230H1 for HMB265H1 and that EEB waive the prerequisite of BIO230H1 for EEB460H1. These waivers will only be considered for students in the Applied Statistics specialist focus in Evolutionary Biology. All other pre- and co-requisites are required.

Economics (3.5 FCE): (ECO101H1, ECO102H1), ECO200Y1/ECO206Y1, ECO202Y1/ECO208Y1, 0.5 FCE 300+ series ECO course with the exception of ECO374H1 and ECO375H1

Biochemistry: (3.0 FCE)  
CHM135H1, CHM136H1, BCH210H1, BCH311H1, BCH370H1, BCH441H1

Physics: (2.5 FCE)  
(PHY131H1/PHY151H1), (PHY132H1/PHY152H1), PHY224H1, (PHY252H1/PHY254H1/PHY256H1), PHY324H1

Description of Proposed Changes:

The Applied Statistics Specialist program was established in 2012. Its creation was in direct response to the Department of Statistical Sciences’ academic plan, including the strengthening of our reputation in collaborative scientific activity and curriculum renewal focused on statistical communication, consultation, and collaboration.

The Applied Statistics Specialist program currently has focuses in Health Studies, Global Health, Health and Disease, Genes Genetics and Biotechnology, Neuroscience, Social Psychology, Cognitive Psychology, Sociolinguistics, Psycholinguistics, Astronomy & Astrophysics, Sociology, Ecology, Evolutionary Biology, and Economics. Seven of these focuses were added after the establishment of the program and our intent has been to continue to broaden the choice of focuses available to students.

The creation of the proposed focuses in Biochemistry and Physics will create opportunities for interested students to develop an appreciation of the need for and application of statistical methods to important problems in these areas and to gain expertise in the computational methods and internet resources used in modern chemistry and molecular biology and physics.

1. We are proposing to change our two specialist programs in statistics (the Statistics specialist and Applied Statistics specialist POSs) from Type 1 to Type 2L. We plan to aim for an enrolment of 48 students per year in each specialist program (96 students per year in total). This proposal has been considered and approved by the Committee on Admissions.

2. We are adding the course STA130H1 as a program requirement. It is currently strongly recommended. This results in a change of 0.5 FCE in our program requirements (from 10.0 FCE to 10.5 FCE plus a focus requiring between 2.0 and 3.5 FCE).

3. We are adding as an option the new 2nd year stream of statistics courses STA237H1+STA238H1, which are designed primarily to meet the needs of students in the statistics major. These are being allowed for the Applied Statistics specialist program because many students transfer into this program.

4. The Applied Statistics Specialist program currently has focuses in Health Studies, Global Health, Health and Disease, Genes Genetics and Biotechnology, Neuroscience, Social Psychology, Cognitive Psychology, Sociolinguistics, Psycholinguistics, Astronomy & Astrophysics, Sociology, Ecology, Evolutionary Biology, and Economics. Seven of these focuses were added after the establishment of the program and our intent has been to continue to broaden the choice of focuses available to students. This proposed minor modification includes the addition of new focuses in Biochemistry and Physics. Theses focuses have been created in collaboration with the relevant units.

5. Some housekeeping (commas replacing slashes, excluding a UTM course that is not intended for students in statistics programs of study, recommended choices among various streams)

There are no changes to the statistics program learning outcomes. Regarding the additional program requirement of STA130H1: Currently there is no required first year course in statistics, and students are choosing our programs of study without an adequate understanding of the discipline and
what they can expect in future courses. STA130H1 serves many purposes, including a broad introduction to statistical reasoning in a variety of contexts and for a variety of purposes (description, explanation, prediction) supplemented by an introduction to modern practices in statistical computation, some consideration of the underlying mathematical theory, and extensive development of oral and written communication skills. The communications aspects of the course have been developed with extensive support from the ELL and WIT teams with recognition of the large percentage (approximately 60%) of international students in our programs of study.

Regarding the proposed new focuses: To complement their training in statistical methods, students in the Applied Statistics program are required to have a focus in an area of application of quantitative methods. Through prescribed study in that area, students acquire an understanding of the application of statistics to practical problems, the ability to identify areas that could benefit from appropriate use of statistical methods, and the importance of the context of the problem in the development and communication of quantitative solutions.

In the proposed focus in Biochemistry, students will obtain a strong foundation in CHM135H1 and CHM136H1, including an understanding of the scientific method and communication in science (writing and oral presentations) that are addressed in the laboratories of these courses. In the upper years, the development of these skills initially centres on the use of problem solving techniques to address problems both in theory and practice, skills which are promoted in BCH 210H and 311H. Both courses have tutorials that allow solution of theoretical problems within the course area and foster student inquiries and ultimately written work in assignment areas. The laboratory course BCH 370H promotes small group collaboration and discussion, showing how experimental data serves as the foundation for important discovery. Discussion days also promote students’ ability to think critically about experimental protocols, results and conclusions based on scientific principles. Oral communication skills are also developed in BCH 370H as students present their experimental data to the class. The fourth year BCH44H1 course will provide an introduction to computational methods and internet resources in modern biochemistry and molecular biology. Topics studied include sequence and genome databases, sequence alignment and homology search, use and interpretation of molecular structure, and phylogenetic analysis. Assignments will focus on hands-on competence building with web-based bioinformatics tools and databases, downloadable software including a molecular viewer and a multiple sequence alignment editor, and the statistics workbench and programming language.

In the focus in Physics, students will obtain a strong foundation in Newtonian mechanics and classical electromagnetism in the first year. Experimental techniques such as quantifying measurement uncertainty and data fitting will be introduced. In the Practical Physics courses, PHY224 and PHY324, students will extend the experimental skills acquired in first year. Computational elements are combined with laboratory exercises, aiming at giving students the tools to analyse experimental data and to model simple systems and phenomena. Specifically, students will solve problems in a hands-on context, plan an experiment and design a procedure, and perform data analysis with appropriate uncertainty analysis, using their own data fitting program. In the theory course, students will apply mathematical methods solve realistic problems in thermal physics, quantum mechanics or classical mechanics.

Rationale:

1. Regarding change from Type 1 to Type 2L: Statistics programs of study have been experiencing enormous enrolment pressures; we have experienced a 9-fold increase in enrolment in the past 10 years, and more than a 2.5-fold increase in the past 3 years. Current enrolment in statistics programs of study is about 3600 students. A recent external review of the Department of Statistical Sciences recommended restraining this growth. Most of our students are in the statistics major (60% of students in statistics POSIs), with another 20% in the statistics minor. No changes are being proposed to enrolment requirements in the statistics major and minor. This change will alleviate enrolment pressures on our 4th year courses, in particular, and ensure students are appropriately prepared for the demands of our specialist programs. Our analysis shows that success in 2nd year statistics courses is closely related to performance in first year calculus courses and that students with grades below the proposed minimum grade requirements do not succeed in 2nd year statistics courses, with large drop rates and grades that drop by as much as 30%, on average, from their first-year calculus grade (depending on course taken). Additional analysis shows that students who chose the less mathematically rigorous sequences of 2nd year statistics courses struggle in 3rd and 4th year courses that are required of students in the specialist programs. This change will also discourage the large number of students who enroll in our specialist programs late in their degree, often the summer before their 4th year, either because of inappropriate academic planning or to try to gain access to courses that have priority enrolment. Statistics specialist programs at UTSC and UTM are already Type 2L programs. Our analysis of current students suggests that almost all students who are currently enrolled in our specialist programs who have met the proposed minimum grade requirements and who are on track to complete the program they are enrolled in would have been admitted to the program under the proposed enrolment requirements. (A detailed document outlining our rationale for introduction enrolment requirements and the related data analysis carried out is attached.)

2. Regarding adding STA130H1 as a program requirement: The Department of Statistical Sciences has recently
undertaking a major curriculum renewal project. The requirement of STA130H1 for students in all of our major and specialist programs is an outcome of this project. Currently there is no required first year course in statistics, and students are choosing our programs of study without an adequate understanding of the discipline and what they can expect in future courses.

3. Regarding the addition of STA237H1,STA238H1 as an option for the stream of courses that can be taken in 2nd year: Currently, students in the statistics major POS and the applied statistics specialist POS have the option of taking the second year sequence (STA220H1,STA255H1), or (STA247H1,STA248H1) designed for students in computer science programs, or the mathematically rigorous sequence (STA257H1,STA261H1) designed for students in the statistics specialist. We plan to replace the option for (STA220H1,STA255H1) for these programs with a new sequence of courses (STA237H1,STA238H1) which will cover similar content to (STA257H1,STA261H1) but with less mathematical rigour and a stronger connection to the practice of statistics. Analysis of student performance in a variety of third year courses in statistics has shown that students who completed the (STA220H1,STA255H1) sequence have performed, on average, several percentage points below students who completed the sequence (STA257H1,STA261H1) after controlling for their grade in the second year courses. We anticipate that (STA237H1,STA238H1) will help close that gap, particularly for courses in applied statistics. (STA237H1,STA238H1) will also include a strong statistical computation component, using computation for data analysis and for simulation to support the development of theoretical results.

4. Regarding the proposed new focuses: The Applied Statistics Specialist program was established in 2012. Its creation was in direct response to the Department of Statistical Sciences’ academic plan, including the strengthening of our reputation in collaborative scientific activity and curriculum renewal focused on statistical communication, consultation, and collaboration. Since the creation of the program, our intent has been to continue to broaden the choice of focuses available to students. The creation of the proposed focuses in Biochemistry and Physics will create opportunities for interested students to develop an appreciation of the need for and application of statistical methods to important problems in these areas and to gain expertise in the computational methods and internet resources used in modern chemistry and molecular biology and physics.

Impact:
Students will have one additional course (0.5 FCE) required to complete their program of study, but the number of required FCE remains well within guidelines.
Regarding the addition of (STA237H1,STA238H1) as an option for the stream of courses that can be taken in 2nd year: This new course sequence will give students more choice in completing the program, depending on their mathematical background, which will be particularly useful for students who decide to complete the program after already completing courses that are exclusions to other options, typically less mathematically rigorous courses. Regarding the addition of two new focuses: We expect that the number of students in each of the new focuses will be 5 or fewer per year. Letters of support from Biochemistry and Physics are attached.

Consultation:
Developed in collaboration with the Departments of Biochemistry and Physics.

The Mathematics department has been consulted about the proposed enrolment requirements. They have been approved by the Committee on Admissions.
As part of our curriculum renewal project, students in Statistics programs of study were extensively consulted (through a survey, a town hall, and through students serving on our curriculum committee). The program additions of STA130H1 and (STA237H1,STA238H1) are a direct result of this project. These changes have been approved by the Statistics undergraduate committee and by the department faculty at a department meeting.
Statistics programs of study are commonly combined with programs in Economics, Mathematics and Computer Science. All of these programs have been consulted regarding these changes. The Department of Economics has plans to allow (STA237H1,STA238H1) as an alternative to their second year statistics courses, for students completing programs in both Economics and Statistics. The Department of Computer Science will consider the new stream of courses as a program substitution for (STA247H1, STA248H1). The Rotman Commerce program has also been informed.
The new focuses have been developed in collaboration with Biochemistry and Physics. Statistics students have previously expressed interest in having a Physics focus and in accessing some Bioinformatics courses, and these programs will provide the opportunity for students to pursue those interests within the Applied Statistics specialist program.
Statistical Sciences (FAS), Department of

Resource Implications:
The necessary resources to create space in STA130H1 so that we can make it a required course have already been approved by the Dean’s office.
For the addition of the (STA237H1,STA238H1) stream there are no net resource requirements, other than existing needs for our growing programs. There will be a reshuffling of students among courses and we will offer fewer sections of other courses to add these new courses.
Students in the new focuses will be accommodated in existing courses. There are no new resource requirements.

Statistics Major

Description:

Previous:

New:

Completion Requirements:

(7.0 full courses or their equivalent, including at least one STA 400-series course)

First Year:

STA130H1, CSC108H1/CSC120H1/CSC121H1/CSC148H1, (may be taken in 2nd year) ; (MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1.

( MAT223H1 / MAT240H1 STA130H1 is strongly recommended in 1st year):

Second Year:

MAT223H1/MAT240H1, MAT235Y1/MAT237Y1/MAT257Y1; (STA247H1 STA220H1/STA221H1/ECO220Y1, STA248H1 STA255H1)/(STA237H1 STA247H1, STA238H1 STA248H1)/(STA257H1, STA261H1)/ECO227Y1

(MAT223H1/MAT240H1 recommended in 1st year, MAT221H1 is not allowed)

Higher Years:

1. STA302H1
2. 3 half (H) course equivalents from all available STA300+ level courses, excluding STA310H5 (For example, a student interested in economics/commerce/finance might think to include STA304H1, STA347H1, STA457H1 in their program programme, while someone engaged in a life science might entertain STA303H1, STA305H1, STA437H1. On the other hand, a student with an interest in pure math might choose to focus on applications of that subject matter to theoretical probability and statistics, selecting STA347H1, STA355H1 towards a major in statistics.)
3. 1 half (H) course equivalent from the available STA400+ level courses (For those anticipating a future professional need to analyze large arrays of data STA410H1, STA414H1 are certainly very worthy of consideration.)

Description of Proposed Changes:

1. We are adding the course STA130H1 as a program requirement. It is currently strongly recommended. This results in a change of 0.5 FCE in our program requirements (from 6.5 FCE to 7.0 FCE).

2. We are adding as an option the new 2nd year stream of statistics courses STA237H1+STA238H1, which are designed primarily to meet the needs of students in the statistics major.

3. Some housekeeping (excluding a UTM course that is not intended for students in statistics programs of study, recommending MAT223H1/MAT240H1 in 1st year)

There are no changes to the statistics program learning outcomes.

Regarding the additional program requirement of STA130H1: Currently there is no required first year course in statistics, and students are choosing our programs of study without an adequate understanding of the discipline and what they can expect in future courses. STA130H1 serves many purposes, including a broad introduction to statistical
reasoning in a variety of contexts and for a variety of purposes (description, explanation, prediction) supplemented by an introduction to modern practices in statistical computation, some consideration of the underlying mathematical theory, and extensive development of oral and written communication skills. The communications aspects of the course have been developed with extensive support from the ELL and WIT teams with recognition of the large percentage (approximately 60%) of international students in our programs of study.

The new 2nd year sequence of courses (STA237H1,STA238H1) can be used as an alternative other streams of courses in 2nd year, replacing the stream (STA220H1,STA255H1). This new stream was designed primarily for the statistics major, to address some weaknesses in preparation for more advanced courses in statistics (see Rationale).

(See document for minor changes to Applied Statistics specialist program for small change to program description in calendar that applies to all statistics programs of study.)

**Rationale:**

Regarding adding STA130H1 as a program requirement: The Department of Statistical Sciences has recently been undertaking a major curriculum renewal project. The requirement of STA130H1 for students in all of our major and specialist programs is an outcome of this project. Currently there is no required first year course in statistics, and students are choosing our programs of study without an adequate understanding of the discipline and what they can expect in future courses.

Regarding the addition of STA237H1,STA238H1 as an option for the stream of courses that can be taken in 2nd year: Currently, students in the statistics major POST and the applied statistics specialist POST have the option of taking the second year sequence (STA220H1,STA255H1), or (STA247H1,STA248H1) designed for students in computer science programs, or the mathematically rigorous sequence (STA257H1,STA261H1) designed for students in the statistics specialist. We plan to replace the option for (STA220H1,STA255H1) for these programs with a new sequence of courses (STA237H1,STA238H1) which will cover similar content to (STA257H1,STA261H1) but with less mathematical rigour and a stronger connection to the practice of statistics. Analysis of student performance in a variety of third year courses in statistics has shown that students who completed the (STA220H1,STA255H1) sequence have performed, on average, several percentage points below students who completed the sequence (STA257H1,STA261H1) after controlling for their grade in the second year courses. We anticipate that (STA237H1,STA238H1) will help close that gap, particularly for courses in applied statistics. (STA237H1,STA238H1) will also include a strong statistical computation component, using computation for data analysis and for simulation to support the development of theoretical results.

**Impact:**

Students will have one additional course (0.5 FCE) required to complete their program of study, but the number of required FCE remains well within guidelines (7.0 FCE).

Regarding the addition of (STA237H1,STA238H1) as an option for the stream of courses that can be taken in 2nd year: This new course sequence will give students more choice in completing the program, depending on their mathematical background, which will be particularly useful for students who decide to complete the program after already completing courses that are exclusions to other options, typically less mathematically rigorous courses.

**Consultation:**

Consultation (Describe consultation that has already been done with students, faculty, and other units.)
As part of our curriculum renewal project, students in Statistics programs of study were extensively consulted (through a survey, a town hall, and through students serving on our curriculum committee). The program additions of STA130H1 and (STA237H1,STA238H1) are a direct result of this project. These changes have been approved by the Statistics undergraduate committee and by the department faculty at a department meeting.

Statistics programs of study are commonly combined with programs in Economics, Mathematics and Computer Science. All of these programs have been consulted regarding these changes. The Department of Economics has plans to allow (STA237H1,STA238H1) as an alternative to their second year statistics courses, for students completing programs in both Economics and Statistics. The Department of Computer Science will consider the new stream of courses as a program substitution for (STA247H1, STA248H1). The Rotman Commerce program has also been informed.

**Resource Implications:**
The necessary resources to create space in STA130H1 so that we can make it a required course have already been approved by the Dean’s office.

For the addition of the (STA237H1, STA238H1) stream there are no net resource requirements, other than existing needs for our growing programs. There will be a reshuffling of students among courses and we will offer fewer sections of other courses to add these new courses.

Statistics Minor

Description:

Previous:

New:

See proposal for Applied Statistics Specialist for more changes.

Enrolment Requirements:

Previous:

New:

Completion Requirements:

(4 full courses or their equivalent)

First Year:

MAT133Y1 (70%) / (MAT135H1, MAT136H1) / MAT137Y1 / MAT157Y1, CSC108H1 / CSC120H1 / CSC121H1 / CSC148H1 / (MAT135H1, MAT136H1) / MAT137Y1 / MAT157Y1 is strongly recommended.

STA130H1 is also strongly recommended.

Second Year:

MAT221H1 (70%) / MAT223H1 / MAT240H1, (STA220H1 / STA221H1 / ECO220Y1, STA255H1) / (STA237H1, STA238H1) / (STA247H1, STA248H1) / (STA257H1, STA261H1) / ECO227Y1

MAT221H1 (70%) / MAT223H1 / MAT240H1 recommended in 1st year

Higher Years:

STA302H1

2. 2 half (H) course equivalents from all available STA300+ level courses (excluding STA310H5)

Description of Proposed Changes:

We are adding as an option the new 2nd year stream of statistics courses STA237H1 + STA238H1, which are designed primarily to meet the needs of students in the statistics major.

We are excluding a UTM course (STA310H5) that is not intended for students in statistics programs of study.

No changes except that these 2nd year courses can be used as an alternative to existing streams of courses in 2nd year (STA220H1 + STA255H1 or STA257H1 + STA261H1). (See document for minor changes to Applied Statistics specialist program for small change to program description in calendar.)

Rationale:

Currently, students in the statistics major POS and the applied statistics specialist POS have the option of taking the second year sequence (STA220H1, STA255H1), or (STA247H1, STA248H1) designed for students in computer science...
programs, or the mathematically rigorous sequence (STA257H1, STA261H1) designed for students in the statistics specialist. We plan to replace the option for (STA220H1, STA255H1) for these programs with a new sequence of courses (STA237H1, STA238H1) which will cover similar content to (STA257H1, STA261H1) but with less mathematical rigour and a stronger connection to the practice of statistics. Analysis of student performance in a variety of third year courses in statistics has shown that students who completed the (STA220H1, STA255H1) sequence have performed, on average, several percentage points below students who completed the sequence (STA257H1, STA261H1) after controlling for their grade in the second year courses. We anticipate that (STA237H1, STA238H1) will help close that gap, particularly for courses in applied statistics. (STA237H1, STA238H1) will also include a strong statistical computation component, using computation for data analysis and for simulation to support the development of theoretical results. We are also making this an option for students in the statistics minor.

Impact:
This new course sequence will give students more choice in completing the statistics minor, depending on their mathematical background and interest in probability and statistical theory.

Consultation:
Statistics programs of study are commonly combined with programs in Economics, Mathematics and Computer Science. The Department of Economics is aware of these changes and has plans to allow (STA237H1, STA238H1) as an alternative to their second year statistics courses, for students completing programs in both Economics and Statistics. The Department of Computer Science will consider the new stream of courses as a program substitution for (STA247H1, STA248H1). The Rotman Commerce program has also been informed. Students in Rotman Commerce who wish to complete a minor in statistics would more typically complete STA220H1 (or ECO220Y1) + STA255H1 but this new stream is another option for their students who have sufficient mathematical preparation.

Resource Implications:
No net resource requirements, other than existing needs for our growing programs. There will be a reshuffling of students among courses and we will offer fewer sections of other courses to add these new courses.

Statistics Specialist

Description:

Previous:

New:

Statistical methods have applications in almost all areas of science, engineering, business, government, and industry. The practising statistician is involved in such diverse projects as designing clinical trials to test a new drug, economic model-building to evaluate the costs of a guaranteed-income scheme, predicting the outcome of a national election, planning a survey of television viewing habits, and estimating animal populations.

Today’s consumer is bombarded with the results of so many quantitative studies using statistical methodology that it is necessary to know something about statistics in order to be properly critical. A basic knowledge of statistics should be an integral part of everyone’s general education.

Probability theory is used to analyse the changing balance among the age-groups in a population as the birth rate changes, the control force needed to keep an aircraft on course through gusts of wind, the chance that the demand for electricity by all the customers served by a substation will exceed its capacity. These are just three of many phenomena that can be analysed in terms of randomness and probability.

The course offerings are intended not only for specialists in the theory of the subject but also to serve the needs of the many other disciplines that use statistical methods, e.g. in sample survey design and experimental design. Students following the Specialist Program are encouraged to include courses in major fields of application in their overall program. The Major Program can be profitably combined with specialization in another discipline. Students in these programs may also qualify for the A. Stat. designation from the Statistical Society of Canada.

Both applied and theoretical courses are offered in Statistics and Probability. The foundation courses STA220H1, STA221H1, STA237H1, STA238H1, STA247H1, STA248H1, STA255H1, STA257H1, and STA261H1 are distinguished primarily by their mathematical demands, as indicated by the prerequisites. Students interested in the Biological or Social
Statistics will generally find the most relevant courses of the more advanced offerings to be STA302H1, STA303H1, STA304H1, STA305H1 and STA429H1. The probability course STA347H1 will be of interest to those whose field of application includes stochastic models. Students interested in Data Science may want to consider the program of study in Data Science, offered jointly between the Departments of Statistical Science and Computer Science. The required courses in that program can be used as a guide to picking Statistics courses that are most relevant to Data Science.

Students in the Applied Statistics Specialist program must complete at least one disciplinary focus.

To enrol in one or more focuses, students must first be enrolled in the Applied Statistics Specialist program. Enrolment instructions can be found on the Arts & Science Current Students program enrolment website. Focuses can be chosen on ACORN after admission to the program.

**Admission Requirements:**
- **Previous:**
- **New:**

**Enrolment Requirements:**
- **Previous:**
- **New:**

(Note: The following enrolment requirements will be in effect for students enrolling in Spring 2019. For students enrolling in the Spring 2018 enrolment period, consult the requirements stated in the 2017-18 Calendar.)

This is a limited enrolment program (Type 2L) that can only accommodate a certain number of students. Eligibility is based on the following criteria:

For students entering the program after first year:

1. Completion of at least 4.0 FCEs including:

   - STA130H1,
   - CSC108H1/CSC120H1/CSC121H1/CSC148H1,
   - MAT223H1/MAT240H1,
   - MAT137Y1 with a minimum grade of 65% or MAT157Y1 with a minimum grade of 65%

   AND

2. An average of the grades in STA130H1 and MAT137Y1/MAT157Y1 that meets the department's annual cutoff

For students entering the program after 2nd year (for transfer students or as a 2nd chance for students who didn’t meet the 1st year requirements):

1. Completion of:

   - CSC108H1/CSC120H1/CSC121H1/CSC148H1,
   - MAT223H1/MAT240H1
   - MAT237Y1/MAT257Y1
   - STA257H1 with a minimum grade of 65% and STA261H1 with a minimum grade of 65%

   AND

2. An average of the grades in STA257H1 and STA261H1 and MAT237Y1/MAT257Y1 that meets the department's annual cutoff

134
**Completion Requirements:**

(11.5 full courses or their equivalent)

**First Year:**

**STA130H1, CSC108H1/CSC120H1/CSC121H1/CSC148H1, MAT137Y1/MAT157Y1, MAT223H1/MAT240H1**

- **STA130H1** is strongly recommended.

**Second Year:**

**MAT223H1/MAT240H1, MAT224H1/MAT247H1, MAT237Y1/MAT257Y1; STA257H1, STA261H1**

(MAT223H1/MAT240H1 recommended in 1st year while CSC148H1 might well be taken in 2nd year)

**Higher Years:**

1. STA302H1, STA303H1, STA347H1, STA355H1, STA410H1, STA442H1
2. 2 full year courses from the given list: (STA414H1/CSC411H1), STA422H1, STA437H1, STA447H1, STA452H1, STA453H1, STA457H1, STA465H1, STA480H1
3. 1.5 full year courses from: ACT451H1, ACT452H1, ACT460H1; APM412H1; MAT327H1, MAT334H1/MAT354H1, MAT337H1/MAT357H1, MAT301H1/MAT347Y1, CSC207H1, CSC310H1, CSC336H1/CSC436H1, STA300 + level courses (excluding STA310H5)

**Note:** Students planning to take any of these courses should ensure they have the required prerequisites

**Description of Proposed Changes:**

1. We are proposing to change our two specialist programs in statistics (the Statistics specialist and Applied Statistics specialist POSts) from Type 1 to Type 2L. We plan to aim for an enrolment of 48 students per year in each specialist program (96 students per year in total). This proposal has been considered and approved by the Committee on Admissions.

2. We are adding the course STA130H1 as a program requirement. It is currently strongly recommended. This results in a change of 0.5 FCE in our program requirements (from 11.0 FCE to 11.5 FCE).

3. Some housekeeping (excluding a UTM course that is not intended for students in statistics programs of study, requiring MAT223H1/MAT240H1 in first year (was in second year) since it is a prerequisite for MAT237Y1)

There are no changes to the statistics program learning outcomes.

Regarding the additional program requirement of STA130H1: Currently there is no required first year course in statistics, and students are choosing our programs of study without an adequate understanding of the discipline and what they can expect in future courses. STA130H1 serves many purposes, including a broad introduction to statistical reasoning in a variety of contexts and for a variety of purposes (description, explanation, prediction) supplemented by an introduction to modern practices in statistical computation, some consideration of the underlying mathematical theory, and extensive development of oral and written communication skills. The communications aspects of the course have been developed with extensive support from the ELL and WIT teams with recognition of the large percentage (approximately 60%) of international students in our programs of study.

**Rationale:**

1. Regarding change from Type 1 to Type 2L: Statistics programs of study have been experiencing enormous enrolment pressures; we have experienced a 9-fold increase in enrolment in the past 10 years, and more than a 2.5-fold increase in the past 3 years. Current enrolment in statistics programs of study is about 3600 students. A recent external review of the Department of Statistical Sciences recommended restraining this growth. Most of our students are in the statistics major (60% of students in statistics POSs), with another 20% in the statistics minor. No changes are being proposed to enrolment requirements in the statistics major and minor. This change will alleviate enrolment pressures on our 4th year courses, in particular, and ensure students are appropriately prepared for the demands of our specialist programs. Our analysis shows that success in 2nd year statistics courses is closely related to performance in first year calculus courses and that students with grades below the proposed minimum grade requirements do not succeed in 2nd year.
statistics courses, with large drop rates and grades that drop by as much as 30%, on average, from their first-year calculus grade (depending on course taken). Additional analysis shows that students who chose the less mathematically rigorous sequences of 2nd year statistics courses struggle in 3rd and 4th year courses that are required of students in the specialist programs. This change will also discourage the large number of students who enroll in our specialist programs late in their degree, often the summer before their 4th year, either because of inappropriate academic planning or to try to gain access to courses that have priority enrolment. Statistics specialist programs at UTSC and UTM are already Type 2L programs. Our analysis of current students suggests that almost all students who are currently enrolled in our specialist programs who have met the proposed minimum grade requirements and who are on track to complete the program they are enrolled in would have been admitted to the program under the proposed enrolment requirements. (A detailed document outlining our rationale for introduction enrolment requirements and the related data analysis carried out is attached.)

2. Regarding adding STA130H1 as a program requirement: The Department of Statistical Sciences has recently been undertaking a major curriculum renewal project. The requirement of STA130H1 for students in all of our major and specialist programs is an outcome of this project. Currently there is no required first year course in statistics, and students are choosing our programs of study without an adequate understanding of the discipline and what they can expect in future courses.

Impact:
Students will have one additional course (0.5 FCE) required to complete their program of study, but the number of required FCE remains well within guidelines (11.5 FCE).

Consultation:
The Mathematics department has been consulted about the proposed enrolment requirements. They have been approved by the Committee on Admissions.

As part of our curriculum renewal project, students in Statistics programs of study were extensively consulted (through a survey, a town hall, and through students serving on our curriculum committee). The program addition of STA130H1 is a direct result of this project. These changes have been approved by the Statistics undergraduate committee and by the department faculty at a department meeting.

Resource Implications:
The necessary resources to create space in STA130H1 so that we can make it a required course have already been approved by the Dean’s office.

2 New Courses:

STA237H1: Probability, Statistics and Data Analysis I

Impact on Programs:
This proposal triggers modifications in the unit’s program(s)

Contact Hours:
Lecture: 36 / Tutorial: 12

Description:
An introduction to probability using simulation and mathematical frameworks, with emphasis on the probability needed for more advanced study in statistical practice. Topics covered include probability spaces, random variables, discrete and continuous probability distributions, probability mass, density, and distribution functions, expectation and variance, independence, conditional probability, the law of large numbers, the central limit theorem, sampling distributions. Computer simulation will be taught and used extensively for calculations and to guide the theoretical development.

Prerequisites:
(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1
Statistical Sciences (FAS), Department of

Corequisites:

Exclusions:
STA247H1, STA255H1, STA257H1, ECO227Y1

Recommended Preparation:

Breadth Requirements:
The Physical and Mathematical Universes (5)

Distribution Requirements:
Science

Competencies:

Communication: slightly; Critical and Creative Thinking: slightly; Information Literacy: none
Quantitative Reasoning: extensively; Social and Ethical Responsibility: none

Experiential Learning:
Research: none; Other: none

Rationale:
Currently, students in the statistics major POSt and the applied statistics specialist POSt have the option of taking the second year sequence (STA220H1,STA255H1) or the mathematically rigorous sequence (STA257H1,STA261H1) designed for students in the statistics specialist. We plan to replace the option for (STA220H1,STA255H1) with a new sequence of courses (STA237H1,STA238H1) which will cover similar content to (STA257H1,STA261H1) but with less mathematical rigour and a stronger connection to the practice of statistics. (STA237H1,STA238H1) will also include a strong statistical computation component, using computation for data analysis and for simulation to support the development of theoretical results.

This new course sequence is being proposed for a number of reasons:
1. Our new first year course in statistical reasoning and data science, STA130H1, will be a required course for statistics major and specialist programs of study beginning in 2018-19. STA130H1 is a broad and modern introduction to statistics, and data science more broadly, and is designed for students who will go on to study statistics in greater depth. In statistics programs of study, STA130H1 will supplant the role currently played by STA220H1, a general statistics courses for students from any program of study.
2. Analysis of student performance in a variety of third year courses in statistics has shown that students who completed the (STA220H1,STA255H1) sequence have performed, on average, several percentage points below students who completed the sequence (STA257H1,STA261H1) after controlling for their grade in the second year courses. We anticipate that (STA237H1,STA238H1) will help close that gap, particularly for courses in applied statistics.
3. Many students struggle with the mathematical rigour in (STA257H1,STA261H1). The proposed sequence will give these students an option to drop down to the corresponding course in (STA237H1,STA238H1).
4. The new courses (STA237H1,STA238H1) have been designed to map directly to the new program learning outcomes recently developed as part of our curriculum renewal project in statistics.

Consultation:
The Department of Economics is aware of these changes and has plans to allow (STA237H1,STA238H1) as an alternative to their second year statistics courses, for students completing programs in both Economics and Statistics. The Rotman Commerce program has also been informed, in particular to clarify paths for their students, many of whom complete a minor in statistics.

Resources:
Instructor and TA support at the level we currently provide to our second-year courses in statistics.

Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:
The course overlaps with the exclusions noted but will play a unique role, designed particularly for students in the statistics major (of which there are now over 2000 students).
### Programs of Study for Which This Course Might be Suitable:
Statistics, Economics

### Estimated Enrolment:
500

### Instructor:
Bethany White (or any faculty member in the Department of Statistical Sciences)

# STA238H1: Probability, Statistics and Data Analysis II

## Impact on Programs:
This proposal triggers modifications in the unit’s program(s)

## Contact Hours:
- **Lecture:** 36  
- **Tutorial:** 12

## Description:
An introduction to statistical inference and practice. Statistical models and parameters, estimators of parameters and their statistical properties, methods of estimation, confidence intervals, hypothesis testing, likelihood function, the linear model. Use of statistical computation for data analysis and simulation.

## Prerequisites:
-(MAT135H1, MAT136H1)/MAT137Y1/MAT157Y1

## Corequisites:

## Exclusions:
- STA248H1, STA255H1, STA261H1, ECO227Y1

## Recommended Preparation:

## Breadth Requirements:
The Physical and Mathematical Universes (5)

## Distribution Requirements:
Science

## Competencies:
- **Communication:** slightly;  
- **Critical and Creative Thinking:** slightly;  
- **Information Literacy:** none  
- **Quantitative Reasoning:** extensively;  
- **Social and Ethical Responsibility:** slightly

## Experiential Learning:
- **Research:** none;  
- **Other:** none

## Rationale:
Currently, students in the statistics major POSt and the applied statistics specialist POSt have the option of taking the second year sequence (STA220H1,STA255H1) or the mathematically rigorous sequence (STA257H1,STA261H1). We plan to replace the option of (STA220H1,STA255H1) with a new sequence of courses (STA237H1,STA238H1) which will cover similar content to (STA257H1,STA261H1) but with less mathematical rigour and a stronger connection to the practice of statistics. (STA237H1,STA238H1) will also include a strong statistical computation component, using computation for data analysis and for simulation to support the development of theoretical results.

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4. The new courses (STA237H1,STA238H1) have been designed to map directly to the new program learning outcomes recently developed as part of our curriculum renewal project in statistics.

Consultation:
The Department of Economics is aware of these changes and plans to allow (STA237H1,STA238H1) as an alternative to their second year statistics courses, for students completing programs in both Economics and Statistics. The Rotman Commerce program has also been informed to clarify paths for their students, many of whom complete a minor in statistics.

Resources:
Instructor and TA support at the level we currently provide to our second-year courses in statistics.

Budget Implications:
The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:
The course overlaps with the exclusions noted but will play a unique role, designed particularly for students in the statistics major (in which there are now over 2000 students).

Programs of Study for Which This Course Might be Suitable:
Arts & Science

Estimated Enrolment:
500

Instructor:
Bethany White (or any faculty member in the Department of Statistical Sciences)

3 Course Modifications:

STA130H1: An Introduction to Statistical Reasoning and Data Science

Corequisites:
MAT135H1/MAT136H1/MAT137Y1/MAT157Y1. Strongly recommended:, CSC108H1/CSC120H1/CSC121H1/CSC148H1

Rationale:
Early conversations and course enrolment considerations around STA130H1 suggest it would be good to have first-year CSC as a strongly recommended corequisite rather than required.

Consultation:

Resources:

STA302H1: Methods of Data Analysis I

Prerequisites:
STA238H1/STA248H1/STA255H1/STA261H1/ECO227Y1, CSC108H1/CSC120H1/CSC121H1/CSC148H1, MAT221H1 (70%)/MAT223H1/MAT240H1

Rationale:
### STA355H1: Theory of Statistical Practice

#### Prerequisites:

- STA255H1 (75%: beginning Fall 2019)
- STA261H1 (60%: beginning Fall 2019)
- STA248H1 (75%: beginning Fall 2019)
- STA238H1 (75%: beginning Fall 2019)
- ECO227Y1 (60%: beginning Fall 2019)
- MAT223H1/MAT240H1
- MAT235Y1/MAT237Y1/MAT257Y1

#### Rationale:

We are introducing the requirement of minimum grades in the prerequisite courses. STA355H1 was designed as a core course in the statistics specialist programs of study. Recently many students from other programs of study have enrolled in the course and the course has a very large drop rate as many of these students did not have adequate preparation. Using data from previous students enrolled in STA355H1, analysis was carried out on the relationship between academic performance in STA355H1 and marks in the prerequisite courses in order to determine the minimum performance in the prerequisite courses that is associated with successful completion of STA355H1. The proposed required minimum grades in the prerequisite courses were chosen based on this analysis.
# 2 New Courses:

### COG260H1: Data, Computation, and the Mind

<table>
<thead>
<tr>
<th>Contact Hours:</th>
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<tbody>
<tr>
<td>Lecture: 24</td>
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**Description:**

How does the human mind work? We explore this question by analyzing a range of data concerning such topics as human rationality and irrationality, human memory, how objects are represented in the mind, and the relation of language and cognition. This class provides critical thinking and practical computational skills that will allow students to work with data in cognitive science and related disciplines.

**Prerequisites:**

CSC108H1

**Corequisites:**

COG250Y1

**Exclusions:**

**Recommended Preparation:**

**Breadth Requirements:**

Society and its Institutions (3)

**Distribution Requirements:**

Social Science

**Competencies:**

- **Communication:** notably; **Critical and Creative Thinking:** extensively; **Information Literacy:** notably
- **Quantitative Reasoning:** extensively; **Social and Ethical Responsibility:** slightly

**Experiential Learning:**

- **Research:** notably; **Other:** none

**Rationale:**

An important skill for cognitive science students to acquire is the ability to relate human behavioral data (from experimental or observational studies), and/or brain imaging data, to theories and models about the representations and mechanisms that underlie various aspects of cognition. Advances in data science are key to making these links in theoretically-motivated and methodologically-justified ways. This course will develop in students these disciplinary-specific skills (which have wide applicability in various fields, such as organizational behaviour, human-computer interaction design, various medical fields, etc.), as well as transferable skills such as data analysis techniques and computational design and implementation methods.

**Consultation:**

Psychology and Computer Science

**Resources:**

TA support in the amount of 80 hours, following the standard practice in courses in CSC (2 hr/student), that are comparable in format to the present course.

**Budget Implications:** The academic unit will provide the resources required for this course from existing budget.

**Overlap with Existing Courses:**
## COG343H1: Issues on Cognitive Science III: Computational Cognition

### Contact Hours:
- **Lecture**: 24  
- **Practical**: 12

### Description:
An examination of core topics in cognitive science building on introductions in COG250Y1. Typical topics include: computational models of cognition and learning, natural language processing, computer intelligence.

### Prerequisites:
- CSC148H1, STA220H1/PSY201H1

### Corequisites:
- COG250Y1

### Exclusions:

### Recommended Preparation:

### Breadth Requirements:
- The Physical and Mathematical Universes (5)

### Distribution Requirements:
- Science

### Competencies:
- **Communication**: notably;  
- **Critical and Creative Thinking**: extensively;  
- **Information Literacy**: notably;  
- **Quantitative Reasoning**: extensively;  
- **Social and Ethical Responsibility**: slightly

### Experiential Learning:
- **Research**: notably;  
- **Other**: none

### Rationale:
This course will expand our third-year course series (COG341H1/COG342H1), which represent a philosophical and psychological perspective on cognitive science to include a computational cognition perspective.

### Consultation:
Psychology and Computer Science

### Resources:
TA support in the amount of 80 hours, following the standard practice in courses in CSC (2 hr/student), that are comparable in format to the present course.

### Budget Implications:
The academic unit will provide the resources required for this course from existing budget.

### Overlap with Existing Courses:
No direct overlap with existing courses.

**Programs of Study for Which This Course Might be Suitable:**
- COG Major (Science – ASMAJ1446)

**Estimated Enrolment:**
- 40

**Instructor:**
- Prof. Yang Xu
No direct overlap with existing courses.

Programs of Study for Which This Course Might be Suitable:
  COG Major (Science – ASMAJ1446)

Estimated Enrolment:
  40

Instructor:
  Prof. Suzanne Stevenson

1 Course Modification:

COG403H1: Seminar in Cognitive Science

Impact on Programs:
  This proposal triggers modifications in the unit's program(s)

Description:
  Previous:
  The role of Artificial Intelligence / Machine Learning in the design and construction of cognitive systems and their role within Cognitive Science. Topics may vary from year to year, but may include deep learning, neural networks, knowledge representation and reasoning, and computational Neuroscience.

  New:
  Advanced treatment of cognitive science topics, including the application of core ideas from probability theory, information theory, statistics, and machine learning to modelling human cognition and artificial intelligence.

Prerequisites:
  5.0 credits in courses listed in the cognitive science major COG250Y1, CSC148H1, ESC384H1 (requires permission of the Cognitive Science director), (MAT135H1, MAT136H1)/MAT137Y1, PHL342H1, PSY473H1/PSY493H1, 0.5 FCE in statistics

Rationale:

Consultation:

Resources:
7 New Courses:

WDW335H1: From Book to Map to Video Game: Texts and their Digital Transformations

Impact on Programs: This proposal triggers modifications in the unit's program(s)

Contact Hours: 

Lecture: 24 / Practical: 12

Description: An examination of the new forms of storytelling made possible by digital media from two perspectives, that of the maker and that of the scholarly reader. Students learn to critically analyze storytelling in new media and experiment with their own adaptations of a literary text to various digital platforms.

Prerequisites: WDW235H1 and WDW236H1; open to students not taking the Digital Humanities Minor by permission of the program coordinator.

Corequisites:

Exclusions:

Recommended Preparation:

Breadth Requirements: Creative and Cultural Representations (1)

Distribution Requirements: Humanities

Competencies: Communication: extensively; Critical and Creative Thinking: extensively; Information Literacy: extensively; Quantitative Reasoning: notably; Social and Ethical Responsibility: notably

Experiential Learning: Research: none; Other: extensively;
Nature of "Other" Experiential Learning: Distinctive Practicals or Laboratories

Rationale: Digital humanities (DH) is an emerging discipline at the intersections of the humanities with computing. DH offers a set of methodologies for approaching traditional humanities areas of inquiry in an age when the materials that humanists study are increasingly digitally mediated: when historical and literary corpora are digitized, when cultural heritage is digitized for preservation and restoration, when scholars use digital tools for community engagement, when online communities create micro-worlds with cultures shaped by their technical platforms as well as the currents of wider cultures. And in turn, Digital Humanities also enables critical perspectives on the digital, bringing humanities insights to bear on digital tools, platforms, and communities. Far from “replacing” traditional humanities disciplines, DH complements them and supports traditional areas of inquiry. Its tools open new ways for researchers to approach their materials, to collaborate with one another and disseminate their knowledge. And its critical engagement with the digital brings humanities modes of understanding and knowledge production into the world of data and algorithms.

The methodological framework of DH enables humanists -- from established researchers to undergraduate students —
to make valuable contributions to the conversation around digital cultures and digital artifacts: about categories and ontologies, complicated and nuanced ways of classifying and understanding data; about the narratives that turn data into knowledge; about the equity concerns around access to digital technologies; about what it means to know, and what kind of knowledge (and whose knowledge) is authoritative, and what kind of knowledge (and whose knowledge) is silenced or left out.

This particular course focuses on the new kinds of storytelling made possible by digital media. From fan fiction archives to video games, from Twitter novels to Virtual Reality exhibits, new media open new storytelling forms and possibilities. Students will gain a theoretical vocabulary for analyzing digitally mediated stories as complex cultural objects, configured by and configuring their communities of readers. And students will complete a creative project in which they learn by making, turning a literary text into a video game, an archive, a map, an exhibit, or a hybrid form.

**Consultation:**

**Resources:**
For the one-hour practical session each week, a computer lab such as Sidney Smith 561 will be needed.

**Budget Implications:** The academic unit will provide the resources required for this course from existing budget.

**Overlap with Existing Courses:**

**Programs of Study for Which This Course Might be Suitable:**
Book and Media Studies, Cinema Studies, English, History & Philosophy of Science and Technology, Medieval Studies, Religion.

**Estimated Enrolment:**
Capped at 50 students.

**Instructor:**
The course will be taught by Teaching Stream faculty appointed at Woodsworth College, usually Professor Alexandra Bolintineanu.

**WDW336H1: Cultural Literacy in the Digital Age**

**Impact on Programs:**
This proposal triggers modifications in the unit's program(s)

**Contact Hours:**

**Lecture:** 24

**Description:**
This course examines two related debates about digital media in education: first, how best to integrate digital technology into learning (digital or computer literacy), and, secondly, what knowledge is required for full cultural participation (cultural literacy). We examine these issues using a range of academic, general interest and discipline-specific sources.

**Prerequisites:**
WDW235H1 and WDW236H1; open to students not taking the Digital Humanities Minor by permission of the program coordinator.

**Corequisites:**

**Exclusions:**

**Recommended Preparation:**
**Woodsworth College**

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<td><strong>Instructor:</strong></td>
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Woodsworth College

The course will be taught by Teaching Stream faculty appointed at Woodsworth College, usually Professor Theresa Moritz.

WDW337H1: Historical Archives in the Digital Age

Impact on Programs:
This proposal triggers modifications in the unit's program(s)

Contact Hours:
Lecture: 24 / Practical: 12

Description:
How do digital surrogates of texts and objects change how we use them? This course examines texts and archives in the digital age: the aims of building them; the new scholarly approaches that they enable; the preservation, access, and equity questions that they raise and require us to answer responsibly.

Prerequisites:
WDW235H1 and WDW236H1; open to students not taking the Digital Humanities Minor by permission of the program coordinator.

Corequisites:

Exclusions:

Recommended Preparation:

Breadth Requirements:
Creative and Cultural Representations (1)

Distribution Requirements:
Humanities

Competencies:
Communication: extensively; Critical and Creative Thinking: extensively; Information Literacy: extensively
Quantitative Reasoning: slightly; Social and Ethical Responsibility: extensively

Experiential Learning:
Research: none; Other: extensively;
Nature of "Other" Experiential Learning: Distinctive Practicals or Laboratories

Rationale:
Digital humanities (DH) is an emerging discipline at the intersections of the humanities with computing. DH offers a set of methodologies for approaching traditional humanities areas of inquiry in an age when the materials that humanists study are increasingly digitally mediated: when historical and literary corpora are digitized, when cultural heritage is digitized for preservation and restoration, when scholars use digital tools for community engagement, when online communities create micro-worlds with cultures shaped by their technical platforms as well as the currents of wider cultures. And in turn, Digital Humanities also enables critical perspectives on the digital, bringing humanities insights to bear on digital tools, platforms, and communities. Far from “replacing” traditional humanities disciplines, DH complements them and supports traditional areas of inquiry. Its tools open new ways for researchers to approach their materials, to collaborate with one another and disseminate their knowledge. And its critical engagement with the digital brings humanities modes of understanding and knowledge production into the world of data and algorithms.

The methodological framework of DH enables humanists -- from established researchers to undergraduate students — to make valuable contributions to the conversation around digital cultures and digital artifacts: about categories and...
ontologies, complicated and nuanced ways of classifying and understanding data; about the narratives that turn data into knowledge; about the equity concerns around access to digital technologies; about what it means to know, and what kind of knowledge (and whose knowledge) is authoritative, and what kind of knowledge (and whose knowledge) is silenced or left out.

This course explores digital historical archives and the scholarly approaches enabled by them, from interpretive digital exhibits (which involve close-reading archives in a rich, multi-layered cultural context) to distant reading (which involves the study of patterns in large corpora of texts, through computational techniques such as metadata analysis, topic modelling, and sentiment analysis). We consider some of the concerns raised by digital archives, from preservation and intellectual property to cultural appropriation. And we digitize our own historical archive of primary sources. (The historical documents used will vary year by year. In the first two years, we will work with the Woodsworth College Archive.)

| Consultation: |
| Resources: |
| For the one-hour practical session each week, a computer lab such as Sidney Smith 561 will be needed. |
| Budget Implications: | The academic unit will provide the resources required for this course from existing budget. |

| Overlap with Existing Courses: |
| Programs of Study for Which This Course Might be Suitable: |

| Estimated Enrolment: |
| Capped at 50 students. |

| Instructor: |
| The course will be taught by Teaching Stream faculty appointed at Woodsworth College, usually Professor Alexandra Bolintineanu. |

**WDW338H1: Data: Access, Creation, Curation, and Interpretation**

| Impact on Programs: |
| This proposal triggers modifications in the unit's program(s) |

| Contact Hours: |
| Lecture: 24 / Practical: 12 |

| Description: |
| A central challenge of digital humanities is the complexity of representing interpretive, narrative, and perspective-dependent humanities data through digital tools and environments. Topics include the history of “data” as term and concept; data standards, databases, and linked data; datasets, data curation and analytics, both qualitative and quantitative; and data visualization. |

| Prerequisites: |
| WDW235H1 and WDW236H1; open to students not taking the Digital Humanities Minor by permission of the program coordinator. |

| Corequisites: |

| Exclusions: |
**Woodsworth College**

**Recommended Preparation:**

**Breadth Requirements:**
- Creative and Cultural Representations (1)

**Distribution Requirements:**
- Humanities

**Competencies:**
- **Communication:** extensively;
- **Critical and Creative Thinking:** extensively;
- **Information Literacy:** extensively
- **Quantitative Reasoning:** notably;
- **Social and Ethical Responsibility:** notably

**Experiential Learning:**
- **Research:** none;
- **Other:** extensively;
- **Nature of "Other" Experiential Learning:** Distinctive Practicals or Laboratories

**Rationale:**

Digital humanities (DH) is an emerging discipline at the intersections of the humanities with computing. DH offers a set of methodologies for approaching traditional humanities areas of inquiry in an age when the materials that humanists study are increasingly digitally mediated: when historical and literary corpora are digitized, when cultural heritage is digitized for preservation and restoration, when scholars use digital tools for community engagement, when online communities create micro-worlds with cultures shaped by their technical platforms as well as the currents of wider cultures. And in turn, Digital Humanities also enables critical perspectives on the digital, bringing humanities insights to bear on digital tools, platforms, and communities. Far from “replacing” traditional humanities disciplines, DH complements them and supports traditional areas of inquiry. Its tools open new ways for researchers to approach their materials, to collaborate with one another and disseminate their knowledge. And its critical engagement with the digital brings humanities modes of understanding and knowledge production into the world of data and algorithms.

The methodological framework of DH enables humanists -- from established researchers to undergraduate students — to make valuable contributions to the conversation around digital cultures and digital artifacts: about categories and ontologies, complicated and nuanced ways of classifying and understanding data; about the narratives that turn data into knowledge; about the equity concerns around access to digital technologies; about what it means to know, and what kind of knowledge (and whose knowledge) is authoritative, and what kind of knowledge (and whose knowledge) is silenced or left out.

Developed in consultation with computer scientists and librarians, this course provides an interdisciplinary introduction to data in the digital humanities and beyond. Scientists and humanities scholars alike ask questions about data access, privacy, surveillance, and security; about data representation, sharing, and preservation; about the stories we tell through data, and the worlds and cultures we create. Students learn the history of data in the sciences, the social sciences, the humanities, and the digital humanities in particular. They become aware of representation and preservation issues around digital data throughout the life cycle of a research projects, and learn to analyze and critique datasets from scholarly projects and open government sources using both qualitative and quantitative perspectives, becoming become familiar with data analysis and visualization tools and with the rudiments of coding in the process.

**Consultation:**

**Resources:**
- For the one-hour practical session each week, a computer lab such as Sidney Smith 561 will be needed.

**Budget Implications:** The academic unit will provide the resources required for this course from existing budget.

**Overlap with Existing Courses:**

**Programs of Study for Which This Course Might be Suitable:**

**Estimated Enrolment:** 149
Woodsworth College

Instructor:
The course will be taught by Teaching Stream faculty appointed at Woodsworth College, usually Professor Alexandra Bolintineanu.

WDW435H1: The Internet Archive

Impact on Programs:
This proposal triggers modifications in the unit's program(s)

Contact Hours:
Lecture: 24 / Practical: 12

Description:
Digital environments change how knowledge is created, communicated, and used. Using the Internet Archive as case study, this course examines the significance of such changes from a variety of perspectives: knowledge representation; technical infrastructure; gender, class, and race issues; disability rights; intellectual property questions; and algorithmic and interpretive scholarly approaches.

Prerequisites:
WDW235H1 and WDW236H1 plus at least 1.0 additional FCE in the Digital Humanities Minor program; open to students not taking the Digital Humanities Minor by permission of the program coordinator.

Recommended Preparation:

Breadth Requirements:
Creative and Cultural Representations (1)

Distribution Requirements:
Humanities

Competencies:
Communication: extensively; Critical and Creative Thinking: extensively; Information Literacy: extensively
Quantitative Reasoning: notably; Social and Ethical Responsibility: notably

Experiential Learning:
Research: none; Other: extensively;
Nature of "Other" Experiential Learning: Distinctive Practicals or Laboratories

Rationale:
Digital humanities (DH) is an emerging discipline at the intersections of the humanities with computing. DH offers a set of methodologies for approaching traditional humanities areas of inquiry in an age when the materials that humanists study are increasingly digitally mediated: when historical and literary corpora are digitized, when cultural heritage is digitized for preservation and restoration, when scholars use digital tools for community engagement, when online communities create micro-worlds with cultures shaped by their technical platforms as well as the currents of wider cultures. And in turn, Digital Humanities also enables critical perspectives on the digital, bringing humanities insights to bear on digital tools, platforms, and communities. Far from “replacing” traditional humanities disciplines, DH complements them and supports traditional areas of inquiry. Its tools open new ways for researchers to approach their materials, to collaborate with one another and disseminate their knowledge. And its critical engagement with the digital brings humanities modes of understanding and knowledge production into the world of data and algorithms.
The methodological framework of DH enables humanists -- from established researchers to undergraduate students — to make valuable contributions to the conversation around digital cultures and digital artifacts: about categories and ontologies, complicated and nuanced ways of classifying and understanding data; about the narratives that turn data into knowledge; about the equity concerns around access to digital technologies; about what it means to know, and what kind of knowledge (and whose knowledge) is authoritative, and what kind of knowledge (and whose knowledge) is silenced or left out.

Founded in 1996 in San Francisco, the Internet Archive is a non-profit digital library of books, movies, software, music, websites, and other media. In this course, using the Internet Archive as the major “text,” students analyze how knowledge is created, communicated, and used in digital environments and communities. As we explore the Internet Archive, we ask questions like these: How should we digitize the crumbling books of the 1920s? or rare, fragile medieval manuscripts with fold-outs and tight gutters? What does “universal access to all knowledge,” the Internet Archive’s motto, mean for readers who need assistive technologies, or for readers who have only limited computing access? How is such access shaped by intellectual property law and institutional dynamics? What research possibilities, from literary analysis to large-scale data mining, does a digital repository like the Internet Archive enable? To answer these questions, students visit the Internet Archive and gain hands-on experience with book digitization. They also extract and critique an Internet Archive data set and, in collaboration, create digital artifacts (exhibit, map, visualization, narrative, video) to communicate their analysis to a wider public.

Consultation:

Resources:

For the one-hour practical session each week, a computer lab such as Sidney Smith 561 will be needed.

Budget Implications: The academic unit will provide the resources required for this course from existing budget.

Overlap with Existing Courses:

Programs of Study for Which This Course Might be Suitable:


Estimated Enrolment:

Capped at 50 students.

Instructor:

The course will be taught by Teaching Stream faculty appointed at Woodsworth College, usually Professor Alexandra Bolintineanu.

WDW436H1: Topics in Digital Humanities

Impact on Programs:

This proposal triggers modifications in the unit's program(s)

Contact Hours:

Lecture: 24 / Practical: 12

Description:

This course serves as a capstone for the Digital Humanities Minor program. It includes opportunities for students to conduct original research. The topics for this course will vary from year to year.

Prerequisites:

WDW235H1 and WDW236H1, plus at least 1.0 additional FCE in the Digital Humanities Minor program.

Corequisites:
Woodsworth College

**Exclusions:**

**Recommended Preparation:**

**Breadth Requirements:**
- Creative and Cultural Representations (1)

**Distribution Requirements:**
- Humanities

**Competencies:**
- *Communication:* extensively; *Critical and Creative Thinking:* extensively; *Information Literacy:* extensively
- *Quantitative Reasoning:* notably; *Social and Ethical Responsibility:* notably

**Experiential Learning:**
- *Research:* none; *Other:* extensively;
- *Nature of "Other" Experiential Learning:* Distinctive Practicals or Laboratories

**Rationale:**

Digital humanities (DH) is an emerging discipline at the intersections of the humanities with computing. DH offers a set of methodologies for approaching traditional humanities areas of inquiry in an age when the materials that humanists study are increasingly digitally mediated: when historical and literary corpora are digitized, when cultural heritage is digitized for preservation and restoration, when scholars use digital tools for community engagement, when online communities create micro-worlds with cultures shaped by their technical platforms as well as the currents of wider cultures. And in turn, Digital Humanities also enables critical perspectives on the digital, bringing humanities insights to bear on digital tools, platforms, and communities. Far from “replacing” traditional humanities disciplines, DH complements them and supports traditional areas of inquiry. Its tools open new ways for researchers to approach their materials, to collaborate with one another and disseminate their knowledge. And its critical engagement with the digital brings humanities modes of understanding and knowledge production into the world of data and algorithms.

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The topics for this course will vary from year to year, but the course will always include opportunities for students to conduct some original research, to make it serve as a capstone for the DH Minor program.

Planned first course: Even as they provide a profound glimpse into medieval ways of conceiving of humanity, monstrosity, and human knowledge and its limits, medieval wonders and monsters survive into modern popular culture and reverberate in modern political and cultural discourses. Through close engagement with medieval texts, images, and manuscripts, student become familiar with medieval wonder traditions, interrogate what they meant to medieval writers, and explore how the images and narratives survive into present-day discourses. At the same time, they will examine the effects of digitization on the study of the past and the creation and dissemination of knowledge.

**Consultation:**

**Resources:**
- For the one-hour practical session each week, a computer lab such as Sidney Smith 561 will be needed.

**Budget Implications:**
- The academic unit will provide the resources required for this course from existing budget.

**Overlap with Existing Courses:**

**Programs of Study for Which This Course Might be Suitable:**

152
Woodsworth College


Estimated Enrolment:
Capped at 50 students.

Instructor:
The course will be taught by Teaching Stream faculty appointed at Woodsworth College, usually Professor Alexandra Bolintineanu.

WDW437H1: Research Projects in Digital Humanities

Impact on Programs:
This proposal triggers modifications in the unit's program(s)

Contact Hours:

Description:
This course is for students who wish to pursue a significant research project, usually participation in a faculty-led DH research project, though it may take other forms. Students must be enrolled in the DH Minor program or obtain special permission of the program coordinator.

Prerequisites:
WDW235H1 and WDW236H1, plus at least 1.0 additional FCE in the Digital Humanities Minor program.

Corequisites:

Exclusions:

Recommended Preparation:

Breadth Requirements:
Creative and Cultural Representations (1)

Distribution Requirements:
Humanities

Competencies:
*Communication*: extensively; *Critical and Creative Thinking*: extensively; *Information Literacy*: extensively
*Quantitative Reasoning*: notably; *Social and Ethical Responsibility*: notably

Experiential Learning:
*Research*: extensively; *Other*: none

Rationale:
Digital humanities (DH) is an emerging discipline at the intersections of the humanities with computing. DH offers a set of methodologies for approaching traditional humanities areas of inquiry in an age when the materials that humanists study are increasingly digitally mediated: when historical and literary corpora are digitized, when cultural heritage is digitized for preservation and restoration, when scholars use digital tools for community engagement, when online communities create micro-worlds with cultures shaped by their technical platforms as well as the currents of wider cultures. And in turn, Digital Humanities also enables critical perspectives on the digital, bringing humanities insights to bear on digital tools, platforms, and communities. Far from “replacing” traditional humanities disciplines, DH complements them and supports traditional areas of inquiry. Its tools open new ways for researchers to approach their materials, to collaborate with one another and disseminate their knowledge. And its critical engagement with the digital brings humanities modes of understanding and knowledge production into the world of data and algorithms.
The methodological framework of DH enables humanists -- from established researchers to undergraduate students — to make valuable contributions to the conversation around digital cultures and digital artifacts: about categories and ontologies, complicated and nuanced ways of classifying and understanding data; about the narratives that turn data into knowledge; about the equity concerns around access to digital technologies; about what it means to know, and what kind of knowledge (and whose knowledge) is authoritative, and what kind of knowledge (and whose knowledge) is silenced or left out.

This course provides an opportunity for undergraduate students in their third or fourth year to work on a major Digital Humanities faculty research project, becoming involved in original, authentic research and in the collaborative research community, comprising graduate students, faculty, and technologists, that such projects bring together. As students complete a substantial piece of Digital Humanities independent research, the course also functions as a capstone for the Minor program, consolidating the technical and critical analysis skills that students have been building throughout the program. In addition to project-specific work, to be determined in collaboration with the faculty member leading the project, students also participate in a series of hands-on workshops that introduce them to (or add to their understanding of) relevant digital tools and approaches, from text analysis and coding to digital exhibits and mapping.

(NB The model for this course builds on the success in recent years of Step Forward-funded projects that enabled undergraduate students to participate in DH research projects led by faculty in History, Medieval Studies, and Religion.)

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| Budget Implications: | The academic unit will provide the resources required for this course from existing budget. |

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| The number of students able to undertake projects of the kind envisioned here depends on the availability of appropriate faculty-led DH research projects and on necessary funding for RA hours. |

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| As coordinator of the DH Minor program, Professor Alexandra Bolintineanu will manage this course in collaboration with the disciplinary faculty leading the DH research projects. |