University of Waterloo
SENATE UNDERGRADUATE COUNCIL
Notice of Meeting

DATE: Tuesday 10 September 2019
TIME: 12:00 noon – 2:00 p.m.
PLACE: NH 3318

Please note:
A light lunch will be served.

Open Session

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<td>c. FAR – Math/Business, Math/CPA, Math/FARM* (Reviewers: Cathy Newell-Kelly, Bruce MacVicar; Guest: TBD)</td>
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<td>f. 2-Year Report – Statistics and Actuarial Science* (Reviewer: Kathy Acheson; Guest: Stefan Steiner)</td>
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<td>7. Other Business</td>
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<td>8. Next Meeting: Tuesday 8 October 2019, 12:00 to 2:00 p.m. in NH 3318</td>
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*material attached/to be distributed**

“SEN-C” to be recommended to Senate for approval (consent agenda)
“SEN-R” to be recommended to Senate for approval (regular agenda)
“UGC” to be approved on behalf of Senate & sent to Senate for information

3 September 2019
Rebecca Wickens
Associate University Secretary
8. Declarations of conflict of interest

8.01 At the beginning of each meeting of Senate or any of Senate’s committees or councils, the chair will call for members to declare any conflicts of interest with regard to any agenda item. For agenda items to be discussed in closed session, the chair will call for declarations of conflict of interest at the beginning of the closed portion of the meeting. Members may nonetheless declare conflicts at any time during a meeting.

8.02 A member shall be considered to have an actual, perceived or potential conflict of interest, when the opportunity exists for the member to use confidential information gained as a member of Senate, or any of Senate’s committees or councils, for the personal profit or advantage of any person, or use the authority, knowledge or influence of the Senate, or a committee or council thereof, to further her/his personal, familial or corporate interests or the interests of an employee of the university with whom the member has a marital, familial or sexual relationship.

8.03 Members who declare conflicts of interest shall not enter into debate nor vote upon the specified item upon which they have declared a conflict of interest. The chair will determine whether it is appropriate for said member to remove themselves from the meeting for the duration of debate on the specified item(s).

8.04 Where Senate or a committee or council of Senate is of the opinion that a conflict of interest exists that has not been declared, the body may declare by a resolution carried by two-thirds of its members present at the meeting that a conflict of interest exists and a member thus found to be in conflict shall not enter into debate on the specified item upon which they have declared a conflict of interest. The chair will determine whether it is appropriate for said member to remove themselves from the meeting for the duration of debate on the specified item(s).
Present: Katherine Acheson, Veronica Austen, William Chesney, Victoria Chu, Mario Coniglio (chair), Thomas Dedinsky, Peter Douglas, Yashar Ebadi, Leann Ferries, Brendon Larson, Clare Mitchell, Cathy Newell Kelly, Francis Poulin, Marlee Spafford, Cristina Vanin, Chris Vigna, Rebeca Wickens (secretary), Jeff Wilson, Dan Wolczuk, Tiana Zhao

Resources: Blair Clarance, Danielle Jeanneault, Amanda McKenzie, Alyssa Voigt

Guests: David DeVidi, Lindsay Campbell

Absent: Joe Barcellos, Vivian Dayeh*, Matthew Gerrits*, Bruce MacVicar, Richard Wikkerink*

*regrets

Organization of Meeting: Mario Coniglio took the chair, and Rebecca Wickens acted as secretary. The secretary advised that a quorum was present. The agenda was approved without formal motion.

1. DECLARATIONS OF CONFLICTS OF INTEREST

No conflicts of interest were declared.

2. APPROVAL OF THE 14 MAY 2019 MINUTES AND BUSINESS ARISING

The minutes were approved as presented. Spafford and Newell Kelly. Carried.

Faculty of Environment Student Engagement Award. Newell Kelly reported that the awards are valued at $2,500 each.

3. CURRICULAR ITEMS FOR APPROVAL & INFORMATION

Applied Health Sciences. Ferries reported on a new mental health literacy course, noting: the proposed effective date is 1 January 2020; it is available to all students; it would be helpful for students to take it in first year or as early as possible in their academic careers; the current capacity is 80-100 students with the hope of eventually offering it online to a larger group. There was a motion to approve the proposed course as presented, effective 1 January 2020. Ferries and Douglas. Carried.

Arts. Acheson presented item 3b1 of the agenda. Following a brief discussion re: the title change for RS260, there was a motion to approve the plan changes, new courses, course changes and course inactivations set forth in item 3b1 of the agenda package on behalf of Senate. Acheson and Chesney. Carried.

Acheson took members through Section 2 of item 3b2 of the agenda package, noting: the creation of new language diplomas in Arabic, Chinese, Korean and Japanese; the new Diversity and Equity Specialization. There was a motion to recommend that Senate approve the new academic plans set forth in Section 2 of item 3b2 of the agenda. Acheson and Chesney. Carried.

Acheson took members through the remainder of item 3b2 of the agenda package, noting: the addition of the new course code, ARABIC, to the breadth requirements; changes to and inactivations of certain language diplomas and certificates (related to the creation of the new diplomas in Arabic, Chinese, Korean and Japanese); inactivation of the Cultural Diversity Specialization (replaced by the new Diversity and Equity Specialization); minor plan changes, new courses and course changes. There was a motion to recommend that Senate approve the changes to the breadth requirements, major modifications to plans (3.1.1-3.1.6) and plan inactivations. Acheson and Chesney. Carried. There was a motion to approve the remaining plan changes, new courses and course changes set forth in item 3b2 of the agenda package on behalf of Senate. Acheson and Chesney. Carried. Item 3b3 was received for information.
Science. Spafford took members through the science submission (pp.105-110), noting the rationales for the plan changes, and the drivers behind the plan inactivation (sustained low enrollment, other options available to students). There was a motion to approve the course and plan changes on behalf of Senate and to recommend that Senate approve the inactivation of the Honours Chemical Physics (Regular and Co-op) plans. Spafford and Poulin. Carried. Spafford spoke to the additional motion to amend the Honours Co-operative Science and Business/Biotechnology plan (p.111), the requirements of which had been amended in error in 2017. There was a motion to approve the plan change on behalf of Senate. Spafford and Dedinsky. Carried.

4. ACADEMIC PROGRAM REVIEWS
Academic Program Reviews – Status & Handling of Final Assessment Reports. This item was received for information. Voigt reported on the increased number of reviews over the past two years and thanked members for their participation in this important process.

5. OTHER BUSINESS
The chair acknowledged departing members and resources – Bill Chesney, Francis Poulin and Mary Lynn Benninger – for their service and dedication. The chair also acknowledged the contributions of another long serving member, Carey Bissonnette, who stepped down in 2018 and passed away recently. Members of Council then thanked the chair for his leadership, skills as chair and generosity with his time and advice, wishing him well in his retirement. There was a round of applause for the departing members and chair.

6. NEXT MEETING
The next meeting is scheduled for Tuesday 10 September 2019, 12:00 noon to 2:00 p.m. in NH 3318.

3 September 2019

Rebecca Wickens
Associate University Secretary
MEMORANDUM

TO: Rebecca Wickens, Secretary, Senate Undergraduate Council
FROM: Catherine Archibald, Faculty Undergraduate Operations Manager, Applied Health Sciences
cc: Leeann Ferries, Associate Dean, Undergraduate Studies, Applied Health Sciences
DATE: August 16, 2019 (September 4, 2019 - revised report)

SUBJECT: Applied Health Sciences Faculty Undergraduate Studies (FUGS) Report to Senate Undergraduate Council

The attached report was approved by Applied Health Sciences’ Faculty Council on May 31, 2019, and is being submitted for consideration and approval by Senate Undergraduate Council at its meeting of September 10, 2019.
TO SENATE UNDERGRADUATE COUNCIL (September 10, 2019)
FROM APPLIED HEALTH SCIENCES FACULTY COUNCIL (May 31, 2019)

Undergraduate curriculum changes from Applied Health Sciences
for inclusion in the 2020/2021 Undergraduate Calendar

Legend
Bold = new text being added
Strikeout = text being removed

1. NEW ACADEMIC PLANS (For Approval)
   1.1. Department of Kinesiology ................................................................. Page 1

2. ACADEMIC PLAN CHANGES (For Approval)
   2.1. Department of Kinesiology ................................................................. Page 2
   2.2. School of Public Health and Health Systems .................................. Page 5

3. ACADEMIC PLAN INACTIVATIONS (For Approval)
   3.1. Department of Kinesiology ................................................................. Page 9

4. NEW COURSES (For Approval) – Catalog Report 7 (Page No. 1 to 3)
   4.1. School of Public Health and Health Systems ................................ Page 10
   4.2. Department of Kinesiology ................................................................. Page 10

5. COURSE CHANGES (For Approval) – Catalog Report 7 (Page No. 4 to 7)
   5.1. School of Public Health and Health Systems ................................ Page 10
   5.2. Department of Kinesiology ................................................................. Page 10
NEW ACADEMIC PLANS (For Approval)

Department of Kinesiology

To add a new Rehabilitation Sciences Specialization to the undergraduate program offerings of the Department of Kinesiology, effective September 2020, as follows:

Rehabilitation Sciences Specialization

The Rehabilitation Sciences Specialization is open to Kinesiology students who wish to obtain some specialization in rehabilitation sciences.

The kinesiology program is well suited to prepare students for future study/practice in a wide variety of health professions (e.g., physical therapy, chiropractics, occupational therapy, athletic therapy, clinical kinesiology). Although the kinesiology core includes several rehabilitation science courses, the Rehabilitation Sciences Specialization is designed to provide additional elective courses in rehabilitation sciences to prepare students for success in post-degree study/practice in the health professions.

Requirements

1. Normally, a maximum of 2.0 units (four courses) obtained on a Letter of Permission Form or in transfer credit may be applied toward fulfilment of the Rehabilitation Sciences Specialization course requirements. These courses must be equivalent to courses listed in the course requirements (including any prerequisites) as assessed by the department offering the replaced course.

2. Successful completion of 4.0 units from the requirements listed below, with an overall average of 60%.

Legend

* KIN 431, KIN 432, KIN 433, KIN 472 must be on a rehabilitation sciences topic and approved in advance by the course instructor and associate chair, undergraduate studies.

1. Required courses (2.0 units):
   - KIN 312
   - KIN 340
   - KIN 407
   - KIN 422

2. Elective courses (2.0 units):
   - KIN 301
   - KIN 351
   - KIN 356
   - KIN 357
   - KIN 414
   - KIN 415
   - KIN 416
   - KIN 418
   - KIN 427
   - KIN 428
   - KIN 429
   - KIN 431*
   - KIN 432*
   - KIN 433* or KIN 472*
   - KIN 456
   - KIN 457
   - KIN 491
   - KIN 492A and KIN 492B
Rationale: To be consistent with the recent changes to University definitions of minors, options and specializations, the Department of Kinesiology is inactivating the Rehabilitation Sciences Minor (motion 3.1.1.) and adding a new Rehabilitation Sciences Specialization. The Rehabilitation Sciences Minor was only open to Kinesiology students as the required courses (KIN 340, 407, 414, 415, 422) included prerequisites that made it difficult for other students to access this Minor. The Rehabilitation Sciences Specialization is most appropriate for Kinesiology students only, and the list of required courses (KIN 312, 340, 407, 422) provides appropriate depth of knowledge for a specialization in rehabilitation sciences.

2. ACADEMIC PLAN CHANGES (For Approval)

2.1. Department of Kinesiology

2.1.1. To revise the Human Nutrition Minor degree requirements, effective September 2020, as follows:

Human Nutrition Minor

Human Nutrition Minor examines the effects of diet and food on health and disease in human individuals and at the population level. Fundamental and applied knowledge in human nutrition is deemed crucial for a variety of health professions. The study of nutrition includes investigations of cellular metabolism and physiological responses to nutrients, the impact of diet on chronic disease risk, and examinations of food choices in populations. As such, the study of nutrition is multidisciplinary, but at the core requires a fundamental understanding of biochemistry and physiology. The kinesiology core includes physiology, biochemistry, and nutrition courses, and the Minor is designed to provide these fundamentals followed by the application of the basic concepts of nutrition to various aspects of health and disease.

Requirements

1. Students must be in an honours or three- or four-year general program at Waterloo.
2. Normally, a maximum of 2.5 units (five courses) obtained on a Letter of Permission Form or in transfer credit may be applied toward fulfillment of the Human Nutrition Minor course requirements. These courses must be equivalent to courses listed in the course requirements (including any prerequisites) as assessed by the department offering the replaced course.
3. Successful completion of 5.0 units from the requirements listed below, with an overall average of 60%.

Legend
* Transfer course equivalency, topic of independent study, research projects and essay courses, must be approved in advance by the course instructor and associate chair, undergraduate studies.

Note: Students must take either KIN 343 or KIN 346 as a required course and if students take both KIN 343 and KIN 346, then one course will be counted as a required course and one as an elective course.

1. Required courses (2.5 2.0 units):
   BIOL 373
   KIN 146
   KIN 217 or CHEM 233 or CHEM 237
   KIN 343 or KIN 346
   KIN 446

2. Elective courses (2.5 3.0 units):
   BIOL 241
   BIOL 345
   HLTH 340
   HLTH 355
   HLTH 421
   HLTH 449
   HLTH 471
   KIN 307
   KIN 342
   KIN 343 or KIN 346
Changes to the Human Nutrition Minor are being made to provide more flexibility to students and to increase access, especially for non-Kinesiology students. These changes include: 1) reducing the number of required courses from 5 to 4, while increasing the number of elective courses required from 5 to 6 in order to maintain the same number of total courses required; 2) making either KIN 343 (Micronutrient Metabolism) or KIN 346 (Human Nutrition and Metabolism) but not both a required course (Note: KIN 343 and KIN 346 may be taken either as a required course or an elective course but cannot be counted as both); and 3) KIN 446 (Physiological and Biochemical Aspects of Nutrition and Health) is being removed from the list of required courses and added to the list of elective courses. KIN 217 (Human Biochemistry) or CHEM 233 (Fundamentals of Biochemistry) or CHEM 237 (Introductory Biochemistry) is being added as a required course, which is consistent with other similar programs at other universities as the study of nutrition requires a fundamental understanding of biochemistry. The Faculty of Science gave approval to add CHEM 233 and CHEM 237 as choices to the required courses list. KIN 405 included in the electives list, is not a relevant topic area for those pursuing the Human Nutrition Minor. To follow the new curriculum guidelines, the overall average requirement has also been added to the Minor.

2.1.2. To revise the Ergonomics and Injury Prevention Minor degree requirements, effective September 2020, as follows:

Ergonomics and Injury Prevention Minor
The honours kinesiology program has been a leader in preparing students for future study/practice in ergonomics and injury prevention. Kinesiologists are concerned with the assessment and prescription of solutions to problems in the workplace that involve issues such as human-machine interaction, matching skill level with job demands, employee wellness, circadian rhythm, workplace boredom, fatigue, and design of equipment in the interests of maximizing productivity and minimizing the risk of injury. The kinesiology core includes several courses in ergonomics and injury prevention; the course requirements for the Ergonomics and Injury Prevention Minor have been selected to provide students with a thorough background in the biophysical and behavioural sciences of human motion and related measurement and problem-solving skills directly relevant for further study/certification/practice in ergonomics and injury prevention.

Requirements
1. Students must be in an honours or three- or four-year general program at the University of Waterloo.
2. Normally, a maximum of 2.5 units (five courses) obtained on a Letter of Permission Form or in transfer credit may be applied toward fulfilment of the Ergonomics and Injury Prevention Minor course requirements. These courses must be equivalent to courses listed in the course requirements (including any prerequisites) as assessed by the department offering the replaced course.
3. Successful completion of 5.0 units from the requirements listed below, with an overall average of 60%.

Legend
* KIN 431, KIN 432, KIN 433, KIN 472 must be an ergonomics and injury prevention topic and approved in advance by the course instructor and associate chair, undergraduate studies.

Note: Elective courses can only count towards List A or B but not both.

1. Required courses (2.5 units):
   KIN 221
   KIN 320
   KIN 420
   KIN 428
   HRM 200
2. Elective courses List A (0.5 unit):
KIN 326  
KIN 327  
KIN 427  
KIN 428

2.3. Elective courses List B (2.5-3.0 units):
KIN 326  
KIN 327  
KIN 340  
KIN 356  
KIN 403  
KIN 427  
KIN 428  
KIN 431*  
KIN 432*  
KIN 433* or KIN 472*  
KIN 451  
HLTH 340  
HLTH 350  
HRM 200  
MSCI 211  
STV 202  
STV 302  
SYDE 348  
SYDE 542  
SYDE 543

Rationale: Changes to the Ergonomics and Injury Prevention Minor are being made to provide more flexibility to students in order to increase access, especially for non-Kinesiology students. These changes include: 1) reducing the number of required courses from 5 to 3, while increasing the number of elective courses required from 5 to 7 (1 from List A and 6 from List B - Note: these courses can only count towards List A or B but not both), in order to maintain the same number of total courses required; 2) KIN 428 (Upper Extremity Musculoskeletal Disorders: Prevention, Assessment, and Rehabilitation) and HRM 200 (Basic Human Resources Management) are being removed from the list of required courses and added to one of the lists of elective courses. The Faculty of Arts has been informed that HRM 200 is being removed as a required course. 3) KIN 326 (new course effective September 2019, approved at Senate Undergraduate Council, March 2019) and KIN 327, Trauma Biomechanics (Catalog Report 7, New Courses, page 3), are also appropriate to be added to the electives list category. To follow the new curriculum guidelines, the overall average requirement has also been added to the Minor.

2.1.3. To revise the Medical Physiology Minor degree requirements, effective September 2020, as follows:

The Medical Physiology Minor is a joint minor between the Departments of Biology and Kinesiology. The Departments of Biology and Kinesiology have complementary strengths within medical sciences fields. The Minor is designed to provide additional elective courses to prepare University of Waterloo students for health professional school and/or other biomedical graduate programs/careers.

Requirements
1. Students must be in an honours or three- or four-year general program at Waterloo.
2. Normally, a maximum of 2.5 units (five courses) obtained on a Letter of Permission Form or in transfer credit from another institution may be applied toward fulfillment of the Medical Physiology Minor course requirements. These courses must be equivalent to courses listed in the course requirements as assessed and approved by the department.
3. Successful completion of 5.0 units from the requirements listed below, with an overall average of 60%.
1. Required Courses (2.5 units):

BIOL 239
BIOL 373
**KIN 404**
KIN 406
KIN 408
PHIL 226 or PHIL 319J

2. Elective Courses (2.5 units):

Select 1.0 unit from:
KIN 301
**KIN 343**
**KIN 356**
KIN 310/HLTH 310
KIN 402
KIN 404
**KIN 406**
KIN 407
KIN 416
KIN 429

Select 1.0 unit from:

BIOL 240
BIOL 341
BIOL 355
BIOL 376
BIOL 444
BIOL 473
BIOL 476

Select 0.5 unit from:

PSYCH 207
PSYCH 261
PSYCH 307
PSYCH 335

Rationale: **KIN 404** replaces **KIN 406** as a required course because **KIN 404** (Physiological Basis of Obesity and Type 2 Diabetes) is more fundamental to medical physiology. **KIN 406** (Physiology of Muscle Aging and Disease) will remain as an elective kinesiology course. **KIN 402** is being removed from the list of elective courses because students enrolled in the Minor have limited access to that course as it is only offered every other year. **KIN 343** (Micronutrient Metabolism) and **KIN 356** (Sensory Systems Neuroscience) are being added to the list of electives because they are appropriate medical physiology courses. **BIOL 240** is removed from the list of elective biology courses because the Biomedical Science Specialization requires students to complete **BIOL 239**, **BIOL 240** and **BIOL 373**. Therefore, they must select 1.0 units of biology from outside their core program.

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2.2. School of Public Health and Health Systems

2.2.1. To revise the Honours Bachelor of Public Health degree requirements, effective September 2020, as follows:

The Honours Bachelor of Public Health will be of interest to students concerned with the determinants of health, including those who value social justice and those with interests in how economic, cultural, social, political, ecological, biological, and geographic factors affect individual and population health. Graduates of the program will be practitioners of public health with a breadth of understanding across the full spectrum of public health activities and domains, including epidemiology, education, health communication and social marketing, health policy, and health systems.

Students may apply for admission directly into Honours Bachelor of Public Health, regular or co-operative system of study.
In order to receive the Honours Bachelor of Public Health degree the student must successfully complete 20.0 units of which at least 10.0 total units are at or above 200-level and including the following requirements:

1. Required health courses (7.0 units):
   - HLTH 101, HLTH 102, HLTH 103, HLTH 201, HLTH 202, HLTH 204, HLTH 230, HLTH 245, HLTH 260, HLTH 280, HLTH 320, HLTH 333, HLTH 355, HLTH 370

2. Required applied health sciences courses (1.0 unit):
   - AHS 107
   - AHS 150

3. Methods/application cluster (1.0 unit):
   - Two of: HLTH 303, HLTH 344, HLTH 433, HLTH 435, HLTH 442, HLTH 443, HLTH 451, HLTH 453, HLTH 458, HLTH 335 or STAT 316

4. Core content clusters (minimum 0.5 unit per cluster; total 1.5 units):
   - One course in the area of health systems and policy: HLTH 401, HLTH 410, HLTH 412, HLTH 373*, or HLTH 473* with an approved topic in health systems and policy
   - One course in the area of social behavioural sciences: HLTH 301, HLTH 304, HLTH 305, HLTH 352, HLTH 448, HLTH 373*, or HLTH 473* with an approved topic in social behavioural sciences
   - One additional course from any Core Content Clusters lists in the areas of health systems and policy or social behavioural sciences.

5. One additional HLTH course at the 300- or 400-level (0.5 unit).

6. Capstone course (0.5 unit):
   - One of: HLTH 481, HLTH 472*, HLTH 432A/HLTH 432B, or any fourth-year seminar course (cannot double count)

7. Required course from another department (0.5 unit):
   - PSYCH 101

8. Restricted elective courses (1.5 units):
   - One of: ENGL 109 or ENGL 140R (recommended for Year One) or any ENGL 210 (recommended for Year Two)
   - One of: ANTH, ECON, PSCI, PSYCH, SDS, SMF, SOC
   - One of: CLAS, ENGL, HIST, MEDVL, PACS, PHIL, RS

9. Free elective courses: 6.5 units

**Rationale:** HLTH 335 is a new course, Introduction to Statistical Analytics in Health, effective September 2020 (Senate Undergraduate Council, May 2019), that covers the same content as STAT 316 (Introduction to Statistical Problem Solving by Computer), including labs that incorporate the use of statistical software. HLTH 335 is appropriate to be included as one of the electives in the methods/application cluster. These courses are antirequisites so students can take HLTH 335 or STAT 316.

**2.2.2.** To revise the Honours Bachelor of Science, Health Studies degree requirements, effective September 2020, as follows:

In the Health Studies academic plan the knowledge from several traditional disciplines is combined and focused on the study of health and prevention of disease. Courses provide students with an understanding of the biological and social determinants of health and causes of disease.

The curriculum has four core areas:

1. Health sciences – the scientific knowledge and principles pertinent to personal and community health. Specific subject areas include:
   - introduction to health sciences,
   - fundamentals of population and public health,
   - determinants and distribution of disease (pathobiology, epidemiology), and
   - environmental and occupational health.

2. Social and behavioural sciences – social factors that affect health, determinants of health behaviour, and health behaviour modification.

3. Life sciences – the basic principles of biology, kinesiology, physiology, and biochemistry.

4. Evaluation and research – the principles of statistics and research design aimed at developing sufficient competencies to enable students to evaluate, interpret, and apply the findings of health-related research.

Students may apply for admission directly into Honours Health Studies, regular or co-operative system of study.

Legend

* Must be approved by the School of Public Health and Health Systems associate director, undergraduate studies.

** Cannot be used for both the methods/application cluster and core content clusters.
In order to receive the Bachelor of Science, Honours Health Studies degree, the student must successfully complete 20.0 units of which at least 10.0 total units are at or above the 200-level and including the following requirements:

1. Required health studies courses (6.25 units):
   HLTH 101, HLTH 102, HLTH 201, HLTH 202, HLTH 204, HLTH 230, HLTH 245, HLTH 260, HLTH 280, HLTH 310, HLTH 333, HLTH 370, HLTH 480 (0.25 unit)

2. Required applied health sciences course (0.5 unit):
   AHS 107

3. Required statistics course (0.5 unit):
   One of: HLTH 335, STAT 316

4. Methods/application cluster (0.5 unit):
   One of: HLTH 303, HLTH 344, HLTH 433, HLTH 435, HLTH 442, HLTH 443, HLTH 451, HLTH 453, HLTH 458**

5. Core content clusters (2.0 units):
   One of: HLTH 401, HLTH 410, HLTH 412, HLTH 373*, or HLTH 473* with an approved topic in health systems and policy
   One of: HLTH 301, HLTH 304, HLTH 305, HLTH 320, HLTH 352, HLTH 448, HLTH 373*, or HLTH 473* with an approved topic in social behavioural sciences
   Two of: HLTH 340, HLTH 341, HLTH 407, HLTH 421, HLTH 458**, HLTH 461, HLTH 465, HLTH 471, HLTH 373*, HLTH 472*, or HLTH 473* with an approved topic in biohealth

6. Required courses from other departments (4.25 units):
   BIOL 130/BIOL 130L, BIOL 239, BIOL 273
   CHEM 120/CHEM 120L, CHEM 123/CHEM 123L
   KIN 217
   PSYCH 101

7. Restricted elective course (0.5 unit):
   One of: ENGL 109 or ENGL 140R (recommended for Year One) or any ENGL 210 (recommended for Year Two)

Free elective courses: 5.5 units

Rationale: HLTH 465, Epigenetics and Health, is a new course to be effective September 2020 (Catalog Report 7, New Courses, page 2) that was previously offered as a HLTH 473 (Contemporary Issues in Health 4) special topic. This course is taught by a biohealth faculty member and covers topics at the interface between genetics, physiology, development, and the environment. This course is appropriate to be included in the list of courses for the biohealth core content cluster.

2.2.3. To revise the Gerontology Minor requirements, effective September 2020, as follows:

The Gerontology Minor is open to University of Waterloo students who wish to obtain some specialization in gerontology.

Degree Requirements for the Minor

1. Students must be in an honours or four-year general program at the University of Waterloo.

2. An overall minimum average of 67% is required for courses presented for the minor.

3. Normally, a maximum of two courses (1.0 unit) obtained on Letter of Permission or in transfer credit may be applied toward fulfillment of the Gerontology Minor course requirements. These courses must be equivalent to courses listed in the course requirements as assessed by the school/department offering the replaced course.

4. Successful completion of 5.0 units from the following requirements:
   ○ Required courses (1.0 unit):
     GERON 201/HLTH 201 (it is recommended that students begin their studies with GERON 201/HLTH 201)
     GERON 400/HLTH 400
   ○ Restricted elective courses (4.0 units):
     GERON 218/HLTH 218/PSYCH 218
     GERON 245/HLTH 245
     GERON 310/HLTH 310/KIN 310
     GERON 320/HLTH 320
     GERON 352/HLTH 352/KIN 352/REC 362/SOC 352
     GERON 355/BIOL 355
     GERON 401A/GERON 401B
     HLTH 253/SOC 253
     HLTH 280
     HLTH 407/KIN 407
     HLTH 420/GEOG 432/PLAN 432
     HLTH 427
     HLTH 430
HLTH 451
HLTH 473 (course topic must be approved by the associate director, undergraduate studies)
KIN 342
KIN 343
KIN 406
KIN 418
KIN 422
KIN 429
KIN 456
PHIL 226
PHIL 319J
PSYCH 398
REC 361
SOC 248
SOCWK 240R
SDS 367R

An approved course in statistics (a list of approved courses is available from the School of Public Health and Health Systems Undergraduate Office).

Rationale: HLTH 427, Dementia Care (Catalog Report 7, New Courses, page 1), and HLTH 430, Geriatric Medicine and Health Care (Catalog Report 7, New Courses, page 1), are new courses to be effective September 2020 that were previously offered as a HLTH 473 (Contemporary Issues in Health 4) special topic. These courses have a gerontology focus and are taught by faculty members who are experts in the gerontology field, thus both of these courses are appropriate to be included in the list of restricted electives for the Gerontology Minor.

2.2.4. To revise the Aging Studies Option requirements, effective September 2020, as follows:

The Aging Studies Option is open to Applied Health Sciences students who wish to obtain some interdisciplinary knowledge in issues related to aging, but do not wish to complete the Gerontology Minor.

Degree Requirements for the Option
1. A minimum overall average of 67% is required for the courses presented for the option.
2. Normally all courses must be taken at University of Waterloo; there is no allowance for transfer of credit from other institutions.
3. Successful completion of 3.0 units from the following requirements:
   o Required courses (0.5 unit):
     GERON 201/HLTH 201 (it is recommended that students begin their studies with GERON 201/HLTH 201)
   o Restricted elective courses (2.5 units):
     GERON 218/HLTH 218/PSYCH 218
     GERON 245/HLTH 245
     GERON 310/HLTH 310/KIN 310
     GERON 320/HLTH 320
     GERON 352/HLTH 352/KIN 352/REC 362/SOC 352
     GERON 355/BIOL 355
     GERON 401A/GERON 401B
     HLTH 253/SOC 253
     HLTH 280
     HLTH 407/KIN 407
     HLTH 420/GEOG 432/PLAN 432

HLTH 427
HLTH 430
HLTH 451
HLTH 473 (course topic must be approved by the associate director, undergraduate studies)
KIN 342
KIN 343
KIN 406
KIN 418
KIN 422
KIN 429
KIN 456
PHIL 226
PHIL 319J
PSYCH 398
REC 361
SOC 248
SOCWK 240R
SDS 367R
An approved course in statistics (a list of approved courses is available from the School of Public Health and Health Systems Undergraduate Office).

Rationale: HLTH 427, Dementia Care (Catalog Report 7, New Courses, page 1), and HLTH 430, Geriatric Medicine and Health Care (Catalog Report 7, New Courses, page 1), are new courses to be effective September 2020 that were previously offered as a HLTH 473 (Contemporary Issues in Health 4) special topic. These courses have a gerontology focus and are taught by faculty members who are experts in the gerontology field, thus both of these courses are appropriate to be included in the list of restricted electives for the Aging Studies Option.

3. ACADEMIC PLAN INACTIVATIONS (For Approval)

3.1. Department of Kinesiology

3.1.1. To inactivate the Rehabilitation Sciences Minor, effective September 2020.

The Rehabilitation Sciences Minor is open to University of Waterloo students who wish to obtain some specialization in rehabilitation sciences.

The honours kinesiology program is well suited to prepare students for future study/practice in a wide variety of health professions (e.g., physical therapy, chiropractics, occupational therapy, athletic therapy, clinical kinesiology). Although the kinesiology core includes several rehabilitation science courses, the Rehabilitation Sciences Minor is designed to provide additional elective courses in rehabilitation sciences to prepare students for success in post degree study/practice in the health professions.

Requirements
1. Students must be in an honours or three- or four-year general program at Waterloo.
2. Normally, a maximum of 2.5 units (five courses) obtained on a Letter of Permission Form or in transfer credit may be applied toward fulfilment of the Rehabilitation Sciences Minor course requirements. These courses must be equivalent to courses listed in the course requirements (including any prerequisites) as assessed by the department offering the replaced course.
3. Successful completion of 5.0 units from the requirements listed below.

Legend
* KIN 431, KIN 432, KIN 433, KIN 472 must be on a rehabilitation sciences topic and approved in advance by the course supervisor and associate chair, undergraduate studies.

Required courses (2.5 units):
KIN 340
KIN 407
KIN 414
KIN 415
KIN 422

Elective courses (2.5 units):
KIN 301
KIN 312
KIN 356
KIN 357
KIN 404
KIN 405
KIN 416
KIN 418
KIN 427
KIN 428
KIN 429
KIN 431*
KIN 432*
KIN 433* or KIN 472*
KIN 446
KIN 456
KIN 457
KIN 458
KIN 491
KIN 492A and KIN 492B
ENGL 109 or ENGL 140R or any one of ENGL 210E, ENGL 210F, ENGL 210H

Note
Admission requirements vary greatly among professional schools (e.g., physiotherapy, chiropractic, occupational therapy). It is therefore imperative that students consult professional schools directly when choosing courses.

Rationale: To be consistent with the recent changes to University definitions of minors, options and specializations, the Rehabilitation Sciences Minor is being inactivated and a new Rehabilitation Sciences Specialization added. The Rehabilitation Sciences Minor was only open to Kinesiology students as the required courses included prerequisites that made it difficult for other students to access the Minor.

4. NEW COURSES (For Approval) – Catalog Report 7 (Page No. 1 to 3)

4.1. School of Public Health and Health Systems

4.1.1. To add HLTH 427 to the curriculum as a new undergraduate course offering.

4.1.2. To add HLTH 430 to the curriculum as a new undergraduate course offering.

4.1.3. To add HLTH 450 to the curriculum as a new undergraduate course offering.

4.1.4. To add HLTH 465 to the curriculum as a new undergraduate course offering.

4.1.5. To add HLTH 474 to the curriculum as a new undergraduate course offering.

4.2. Department of Kinesiology

4.2.1. To add KIN 327 to the curriculum as a new undergraduate course offering.

5. COURSE CHANGES (For Approval) – Catalog Report 7 (Page No. 4 to 7)

5.1. School of Public Health and Health Systems

5.1.1. To revise the prerequisite for HLTH 253 (cross-listed with SOC 253).

5.1.2. To revise the title, description, and requisite for HLTH 301.

5.1.3. To revise the prerequisite for HLTH 433.

5.1.4. To revise the prerequisite for HLTH 442.

5.1.5. To revise the prerequisite for HLTH 451.

5.2. Department of Kinesiology

5.2.1. To revise the title, description, and prerequisite for KIN 356.

5.2.2. To revise the description for KIN 491.
NEW COURSES  (for approval)

Public Health and Health Systems - School of

Effective 01-SEP-2020

HLTH 427 (0.50) SEM Dementia Care
This course provides a comprehensive examination of dementia from multiple perspectives, including the person living with dementia, family care partners, and the health and social care systems. Key topics include epidemiology, prevention, stigma, meaningful engagement, care, and support.

Requisites: Prereq: Level at least 4A School of Public Health and Health Systems students

Rationale: The prevalence of dementia is expected to significantly increase over time. With the aging of the population, individuals working in public health and other health care settings will almost always be working with older adults and, as a result, have a high likelihood of working with those with dementia. Thus, understanding dementia, and the stigma associated with dementia, is important for future professionals in the health care field. There are no upper level in-depth courses on dementia in the School of Public Health and Health Systems.

Effective 01-SEP-2020

HLTH 430 (0.50) SEM Geriatric Medicine and Health Care
Why do some people age well, and others don’t? How do we care for them? This course will address the role of geriatric medicine in the context of an aging population and provide in-depth coverage of frailty and geriatric syndromes. Students will practice critical appraisal skills of geriatric literature, and apply these to understanding how system design, interprofessional care, and geriatric medicine can improve outcomes for older persons. Students will also have the opportunity to learn about health system issues directly from stakeholders.

Requisites: Prereq: Level at least 4A School of Public Health and Health Systems students

Rationale: This course has been a popular offer as a HLTH 473 (Contemporary Issues in Health 4) special topic taught by a School of Public Health and Health Systems faculty member who is also a practitioner of geriatric medicine.

Effective 01-SEP-2020

HLTH 450 (0.50) SEM Gender, Sex, and Health
This course examines the links between gender and health. Students are introduced to the social and cultural theorizing on sex and gender, including critical and postmodern approaches. Topics that are explored in this course deal with the social construction of gender, medicalization, gender and health inequalities, reproductive
health, gender in the context of health care organization and structure, and intersection of gender with other systems of social inequalities.

Requisites: Prereq: Level at least 4A Health Studies students
Rationale: Gender is key social determinant of health. Currently, the School of Public Health and Health Systems does not offer courses on gender, sex, and health and many other programs in public health and health sciences do offer courses on gender. This course will add to the number and breadth of the social behavioural sciences core content cluster in the Health Studies program.

Effective 01-SEP-2020
HLTH 465 (0.50) SEM Epigenetics and Health
This course provides an in-depth examination into how genes, environment, and epigenetics interact over the lifespan to increase risks for complex diseases and disorders. Students will explore how environmental exposures such as diet, drugs, psychosocial stress, and environmental toxicants can become biologically-embedded via stable epigenetic changes that affect long-term gene expression. Underlying molecular mechanisms for epigenetic modifications, such as DNA methylation, histone modification, and the role of non-coding RNAs will also be covered.

Requisites: Prereq: Level at least 4A Health Studies students
Rationale: Epigenetics and health is a rapidly growing field at the interface between genetics, physiology, development, and the environment that fits well into the transdisciplinary expertise in the School of Public Health and Health Systems. There are currently no courses on epigenetics and health and this area of study has been a popular offer as a HLTH 473 (Contemporary Issues in Health 4) special topic. This course will add to the number and breadth of the biohealth core content cluster in the Health Studies program.

Effective 01-SEP-2020
HLTH 474 (0.50) FLD Health Apprenticeship
This course provides students with an opportunity for an in-depth exploration of a topic of specific interest to the student, and to develop/enhance skills related to this area. For example, students could work as a member of a research team (on or off campus), or complete a placement at a health care, community-based, or other type of organization. Students must identify a supervisor, design an apprenticeship experience, establish individualized learning goals, and develop a plan for evaluation. As this course will be graded, there must be at least one academic deliverable (e.g., a review of the literature, proposal, presentation, knowledge dissemination product, etc.). The apprenticeship is unpaid and students will normally spend 6-8 hours per week for at least 12 weeks during the term.

Requisites: Prereq: Level at least 4A School of Public Health and Health Systems students
Rationale: This course provides an opportunity to gain experience working in a
specific setting and/or developing/enhancing a set of skills that will help
prepare students for further education (e.g., graduate or professional
school) and/or future careers. This course is distinct from HLTH 472
(Independent Study) as it can extend beyond independent research and/or
reading, and is unique from HLTH 481 (Community Learning Project) as it is
not limited to working with a community organization. An academic product
is required to be submitted in order to facilitate the determination of a
course grade. Department Consent Required.

Kinesiology

Effective 01-SEP-2020

KIN 327 (0.50) LEC Trauma Biomechanics

This course provides students with an understanding of the mechanical behaviour of
human tissues, with specific emphasis on the musculoskeletal system. Students will
learn how to describe the mechanical properties of specific tissues (with a focus on
bone, in addition to ligaments, tendons, cartilage). Emphasis will be placed on
understanding how tissues are structured to meet their functional demands, and how
they respond to traumatic, dynamic impact events. In addition, content will cover
engineering interventions to reduce the risk of traumatic injury (e.g., helmets,
sporting equipment, transportation safety features such as seat belts and airbags),
and orthopaedic devices to treat traumatic injuries, their underlying mechanical
properties, and how they interact with biological tissues/systems.

Requisites:
Prereq: KIN 221, KIN 221L

Rationale:
This course has been offered twice previously by Dr. Laing as a special
topic under KIN 471, Contemporary Issues in Kinesiology: Trauma
Biomechanics. Student feedback has been positive. The course will now be
offered as a 300-level as this the appropriate level for this course as KIN
471 is a placeholder course for special topics. A digital copy of the
textbook is free for download through the library, which really appeals to
the students and provides a lasting resource for them following graduation.
The course builds directly from material taught in our required courses
(KIN 121, KIN 221). It addresses a gap in the curriculum and prepares our
undergraduate students for direct entry into the workforce in the injury
prevention and trauma biomechanics industries. It also assists students who
move into related occupations (e.g., injury management, rehabilitation,
orthopaedics, sports medicine, athletic therapy) to provide improved
services through a better understanding of the underlying mechanisms of
traumatic injuries. Finally, in addition to course-specific content, the
course emphasizes and provides students an opportunity to build important
general skills related to problem solving, critical evaluation and
appraisal, and written and oral communication.
COURSE CHANGES  (for approval)

Public Health and Health Systems - School of

Current Catalog Information
HLTH  253 ( 0.50 )  LEC  Demographic Change in Canada
An introduction to the study of human population, with a focus on mortality, fertility, migration, and spatial distribution in Canada. Methods and measures used in demographic research, sources of demographic data, and the health and social implications of the major demographic trends are discussed.
No Special Consent Required
Requisites : Prereq: Level at least 2A
Cross-listed as: SOC 253
Effective 01-SEP-2020
Rationale : To change prerequisites. The prerequisite of ”Level at least 2A” is too vague, and does not adequately capture the skills required to benefit fully from the course content. SOC 221 (Introduction to Research Methods) or similar is a more appropriate prerequisite. The Faculties of Arts and Applied Health Sciences are bringing this for approval to the September 10, 2019, Senate Undergraduate Council meeting.

Current Catalog Information
HLTH  301 ( 0.50 )  LEC, TUT  Applied Health Promotion: Theory and Practice
This course introduces health promotion history, theories, and change strategies that address individual-level behaviour plus sociocultural, economic, political, and environmental conditions and resources for health. Topics include educational, persuasive, organizational, regulatory, and empowerment approaches. Examples may be drawn from school and workplace programs, mHealth and eHealth, social marketing, community development, and social mobilization and advocacy for policy change.
No Special Consent Required
Requisites : Prereq: HLTH 202; HLTH/GSJ 260
Effective 01-SEP-2020
Title Change: Applied Health Promotion: Theory and Community Engagement
Description Change: This course introduces health promotion history, theories, and change strategies that address individual-level behaviour plus sociocultural, economic, political, and environmental conditions and resources for health that impact communities and foster engagement, empowerment, and functional collaborations. Topics include educational, persuasive, organizational, regulatory, and empowerment approaches for improving health at individual and community levels.
Requisite Change: Prereq: HLTH 202, HLTH/GSJ 260. Antireq: HLTH 305
Rationale: The new course title and description reflect an increase in community-based engagement. The revised version of the course provides better experiential learning opportunities for students since they will apply theories of health promotion directly to community development and engagement. The addition of the antirequisite of HLTH 305 reflects that a significant portion of the content from that course will be incorporated into HLTH 301.

Current Catalog Information
HLTH 433 (0.50) LEC Experimental Methods
This course focuses on the key issues related to the design, conduct, analyses, and interpretation of experimental studies. Examples will be drawn from animal research investigating disease mechanisms and from clinical and population studies investigating efficacy of preventive or therapeutic strategies.
No Special Consent Required
Requisites: Prereq: STAT 316; Level at least 4A School of Public Health and Health Systems students
Effective 01-SEP-2020
Requisite Change: Prereq: HLTH 335 or STAT 316; Level at least 4A School of Public Health and Health Systems students
Rationale: HLTH 335 is a new course, Introduction to Statistical Analytics in Health, effective September 2020 (Senate Undergraduate Council, May 2019), that covers the same content as STAT 316, including labs that incorporate the use of statistical software. Therefore, students may take either HLTH 335 or STAT 316 (antirequisites) as a prerequisite for HLTH 433.

Current Catalog Information
HLTH 442 (0.50) LEC Epidemiology of Non-Communicable Diseases
This course builds upon the concepts learned in HLTH 333. The primary objective is to provide an understanding of the fundamental concepts, principles and applications of non-communicable disease epidemiology. The course emphasizes understanding of epidemiologic methods and identification of risk and protective factors.
No Special Consent Required
Requisites: Prereq: HLTH 333, STAT 316; Level at least 4A School of Public Health and Health Systems students
Effective 02-SEP-2020
Requisite Change: Prereq: HLTH 333; HLTH 335 or STAT 316; Level at least 4A School of Public Health and Health Systems students
Rationale: HLTH 335 is a new course, Introduction to Statistical Analytics in Health, effective September 2020 (Senate Undergraduate Council, May 2019), that covers the same content as STAT 316, including labs that incorporate the use of statistical software. Therefore, students may take either HLTH 335 or STAT 316 (antirequisites) as a prerequisite for HLTH 442.

Current Catalog Information
HLTH 451 (0.50) SEM 
Analysis and Management of Health Information in Aging Populations

The course combines an overview of health policy issues and service delivery with methodological considerations in the analysis of health information from a variety of sources. The topics to be addressed may include the role of health information in evidence-based practice and policy development; basic concepts of demography and health information management; secondary data analysis; case-mix based funding systems; performance indicators, quality, and accountability in health care; clinical applications of health data; need analysis; cost analysis; international comparisons.

No Special Consent Required
Requisites: Prereq: STAT 316; Level at least 4A School of Public Health and Health Systems students

Effective 01-SEP-2020
Requisite Change: Prereq: HLTH 335 or STAT 316; Level at least 4A School of Public Health and Health Systems students
Rationale: HLTH 335 is a new course, Introduction to Statistical Analytics in Health, effective September 2020 (Senate Undergraduate Council, May 2019), that covers the same content as STAT 316, including labs that incorporate the use of statistical software. Therefore, students may take either HLTH 335 or STAT 316 (antirequisites) as a prerequisite for HLTH 451.

Kinesiology

Current Catalog Information
KIN 356 (0.50) LEC 
Information Processing in Human Perceptual Motor Performance

An information processing model of perceptual-motor behaviour is presented. Human performance theory is used to study processes mediating input and output information. Specifically, the subprocesses of storage of information in memory, perception, retrieval of information from memory and execution of movement are examined.

No Special Consent Required
Requisites: Prereq: KIN 255, KIN 255L

Effective 02-SEP-2021
Title Change: Sensory Systems Neuroscience
Description Change: Sensory systems neuroscience considers how different regions of the nervous system interact to produce perception, decisions, memories, movements and consciousness. This course will look specifically at the role of the sensory systems in transducing external stimuli into neural activity, processing of sensory information within and across sensory modalities (i.e., multisensory integration), and changing how other regions of the nervous system function. This course will also provide an introductory understanding of how changes from development, injury, disease, and aging, affect sensory processing and recovery of neural function.

Requisite Change: Prereq: (KIN 255, KIN 255L) or PSYCH 261
Rationale: The Department of Kinesiology decided to revise the course title and calendar description in order to more accurately reflect the course content, which focuses on sensing and processing sensory information and
understanding how the various sensory systems work together. PSYCH 261, Physiological Psychology, is an appropriate and sufficient prerequisite for KIN 356 and adding this prerequisite will provide better access to this course for non-KIN students. The Department of Psychology has approved the addition of PSYCH 261 as a prerequisite.

Current Catalog Information

KIN 491 (0.50) CLN, LAB  Clinical Kinesiology -- Sports Injuries Assessment
Practical experience in the examination, diagnosis, and treatment of sports injuries under the supervision of a Certified Athletic Therapist. Case presentations and musculoskeletal assessments are discussed in a group setting. Preference will be given to those who have taken KIN 140L.
No Special Consent Required
Requisites: Prereq: KIN 340; Kinesiology students only
Effective 01-SEP-2020

Description Change:
Practical experience in the examination, diagnosis, and treatment of sports injuries under the supervision of a Certified Athletic Therapist. Case presentations and musculoskeletal assessments are discussed in a group setting.

Rationale:
KIN 140L is an elective course with a prerequisite of Year 1 or 2 Kinesiology students and normally has a low enrollment capacity when offered in the winter term. Including a sentence in the KIN 491 course description that preference will be given to students who have taken KIN 140L is unfair for students who either could not access KIN 140L because it has a small enrollment capacity, or did not take the course because it would be a 6th course in addition to the five required courses in Year 1 and 2. KIN 140L is also not a prerequisite for KIN 491. It is for these reasons that the Department of Kinesiology is removing this sentence from the KIN 491 course description.
Memorandum
Faculty of Arts

TO: Senate Undergraduate Council

FROM: Katherine Acheson, Associate Dean of Arts, Undergraduate Programs

DATE: August 16, 2019

RE: Curriculum Change – For Approval

SOC 253/HLTH 253
Effective 01 September 2020

This item was approved at the Undergraduate Affairs Group meeting of April 4, 2019. It is being sent to the September meeting of Senate Undergraduate Council for approval to coincide with the submission of the cross-listed course HLTH 253 from Applied Health Sciences.
COURSE CHANGES  (for approval)

Sociology and Legal Studies

Current Catalog Information
SOC 253 (0.50) LEC Demographic Change in Canada
An introduction to the study of human population, with a focus on mortality, fertility, migration, and spatial distribution in Canada. Methods and measures used in demographic research, sources of demographic data, and the health and social implications of the major demographic trends are discussed.
No Special Consent Required
Requisites : Prereq: Level at least 2A
Cross-listed as: HLTH 253
Effective 01-SEP-2020
Rationale : To change prerequisites. The prerequisite of "Level at least 2A" is too vague, and does not adequately capture the skills required to benefit fully from the course content. SOC 221 (Introduction to Research Methods) or similar is a more appropriate prerequisite. The Faculties of Arts and Applied Health Sciences are bringing this for approval to the September 10, 2019, Senate Undergraduate Council meeting.
SCIENCE FACULTY COUNCIL
REPORT TO SENATE UNDERGRADUATE COUNCIL
FACULTY OF SCIENCE SUBMISSION- for September 2019 SUC
For approval and inclusion in the 2020-2021 Undergraduate Calendar

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A. COURSE CHANGES (see report 9 and 99)

i. New Courses
   a) Biology
      BIOL 451

   b) Physics
      PHYS 267

ii. Reactivations of Courses
   a) Chemistry
      CHEM 121, 121L, 125, 125L
      All courses listing CHEM 120, 120L, 123, and/or 123L as requisites will be updated
      to list the reactivated CHEM 121, 121L, 125 and/or 125L course options, where
      appropriate.

iii. Changes to Existing Courses

Legend
* Requisite changes ONLY, to add CHEM 121, CHEM 121L, CHEM 125, and/or CHEM 125L
   to CHEM 120, CHEM 120L, CHEM 123, and/or CHEM 123, where applicable.

   a) Biology
      BIOL 280, 428, and 462

   b) Chemistry
      CHEM 120, 120L, 123, 123, 140*, 200, 209*, 212*, 220*, 220L, 224L, 233L, 254,
      264, 265L, 266, 266L*, 310L*, 313L*, 331, 339, 357 and 404*

   c) Earth Sciences
      EARTH 221*, 421*, 438, and 444

   d) Materials and Nanosciences
      MNS 211*, 410, and 431

   e) Physics
      PHYS 239, 263, 270L, 280, 334, 342, 359, 360A, 360B, 363, 364, 365, 370L, 375,
      380, 383, 395, 396, 434, 435, 454, 468, and 476

iv. Inactivated Courses
   a) Chemistry
      CHEM 100, 101, and 239
b) Physics
   PHYS 270

c) Science
   SCI 240

B. NEW PROGRAMS/PLANS - None

C. CHANGES TO PROGRAMS/PLANS

   i. Honours Co-operative Biotechnology/Economics *(for information only)*

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Recommended Course Sequence

Year One

*Fall*
BIOL 130 Introductory Cell Biology
BIOL 240 Fundamentals of Microbiology
BIOL 240L Microbiology Laboratory
CHEM 120/CHEM 120L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1
ECON 101 Introduction to Microeconomics
SCBUS 123 Workshop 1: Science and Business
One of ENGL 193/SPCOM 193 Communication in the Sciences

*Winter*
BIOL 239 Genetics
BIOL 241 Introduction to Applied Microbiology
CHEM 123/CHEM 123L Chemical Reactions, Equilibria and Kinetics/Chemical Reaction Laboratory 2
ECON 101 Introduction to Microeconomics
ECON 102 Introduction to Macroeconomics
CS 100 Introduction to Computing through Applications
One of ENGL 193/SPCOM 193 Communication in the Sciences

**Rationale:** Currently there are no ECON courses in the 1A term for the Honours Biotechnology/Economics program. ECON 101 is offered both fall and winter term, and the teaching strain for ENGL 193/SPCOM 193 is greater in the fall, therefore the communication course will be sequenced in Year one fall, switching with ECON 101. The Economics department is aware of the plan and has no issues with supplying additional teaching capacity for ECON 101 in the fall term.
ii. Honour Biology, Environmental Biology Specialization (Reg. & Co-op)

Successful completion of this program requires:

21.5 units distributed as follows:

- 9.0 9.5 BIOL units: BIOL 110, BIOL 120, BIOL 130, BIOL 130L, BIOL 150, BIOL 165, (BIOL 211 or BIOL 241), BIOL 239, BIOL 240, BIOL 240L, BIOL 273, BIOL 308, BIOL 350, BIOL 351, BIOL 354, BIOL 359, BIOL 361, BIOL 451, BIOL 457, and BIOL 458
- 2.0 1.5 BIOL units chosen from: BIOL 312, BIOL 321, BIOL 323, BIOL 325, BIOL 335L, BIOL 346, BIOL 364, BIOL 370, BIOL 371, BIOL 383, BIOL 414, BIOL 426, BIOL 439, BIOL 447, BIOL 450, BIOL 452, BIOL 455, BIOL 456, BIOL 462, BIOL 470, BIOL 479, BIOL 485, BIOL 488, BIOL 489, BIOL 490A, BIOL 490B, BIOL 498A and BIOL 498B, or BIOL 499A and BIOL 499B with the following condition:
  - 1.5 1.0 units must be at 400-level
- 0.5 BIOL unit 300-level or higher
- 3.0 CHEM units: CHEM 120, CHEM 120L, CHEM 123, CHEM 123L, CHEM 237, CHEM 237L, CHEM 266, and CHEM 266L
- 0.5 unit program elective chosen from: MATH 114, MATH 127, or PHYS 111
- 0.5 STAT unit: STAT 202
- 5.5 elective units
- 0.5 unit ENGL: ENGL 193/SPCOM 193

Recommended Course Sequence

Year 4 (Regular)
BIOL 451, BIOL 457, BIOL 458

Three Two BIOL electives (1.5 1.0 units) - specific for Environmental Biology Specialization
One BIOL elective 300-level or higher (0.5 unit)
Four electives (2.0 units)

Year 4 (Co-op)

Fall
BIOL 451, BIOL 458

Two One BIOL electives (1.0 0.5 unit) - specific for Environmental Biology Specialization
Two electives (1.0 unit)

Winter
BIOL 457

One BIOL elective (0.5 unit) - specific for Environmental Biology Specialization
One BIOL elective 300-level or higher (0.5 unit)
Two electives (1.0 unit)
Rationale: BIOL 451 will serve as a “capstone course” for Honours Biology students taking the Environmental Biology Specialization. The goal is to have all Honours Biology students take one capstone course for the completion of their degree. Capstone courses will have smaller enrollments, be highly interactive, and place emphasis on concept integration, critical analysis and communication. The inclusion of BIOL 451 increases the required BIOL units by 0.5, thus reducing the BIOL elective units by a 0.5. The addition of BIOL 312 to the elective list will provide students with a spring term program elective option.

iii. Honours Environmental Science, Ecology Specialization (Reg. & Co-op)

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Successful completion of this program requires:

21.25 units distributed as follows:
• 6.25 6.75 BIOL units: BIOL 110, BIOL 120, BIOL 150, BIOL 165, BIOL 239, BIOL 240, BIOL 240L, BIOL 350, BIOL 351, BIOL 354, BIOL 359, BIOL 361, BIOL 451, and BIOL 457
• 0.5 BIOL unit from: BIOL 456 or BIOL 458
• 2.0 CHEM units: CHEM 120, CHEM 120L, CHEM 123, CHEM 123L, and CHEM 266
• 0.5 CHEM unit from: CHEM 233 or CHEM 237
• 3.0 EARTH units: EARTH 121, EARTH 121L, EARTH 122, EARTH 122L, EARTH 123, EARTH 223, and EARTH 342
• 0.5 PHYS unit: PHYS 111
• 2.0 1.5 BIOL units from: BIOL 309, BIOL 310, BIOL 312, BIOL 321, BIOL 323, BIOL 325, BIOL 335L, BIOL 346, BIOL 370, BIOL 371, BIOL 383, BIOL 414, BIOL 426, BIOL 439, BIOL 447, BIOL 448, BIOL 450, BIOL 452, BIOL 455, BIOL 461, BIOL 462, BIOL 470, BIOL 479, BIOL 485, BIOL 488, BIOL 489, BIOL 490A, BIOL 490B, BIOL 490C, or BIOL 499A and BIOL 499B with the following condition:
  o 0.5 BIOL unit must be at 400-level
• 0.5 EARTH units from: EARTH 321, EARTH 333, EARTH 358, EARTH 421, EARTH 440, EARTH 458, or EARTH 459
• 0.5 BIOL or EARTH unit from: BIOL 211, BIOL 241, BIOL 309, BIOL 310, BIOL 312, BIOL 321, BIOL 323, BIOL 325, BIOL 335L, BIOL 346, BIOL 370, BIOL 371, BIOL 383, BIOL 414, BIOL 426, BIOL 439, BIOL 447, BIOL 448, BIOL 450, BIOL 452, BIOL 455, BIOL 461, BIOL 462, BIOL 470, BIOL 479, BIOL 485, BIOL 488, BIOL 489, BIOL 490A, BIOL 490B, BIOL 490C, BIOL 499A, and BIOL 499B; EARTH 221, EARTH 232, EARTH 235, EARTH 238, EARTH 281, EARTH 321, EARTH 333, EARTH 358, EARTH 421, EARTH 440, EARTH 458, or EARTH 459
• 0.5 ERS unit: ERS 215
• 0.5 MATH unit: MATH 127
• 0.5 STAT unit: STAT 202
• 0.5 ENGL unit: ENGL 193/SPCOM 193
• 3.5 elective lecture course units

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Year Four (Reg.)
Fall and Winter
BIOL 456 Population Biology or BIOL 458 Quantitative Ecology (Fall)
BIOL 451 Advanced Ecology and Evolution (fall)
BIOL 457 Analysis of Communities (Winter)
Three Two BIOL electives 300-level or higher (4.5 1.0 units) - specific for Ecology Specialization
One EARTH elective 300-level or higher (0.5 unit) - specific for the Ecology Specialization
Four electives (2.0 units)

Year Four (Co-op)
Fall and Winter
BIOL 456 Population Biology
or BIOL 458 Quantitative Ecology (fall)
BIOL 451 Advanced Ecology and Evolution (fall)
BIOL 457 Analysis of Communities (winter)
ERS 215 Environmental and Sustainability Assessment I
Two One BIOL electives 300-level or higher (0.5 1.0 unit) - specifically for Ecology Specialization
One BIOL elective 400-level (0.5 unit) - specifically for Ecology Specialization
One EARTH elective 300-level or higher (0.5 unit) - specifically for Ecology Specialization
Three electives (1.5 units)

Rationale: BIOL 451 will serve as a “capstone course” for Honours Environmental Science students taking the Ecology Specialization. The goal is to have all Honours Biology and Honours Environmental Science, Ecology Specialization students take one capstone course for the completion of their degree. Capstone courses will have smaller enrollments, be highly interactive, and place emphasis on concept integration, critical analysis and communication. The inclusion of BIOL 451 increases the required BIOL units by 0.5 and as a result, BIOL electives units are reduced by 0.5. The addition of BIOL 312 to the elective list will provide students with a spring term program elective option.

iv. Honours Physics (Reg. & Co-op)

In order to graduate with an Honours Physics degree, the following requirements must be successfully completed:

1. 22.0 units that include:
   o 9.5-10.0 PHYS units: PHYS 121, PHYS 122, PHYS 124, PHYS 131L, PHYS 132L, PHYS 232L, PHYS 234, PHYS 236, PHYS 242, PHYS 242L, PHYS 256, PHYS 256L, PHYS 260L, PHYS 263, PHYS 267, PHYS 334, PHYS 342, PHYS 358, PHYS 359, PHYS 360A, PHYS 363, PHYS 364, and PHYS 365
   o 2.5 MATH units: MATH 114, MATH 127, MATH 128, MATH 227, and MATH 228
   o 1.25 CHEM units: CHEM 120, CHEM 120L, and CHEM 123
   o 0.5 ENGL unit: ENGL 193/SPCOM 193
8.25 elective units distributed as follows:

- 2.5 2.0 PHYS lecture units that must include at least 1.5 units at the 400-level
- 0.25 PHYS lab unit at the 300- or 400-level
- 5.5 units chosen from subject and, with a maximum of 1.5 lab units

2. Enrolment in PHYS 10 when offered

Recommended Course Sequence

Year Two

Fall
MATH 227 Calculus 3 for Honours Physics
MATH 228 Differential Equations for Physics and Chemistry
PHYS 10 Physics Seminar
PHYS 232L Measurement Laboratory
PHYS 236 Computational Physics 1
PHYS 256 Geometrical and Physical Optics
PHYS 256L Optics Laboratory
One elective (0.5 unit)

Winter (Reg.) or Spring (Co-op)
PHYS 10 Physics Seminar (winter only)
PHYS 234 Quantum Physics 1
PHYS 242 Electricity and Magnetism 1
PHYS 242L Electricity and Magnetism Laboratory
PHYS 260L Intermediate Physics Laboratory
PHYS 263 Classical Mechanics and Special Relativity
PHYS 267 Probability, Statistics, and Data Analysis for Physics and Astronomy
Two One electives (1.0 0.5 unit)

Year Four

Fall and Winter
PHYS 10 Physics Seminar
Three PHYS electives 400-level (1.5 units)
Two One PHYS electives (1.0 0.5 unit)
Four Five electives (2.0 2.5 units)

Rationale: A new probability, statistics and data analysis course is being introduced as an early program requirement to ensure students have sufficiently mastered important skills that they can use effectively in their later lab courses and to help reinforce material taught in MATH 227 and PHYS 236. This added PHYS requirement replaces one PHYS elective. An elective from Year 2 moves to Year 4 to accommodate PHYS 267.
v. Honours Physics and Astronomy (Reg. & Co-op)

In order to graduate with an Honours Physics and Astronomy degree, the following requirements must be successfully completed:

1. 22.0 units that include:
   - 11.25 PHYS units: PHYS 121, PHYS 122, PHYS 122L, PHYS 124, PHYS 131L, PHYS 175, PHYS 175L, PHYS 234, PHYS 236, PHYS 242, PHYS 242L, PHYS 256, PHYS 256L, PHYS 263, PHYS 267, PHYS 270, PHYS 270L, PHYS 334, PHYS 342, PHYS 358, PHYS 359, PHYS 363, PHYS 364, PHYS 370L, PHYS 375, PHYS 474, and PHYS 475
   - 1.0 PHYS elective unit selected from: PHYS 239, PHYS 275, or PHYS 476
   - 2.5 MATH units: MATH 114, MATH 127, MATH 128, MATH 227, and MATH 228
   - 1.25 CHEM units: CHEM 120, CHEM 120L, and CHEM 123
   - 0.5 ENGL unit: ENGL 193/SPCOM 193
   - 5.5 elective units distributed as follows:
     - 1.5 PHYS lecture units that include at least a 0.5 unit at the 400-level
     - 0.5 PHYS lab unit 300-level or higher
     - 3.5 units chosen from any subject, with a maximum of 1.5 lab units

2. Enrolment in PHYS 10 when offered

Recommended Course Sequence

Year Two

Fall
MATH 227 Calculus 3 for Honours Physics
MATH 228 Differential Equations for Physics and Chemistry
PHYS 10 Physics Seminar
PHYS 236 Computational Physics 1
PHYS 256 Geometrical and Physical Optics
PHYS 256L Optics Laboratory
One elective (0.5 unit)

Winter (Reg.) or Spring (Co-op)
PHYS 10 Physics Seminar (winter only)
PHYS 234 Quantum Physics 1
PHYS 242 Electricity and Magnetism 1
PHYS 242L Electricity and Magnetism Laboratory
PHYS 263 Classical Mechanics and Special Relativity
PHYS 270 Astronomical Observations, Instrumentation and Data Analysis
PHYS 267 Probability, Statistics, and Data Analysis for Physics and Astronomy
PHYS 270L Astronomical Observations, Instrumentation and Data Analysis Laboratory
One elective (0.5 unit)
Rationale: A new probability, statistics and data analysis course (PHYS 267) is being introduced as an early program requirement to ensure students have sufficiently mastered important skills so they will be able to use them effectively in their later lab courses and to help reinforce material taught in MATH 227 and PHYS 236. PHYS 270 is removed from the program requirements and inactivated because its content partially overlaps with PHYS 267.

vi. Honours Biochemistry (with and without Biotechnology Specialization; Reg. & Co-op)

(without specialization)

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Successful completion of this program requires:

22.0 units that include:

- 3.0 BIOL units: BIOL 130, BIOL 130L, BIOL 239, BIOL 240, BIOL 240L, BIOL 309, and BIOL 331
- 0.5 BIOL elective unit 200-level
- 7.75 CHEM units: CHEM 101, CHEM 120, CHEM 121, CHEM 120L, 121L, CHEM 123, 125, CHEM 123L, 125L, CHEM 140, CHEM 200, CHEM 212, CHEM 220, CHEM 220L, CHEM 233, CHEM 233L, CHEM 254, CHEM 264, CHEM 265, CHEM 265L, CHEM 331, CHEM 335L, and CHEM 357

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(with Biotechnology Specialization)

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Successful completion of this program requires:

22.0 units that include:

- 6.0 BIOL units: BIOL 130, BIOL 130L, BIOL 239, BIOL 240, BIOL 240L, BIOL 241, BIOL 309, BIOL 331, BIOL 342, BIOL 354, BIOL 432, BIOL 439, and BIOL 443
- 7.75 CHEM units: CHEM 101, CHEM 120, CHEM 120L, CHEM 123, CHEM 123L, CHEM 121, CHEM 121L, CHEM 125, CHEM 125L, CHEM 140, CHEM 200, CHEM 212, CHEM 220, CHEM 220L, CHEM 233, CHEM 233L, CHEM 254, CHEM 264, CHEM 265, CHEM 265L, CHEM 331, CHEM 335L, and CHEM 357
Recommended Course Sequence (both with and without specialization)

Year One
Fall
BIOL 130/BIOL 130L Introductory Cell Biology/Cell Biology Laboratory
CHEM 101 Introduction to Biochemical Sciences
CHEM 120/121/CHEM 120L/121L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1
MATH 127 Calculus 1 for the Sciences
PHYS 111 Physics 1
or PHYS 121 Mechanics
One of ENGL 193/SPCOM 193 Communication in the Sciences

Winter
BIOL 239 Genetics
CHEM 123/125/CHEM 123L/125L Chemical Reactions, Equilibria and Kinetics/Chemical Reaction Laboratory 2
CHEM 140 Introduction to Scientific Calculations
MATH 128 Calculus 2 for the Sciences
PHYS 112 Physics 2
or PHYS 122 Waves, Electricity and Magnetism

Year Two
Fall
BIOL 240/BIOL 240L Fundamentals of Microbiology/Microbiology Laboratory
BIOL 309 Analytical Methods in Molecular Biology
CHEM 200 Introduction to Laboratory Techniques
CHEM 220/CHEM 220L Intro Analytical Chemistry/Analytical Chemistry Lab 1 Quantitative Chemical Analysis Laboratory
CHEM 264 Organic Chemistry 1

Note: Students transferring into this plan after their 2A term must take a 0.5 unit CHEM lecture or lab course in place of CHEM 200.

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vii. Honours Chemistry (Reg. & Co-op)

22.0 units that include:

- 9.0-8.0 units of required CHEM courses: CHEM 100, CHEM 120, 121, CHEM 120L, 121L, CHEM 123, 125, CHEM 123L, 125L, CHEM 140, CHEM 200, CHEM 212, CHEM 220, CHEM 220L, CHEM 221, CHEM 233, CHEM 240, CHEM 250L, CHEM 254, CHEM 264, CHEM 265, CHEM 265L, CHEM 313L, and CHEM 356, CHEM 494A, and CHEM 494B
- 1.0 unit of required MATH courses: MATH 127 and MATH 128
- 1.5 units of required PHYS courses: PHYS 111/PHYS 111L or PHYS 121/PHYS 121L; and PHYS 112/PHYS 112L or PHYS 122/PHYS 122L
- 10.0-11.0 elective units distributed as follows:
  - 5.5-6.5 CHEM units of CHEM from the list of program electives with the following additional restrictions:
    - a minimum of 1.0 lab unit chosen from CHEM 224L, CHEM 310L, CHEM 350L, and CHEM 360L
    - CHEM 494A and CHEM 494B or 1.0 unit from the list of program electives, of which a minimum of 0.5 unit must be CHEM 224L, CHEM 310L, CHEM 350L, or CHEM 360L
    - a minimum of 1.5 lecture units chosen from CHEM 310, CHEM 313, CHEM 323, CHEM 350, and CHEM 360, with a minimum of 0.5 unit chosen from CHEM 310 and CHEM 313
    - a minimum of 2.0 lecture units from 400-level lecture courses
    - 0.5 unit chosen from AMATH, CO, MATH, PMATH, or STAT courses.
    - Students should contact their academic advisor for a list of recommended courses
  - 4.0 units chosen from any 0.5 unit lecture or lab course
- 0.5 ENGL unit: ENGL 193/SPCOM 193

Students can build strength in a specific focus area by directing their program electives in Year Two and Year Three towards specific courses. By doing so, students will be adequately prepared for 400-level courses in those areas. Students interested in pursuing graduate studies in Chemistry should build strength in at least two focus areas and take CHEM 494A and CHEM 494B.

Recommended Course Sequence

Year One
Fall
CHEM 100 Introduction to Chemical Sciences
CHEM 120/121/CHEM 120L/121L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1
MATH 127 Calculus 1 for the Sciences
PHYS 111/PHYS 111L Physics 1/Physics 1 Laboratory or PHYS 121/PHYS 121L Mechanics/Mechanics Laboratory
One of ENGL 193/SPCOM 193 Communication in the Sciences
One elective (0.5 unit)
Winter
CHEM 123/125/CHEM 123L/125L Chemical Reactions, Equilibria and Kinetics/Chemical Reaction Laboratory 2
CHEM 140 Introduction to Scientific Calculations
MATH 128 Calculus 2 for the Sciences
PHYS 112/PHYS 112L Physics 2/Physics 2 Laboratory or PHYS 122/PHYS 122L Waves, Electricity and Magnetism/Waves, Electricity and Magnetism Laboratory
One elective (0.5 unit)

Year Two
Fall
CHEM 200 Introductory to Laboratory Techniques
CHEM 220/CHEM 220L Intro Analytical Chemistry/Analytical Chemistry Lab 1/Quantitative Chemical Analysis Laboratory
CHEM 240 Mathematical Methods for Chemistry
CHEM 250L Physical Chemistry Laboratory 1
CHEM 264 Organic Chemistry 1
One elective (0.5 unit)

Note: Students transferring into this plan after their 2A term must take a 0.5 unit CHEM lecture or lab course in place of CHEM 200.

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Year Four
CHEM 494A Research Project
CHEM 494B Research Project
Eight Ten electives (4.0 5.0 units)

Rationale: Program requirements and recommended course sequencing are revised to account for the inactivation of CHEM 100; the reactivation of CHEM 121, 121L, 125 and 125L, which replace CHEM 120, 120L, 123, and 123L in all Chemistry programs; the course name change for CHEM 220L; the eligibility of CHEM 200 in Year Two Fall (Students transferring into the program after 2A who have not yet met the CHEM 200 requirement will be ineligible to enroll in this lab and must replace the requirement with a 0.5 unit CHEM lecture or lab); and, the removal of CHEM 494A/CHEM 494B as required CHEM units in Year Four. CHEM 494A/CHEM 494B will be included in the list of program electives for Chemistry. Moving CHEM 494A/CHEM 494B from required CHEM units to optional elective units increases the number of elective units by 1.0 and provides the program with more flexibility. Students pursing graduate studies are encouraged to take CHEM 494A/CHEM 494B.
viii. Honours Chemistry, Computational Specialization (Reg. & Co-op)

22.0 units that include:

- **8.25 7.25** CHEM units: CHEM 100, CHEM 120, 121, CHEM 120L, 121L, CHEM 123, 125, CHEM 123L, 125L, CHEM 140, CHEM 209, CHEM 212, CHEM 220, CHEM 240, CHEM 250L, CHEM 254, CHEM 264, CHEM 340, CHEM 350, CHEM 350L, and CHEM 356, CHEM 494A, and CHEM 494B
- **0.5** CHEM unit chosen from: CHEM 233 or CHEM 237
- **1.5** MATH units: MATH 106 or MATH 114; MATH 127, and MATH 128
- **1.5** PHYS units: PHYS 111 and PHYS 111L or PHYS 121 and PHYS 121L; and PHYS 112 and PHYS 112L or PHYS 122 and PHYS 122L
- **2.0** CS unit: CS 115, CS 116, CS 234, and CS 370
- **0.5** ENGL unit: ENGL 193/SPCOM 193
- **7.75 8.75** elective units distributed as follows:
  - **1.25** CHEM elective units chosen from: CHEM 200, CHEM 220L, CHEM 224L, CHEM 265L, CHEM 310L, CHEM 313L, CHEM 335L, and CHEM 360L
  - CHEM 494A and CHEM 494B or **1.0** CHEM elective unit of which a minimum of 0.5 unit must be CHEM 200, CHEM 220L, CHEM 224L, CHEM 265L, CHEM 310L, CHEM 313L, CHEM 335L, or CHEM 360L
  - **1.0** CHEM elective unit chosen from: CHEM 221, CHEM 265, CHEM 310, CHEM 313, CHEM 331, CHEM 357, and CHEM 360
  - **0.5** CS elective units chosen from: CS 230, CS 330, CS 338, CS 467, and CS 475
  - **2.5** program elective units chosen from: BIOL 266, BIOL 382, CHEM 404, CHEM 400, CHEM 430, PHYS 359, NE 451, and NE 452, with the following conditions:
    - **1.0** unit must be CHEM
    - **2.0** units must be 400-level or higher
  - **2.5** elective units chosen from any 0.5 unit lecture or lab course

Recommended Course Sequence

Year One

**Fall**

**CHEM 100 Introduction to Chemical Sciences**
**CHEM 120/121/120L/121L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1**
**CS 115 Introduction to Computer Science 1**
**MATH 127 Calculus 1 for the Sciences**
**PHYS 111/PHYS 111L Physics 1/Physics 1 Laboratory or PHYS 121/PHYS 121L Mechanics/Mechanics Laboratory**
One of ENGL 193/SPCOM 193 Communication in the Sciences
Winter
CHEM 123/125/CHEM 123L/125L Chemical Reactions, Equilibria and Kinetics/Chemical Reaction Laboratory 2
CHEM 140 Introduction to Scientific Calculations
CS 116 Introduction to Computer Science 2
MATH 128 Calculus 2 for the Sciences
PHYS 112/PHYS 112L Physics 2/Physics 2 Laboratory
or PHYS 122/PHYS 122L Waves, Electricity and Magnetism/Waves, Electricity and Magnetism Laboratory

Year Four
CHEM 494A Research Project
CHEM 494B Research Project
Eight Ten electives (4.0 5.0 units)

Rationale: Program requirements and recommended course sequencing are revised to account for the inactivation of CHEM 100; the reactivation of CHEM 121, 121L, 125 and 125L, which replace CHEM 120, 120L, 123, and 123L in all Chemistry programs; and, the removal of CHEM 494A/CHEM 494B as required CHEM units in Year Four. CHEM 494A/CHEM 494B will be included in the list of program electives for Chemistry. Moving CHEM 494A/CHEM 494B from required CHEM units to optional CHEM elective units increases the number of elective units by 1.0 and provides the program with more flexibility.

ix. Honours Chemistry, Biobased Chemistry

22.0 units that include:

- 12.25 CHEM units: CHEM 100, CHEM 120, 121, CHEM 120L, 121L, CHEM 123, 125, CHEM 123L, 125L, CHEM 140, CHEM 200, CHEM 201, CHEM 212, CHEM 220, CHEM 220L, CHEM 221, CHEM 233, CHEM 233L, CHEM 239, CHEM 240, CHEM 254, CHEM 264, CHEM 265, CHEM 265L, CHEM 301, CHEM 302, CHEM 313, CHEM 331, CHEM 339, CHEM 356, CHEM 479, CHEM 491A, and CHEM 491B
- 0.5 BIOL unit: BIOL 130
- 1.0 MATH unit: MATH 127 and MATH 128
- 1.5 PHYS units: PHYS 111/PHYS 111L or PHYS 121/PHYS 121L; and PHYS 112/PHYS 112L or PHYS 122/PHYS 122L
- 6.75 6.25 elective units distributed as follows:
  o 0.25 lab unit: CHEM 250L or CHEM 313L
  o 3.5 units of CHEM from the list of program electives with the following additional restrictions:
- 1.0 lab unit from: CHEM 224L, CHEM 310L, CHEM 335L, CHEM 350L, and CHEM 360L
- 0.5 lecture unit from: CHEM 357 or CHEM 360
- 2.0 lecture units from 400-level lecture courses
  - 1.0 unit chosen from lecture courses offered in the Faculties of Arts or Environment
  - 0.5 unit chosen from AMATH, CO, MATH, PMATH, or STAT courses
  - 1.5 units chosen from any 0.5 unit lecture or lab course
- 0.5 ENGL unit: ENGL 193/SPCOM 193

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**Recommended Course Sequence**

**Year One**

**Fall**
- CHEM 100 Introduction to Chemical Sciences
- BIOL 130 Introductory Cell Biology
- CHEM 120/121/CHEM 120L/121L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1
- MATH 127 Calculus 1 for the Sciences
- PHYS 111/PHYS 111L Physics 1/Physics 1 Laboratory or PHYS 121/PHYS 121L Mechanics/Mechanics Laboratory
- One of ENGL 193/SPCOM 193 Communication in the Sciences
- One elective (0.5 unit)

**Winter**
- CHEM 123/125/CHEM 123L/125L Chemical Reactions, Equilibria and Kinetics/Chemical Reaction Laboratory 2
- CHEM 140 Introduction to Scientific Calculations
- MATH 128 Calculus 2 for the Sciences
- PHYS 112/PHYS 112L Physics 2/Physics 2 Laboratory or PHYS 122/PHYS 122L Waves, Electricity and Magnetism/Waves, Electricity and Magnetism Laboratory
- One elective (0.5 unit)

**Year Two**

**Fall**
- CHEM 200 Introduction to Laboratory Techniques
- CHEM 201 Environmental Impact and Management of Resources 1
- CHEM 220/CHEM 220L Intro Analytical Chemistry/Analytical Chemistry Lab 1
- CHEM 240 Mathematical Methods for Chemistry
- CHEM 264 Organic Chemistry 1
- One elective (0.5 unit)

**Note:** Students transferring into this plan after their 2A term must take a 0.5 unit CHEM lecture or lab course in place of CHEM 200.
Winter
CHEM 212 Structure and Bonding
CHEM 221 Multi-Component Analysis
CHEM 233 Fundamentals of Biochemistry
CHEM 233L Fundamentals of Biochemistry Laboratory
CHEM 239 Introduction to Biological Systems (online)
CHEM 254 Introductory Chemical Thermodynamics
CHEM 265/CHEM 265L Organic Chemistry 2/Organic Chemistry Laboratory 1

Rationale: Program requirements and recommended course sequencing are revised to account for the inactivation of CHEM 100; the reactivation of CHEM 121, 121L, 125 and 125L, which replace CHEM 120, 120L, 123, and 123L in all Chemistry programs; the addition of BIOL 130 as a required first year course, replacing a first year elective; the inactivation of CHEM 239 which is replaced with a CHEM 233 requirement; the course name change for CHEM 220L; and the eligibility of CHEM 200 in Year Two Fall. Students transferring into the program after 2A who have not yet met the CHEM 200 requirement will be ineligible to enroll in this lab and must replace the requirement with a 0.5 unit CHEM lecture or lab.

x. Honours Co-operative Medicinal Chemistry

Continuing in Honours Co-operative Medicinal Chemistry requires a 60% cumulative overall average, a 60% cumulative average in all Chemistry courses, and a 60%–70% combined average in CHEM 264 and CHEM 265, and a grade of at least 70% in CHEM 360, CHEM 360L, CHEM 381, CHEM 382L, and CHEM 383.

In order to graduate from the Honours Co-operative Medicinal Chemistry program, the following requirements must be successfully completed:

1. 22.0 units that include:
   - 14.0 units of required CHEM courses: CHEM 100, CHEM 120 121, CHEM 120L 121L, CHEM 123 125, CHEM 123L 125L, CHEM 140, CHEM 200, CHEM 212, CHEM 220, CHEM 220L, CHEM 221, CHEM 224L, CHEM 233, CHEM 240, CHEM 250L, CHEM 254, CHEM 264, CHEM 265, CHEM 265L, CHEM 310, CHEM 313L, CHEM 331, CHEM 340, CHEM 350, CHEM 360, CHEM 360L, CHEM 381, CHEM 382L, CHEM 383, CHEM 464, CHEM 494A, and CHEM 494B
   - 1.0 unit of required MATH courses: MATH 127 and MATH 128
   - 1.5 units of required PHYS courses: PHYS 111/PHYS 111L or PHYS 121/PHYS 121L; and PHYS 112/PHYS 112L or PHYS 122/PHYS 122L
   - 0.5 unit of required BIOL courses: BIOL 130
   - 4.5 elective units distributed as follows:
     - 3.0 CHEM units from the list of program electives with a minimum of 2.0 lecture units from 400-level courses
     - 1.5 units chosen from any 0.5 unit lecture or lab course
   - 0.5 ENGL unit: ENGL 193/SPCOM 193

2. Full-time enrolment in Years Two, Three, and Four.
3. ……
Recommended Course Sequence

Year One
Fall
BIOL 130 Introductory Cell Biology
CHEM 100 Introduction to Chemical Sciences
CHEM 120/121L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1
MATH 127 Calculus 1 for the Sciences
PHYS 111/111L Physics 1/Physics 1 Laboratory
or PHYS 121/121L Mechanics/Mechanics Laboratory
One of ENGL 193/SPCOM 193 Communication in the Sciences

Winter
CHEM 123/125/125L Chemical Reactions, Equilibria and Kinetics/Chemical Reaction Laboratory 2
CHEM 140 Introduction to Scientific Calculations
MATH 128 Calculus 2 for the Sciences
PHYS 112/112L Physics 2/Physics 2 Laboratory
or PHYS 122/122L Waves, Electricity and Magnetism/Waves, Electricity and Magnetism Laboratory
One elective (0.5 unit)

Year Two
Fall
CHEM 200 Introduction to Laboratory Techniques
CHEM 220L Intro Analytical Chemistry Analytical Chemistry Lab 1 Quantitative Chemical Analysis Laboratory
CHEM 240 Mathematical Methods for Chemistry
CHEM 250L Physical Chemistry Laboratory 1
CHEM 264 Organic Chemistry 1
One elective (0.5 unit)

Note: Students transferring into this plan after their 2A term must take a 0.5 unit CHEM lecture or lab course in place of CHEM 200.

Rationale: Medicinal chemistry is the science of drug discovery and so the program has a strong (synthetic) organic chemistry core. Students need to demonstrate aptitude in basic organic chemistry to advance in this program and ultimately, to succeed in this field. Students are expected to maintain grades above 70% in the core courses of the medicinal chemistry program. (CHEM 360: Organic Chemistry 3, CHEM 360L: Senior Organic Chemistry Laboratory, CHEM 381: Bioorganic Chemistry, CHEM 382L: Advanced Organic Synthesis lab, CHEM 383: Medicinal Chemistry). In addition, program requirements and recommended course sequencing are revised to account for the inactivation of CHEM 100; the reactivation of CHEM 121, 121L, 125 and 125L, which replace CHEM 120, 120L, 123, and 123L in all Chemistry programs; the course name change for CHEM 220L; and the eligibility of CHEM 200 in Year Two Fall. Students transferring into the program after 2A who have not yet met the CHEM 200 requirement will be ineligible to enroll in this lab and must replace the requirement with a 0.5 unit CHEM lecture or lab.
xi. Honours Geochemistry (Reg. & Co-op)

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21.25 total units that include:

- 5.25 CHEM units: CHEM 100, CHEM 120, CHEM 120L, CHEM 123, CHEM 123L, CHEM 212, CHEM 220, CHEM 220L, CHEM 221, CHEM 224L, CHEM 254, CHEM 264, and CHEM 323
- 1.5 CHEM units: CHEM 120, CHEM 120L, CHEM 123, and CHEM 123L, or CHEM 121, CHEM 121L, CHEM 125 and CHEM 125L
- 7.0 EARTH units: EARTH 121, EARTH 121L, EARTH 122, EARTH 122L, EARTH 123, EARTH 221, EARTH 223, EARTH 231, EARTH 232, EARTH 235, EARTH 238, EARTH 321, EARTH 390, EARTH 421, and EARTH 458
- 0.5 EARTH elective unit: EARTH 281 or EARTH 358
- 1.0 EARTH unit: EARTH 436A and EARTH 436B; or EARTH 499 and one EARTH elective at 300-level or higher
- 1.0 MATH unit: MATH 127 and MATH 128
- 1.0 PHYS units: PHYS 111 or PHYS 121; and PHYS 112 or PHYS 122
- 0.5 STAT unit: STAT 202
- 0.5 ENGL unit: ENGL 193/SPCOM 193
- 4.5 electives units distributed as follows:
  - 1.5 units of CHEM electives chosen from: CHEM 265, CHEM 310, CHEM 313, CHEM 350, CHEM 360, CHEM 400, and CHEM 404
  - 1.5 units of EARTH electives chosen from: EARTH 331, EARTH 332, EARTH 439, EARTH 456, EARTH 459, and EARTH 471
  - 1.5 units chosen from any 0.5 unit courses

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Recommended Course Sequence

Year One
Fall
CHEM 100 Introduction to Chemical Sciences
CHEM 120/ CHEM 120L General Chemistry 1/General Chemistry Laboratory 1 or CHEM 121/ CHEM 121L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1
EARTH 121/EARTH 121L Introductory Earth Sciences/Introductory Earth Sciences Laboratory
EARTH 123 Introductory Hydrology
MATH 127 Calculus 1 for the Sciences
PHYS 111 Physics 1
  or PHYS 121 Mechanics
Winter
CHEM 123/CHEM 123L General Chemistry 2/General Chemistry Laboratory 2 or CHEM 125/CHEM 125L Chemical Reactions, Equilibria and Kinetics/Chemical Reaction Laboratory 2
EARTH 122/EARTH 122L Introductory Environmental Sciences/Introductory Environmental Laboratory
MATH 128 Calculus 2 for the Sciences
PHYS 112 Physics 2
or PHYS 122 Waves, Electricity and Magnetism
One of ENGL 193/SPCOM 193 Communication in the Sciences

Rationale: Program requirements and recommended course sequencing are revised to account for the inactivation of CHEM 100; the reactivation of CHEM 121, 121L, 125 and 125L, which will be an optional for CHEM 120, 120L, 123, and 123L in the Geochemistry program; and the new courses titles for CHEM 120, 120L, CHEM 123 and CHEM 123L.

xii. BSc Science programs and Faculty of Science Calendar pages
All BSc programs listing CHEM 120/120L and/or CHEM 123/123L with full title, and any Faculty of Science Calendar page listing the full titles for these Chemistry courses and labs, will be updated with their new titles, as noted below, effective September 1, 2020.

- CHEM 120, General Chemistry 1
- CHEM 120L, General Chemistry Laboratory 1
- CHEM 123, General Chemistry 2
- CHEM 123L, General Chemistry Laboratory 2

Rationale: With the reactivation of CHEM 121/121L and CHEM 125/125L, effective September 1, 2020, CHEM 120/120L and CHEM 123/123L will be given new course titles.
xiii. Honours Material and Nanosciences

The Honours Materials and Nanosciences program is an interdisciplinary plan offered jointly by the Department of Chemistry and the Department of Physics and Astronomy. Both materials science and nanoscience have been very active research areas during the past few decades, and are now having a major impact in diverse fields, ranging from manufacturing to materials technology to nanomedicine to renewable energy to computer information technology. This program is aimed at students interested in learning about and working in these rapidly evolving high-tech fields and is distinct from the more applied complements the Nanotechnology Engineering program offered through the Faculty of Engineering. It is designed for students who are motivated by, and interested in the fundamental building blocks of materials and devices, both at the macroscopic and nanometer scales.

Continuing in the Honours Materials and Nanosciences program requires a cumulative overall average of 60% and a cumulative overall Science average of 60%.

Successful completion of this program requires:

22.0 units that include:

- 4.5-5.0 MNS units: MNS 101, MNS 102, MNS 201L, MNS 211, MNS 221, MNS 321, MNS 322, MNS 331, and MNS 410 or and MNS 431
- 2.75-3.5 CHEM units: CHEM 120-121, CHEM 120L-121L, CHEM 123-125, CHEM 123L-125L, CHEM 140, CHEM 209, CHEM 250L, CHEM 254, and CHEM 266L, and CHEM 356
- 3.0-4.5 PHYS units: PHYS 121, PHYS 121L, PHYS 122, PHYS 132L, PHYS 232L, PHYS 234, PHYS 242, and PHYS 334, PHYS 342, and PHYS 359
- 2.5 MATH units: MATH 114, MATH 127, MATH 128, MATH 227, and MATH 228
- 8.75-6.0 elective units distributed as follows:
  - a minimum of 0.25 unit from CHEM 237L and CHEM 250L (Refer to Note 1)
  - 0.5 unit from CHEM 233 or CHEM 237 (Refer to Note 21)
  - 0.5 unit from CHEM 264 or CHEM 266 (Refer to Note 32)
  - 0.5 unit from CHEM 254 or PHYS 358 (Refer to Note 4)
  - a minimum of 0.5 unit from PHYS 280 and PHYS 335
  - 2.0-1.0 program elective units, 300-level or higher
  - 1.0 program elective unit, 400-level
  - 2.0-1.5 program elective units, any level
  - 1.5 units from any 0.25 or 0.5 unit courses
- 0.5 ENGL unit: ENGL 193/SPCOM 193

Additional Program Requirement:
Students should enrol in MNS 10 every fall and winter term.
Notes

1. Students should take CHEM 237L in Year Three winter or CHEM 250L in Year Three fall.
2. Students wishing to take CHEM 233 and CHEM 237L must obtain permission from the instructor of CHEM 237L to override the prerequisite of CHEM 237.
3. Students wishing to take CHEM 264 instead of CHEM 266 must obtain permission from the instructor of CHEM 266L to override the prerequisite of CHEM 266.
4. Students should take CHEM 254 in Year Two winter or PHYS 358 in Year Three fall.

Recommended Course Sequence

Year One

Fall
CHEM 120/CHEM 120LCHEM 121/CHEM 121L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1
MATH 114 Linear Algebra for Science
MATH 127 Calculus 1 for the Sciences
MNS 10 Materials and Nanosciences Seminar
MNS 101 Materials and Nanosciences in the Modern World
PHYS 121/PHYS 121L Mechanics/Mechanics Laboratory

Winter
CHEM 123/CHEM 123LCHEM 125/CHEM 125L Chemical Reactions, Equilibria and Kinetics/Chemical Reactions Laboratory 2
MATH 128 Calculus 2 for the Sciences
MNS 10 Materials and Nanosciences Seminar
MNS 102 Techniques for Materials and Nanosciences
PHYS 122/PHYS 132L Waves, Electricity and Magnetism/Waves, Electricity and Magnetism Laboratory
One of ENGL 193/SPCOM 193 Communication in the Sciences

Year Two

Fall
CHEM 140 Introduction to Scientific Calculations
CHEM 209 Introductory Spectroscopy and Structure
CHEM 266 Basic Organic Chemistry 1
  or CHEM 264 Organic Chemistry 1 - (Refer to Note 32)
CHEM 266L Basic Organic Chemistry Laboratory
MATH 227 Calculus 3 for Honours Physics
MNS 10 Materials and Nanosciences Seminar
MNS 211 Chemistry and the Solid State
PHYS 232L Measurement Laboratory
One elective (0.5 unit)
Winter
MATH 228 Differential Equations for Physics and Chemistry
MNS 10 Materials and Nanosciences Seminar
MNS 211L Materials and Nanosciences Laboratory
MNS 221 Physics and the Solid State
PHYS 242 Electricity and Magnetism 1
PHYS 234 Quantum Physics 1
CHEM 254 Introductory Chemical Thermodynamics
One elective (0.5 unit) — (Refer to Note 4)

Year Three
Fall
CHEM 250L Physical Chemistry Laboratory 1 — (Refer to Note 1)
CHEM 256 Introductory Quantum Mechanics
MNS 10 Materials and Nanosciences Seminar
MNS 321 Electrical and Optical Properties of Materials
Three Four electives (1.52.0 units) — (Refer to Note 4)

Winter
CHEM 237 Introductory Biochemistry
or CHEM 233 Fundamentals of Biochemistry - (Refer to Note 21)
CHEM 237L Introductory Biochemistry Laboratory — (Refer to Note 1)
MNS 10 Materials and Nanosciences Seminar
MNS 201L Materials and Nanosciences Laboratory
MNS 322 Polymer Materials
MNS 331 Biomaterials
PHYS 280 Introduction to Biophysics
or PHYS 335 Condensed Matter Physics
PHYS 359 Statistical Mechanics
One elective (0.5 unit)

Year Four
Fall
MNS 10 Materials and Nanosciences Seminar
PHYS 342 Electricity and Magnetism 2
Four electives (2.0 units)

Winter
MNS 10 Materials and Nanosciences Seminar
MNS 410 Special Topics in Solid-State Materials
or MNS 431 Special Topics in Nano-Biomaterials
PHYS 334 Quantum Physics 2
Four Two electives (2.01.0 units)
List of Program Electives
CHEM 212 Structure and Bonding
CHEM 220 Intro Analytical Chemistry
CHEM 220L Analytical Chemistry Lab 1
CHEM 221 Multi-Component Analysis
CHEM 237L Introductory Biochemistry Laboratory
CHEM 267 Basic Organic Chemistry 2
CHEM 267L Organic Chemistry Laboratory
CHEM 310 Transition Metals/Inorganic Materials
CHEM 333 Metabolism 1
CHEM 340 Introduction to Computational Chemistry
CHEM 350 Chemical Kinetics
CHEM 357 Physical Biochemistry
CHEM 400 Special Topics in Chemistry (excluding Special Topics: Polymer Properties and Polymerization)
CHEM 430 Special Topics in Biochemistry
CHEM 494A Research Project and CHEM 494B Research Project
PHYS 225 Modelling Life Physics
PHYS 236 Computational Physics 1
PHYS 242L Electricity and Magnetism Laboratory
PHYS 256 Geometrical and Physical Optics
PHYS 256L Optics Laboratory
PHYS 260L Intermediate Physics Laboratory
PHYS 280 Introduction to Biophysics
PHYS 334 Quantum Physics 2
PHYS 335 Condensed Matter Physics
PHYS 359 Statistical Mechanics
PHYS 360A Modern Physics, Laboratory 1
PHYS 360B Modern Physics Laboratory 2
PHYS 364 Mathematical Physics 1
PHYS 365 Mathematical Physics 2
PHYS 380 Molecular and Cellular Biophysics
PHYS 391 Electronics
PHYS 391L Electronics Laboratory
PHYS 392 Scientific Measurement and Control
PHYS 396 Biophysics of Imaging
PHYS 434 Quantum Physics 3
PHYS 435 Current Topics in Condensed Matter Physics
PHYS 437A Research Project and PHYS 437B Research Project
PHYS 461 Nanophysics

Rationale: Several changes are made to the regular MNS program (including editorial changes to the first paragraph that do not require approval) either to: a) account for first year Chemistry course changes; b) consolidate and standardize courses taken by both the regular and co-op streams; c) add additional core course requirements; d) add additional program electives; and e) make sequence changes to required courses based on course changes, prerequisites and terms of offering. The changes are summarized as follows:
• Replace the CHEM 120/120L and CHEM 123/123L requirements with CHEM 121/121L and CHEM 125/125L;
• Consolidate and standardize the courses taken by both the regular and co-op streams replacing CHEM 356 (Introductory Quantum Mechanics) with PHYS 234 (Quantum Physics 1) for the regular stream to match the co-op stream;
• Remove the option of choosing either MNS 410 (Special Topics in Solid-State Materials) or MNS 431 (Special Topics in Nano-Biomaterials) in Year 4, making both required MNS courses because both are core in providing students with broad advanced knowledge in both hard and soft nanomaterials;
• Remove the option of choosing either Physics 358 (Thermal Physics) or CHEM 254 (Introductory Chemical Thermodynamics) from the required electives list, and add CHEM 254 as a required course. CHEM 254 is a pre-requisite for other upper-year courses and it does not require Math 228 as the pre-requisite, therefore, can be sequences ahead of MATH 228 for both streams;
• Remove the option of choosing either CHEM 250L or CHEM 237L from the required electives list, adding CHEM 250L as a required course. This removes the need for a note suggesting the sequencing of these two 0.25-unit lab courses;
• Remove the option of choosing PHYS 280 (Introduction to Biophysics) or PHYS 335 (Condensed Matter Physics) from required electives list, re-designating both courses as option in the list of program electives;
• Add PHYS 359 (Statistical Mechanics) as a required PHYS courses because Statistical Mechanics is viewed as one of the core subjects in physics;
• Add PHYS 334 (Quantum Physics 2) as a required PHYS course, removing it from the list of program electives, to provide a more complete discussion of quantum physics, building on PHYS 234 (Quantum Physics 1);
• Add CHEM 140 as a required CHEM course, sequencing it for Year 2A as it is a prerequisite for CHEM 250L and CHEM 340. This course is beneficial to allow students to learn the necessary computer skills for other lab courses;
• Move MNS 201L from Year 2 winter to Year 3 winter for the regular stream, to lighten up the load in Year 2 winter (MNS 201L stays in Year 2 spring for the co-op stream as this term is less intense than that for the regular stream, which must take MATH 228 and PHYS 234 in Year 2 winter, whereas these courses are part of Year 3 for the co-op stream);
• Add PHYS 242L (Electricity and Magnetism Laboratory), PHYS 256L (Optical Laboratory), PHYS 260L (Intermediate Physics Laboratory), PHYS 391L (Electronics Laboratory), and CHEM 267L (Organic Chemistry Laboratory) to the program elective list of courses to provide students with more choices and flexibility;
• Remove the obsolete PHYS 392 from the program elective list;
• Remove 1.5 units of program elective options to maintain total program units at 22.0.
• Remove the exclusion of CHEM 400 special topic on polymers, the “Polymer Properties and Polymerization” from the Program elective list as revised content of this topics course no longer significantly overlaps content of required course, MNS 322.
xiv. Honours Co-operative Material and Nanosciences

The Honours Co-operative Materials and Nanosciences program is an interdisciplinary program offered jointly by the Department of Chemistry and the Department of Physics and Astronomy. Both materials science and nanoscience have been very active research areas during the past few decades, and are now having a major impact in diverse fields, ranging from manufacturing to materials technology to nanomedicine to renewable energy to computer information technology. This program is aimed at students interested in learning about and working in these rapidly evolving high-technology fields and is distinct from the more applied complements the Nanotechnology Engineering program offered through the Faculty of Engineering. It is designed for students who are motivated by, and interested in the fundamental building blocks of materials and devices, both at the macroscopic and nanometer scales.

The Honours Co-operative Materials and Nanosciences program meets admission requirements for graduate programs in Chemistry, and would be particularly suitable for admission into Nanoscience and Nanotechnology graduate programs. It is also intended for students who wish to find employment in industries associated with such fields as alternative energy sources, information technology, emerging materials, and biomedical therapies and diagnostics.

The Honours Co-operative Materials and Nanosciences program takes the form of a core of required courses plus appropriate electives. The electives allow students to strengthen complementary areas of interest.

This program, which offers the Honours Materials and Nanoscience courses integrated with five four-month work terms, extends over five four and two-third years. Students work and study in alternate terms starting at the end of 2A term. There is a double work term between terms 3B and 4A. Detailed information on co-op program requirements is located in the Co-operative Education and Career Action (CECA) section of this Calendar and in the Science Faculty work-term report guidelines. WatPD courses information is located on the Professional Development program website.

Continuing in the Honours Co-operative Materials and Nanosciences program requires a cumulative overall average of 60% and a cumulative overall Science average of 60%.

Successful completion of this program requires:

1. **22.0 units that include:**
   - **4.5-5.0 MNS units:** MNS 101, MNS 102, MNS 201L, MNS 211, MNS 221, MNS 321, MNS 322, MNS 331, and MNS 410 or and MNS 431
   - **2.25-3.5 CHEM units:** CHEM 120, 121, CHEM 120L, 121L, CHEM 123, 125, CHEM 123L, 125L, CHEM 209, CHEM 250L, CHEM 254, and CHEM 266L
   - **3.5-4.5 PHYS units:** PHYS 121, PHYS 121L, PHYS 122, PHYS 132L, PHYS 232L, PHYS 234, PHYS 242, and PHYS 334, PHYS 342, and PHYS 359
   - **2.0-2.5 MATH units:** MATH 114, MATH 127, MATH 128, and MATH 227, and MATH 228
   - **0.5 AMATH unit:** AMATH 250
8.75 elective units, distributed as follows:

- a minimum of 0.25 unit from CHEM 237L and CHEM 250L (Refer to Note 1)
  - 0.5 unit from CHEM 233 or CHEM 237 (Refer to Note 2)
  - 0.5 unit from CHEM 264 or CHEM 266 (Refer to Note 3)
- 0.5 unit from CHEM 254 or PHYS 358 (Refer to Note 4)
- a minimum of 0.5 unit from PHYS 280 and PHYS 335
- 2.01 program units, 300-level or higher
- 1.0 program unit, 400-level
- 2.01.5 program units, any level
- 1.5 units of any 0.25 or 0.5 unit courses

- 0.5 ENGL unit: ENGL 193/SPCOM 193

2. Co-operative education requirements that include:

- A minimum of four work terms
- Four WatPD (professional development) courses that must include PD 1, PD 11, and two PD elective courses
- Four work-term reports:
  - One completed as part of PD 11
  - Three completed in required WKRPT courses: WKRPT 200S, WKRPT 300S, and WKRPT 400S

Additional Program Condition:
Student should enrol in MNS 10 every fall and winter academic term.

Notes

1. Students should take CHEM 237L in Year Three winter (before the double work term) or CHEM 250L in Year Four fall.

21. Students wishing to take CHEM 233 and CHEM 237L must obtain permission from the instructor of CHEM 237L to override the prerequisite of CHEM 237.

32. Students wishing to take CHEM 264 instead of CHEM 266 must obtain permission from the instructor of CHEM 266L to override the prerequisite of CHEM 266.

4. Students should take CHEM 254 (instead of PHYS 358) in Year Two spring to be eligible for MNS 331 in Year Three.

Recommended Course Sequence

Year One
Fall
CHEM 120/CHEM 120L, CHEM 121/CHEM 121L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1
MATH 114 Linear Algebra for Science
MATH 127 Calculus 1 for Sciences
MNS 10 Materials and Nanosciences Seminar
MNS 101 Materials and Nanoscience in the Modern World
PHYS 121/PHYS 121L Mechanics/Mechanics Laboratory
Winter
CHEM 123/CHEM 123L CHEM 125/CHEM 125L Chemical Reactions, Equilibria, and Kinetics/Chemical Reactions Laboratory 2
MATH 128 Calculus 2 for Sciences
MNS 10 Materials and Nanosciences Seminar
MNS 102 Techniques for Materials and Nanosciences
PHYS 122/PHYS 132L Waves, Electricity and Magnetism/Waves, Electricity and Magnetism Laboratory
One of ENGL 193/SPCOM 193 Communication in the Sciences

Year Two
Fall
CHEM 140 Introduction to Scientific Calculations
CHEM 209 Introductory Spectroscopy and Structure
CHEM 266 Basic Organic Chemistry 1
or CHEM 264 Organic Chemistry 1 - (Refer to Note 2)
CHEM 266L Basic Organic Chemistry Laboratory
MATH 227 Calculus 3 for Honours Physics
MNS 10 Materials and Nanosciences Seminar
MNS 211 Chemistry and the Solid State
PHYS 232L Measurement Laboratory
One elective (0.5 unit)

Spring
AMATH 250 Introduction to Differential Equations
CHEM 254 Introductory Chemical Thermodynamics — (Refer to Note 4)
MNS 201L Materials and Nanoscience Laboratory
MNS 221 Physics and the Solid State
PHYS 242 Electricity and Magnetism 1
One elective (0.5 unit)

Year Three
Winter (Before double work term)
MATH 228 Differential Equations for Physics and Chemistry
CHEM 233 Fundamentals of Biochemistry - (Refer to Note 1)
or CHEM 237 Introductory Biochemistry
CHEM 237L Introductory Biochemistry Laboratory - (Refer to Note 1)
MNS 10 Materials and Nanosciences Seminar
MNS 322 Polymer Materials
PHYS 234 Quantum Physics 1
Two One electives (1.0-0.5 unit)

Winter (After double work term)
MNS 10 Materials and Nanosciences Seminar
MNS 331 Biomaterials
PHYS 280 Introduction to Biophysics
— or PHYS 335 Condensed Matter Physics
PHYS 359 Statistical Mechanics
Three electives (1.5 units)
Year Four
Fall
CHEM 250L Physical Chemistry Laboratory 1
PHYS 342 Electricity and Magnetism 2
MNS 10 Materials and Nanosciences Seminar
MNS 321 Electrical and Optical Properties of Materials
Three electives (1.5 units)

Winter
MNS 10 Materials and Nanosciences Seminar
MNS 410 Special Topics in Solid-State Materials
–or– MNS 431 Special Topics in Nano-Biomaterials
PHYS 334 Quantum Physics 2
Four Two electives (2.0 units)

List of Program Electives
CHEM 212 Structure and Bonding
CHEM 220 Intro Analytical Chemistry
CHEM 220L Analytical Chemistry Lab 1
CHEM 221 Multi-Component Analysis
CHEM 237L Introductory Biochemistry Laboratory
CHEM 267 Basic Organic Chemistry 2
CHEM 267L Organic Chemistry Laboratory
CHEM 310 Transition Metals/Inorganic Materials
CHEM 333 Metabolism 1
CHEM 340 Introduction to Computational Chemistry
CHEM 350 Chemical Kinetics
CHEM 357 Physical Biochemistry
CHEM 400 Special Topics in Chemistry (excluding Special Topics: Polymer Properties and Polymerization)
CHEM 430 Special Topics in Biochemistry
CHEM 494A Research Project and CHEM 494B Research Project
PHYS 225 Modelling Life Physics
PHYS 236 Computational Physics I
PHYS 242L Electricity and Magnetism Laboratory
PHYS 256 Geometrical and Physical Optics
PHYS 256L Optics Laboratory
PHYS 260L Intermediate Physics Laboratory
PHYS 280 Introduction to Biophysics
PHYS 334 Quantum Physics 2
PHYS 335 Condensed Matter Physics
PHYS 359 Statistical Mechanics
PHYS 360A Modern Physics, Laboratory 1
PHYS 360B Modern Physics, Laboratory 2
PHYS 364 Mathematical Physics 1
PHYS 365 Mathematical Physics 2
PHYS 380 Molecular and Cellular Biophysics
PHYS 391 Electronics
PHYS 391L Electronics Laboratory
PHYS 392 Scientific Measurement and Control
PHYS 396 Biophysics of Imaging
PHYS 437A Research Project and PHYS 437B Research Project
PHYS 434 Quantum Physics 3
Rationale: Several changes are made to the co-operative MNS program (including editorial ones in the opening paragraphs that do not require approval) either to: a) account for first year Chemistry course changes; b) consolidate and standardize courses taken by both the regular and co-op streams; c) add additional core course requirements; d) add additional program electives; and e) make sequence changes to required courses based on course changes, prerequisites and terms of offering. The changes are summarized as follows:

- Replace the CHEM 120/120L and CHEM 123/123L requirements with CHEM 121/121L and CHEM 125/125L;
- Consolidate and standardize the courses taken by both the regular and co-op streams by replacing AMATH 250 (Introduction to Differential Equations) with MATH 228 (Differential Equations for Physics and Chemistry) for the co-op stream to match the regular stream;
- Remove the option of choosing either MNS 410 (Special Topics in Solid-State Materials) or MNS 431 (Special Topics in Nano-Biomaterials) in Year 4, making both required MNS courses because both are core in providing students with broad advanced knowledge in both hard and soft nanomaterials;
- Remove the option of choosing either Physics 358 (Thermal Physics) or CHEM 254 (Introductory Chemical Thermodynamics) from the required electives list, and add CHEM 254 as a required course. CHEM 254 is a pre-requisite for other upper-year courses and it does not require Math 228 as the pre-requisite, therefore, can be sequenced ahead of MATH 228 for both streams;
- Remove the option of choosing either CHEM 250L or CHEM 237L from the required electives list, adding CHEM 250L as a required course. This removes the need for a note suggesting the sequencing of these two 0.25-unit lab courses;
- Remove the option of choosing PHYS 280 (Introduction to Biophysics) or PHYS 335 (Condensed Matter Physics) from required electives list, re-designating both courses as option in the list of program electives;
- Add PHYS 359 (Statistical Mechanics) as a required PHYS courses because Statistical Mechanics is viewed as one of the core subjects in physics;
- Add PHYS 334 (Quantum Physics 2) as a required PHYS course, removing it from the list of program electives, to provide a more complete discussion of quantum physics, building on PHYS 234 (Quantum Physics 1);
- Add CHEM 140 as a required CHEM course, sequencing it for Year 2A as it is a prerequisite for CHEM 250L and CHEM 340. This course is beneficial to allow students to learn the necessary computer skills for other lab courses;
- Add PHYS 242L (Electricity and Magnetism Laboratory), PHYS 256L (Optical Laboratory), PHYS 260L (Intermediate Physics Laboratory), PHYS 391L (Electronics Laboratory), and CHEM 267L (Organic Chemistry Laboratory) to the program elective list of courses to provide students with more choices and flexibility;
- Remove the obsolete PHYS 392 from the program elective list;
- Remove 1.5 units of program elective options to maintain total program units at 22.0.
- Remove the exclusion of CHEM 400 special topic on polymers, the “Polymer Properties and Polymerization” from the Program elective list as revised content of this topics course no longer significantly overlaps content of required course, MNS 322.
xv. Optometry – Requirements for Admission

Prerequisites

Applicants should satisfy the admissions committee that they are well prepared academically for entry to the School of Optometry and Vision Science. Successful applicants must have attended university for at least three years (15.0 credits) before acceptance into the Doctor of Optometry (OD) program.

The following courses represent the prerequisites for admission to the OD program:

General Biology (with lab) – two terms:
BIOL 130/BIOL 130L Introductory Cell Biology/Cell Biology Laboratory
BIOL 211 Introductory Vertebrate Zoology

General Chemistry (with lab) – one term:
CHEM 120/CHEM 120L General Chemistry 1/General Chemistry Laboratory 1 or CHEM 121/CHEM 121L Physical and Chemical Properties of Matter/Chemical Reaction Laboratory 1

Rationale: CHEM 121/121L are added as an option to CHEM 120/120L in the list of admission course requirements for the OD program based on first year Chemistry course changes for students in Chemistry plans. Changes also reflect the new course titles for CHEM 120 and CHEM 120L.

xvi. Chemistry Minor

Advisors: See Faculty of Science, academic advisors.

A Chemistry Minor is available to students in any Honours academic plan, except for plans offered by the Department of Chemistry or plans that include the designation "Specialization in Chemistry". A Chemistry Minor will not be awarded together with a Biochemistry Minor, as this would require triple counting of some courses.

A Chemistry Minor is intended for students in any Honours academic plan, except for plans offered entirely by or jointly with the Department of Chemistry.

In order to graduate with a Chemistry Minor, students must complete the following requirements successfully:
Successful completion of the Chemistry Minor requires:

1. 5.0 units that include:
   o 1.5 CHEM units: CHEM 120 or CHEM 121, CHEM 120L or CHEM 121L, CHEM 123 or CHEM 125, and CHEM 123L or CHEM 125L
   o 2.0 CHEM lecture units, 200-level or higher
   o 1.0 CHEM lecture unit, 300 or 400-level
   o 3.0 CHEM lecture units, with a minimum of 1.0 unit from 300-level or higher
   o 0.5 CHEM lab unit, 200-level or higher
2. A minimum cumulative average of 60% for all lecture courses.
3. A minimum cumulative average of 60% for all lab courses.

Additional Program Requirements:

1. A maximum of two failures in CHEM courses is allowed.
2. A maximum of 1.5 CHEM lecture units can be from the same theme area. The courses counted towards the 3.0 CHEM lecture unit requirement must span a minimum of three theme areas. For 200-level or higher CHEM courses, the middle digit in the course number designates the theme area. "0" is general interest, "1" is inorganic/materials chemistry, "2" is analytical chemistry, "3" is biological chemistry/biochemistry, "4" is computational/theoretical chemistry, "5" is physical chemistry, "6" is organic chemistry, "7" is polymer chemistry, and "8" is medicinal chemistry.

Note
A Chemistry Minor will not be awarded together with a Biochemistry Minor.

Rationale: Wording is removed to reflect central course counting text. Minor combinations are excluded if both minors are owned or jointly owned by the Chemistry department. There are no longer any plans with a designation of “Specialization in Chemistry” so this phrase is being removed. The change to 3.0 lecture units, with a minimum of 1.0 unit from 300-level or higher allows students greater flexibility in the course selection. For example, CHEM 140 can now be included in the minor. The wording “A maximum of 1.5 CHEM lecture units can be from the same theme area” is problematic for Chemistry or Biochemistry students who have successfully completed more than 3.0 CHEM units and have transferred into Honours Science or other programs with a Chemistry minor. Wording was changed to remove the maximum number of units while maintaining the need for students to take chemistry courses in different theme areas.

Earth Sciences Minor

An Earth Sciences Minor is available to students in programs within and outside the Faculty of Science.

Successful completion of the Earth Sciences Minor requires:

1. 5.0 units that include:
   o 1.5 EARTH units: EARTH 121, EARTH 121L, EARTH 122, and EARTH 122L
   o 2.0 EARTH lecture units, any level
   o 1.5 EARTH lecture units 300- or 400-level
2. A minimum cumulative EARTH average of 60%.
Notes:
1. ENVS 195 can be used in place of EARTH 122 but EARTH 122L still needs to be completed.
2. Students enrolled in any Earth Sciences program or in the Environmental Science program with Geoscience or Water Science Specialization are excluded from this Minor.

Rationale: Plans that cannot be combined with this minor are indicated.

xviii. Co-operative Program Requirement Changes

Rationale: The number of required work-term reports required by all BSc Science programs, with the exception of BSc Psychology, is being reduced from four to three.

This change is intended to reduce both work load and stress for students in the following ways:

1. When PD courses were introduced several years ago, the workload for co-op students was increased by four courses. Nothing was removed from their programs at the time. A reduction in the number of required work-term reports can restore the workload to a more reasonable value.

2. Co-op has recently implemented a rule requiring employers to end work terms at least one week before the start of the next semester. This was done so that students can have some free time to recover between semesters. Reducing the number of required work-term reports further allows students to take advantage of this short break and start the semester more rested.

Communication skills are improving with the implementation of a mandatory first year communication course. As such future work-term reports should be of higher quality.

Only three work-term reports are required for accreditation, therefore, our co-op programs will still be accredited with implementation of this change.

This change will be made retroactively to fall 2015 (affecting 2015-2016, 2016-2017, 2017-2018, 2018-2019, and 2019-2020 Calendars) so that most current students (including any that may have taken a year off or changed their sequence) can benefit from this change. Changes will not be reflected in Calendar pages dating back to 2015. Instead, requirement templates for appropriate BSc programs will be updated back to the 2015 requirement term, allowing either three or four work–term reports. Advisors will let students know that a reduced work-term report requirement will be accepted, when appropriate.

All BSc co-op program pages will be updated to show the reduced number of work-term reports (when applicable), while bringing consistency to the wording and location of the co-op requirements for each program. Co-op requirements will be linked to a new “Co-operative Program Requirements” Calendar page within the Faculty of Science (see section Di). Reference to CECA, PD, and science work-term guideline links will be removed from all co-op program pages so as not to repeat information available on the “Co-operative Program Requirement” page.

Changes to the BSc co-op program pages will occur as noted in one of the five examples below:
Example 1: Honours Co-operative Chemistry shown

The same changes will be made for:
Honours Co-operative Chemistry (with and without specialization), Honours Co-operative Biochemistry (with and without specialization), Honours Co-operative Geochemistry, Honours Co-operative Medicinal Chemistry, Honours Co-operative Materials and Nanosciences, Honours Co-operative Life Physics (with and without specialization), Honours Co-operative Mathematical Physics, Honours Co-operative Physics, and Honours Co-operative Physics and Astronomy programs.

This program, which offers the Honours Chemistry courses integrated with five four-month work terms, extends over four and two-thirds years. Students work and study in alternate terms starting at the end of the 2A term. There is a double work term between terms 3B and 4A. Co-op program information requirements are located in the Co-operative Education and Career Action (CECA) section of this Calendar and in the Science Faculty work-term report guidelines. WatPD course information is located on the Professional Development website.

1. 22.0 units that include:
   - 9.0 units of required CHEM courses: CHEM 100, CHEM 120, CHEM 120L, CHEM 123, CHEM 123L, CHEM 140, CHEM 200, CHEM 212, CHEM 220, CHEM 220L, CHEM 221, CHEM 233, CHEM 240, CHEM 250L, CHEM 254, CHEM 264, CHEM 265, CHEM 265L, CHEM 313L, CHEM 356, CHEM 494A, and CHEM 494B
   - 1.0 unit of required MATH courses: MATH 127 and MATH 128
   - 1.5 units of required PHYS courses: PHYS 111/PHYS 111L or PHYS 121/PHYS 121L; and PHYS 112/PHYS 112L or PHYS 122/PHYS 122L
   - 10.0 electives distributed as follows:
     - 5.5 units of CHEM from the list of program electives with the following additional restrictions:
       - a minimum of 1.0 lab unit from CHEM 224L, CHEM 310L, CHEM 350L, and CHEM 360L
       - a minimum of 1.5 lecture units from CHEM 310, CHEM 313, CHEM 323, CHEM 350, and CHEM 360, with a minimum of 0.5 unit chosen from CHEM 310 and CHEM 313
       - a minimum of 2.0 lecture units from 400-level courses
     - 0.5 unit chosen from AMATH, CO, MATH, PMATH, or STAT courses. Students should contact their academic advisor for a list of recommended courses
     - 4.0 units chosen from any 0.5 unit lecture or lab course
   - 0.5 ENGL unit: ENGL 193/SPCOM 193

2. Full-time enrolment in Years Two, Three, and Four.

3. Co-operative program requirements that include:
   - A minimum of four work terms: COOP 1, COOP 2, COOP 3, and COOP 4.
   - A minimum of three work-term reports: one as part of PD 11, WKRPT 200S, and WKRPT 300S.
   - A minimum of four Professional development courses: PD 1 and PD 11 and two other PD courses.

3. A minimum of four work terms, four satisfactory work reports (including PD 11), and credit in four WatPD courses (PD 1, PD 11, and two other PD courses).
Example 2: Honours Co-operative Biology shown

The same changes will be made for:
All the Honours Co-operative Biology Specializations.

Continuing in Honours Co-operative Biology requires a cumulative overall average of 60%, a cumulative Science average of 60%, and a cumulative Biology average of 60%.

Successful completion of this program requires:

1. 21.5 units distributed as follows:
   o 5.5 BIOL units: BIOL 110, BIOL 120, BIOL 130, BIOL 130L, BIOL 150, BIOL 165, BIOL 239, BIOL 240, BIOL 240L, BIOL 273, BIOL 308, and BIOL 359
   o 5.5 BIOL units 300-level or higher with the following condition:
      o 2.5 units must be 400-level
   o 3.0 CHEM units: CHEM 120, CHEM 120L, CHEM 123, CHEM 123L, CHEM 237, CHEM 237L, CHEM 266, and CHEM 266L
   o 0.5 Science elective unit
   o 0.5 unit program elective chosen from: MATH 114, MATH 127, or PHYS 111
   o 0.5 STAT unit: STAT 202
   o 5.5 elective units
   o 0.5 ENGL unit: ENGL 193/SPCOM 193

2. Co-operative program requirements that include:
   o A minimum of four work terms: COOP 1, COOP 2, COOP 3, and COOP 4.
   o A minimum of three work-term reports: one as part of PD 11, WKRPT 200S, and WKRPT 300S.
   o A minimum of four Professional development courses: PD 1 and PD 11 and two other PD courses.

Additional Program Conditions:
1. A maximum of 3.0 SCI units may be counted toward this program.
2. A maximum of 5.0 failed units is permitted.
3. A failed second attempt of a required course will result in removal from the program (see Faculty of Science policy on repeating courses).
4. Detailed information on co-op program requirements is in the Co-operative Education and Career Action (CECA) section of this Calendar and in the Faculty of Science work-term report guidelines. Co-operative education requirements include:
   o A minimum of four work terms
   o Four WatPD (professional development) courses that must include PD 1, PD 11, and two PD elective courses
   o Four work-term reports:
      o One completed as part of PD 11
5. Three completed in required WKRPT courses: WKRPT 200S, WKRPT 300S, and WKRPT 400S
Example 3: Honours Co-operative Earth Sciences, Geology Specialization is shown

The same changes will be made for:
All the Honours Co-operative Earth Sciences programs, the Honours Co-operative Environmental Science programs, the Honours Co-operative Science and Business programs, and the Honours Biotechnology/Economics program.

......

Successful completion of this program requires:
1. 21.5 units that include:
   o 9.0 EARTH units: EARTH 121, EARTH 121L, EARTH 122, EARTH 122L, EARTH 123, EARTH 221, EARTH 223, EARTH 231, EARTH 232, EARTH 235, EARTH 260, EARTH 331, EARTH 332, EARTH 333, EARTH 342, EARTH 358, EARTH 390, and EARTH 471
   o 1.0 EARTH unit: EARTH 436A and EARTH 436B; or EARTH 499 and one EARTH elective at 300-level or higher
   o 3.0 EARTH elective units with the following conditions:
      • 0.5 unit must be 200-level or higher
      • 2.5 units must be 300-level or higher
   o 1.5 CHEM units: CHEM 120, CHEM 120L, CHEM 123, and CHEM 123L
   o 1.5 PHYS units: PHYS 111 and PHYS 111L or PHYS 121 and PHYS 121L; PHYS 112 and PHYS 112L or PHYS 122 and PHYS 122L
   o 1.5 MATH units: MATH 106 or MATH 114; MATH 127 and MATH 128
   o 0.5 STAT unit: STAT 202
   o 1.0 program elective unit chosen from any 200-level or higher BIOL, CHEM, PHYS, MATH, AMATH course or chosen from BIOL 120, BIOL 130, BIOL 150, CS 115, or CS 116
   o 0.5 ENGL unit: ENGL 193/SPCOM 193
   o 2.0 elective units; must be 0.5 unit lecture courses

2. Co-operative program requirements that include:
   o A minimum of four work terms: COOP 1, COOP 2, COOP 3, and COOP 4.
   o A minimum of three work-term reports: one as part of PD 11, WKRPT 200S, and WKRPT 300S.
   o A minimum of four Professional development courses: PD 1 and PD 11 and two other PD courses.

2. Co-operative education requirements that include:
   o A minimum four work terms
   o Four WatPD (professional development) courses that must include PD 1, PD 11, and two PD elective courses
   o Four work-term reports:
      • One complete as part of PD 11
      • Three completed in required WKRPT courses: WKRPT 200S, WKRPT 300S, and WKRPT 400S

Notes
1. SCI and EARTH courses may not be counted as program electives.
2. A maximum of 1.5 SCI units may be counted as electives.
3. Additional co-op program information is located in the Co-operative Education and Career Action (CECA) section of this Calendar and in the Science Faculty work-term report guidelines.
Example 4: Honours Biotechnology/Chartered Professional Accountancy, where only four work term opportunities exist.

Successful completion of this program requires:

1. 22.0 total units distributed as follows:
   - 8.0 Science units distributed as follows:
     - 4.75 BIOL units: BIOL 130, BIOL 239, BIOL 240, BIOL 240L, BIOL 241, BIOL 309, BIOL 331, BIOL 342, BIOL 432, and BIOL 443
     - 2.75 CHEM units: CHEM 120, CHEM 120L, CHEM 123, CHEM 123L, CHEM 266, CHEM 266L, and CHEM 237
     - 0.5 BIOL or CHEM elective unit chosen from: BIOL 345, BIOL 431, BIOL 434, BIOL 441, BIOL 442, BIOL 444, BIOL 483, CHEM 333, or CHEM 432
   - 0.5 AFM unit chosen from: AFM 205, AFM 206, AFM 207, and AFM 208
   - 1.5 ECON units: ECON 101, ECON 102, and ECON 221
   - 0.5 SCBUS unit: SCBUS 225
   - 0.5 ENGL unit: ENGL 193/SPCOM 193
   - 0.5 SPCOM unit: SPCOM 111

2. Co-operative program requirements that include:
   - Four work terms: COOP 1, COOP 2, COOP 3, and COOP 4.
   - A minimum of three work-term reports: one as part of PD 11, WKRPT 200S, and WKRPT 300S.
   - Four Professional development courses: PD 1 and PD 11 and two other PD courses.

Notes
1. STAT 202 can substitute for ECON 221.
2. Co-op program information requirements are located in the Co-operative Education and Career Action (CECA) section of this Calendar and in the Science Faculty work-term report guidelines.
Example 5: BSc Psychology program, which only has four work-term opportunities, and which is excluded from the reduction of required work-term reports.

Additional Program Requirements:

Students in the co-op program must also complete the co-operative program education requirements which include:

- Four work terms: COOP 1, COOP 2, COOP 3, and COOP 4.
- Four work-term reports: one as part of PD 11, WKRPT 200S, WKRPT 300S, and WKRPT 400S.
- Four Professional development courses: PD 1 and PD 11 and two other PD courses.

- A minimum of four work terms
- Four WatPD (professional development) courses that must include PD 1, PD 11, and two PD elective courses
- Four work-term reports:
  - One completed as part of PD 11
  - Three completed in required WKRPT courses: WKRPT 200S, WKRPT 300S, and WKRPT 400S

D. NEW REGULATIONS AND PROCEDURES

i. Co-operative Program Requirements

Co-op Designation Eligibility

In order to be eligible to receive a co-op designation on the Bachelor of Science (BSc) degree, Faculty of Science students are required to successfully complete:

- a minimum of four work terms,
- a minimum of four professional development (PD) online courses, and
- a minimum of three work-term reports (BSc Psychology students must complete four work-term reports).

With the exception of BSc Psychology and Biotechnology/Chartered Professional Accountancy students who have five work-term opportunities, students are given five work-term opportunities in which to complete these requirements throughout the normal academic/work-term sequence.

Students are expected to follow the work-term sequence specific to their academic plan from the point of entry, subject to the minimum requirements for graduation within their program. Students may not end their sequence with a work term, and must maintain a full-time load in an academic term preceding a work term.

Students not meeting requirements of their program will be transferred to another Science academic program, if possible.
Notes

1. The co-operative system of study is only open to full-time students.
2. The co-operative system of study is not open to students seeking to complete a second degree.
3. The Doctor of Pharmacy degree has different co-op work term requirements.

Work Terms

Information regarding work terms is available on the Co-operative Education website.

Students on a work term are limited to enrolment in one course (0.5 unit), unless they have written support from their employer to take two courses (1.0 unit). COOP, PD, and WKRPT courses are not included in these limits.

Co-op Study/Work Sequences

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F,W,S</td>
<td>Terms: F=September-December; W=January-April; S=May-August</td>
</tr>
<tr>
<td>1,2,3,4 plus A or B</td>
<td>Denotes academic year and term.</td>
</tr>
<tr>
<td>WT</td>
<td>Work term</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plan</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>W</td>
<td>S</td>
<td>F</td>
<td>W</td>
</tr>
<tr>
<td>Biochemistry, Biology, Biotechnology/Economics, Chemistry, Earth Sciences, Environmental Science, Medicinal Chemistry, Science and Business</td>
<td>1A</td>
<td>1B</td>
<td>off</td>
<td>2A</td>
<td>WT</td>
</tr>
<tr>
<td>Biotechnology/Chartered Professional Accountancy</td>
<td>1A</td>
<td>1B</td>
<td>off</td>
<td>2A</td>
<td>WT</td>
</tr>
<tr>
<td>Materials and Nanosciences</td>
<td>1A</td>
<td>1B</td>
<td>off</td>
<td>2A</td>
<td>WT</td>
</tr>
<tr>
<td>Pharmacy (Doctor of Pharmacy)</td>
<td>1A</td>
<td>1B</td>
<td>2A</td>
<td>WT</td>
<td>2B</td>
</tr>
<tr>
<td>Physics, Mathematical Physics, Life Physics, Physics and Astronomy</td>
<td>1A</td>
<td>1B</td>
<td>off</td>
<td>2A</td>
<td>WT</td>
</tr>
<tr>
<td>Psychology</td>
<td>1A</td>
<td>1B</td>
<td>off</td>
<td>2A</td>
<td>2B</td>
</tr>
</tbody>
</table>

Notes:

1. Admission to Psychology Co-op occurs by January for the 2B term.
2. A Master of Accounting (MACc) eight-month graduate program is normally taken in consecutive winter and spring terms immediately following the completion of the 4B term in Biotechnology/Chartered Professional Accountancy.
Professional Development (PD) Courses

Students are required to successfully complete four PD courses. Each PD course is worth 0.5 unit and may not be substituted for regular academic course credit. With the exception of PD 1, students are expected to take the courses while on their co-op work terms. The schedule for completing the PD courses is as follows:

- PD 1: Career Fundamentals, must be taken before the first work term. Students who do not successfully complete PD 1 before their first work term must successfully complete PD 1 before their second work term. Students who do not successfully complete PD 1 by the start of their second work term will be removed from the co-op program.
- PD 11: Processes for Technical Report Writing, must be taken during the first work term. Students who do not successfully complete PD 11 by the end of their first work term must successfully complete PD 11 by the end of their second work term. Students who do not successfully complete PD 11 by the end of their second work term will be removed from the co-op program.
- Two additional PD courses of the student's choice must be completed during subsequent work terms.

Further information is available through the Professional Development Program website.

Work-Term Reports

Students must successfully complete a minimum of three work-term reports (BSc Psychology students must successfully complete four work-term reports). PD 11, which is meant to help prepare students for the completion of subsequent work-term reports, will count as the first required report. Work-term reports two and three will be recorded on the transcript as WKRPT 200S and WKRPT 300S (For BSc Psychology students, work term report four will be recorded as WKRPT 400S).

Work-term reports are normally completed according to the following schedule:

- Work-term report two is normally completed by the end of the second work term and must be completed by the end of the third work term. Students who do not successfully complete their second work-term report by the end of their third work term will be removed from the co-op program.
- Work-term report three is normally completed by the end of the fourth work term but may be completed at the end of the fifth work term.
- BSc Psychology students must submit a work-term report for each work term.

Information regarding work-report guidelines and submission dates is available through the Faculty of Sciences' work-report guidelines website.
Co-op Standing Rules

Students will be removed from their co-op program in the following situations:

- Two unemployed or failed work-term opportunities
- Three missing or failed PD courses
- Two failed work-term reports (including PD 11)
- Failure to successfully meet academic program requirements
- Failure to successfully complete PD 1 before the start of the second work term
- Failure to successfully complete PD 11 by the end of the second work term
- Failure to successfully complete the second work-term report by the end of the third work term

Rationale: This new “Co-operative Program Requirements” page, replaces the inactive “Co-operative Program Evaluation” page (see Fi), currently found under the “Degree Requirements” page, which is under the “Information and Regulations” page of the Science section of the Calendar. The new page is pulled out of the “Degree Requirements” page as a standalone page under “Information and Regulations.

The new co-op requirements page summarizes all the co-op requirements necessary for a co-op designation, and it further broken down into sections which discuss work terms, Professional Development courses (PD), and work-term reports; Notes are added to indicated that co-op is only for full time study students, not for students seeking a second degree, and, that Pharmacy has its own requirements; reference to requirements for a full-time academic term proceeding a co-op term is kept, but reference to there being a maximum of two upper year terms where reduced or part-time studies requires department permission, is removed; and, a summary of situations that would remove a student from a co-op program, is provided.

The section on work terms contains a co-op study/work sequence chart, removed from the CECA section of the calendar. It highlights that 0.5 unit of course enrolment allowed, and that 1.0 unit total of course enrolment is possible with employer permission.

The section on PD courses outlines the PD course schedule, no longer referring to it as milestones. Reference to students being placed on probation for missed milestones is removed. Instead, the acceptable maximum completion time for each PD course, before a student would be removed from a co-op program, is stated. PD 11 must be completed before the end of second work term at maximum, and PD 1 must be completed before the start of second work term, or the student is removed from co-op.

The section on work-term reports highlights a new requirement for three versus four work-term reports, with the exception of BSc Psychology students, who are still required to submit four reports. Work-term report due dates are noted, as well as the WKRPT course number which will represent each on the student transcript.
E. CHANGES TO REGULATIONS AND PROCEDURES

i. Term Unit Load

Sixth and Seventh Course Enrolment

Three-Year General BSc Plan

The maximum allowable per term lecture enrolment is 2.5 lecture units (5 courses). A maximum enrolment of 2.5 units is allowed per term.

Honours BSc Plans

The normal allowable per term course load is five lecture courses and their associated labs. Enrolment will be capped at 3.25 units per term unless it occurs as part of the published course sequence of a Science plan.

Students are advised not to enrol in six lecture courses per term and normally will be required to drop one course unless their cumulative overall average is above 80%.

Students wishing to exceed 3.25 units by enrolling in:

- any combination of lectures and labs, involving less than seven lecture courses will:
  - submit a unit load override request to their academic advisor for consideration, within the course selection period.
- seven lecture courses will:
  - normally have a 90% cumulative average.
  - submit a petition for consideration by the Science Petitions Committee. The petition must be delivered to the Science Undergraduate Office and include the 70A petition form, supporting rationale or documentation, as well as comments from their academic advisor. Petitions must be submitted at least one month before the start of the term (April 1 for spring, August 1 for fall, and December 1 for winter).

Rationale: This page specifically outlines allowable term unit load limits, and provides instruction for students wishing to exceed these units. The new title better fits the page content. Reference to equate total lecture units to the number of courses is removed, as is the process involved in petitioning for seventh course enrolment.

ii. Course Grades and Credits

Rules for Faculty of Science Courses

1. The Faculty constitutes the examining body for all courses. After the results have been considered they will be posted by the Registrar on Quest. Course attributes, definitions, and grades currently can be found in the Glossary of Terms.
2. In the Faculty of Science, course and unit have the following interpretations:
   - **Course** - a unit of study relating to a specific academic discipline and identified by a subject abbreviation and a number (e.g., BIOL 130). A course that has the letter L following the course number is a laboratory course (e.g., BIOL 130L). Course duration is normally one term.
   - **Unit** - the credit value associated with a course as designated in the course description. Unit weights are used in the calculation of averages for academic standing. Courses are given unit weights that vary from 0.00 to 3.00, with most being 0.5.

3. Grades in individual courses will normally be reported as numerical grades on the scale 0 to 100. When appropriate, a non-numeric grade will be assigned by the instructor or associate dean (refer to the Grades section of this Calendar).
   - A non-numeric grade will be assigned to a numerically graded course in some circumstances. See Glossary of Terms.
   - To obtain credit for a course, students must normally obtain a minimum grade of 50. The minimum grade is higher than 50 in certain courses (e.g., OPTOM and PHARM courses). Course instructors are responsible for indicating clearly the grading practices in their courses, and students have a responsibility to understand the criteria used in determining final grades for a course. Some courses have a passing grade of 50 but a higher grade is required to meet the requisites for a subsequent course.
   - Students who do not complete a portion of a course for health or other documented circumstances should consult their course outline, review Faculty information and instructions regarding accommodations, and refer to the Assignments, Tests, and Final Exams.

**Rationale:** The new title better fits the page content and will make it easier to students to figure out what the page will discuss; course attributes, definitions and grades are already covered on the Glossary of Terms page, therefore, duplicated text is removed and reference to the Glossary of Terms is made; text regarding syllabi indicating passing grades and student responsibility for understanding final grade criteria, is removed; and, text is added to indicate that some courses require a higher than passing grade to advance to a subsequent course. The changes are all editorial in nature and do not required SUC approval with the exception of point #3.

iii. **Upgrading of a Bachelor of Science Degree**

University of Waterloo graduates who earn a Bachelor of Science (BSc) degree in General Science with 60.0% minimum Science and overall averages are eligible to apply to upgrade their degree to BSc in Honours Science. A petition and academic advice will be required for an upgrade to any other BSc in Science.

Minors attached to the General Science degree are not transferable. Students considering a future upgrade should consider refraining from adding a minor to their General Science degree, so that it can be awarded with the Honours Science degree, will be reviewed for transferability. Students completing the upgrade are required to return their General Science diploma.

A student with a BSc degree from the University of Waterloo or any other degree granting institution may not be admitted to a BSc degree plan.
Rationale: Minors are not transferrable from a General Science to an Honours Science degree upgrade, and, students are not asked to return their General Science diploma, thus guiding text is added and text regarding the return is removed. Updated text for the 2016-2017 Calendar was misleading, implying that it might be possible to transfer minors to an update Honours Science degree.

iv. Repeating and Counting of Courses

Repeating of Courses

When courses are taken twice but passed once, both grades are included in average calculations regardless of whether the failure occurred on the first or subsequent second registration attempt. In such cases, both a credit and a failure are recorded. In instances where a successfully completed passed course is repeated, and passed again, it the second instance will not receive credit and will not count in the average.

Third attempts in previously failed courses, or their equivalent, are allowed in some plans in Science but not all. Where it is not allowed, the information is outlined in the Science Academic Programs and Plans section of this Calendar. Students uncertain of the rules for their program/plan should contact an academic advisor before starting a third attempt. Fourth attempts are not allowed.

Only some Science plans allow third attempts in previously failed courses. Those that do not allow a third attempt indicate this in their academic plan. Fourth attempts are not permitted.

University rules govern how many times a course can be counted across multiple plans. Students uncertain of the counting or repeating rules for their program/plan combination should contact an academic advisor.

Rationale: A slight rewording is made to help clarify rules related to the repeating of courses. As well, the title of the page is updated so that this page can be used to link to the central Calendar rules regarding counting courses since the Science specific page for double counting is obsolete. The first sentence of the third paragraph will be linked to the new Counting Courses page in the central Calendar.

F. INACTIVATIONS OF REGULATIONS AND PROCEDURES

i. Co-operative Program Evaluation (for information only)

Students in Honours co-operative programs will be evaluated by the following rules, modified where necessary to suit their special needs. In particular:

1. Students are expected to follow the work-term sequence specific to their academic plan from the point of entry, subject to the minimum requirements for graduation within their program. Successful completion of four related work terms and four satisfactory work reports (or equivalent) is normally required. PD 11 counts as one of the work-term reports.

Faculty of Science
2. Students in co-operative programs in the Faculty of Science are required to successfully complete four Professional Development (PD) courses offered by the Waterloo Professional Development Program (WatPD) to qualify for a co-op degree. With the exception of PD 1, students are expected to take these courses while on their co-op work terms. The associate dean of science, co-operative education will grant exceptions only under special circumstances. To maintain good standing in the co-op program, students must meet the following milestones:

   - PD 1 (Career Fundamentals) must be completed before the beginning of the first work term.
   - PD 11 (Processes for Technical Report Writing) must be completed before the beginning of the second work term.
   - One of the remaining PD electives must be completed by the end of the third work term.
   - Another one of the remaining PD electives must be completed by the end of the last work term.

Students missing their first PD milestone will be automatically placed on co-op probation. Students on probation will be given a warning that they are missing their first milestone. Students missing two (or more) milestones will normally be removed from co-op.

3. Normally, students may take a maximum of two upper-year terms on a part-time or reduced course basis and must have special permission from their department to do so. Students must maintain a full-time load in an academic term preceding a work term.

4. Students not meeting requirements of their program will be transferred to another Science academic program (regular system) in Satisfactory or better standing, if possible.

**Rationale:** The information of this page will be moved to a new page (Co-operative Program Requirements), which will be sequenced under the first level of pages under the Science “Information and Regulations” page.

**ii. Alumni Gold Medalist (for information only)**

An Alumni Gold Medal is presented annually, typically during spring convocation, to a student who has demonstrated outstanding academic performance on completion of their undergraduate studies.

**Rationale:** This page has no contractual information and therefore should not be in the Calendar. There is a web page that contains information about this medal.
NEW COURSES  (for approval)

Biology

Effective 01-SEP-2020
BIOL 451 (0.50)  LEC, SEM  Advanced Ecology and Evolution
Students will use scientific literature to explore and analyze a range of advanced
topics in ecology and evolution at the individual, population, community, and
ecosystem scales. Recent advances in understanding of fundamental concepts as well as
current frontiers in the field will be examined through written reports, essays, and
oral presentations. [Note: BIOL 165 is recommended; Offered: F]

Requisites : Prereq: BIOL 150, 359, 361
Rationale : This course will serve as a capstone to advance critical thinking,
analysis, writing and communication skills among upper level students.

Physics & Astronomy

Effective 01-SEP-2021
PHYS 267 (0.50)  LEC, TUT  Probability, Statistics, and Data Analysis for Physics and Astronomy
Probability, probability distributions, errors, descriptive statistics, statistical
inference (hypothesis testing, fitting, confidence intervals), computational methods
(e.g. Monte Carlo), examples from physics and astronomy.
[Offered: W, S]

Requisites : Prereq: PHYS 122, MATH 227; PHYS 236 or CS 116
Antireq: STAT 230, 231
Rationale : This new probability, statistics, and data analysis course, with data and
computational emphasis, will be covered early in the Honours Physics and
Honours Physics and Astronomy programs (regular and co-operative), allowing
students to make use of the techniques in later labs (PHYS 360A, 360B and
370L) while reinforcing some material taught earlier in the program (via
MATH 227 and PHYS 236). The course is expected to widen employment
opportunities for students in the co-op stream.

COURSE REACTIVATIONS  (for approval)

Chemistry

Current Catalog Information
CHEM 121 (0.50)  LEC, TUT  Physical and Chemical Properties of Matter
An enriched version of CHEM 120 for all students in, or planning to enter, Chemistry
and Biochemistry plans. [Note: Science students must also take CHEM 121L. Offered: F]
No Special Consent Required
Requisites : Prereq: OAC Calculus or 4U Advanced Functions and Introductory Calculus and OAC Chemistry or 4U Chemistry. Antireq: CHEM 120

Effective 01-SEP-2020
Description Change: A first year Chemistry course for students in Chemistry-based programs. The stoichiometry of compounds and chemical reactions. Properties of gases. Periodicity and chemical bonding. Energy changes in chemical systems. Electronic structure of atoms and molecules; correlation with the chemical reactivity of common elements, inorganic and organic compounds. [Offered: F]
Requisite Change : Prereq: 1A Biochemistry, Chemistry, Geochemistry, Medicinal Chemistry, and Materials and Nanosciences students only. Antireq: CHEM 120
Rationale : Students specialize in their major of interest starting in first year. CHEM 121 will provide students in Chemistry-based plans a strong foundation for upper year courses and co-op work terms. The course description is updated to better reflect course content and the prerequisite is updated to list eligible programs.

Current Catalog Information
CHEM 121L (0.25) LAB Chemical Reaction Laboratory 1
Selected experiments for students taking CHEM 121. [Note: Students who are not taking, or who have not previously taken CHEM 121, will be removed from CHEM 121L. Offered: F]
No Special Consent Required
Requisites : Antireq: CHEM 120L

Effective 01-SEP-2020
Description Change: Selected experiments for students taking CHEM 121. This course is an introduction to the chemistry laboratory environment and focuses on the development of basic lab skills. [Offered: F]
Requisite Change : Coreq: CHEM 121. Antireq: CHEM 120L
Rationale : Students specialize in their major of interest starting in first year. CHEM 121L will provide students in Chemistry-based plans a strong foundation for upper year labs and co-op work terms. The course description is updated to better reflect course content and CHEM 121 is added as a corequisite.

Current Catalog Information
CHEM 125 (0.50) LEC, TUT Chemical Reactions, Equilibria and Kinetics
An enriched version of CHEM 123 for all students in, or planning to enter, Chemistry or Biochemistry plans. [Note: Science students must also take CHEM 125L. Offered: W,S]
No Special Consent Required
Requisites : Prereq: CHEM 121. Antireq: CHEM 123

Effective 01-SEP-2020
Description Change: A first year Chemistry course for students in Chemistry-based programs.

Requisite Change:
Prereq: CHEM 121. Antireq: CHEM 123

Rationale:
Students specialize in their major of interest starting in first year. CHEM 125 will provide students in Chemistry-based plans a strong foundation for upper year courses and co-op work terms. The course description is updated to better reflect course content and the term of offering is updated for winter term only.

Current Catalog Information
CHEM 125L (0.25) LAB Chemical Reaction Laboratory 2
Selected experiments for students taking CHEM 125. [Note: Students who are not taking, or who have not previously taken CHEM 125, will be removed from CHEM 125L. Offered: W]
No Special Consent Required

Requisites:
Antireq: CHEM 123L

Effective 01-SEP-2020
Description Change:
Selected experiments for student taking CHEM 125. This course is a continuation of CHEM 121L, with increased emphasis on assessment of experimental design. [Offered: W]

Requisite Change:
Prereq: CHEM 121L. Correq: CHEM 125. Antireq: CHEM 123L

Rationale:
Students specialize in their major of interest starting in first year. CHEM 125L will provide students in Chemistry-based plans a strong foundation for upper year labs and co-op work terms. The course description is updated to better reflect course content, CHEM 121L is added as a prerequisite, and CHEM 125 is added as a corequisite.

COURSE CHANGES (for approval)

Biology

Current Catalog Information
BIOL 280 (0.50) LEC Introduction to Biophysics
Introduction to a physical understanding of biological systems at macro and molecular scales. The course is intended for 2nd year science and engineering students and will cover a broad spectrum of topics in biophysics, as well as an introduction to neurobiology, nanotechnology and biotechnology. [Offered: W,S]
No Special Consent Required

Requisites:
Prereq: Level at least 2A Honours Science or Engineering plans
Cross-listed as:
PHYS 280

Effective 01-SEP-2020
Component Change:
LEC, TUT

Rationale:
BIOL 280 and PHYS 280 are cross-listed courses. A tutorial component is
being added to all Year Two and Three core physics courses to assist student learning. Attention to scheduling and student workload has been considered. The Department of Biology has been consulted and approves.

**Current Catalog Information**

**BIOL 428 (0.50) LAB, LEC, TUT** Plant Molecular Genetics

An examination of the current molecular techniques used to study plant development physiology. Topics include mutant isolation, transcript and metabolite profiling, gene silencing and protein localization. [Offered: W]

No Special Consent Required

**Requisites:**
Prereq: BIOL 120, BIOL 208/309 and BIOL 308

**Effective 01-SEP-2020**

**Description Change:**
An examination of the current molecular techniques used to study plant development physiology. Topics include mutant isolation, transcript and metabolite profiling, gene silencing and protein localization. [Note: BIOL 120 is recommended; Offered: W]

**Requisite Change:**
Prereq: BIOL 309

**Rationale:**
The prerequisite is updated to include only BIOL 309 (its former BIOL 208 number removed) as this course alone should adequately prepare students for BIOL 428. A note to recommend BIOL 120 is added to the description.

**Current Catalog Information**

**BIOL 462 (0.50) LEC, TUT** Applied Wetland Science

Advanced concepts on wetland ecosystems in the context of regional and global earth systems processes such as carbon and nitrogen cycling and climate change, applications of wetland paleoecology, use of isotopes and other geochemical tools in wetland science, and wetland engineering in landscape rehabilitation and ecotechnology. Current issues in Canada and abroad will be examined. [Offered: F]

No Special Consent Required

**Requisites:**
Prereq: (One of BIOL 150/250, CIVE 153, EARTH 121, 153, ENVE 153, ENVS 200, GEOE 153) and (one of CHEM 120, 123, CHE 102) and (one of CIVE 224, ENVE 224, STAT 202). Antireq: BIOL 453, GEOG 405

Cross-listed as:
EARTH 444

**Effective 01-SEP-2020**

**Requisite Change:**
Prereq: (One of BIOL 150, CIVE 153, EARTH 121, 153, ENVE 153, ENVS 200, GEOE 153) and (one of CHEM 120, 121, 123, 125 or CHE 102) and (one of CIVE 224, ENVE 224, STAT 202). Antireq: BIOL 453, GEOG 405

**Rationale:**
CHEM 121 and CHEM 125 are added as optional prerequisites and the former number (BIOL 250) of BIOL 150 is removed (renumbering was effective in 2012).

**Chemistry**

**Current Catalog Information**

**CHEM 120 (0.50) LEC, TST, TUT** Physical and Chemical Properties of Matter

The stoichiometry of compounds and chemical reactions. Properties of gases.
Periodicity and chemical bonding. Energy changes in chemical systems. Electronic structure of atoms and molecules; correlation with the chemical reactivity of common elements, inorganic and organic compounds. [Note: Offered: F, W. Science students must also take CHEM 120L. Successful completion of Grade 12 U Calculus and Vectors and Grade 12 U Chemistry or equivalent courses is recommended]

No Special Consent Required

**Effective 01-SEP-2020**

**Title Change:** General Chemistry 1

**Requisite Change:** Antireq: CHEM 121

**Rationale:** The title is changed to "General Chemistry 1" to distinguish this course from CHEM 121, which is added as an antirequisite.

**Current Catalog Information**

**CHEM 120L** (0.25) LAB Chemical Reaction Laboratory 1

Selected experiments based on introductory level chemistry topics. This course is an introduction to the chemistry laboratory environment and focuses on the development of basic lab skills. [Offered: F, S]

No Special Consent Required

**Requisites:** Coreq: CHEM 120

**Effective 01-SEP-2020**

**Title Change:** General Chemistry Laboratory 1

**Requisite Change:** Coreq: CHEM 120. Antireq: CHEM 121L

**Rationale:** The title is updated to "General Chemistry Laboratory 1" to distinguish this lab from CHEM 121L, which is added as an antirequisite.

**Current Catalog Information**

**CHEM 123** (0.50) LEC, TST, TUT Chemical Reactions, Equilibria and Kinetics


No Special Consent Required

**Requisites:** Prereq: CHEM 120 or CHE 102

**Effective 01-SEP-2020**

**Title Change:** General Chemistry 2

**Requisite Change:** Prereq: CHEM 120 or CHE 102. Antireq: CHEM 125

**Rationale:** The title is updated to "General Chemistry 2" to distinguish this course from CHEM 125, which is added as an antirequisite.

**Current Catalog Information**

**CHEM 123L** (0.25) LAB Chemical Reaction Laboratory 2

Selected experiments based on introductory level chemistry topics. This course is a continuation of CHEM 120L, with increased emphasis on assessment of experimental design. [Note: Students who are not taking, or who have not previously taken CHEM 123, will be removed from CHEM 123L; Offered: W,S]

No Special Consent Required

**Requisites:** Prereq: CHEM 120L; Coreq: CHEM 123
Effective 01-SEP-2020
Title Change: General Chemistry Laboratory 2
Requisite Change: Prereq: CHEM 120L. Coreq: CHEM 123. Antireq: CHEM 125L
Rationale: The title is updated to "General Chemistry Laboratory 2" to distinguish this lab from CHEM 125L, which is added as an antirequisite.

Current Catalog Information
CHEM 140 (0.50) LAB, LEC Introduction to Scientific Calculations
The application of numeric computing software to perform basic calculations, data analysis, regression analysis, plotting of scientific graphs, data manipulation, and equation solving will be covered in this course, with an emphasis placed upon chemical and biochemical concepts and applications. [Offered: F,W,S] No Special Consent Required
Requisites: Prereq: CHEM 120; Not open to Mathematics students.

Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 120 or 121; Not open to Mathematics students.
Rationale: CHEM 121 is added as an optional prerequisite.

Current Catalog Information
CHEM 200 (0.50) LAB, SEM Introduction to Laboratory Techniques
This course is an introduction to practical laboratory skills. Laboratory techniques will include: the separation, isolation and purification of compounds (through extraction, reflux, distillation, chromatography, and recrystallization), analysis techniques, and the application of these techniques in synthesis. The subjects covered in this biweekly laboratory provide the foundation for more advanced laboratory courses and the basic training needed for an industrial or research laboratory position. The seminar portion of this course will focus on communication and technical skills; the latter will include analysis of Material Safety Data Sheets (MSDS), use of search engines, and learning of citation formats. [Offered: F] No Special Consent Required
Requisites: Prereq: CHEM 123, 123L; Honours Biochemistry, Chemistry or Medicinal Chemistry students only.

Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 125, 125L, Level 2A Honours Biochemistry, Chemistry, or Medicinal Chemistry students only.
Rationale: Prerequisites are updated to replace CHEM 123/123L with CHEM 125/125L, and to add a "Level 2A" prerequisite to the programs eligible as prerequisites. This introductory course is designed to better prepare students in Chemistry-based plans for their first co-op work term; it is not intended for upper-year students.

Current Catalog Information
CHEM 209 (0.50) LEC, TUT Introductory Spectroscopy and Structure
The nature of electromagnetic radiation and an elementary outline of quantum mechanics in one dimension. For each of microwave, infrared, Raman, electronic,
photoelectron, and nuclear magnetic resonance spectroscopy, the nature of the molecular energy levels involved and the type of molecular information that can be obtained using it are examined. [Offered: F]

No Special Consent Required

**Effective 01-SEP-2020**

Requisite Change:

Prereq: CHEM 120 or NE 121.

Rationale:

CHEM 121 is added as an optional prerequisite.

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**Current Catalog Information**

**CHEM 212 (0.50) LEC, TUT**

Structure and Bonding

An introduction to the principles of chemical structure and bonding, with emphasis on their application to inorganic systems. Topics include: atoms, orbitals, and periodicity; localized bonding models; symmetry and group theory; and molecular orbital theory. The subjects treated in this course are foundational components for advanced studies in all areas of chemistry. [Offered: W,S]

No Special Consent Required

Requisites:

Prereq: CHEM 120, 123; Honours students only

**Effective 01-SEP-2020**

Requisite Change:

Prereq: CHEM 120, 123 or CHEM 121, 125; Honours students only

Rationale:

CHEM 121 and CHEM 125 are added as optional prerequisites.

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**Current Catalog Information**

**CHEM 220L (0.25) LAB**

Analytical Chemistry Lab 1

Selected experiments for students taking CHEM 220. [Offered: F]

No Special Consent Required

Requisites:

Prereq: CHEM 123L; Honours Biochemistry, Chemistry, Geochemistry, Materials and Nanosciences, Medicinal Chemistry, or Science and Business (CHEM, BIOCHEM) students only. Coreq: CHEM 220.

**Effective 02-SEP-2020**

Title Change: Quantitative Chemical Analysis Laboratory

Requisite Change:

Prereq: CHEM 123L or 125L; Honours Biochemistry, Chemistry, Geochemistry, Materials and Nanosciences, Medicinal Chemistry, or Science and Business (Biochemistry) students only. Coreq: CHEM 220.

Rationale:

The course title is updated to better reflect the course content. Prerequisites are updated to include CHEM 125L as an option, and to remove the Honours Co-operative Science and Business, Chemistry Specialization as an eligible program (inactivated in Fall 2019).

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**Current Catalog Information**

**CHEM 224L (0.50) LAB, TUT**

Analytical Chemistry Laboratory 2

Extensive lab experience for students who have taken CHEM 220. [Offered: W,S]

No Special Consent Required

Requisites:

Prereq: CHEM 220 and CHEM 220L; Honours Biochemistry, Chemistry, Geochemistry or Medicinal Chemistry students only.

**Effective 01-SEP-2020**
Component Change: LAB
Title Change: Analytical Instrumentation Laboratory
Rationale: This lab course does not involve tutorial instruction so the TUT component is being removed. The title is updated to better reflect the course content.

Current Catalog Information
CHEM 254 (0.50) LEC, TUT Introductory Chemical Thermodynamics
An introduction to the first, second and third laws of thermodynamics and the application of these laws to ideal systems, mixtures, and chemical reactions. Thermodynamic principles are used to study changes in state, including phase changes, and to establish the link between the equilibrium constant and the properties of the substances involved in a chemical reaction. [Offered: W,S]
No Special Consent Required
Requisites: Prereq: CHEM 123; One of MATH 128, 138, 148; Honours students only. Antireq: PHYS 258/358/ECE 403

Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 123 or CHEM 125; One of MATH 128, 138, 148; Honours students only. Antireq: PHYS 358, ECE 403
Rationale: CHEM 125 is added as an optional prerequisite, the antirequisite is being updated to update course numbering from PHYS 258 number to PHYS 358 (effective Sept. 1, 2016), and ECE 403 is added as a separate antirequisite as it is no longer cross-listed with PHYS 358 (effective Sept. 1, 2017)

Current Catalog Information
CHEM 265L (0.25) LAB Organic Chemistry Laboratory 1
Selected experiments for students taking CHEM 265. [Offered: W,S]
No Special Consent Required
Requisites: Prereq: CHEM 123L; Honours Biochemistry, Chemistry, Medicinal Chemistry, or Science and Business (CHEM, BIOCHEM) students only. Coreq: CHEM 265

Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 123L or CHEM 125L; Honours Biochemistry, Chemistry, Medicinal Chemistry, or Science and Business (BIOCHEM) students only. Coreq: CHEM 265
Rationale: The prerequisites are updated to include CHEM 125L as an option and to remove the Honours Co-operative Science and Business, Chemistry specialization as an eligible program (Inactivated in Fall 2019).

Current Catalog Information
CHEM 266 (0.50) LEC, TST Basic Organic Chemistry 1
Structure, nomenclature and reactions of important classes of organic compounds. Stereochemistry and its role in reaction mechanisms. [Offered: F]
No Special Consent Required
Requisites: Prereq: CHEM 120, 123. Antireq: CHEM 262, 264, NE 122

Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 120, 123 or CHEM 121, 125. Antireq: CHEM 262, 264, NE 122/222
Rationale: The new course number for NE 122 (NE 222) is added to the prerequisite, and CHEM 121 and CHEM 125 are added as optional prerequisites.

Current Catalog Information
CHEM 266L (0.25) LAB Organic Chemistry Laboratory
Selected experiments for students taking (or who have taken) CHEM 266. [Note: Lab alternate weeks. Offered: F]
No Special Consent Required
Requisites: Prereq: CHEM 123L. Coreq: CHEM 266
Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 123L or 125L
Rationale: CHEM 125L is added as an optional prerequisite.

Current Catalog Information
CHEM 310L (0.50) LAB Inorganic Chemistry Laboratory 2
Synthesis of transition and non-transition metal compounds. Characterization of compounds using IR, UV-VIS and NMR spectroscopy. [Offered: F]
No Special Consent Required
Requisites: Prereq: CHEM 123L, CHEM 212; Honours Chemistry, Chemical Physics or Medicinal Chemistry students only.
Effective 02-SEP-2020
Requisite Change: Prereq: CHEM 123L or 125L, CHEM 212; Honours Chemistry, Chemical Physics, or Medicinal Chemistry students only.
Rationale: CHEM 125L is added as an optional prerequisite.

Current Catalog Information
CHEM 313L (0.25) LAB Inorganic Chemistry Laboratory 1
Introduction to synthetic inorganic chemistry. [Offered: W]
No Special Consent Required
Requisites: Prereq: CHEM 123L; Honours Chemistry or Medicinal Chemistry students only. Coreq: CHEM 212.
Effective 02-SEP-2020
Requisite Change: Prereq: CHEM 123L or CHEM 125L; Honours Chemistry or Medicinal Chemistry students only. Coreq: CHEM 212.
Rationale: CHEM 125L is added as an optional prerequisite.

Current Catalog Information
CHEM 331 (0.50) LEC, TUT Fundamentals of Metabolism 1
Thermodynamics of metabolism. Metabolism of carbohydrates and lipids. Chemistry of oxidative phosphorylation and photosynthesis. Emphasis is put on the role and chemical mechanisms of the enzymes in these processes [Offered: F]
No Special Consent Required
Requisites: Prereq: CHEM 233 or CHEM 239, 265. Antireq: CHEM 333
Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 233, 265. Antireq: CHEM 333
Rationale: CHEM 239 will no longer be offered so it is removed as a prerequisite option.

Current Catalog Information
CHEM 339 (0.50) LEC Methods and Tools for Biosyntheses
- Biochemical reactions involved in respiration, fermentation, cell metabolism.
- Enzymatic reactions and their use in major industrial processes for transforming or producing chemicals. Biodigesters and bioreactors. Critical analysis of various processes using energy and mass balances. [Offered: F; online only]
- No Special Consent Required
Requisites: Prereq: CHEM 233 or 239; Honours Biochemistry, Chemistry or Medicinal Chemistry
Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 233. Honours Biochemistry, Chemistry, or Medicinal Chemistry
Rationale: CHEM 239 will no longer be offered so it is removed as a prerequisite option.

Current Catalog Information
CHEM 357 (0.50) LEC, TUT Physical Biochemistry
- The use of diffusion, ultracentrifugation, osmotic pressure, electrophoresis and X-ray diffraction to study the properties of biopolymers. Hyperbolic and allosteric enzyme kinetics, inhibition and regulation. Some spectroscopies important to the life sciences. [Offered: W]
- No Special Consent Required
Requisites: Prereq: CHEM 123, MATH 128; One of CHEM 233, 237, 239, NE 224
Effective 01-SEP-2020
Description Change: The use of diffusion, ultracentrifugation, osmotic pressure, electrophoresis and X-ray diffraction to study the properties of biopolymers. Hyperbolic and allosteric enzyme kinetics, inhibition, and regulation. Some spectroscopies important to the life sciences. [Offered: W]
Requisite Change: Prereq: CHEM 123 or 125, MATH 128; One of CHEM 233, 237, NE 224
Rationale: A typo in the course description is corrected (electrophoresis), CHEM 125 is added as an optional prerequisite, and CHEM 239 is removed as an optional prerequisite (will be inactive).

Current Catalog Information
CHEM 404 (0.50) LEC, TUT Physicochemical Aspects of Natural Waters
- Properties of water; chemicals in the environment; environmental fate of inorganic and organic pollutants; basic phenomena affecting the fate of water pollutants (vapor pressure; activity, solubility, partitioning, diffusion, sorption); acids and bases in water; dissolved carbon dioxide; trace metals in water. [Offered: F or W]
- No Special Consent Required
Requisites: Prereq: Level at least 3A; CHEM 120, 123
Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 120, 123 or CHEM 121, 125; Level at least 3A
Rationale: CHEM 121 and CHEM 125 added to optional prerequisites.

Current Catalog Information
MNS 211 (0.50) LEC Chemistry and the Solid State
Crystal structures and bonding in solids; introduction to diffraction, solid state
synthesis, and thermal analysis techniques employed in the study of materials;
defects, non-stoichiometry, and solid solutions; phase diagrams for solid systems.
[Offered: F]
No Special Consent Required
Requisites: Prereq: CHEM 123, PHYS 122, MNS 102
Effective 01-SEP-2020
Requisite Change: Prereq: CHEM 123 or 125, PHYS 122, MNS 102
Rationale: CHEM 125 added as an optional prerequisite.

Current Catalog Information
MNS 410 (0.50) LEC Special Topics in Solid-State Materials
Topics in this theme area may include: transistors and semiconducting materials and
devices, superconducting materials and superconductivity-based devices (such as
Josephson junctions, SQUIDS), effects of low dimensionality and interfaces, quantum
dots, magnetoresistance, spintronics, design and synthesis of new materials. (Note:
At least one elective course is offered annually in the solid-state materials theme
area. For a current list of offerings, see the academic plan advisor). [Offered: W]
No Special Consent Required
Requisites: Prereq: Level at least 4A; Materials & Nanosciences students only
Effective 01-SEP-2020
Description Change: After a review of the essential concepts in solid-state materials, in-depth
discussion includes two or three of the following topics: transistors, semiconducting materials and
devices, superconducting materials and superconductivity-based devices (such as
Josephson junctions, SQUIDS), effects of low dimensionality and interfaces, quantum
dots, magnetoresistance, spintronics, multiferroics, topological phases, and,
nanofabrication of new materials. [Offered: W]
Rationale: The description is updated to clarify this is not meant to be a student
presentation type course, but rather an advanced senior level course that
covers advanced topics in detail.

Current Catalog Information
MNS 431 (0.50) LEC Special Topics in Nano-Biomaterials
Topics in this theme area may include: biomaterials on atomic and nanometre scales in
which DNA, RNA, and/or polypeptides are incorporated as components; physical,
chemical and biological processes; nanoscale forces, adhesion, indentation;
applications, such as nanomotors, nano-biomimetic materials, nanocomposite materials,
nano-biosensors. (Note: At least one elective course is offered annually in the
Nano-Biomaterials theme area. For a current list of offerings, see the academic plan
advisor). [Offered: W]

No Special Consent Required

Requisites:

Effective 01-SEP-2020

Description Change:

After a review of the essential concepts in nano-biomaterials, in-depth discussion includes two or three of the following topics: biomaterials on atomic and nanometre scales in which DNA, RNA, and/or polypeptides are incorporated as components; physical, chemical and biological processes; nanoscale forces, adhesion, indentation; applications in nanomotors, nano-biomimetic materials, nanocomposite materials, and nano-biosensors.

[Offered: W]

Rationale:
The description is updated to clarify this is not meant to be a student presentation type course, but rather an advanced senior level course that covers advanced topics in detail.

Earth and Environmental Sciences

Current Catalog Information

EARTH 221 (0.50) LEC, TUT Geochemistry 1


No Special Consent Required

Requisites:

Effective 01-SEP-2020

Prereq: CHEM 123 or 2A or higher Geological Engineering

Requisite Change:

Prereq: CHEM 123, 125 or level at least 2A Geological Engineering

Rationale:

CHEM 125 is added as an optional prerequisite.

Current Catalog Information

EARTH 421 (0.50) LAB, LEC Geochemistry 2

The application of chemical thermodynamics to geochemical problems. Development of the three laws of Thermodynamics; Gibbs free energy and equilibria constants. Introduction to various topics in aqueous geochemistry such as mineral equilibria, ion exchange and redox equilibria. Laboratory session will involve various experiments related to mineral solubility, chemical kinetics, acid-base equilibria and chemical modelling. [Offered: F]

No Special Consent Required

Requisites:

Effective 01-SEP-2020

Prereq: EARTH 221 and CHEM 123

Requisite Change:

Prereq: EARTH 221 and CHEM 123 or 125

Rationale:

CHEM 125 is added as an optional prerequisite.

Current Catalog Information

EARTH 438 (0.50) LAB, LEC Engineering Geology

Review of basic concepts in engineering geology as applied to rock and soil, including material properties, variability in properties, external factors such as stress, and evaluation of design adequacy. Site investigation and characterisation
techniques used to define and characterise the properties of geological materials and their use in selected engineering geologic design and construction problems. Laboratory assignments will focus on the determination of physical properties and site assessment problems. [Offered: W]

No Special Consent Required

Requisites:

**Effective 01-SEP-2020**

Requisite Change:

Prereq: One of EARTH 121, 153, GEOE 153, CIVE 153, ENVE 153

Rationale:

The prerequisite is updated for student success. Students without a background in structural geology often struggle and fail EARTH 438 without background in key lab method elements gained from EARTH 238.

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Current Catalog Information

**EARTH 444 (0.50) LEC, TUT**

Applied Wetland Science

Advanced concepts on wetland ecosystems in the context of regional and global earth systems processes such as carbon and nitrogen cycling and climate change, applications of wetland paleoecology, use of isotopes and other geochemical tools in wetland science, and wetland engineering in landscape rehabilitation and ecotechnology. Current issues in Canada and abroad will be examined. [Offered: F]

No Special Consent Required

Requisites:

Prereq: (One of BIOL 150/250, CIVE 153, EARTH 121, 153, ENVE 153, ENVS 200, GEOE 153) and (one of CHEM 120, 123, CHE 102) and (one of CIVE 224, ENVE 224, STAT 202). Antireq: BIOL 453, GEOG 405

Cross-listed as: BIOL 462

**Effective 01-SEP-2020**

Requisite Change:

Prereq: (One of BIOL 150, CIVE 153, EARTH 121, 153, ENVE 153, ENVS 200, GEOE 153) and (one of CHEM 120, 121, 123, 125 or CHE 102) and (one of CIVE 224, ENVE 224, STAT 202). Antireq: BIOL 453, GEOG 405

Rationale:

CHEM 121 and CHEM 125 are added as optional prerequisites and the former number (BIOL 250) of BIOL 150 is removed (renumbering was effective in 2012).

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**Physics & Astronomy**

Current Catalog Information

**PHYS 239 (0.50) LEC, TUT**

Computational Physics 2

Object-oriented programming applied to physical problems in astrophysics, electromagnetism, classical and quantum mechanics. Solution methods for differential equations and Monte Carlo techniques. [Offered: W,S]

No Special Consent Required

Requisites:

Prereq: One of PHYS 139, 236, CS 115, 121, 122, 123, 125, 131, 132, 133, 135, 145, CHE 121, CIVE 121, ECE 150, GENE 121, NE 113, SYDE 121; Not open to students in the Faculty of Mathematics

**Effective 01-SEP-2020**

Component Change: LEC

Rationale:

A TUT component is being removed from all non-core physics courses to
devote resources to tutorials for core physics courses. The TUT for this course is therefore removed.

**Current Catalog Information**

**PHYS 263 (0.50) LEC**

Classical Mechanics and Special Relativity

- [Offered: W,S]
- No Special Consent Required
- Prereqs: One of PHYS 111, 121; One of PHYS 112, 122; One of MATH 108, 128, 138, 148; One of MATH 228, AMATH 250, 251; Antireq: AMATH 261, 271

**Effective 01-SEP-2020**

- Component Change: LEC, TUT
- Rationale: A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.

**Current Catalog Information**

**PHYS 270L (0.25) LAB**

Astronomical Observations, Instrumentation and Data Analysis Laboratory

- For students who are taking PHYS 270. [Offered: W,S]
- No Special Consent Required
- Coreqs: PHYS 270
- Prereq: PHYS 256 or ECE 404

**Effective 01-SEP-2021**

- Description Change: Selected experiments in Astronomy. [Offered: W,S]
- Requisite Change: PHYS 270L will be offered as a stand-alone lab when PHYS 270 becomes inactive on September 1, 2021, therefore, the corequisite is removed and a prerequisite is added.

**Current Catalog Information**

**PHYS 280 (0.50) LEC**

Introduction to Biophysics

- Introduction to a physical understanding of biological systems at macro and molecular scales. The course is intended for 2nd year science and engineering students and will cover a broad spectrum of topics in biophysics, as well as an introduction to neurobiology, nanotechnology and biotechnology. [Offered: W,S]
- No Special Consent Required
- Prereq: Level at least 2A Honours Science or Engineering plans
- Cross-listed as: BIOL 280

**Effective 01-SEP-2020**

- Component Change: LEC, TUT
- BIOL 280 and PHYS 280 are cross-listed courses. A tutorial component is being added to all Year Two and Three core physics courses to assist student learning. Attention to scheduling and student workload has been considered. The Department of Biology has been consulted and approves.
Current Catalog Information
PHYS 334 (0.50) LEC Quantum Physics 2
Formalism of quantum mechanics. Operator approach to the harmonic oscillator.
Quantum mechanics in three dimensions: Hydrogen atom, angular momentum and spin.
Identical particles. The variational principle. Ground state of the helium atom.
Applications in atomic and molecular physics. [Offered: W]
No Special Consent Required
Requisites:
Prereq: PHYS 234 or CHEM 356; One of MATH 228, AMATH 250, 251; MATH 227 or 237 or 247. Antireq: AMATH 373

Effective 01-SEP-2020
Component Change: LEC, TUT
Rationale:
A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.

Current Catalog Information
PHYS 342 (0.50) LEC Electricity and Magnetism 2
Electric and magnetic fields in media, auxiliary fields, Maxwell's equations, electromagnetic waves, electric and magnetic properties of matter. [Note: PHYS 236 or knowledge of computational methods recommended. Offered: F, S]
No Special Consent Required
Requisites:
Prereq: PHYS 242; One of MATH 228, AMATH 250, AMATH 251.

Effective 02-SEP-2020
Component Change: LEC, TUT
Rationale:
A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.

Current Catalog Information
PHYS 359 (0.50) LEC Statistical Mechanics
No Special Consent Required
Requisites:
Prereq: (PHYS 358 or ECE 403 or CHEM 254 or ME 250); (PHYS 233 or 234 or CHEM 356 or co-requisite: AMATH 373).

Effective 01-SEP-2020
Component Change: LEC, TUT
Rationale:
A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.
Current Catalog Information

PHYS 360A (0.25) LAB  Modern Physics Laboratory 1
Selected experiments in mechanics, optics, electronics, atomic, molecular, nuclear and solid state physics. [Note: There will be 18 hours of experiments. Three year-two physics labs will have to be completed before this lab course is undertaken. Offered: F,W,S] No Special Consent Required

Effective 01-SEP-2023
Requisite Change: Prereq: PHYS 267
Rationale: Material covered in the new PHYS 267 course will provide students with techniques that will help them be more successful in this upper year lab. PHYS 267 is added as a prerequisite effective Sept. 1, 2023.

Current Catalog Information

PHYS 360B (0.25) LAB  Modern Physics Laboratory 2
Continuation of 360A. [Note: 18 hours of experiments. Offered: F,W,S] No Special Consent Required

Effective 01-SEP-2023
Requisite Change: Prereq: PHYS 267
Rationale: Material covered in the new PHYS 267 course, will provide students with techniques that will help them be more successful in this upper year lab. PHYS 267 is added as a prerequisite effective Sept. 1, 2023.

Current Catalog Information

PHYS 363 (0.50) LEC  Intermediate Classical Mechanics
Requisites: Prereq: One of PHYS 263, AMATH 261, 271; One of MATH 228, AMATH 250, AMATH 251

Effective 01-SEP-2020
Component Change: LEC, TUT
Rationale: A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.

Current Catalog Information

PHYS 364 (0.50) LEC, TUT  Mathematical Physics 1
Requisites: Prereq: MATH 227, MATH 228 or AMATH 250; Honours Physics, Chemical Physics,
Effective 01-SEP-2022

Description Change:
Sturm-Liouville theory. Legendre, Bessel, and other special functions.
Fourier series and introduction to Fourier transforms. Separation of variables. [Offered: F, S]

Rationale:
Some course content (Green's function) is removed from this course and moved to PHYS 365. The description is updated to account for this change, that will be effective September 1, 2022.

Current Catalog Information

PHYS 365 (0.50) LEC, TUT Mathematical Physics 2
Introduction to probability and statistics. Complex variables, Cauchy-Riemann conditions, Cauchy integral formula, Taylor and Laurent expansions, residue theorem, contour integrals and applications. Fourier and Laplace transforms with applications. [Offered: W]
No Special Consent Required
Requisites:
Prereq: MATH 227, 228 or AMATH 250 or 251; Honours Physics, Chemical Physics, Physics and Astronomy, Life Physics and Materials and Nanosciences students only. Antireq: AMATH 332

Effective 01-SEP-2022

Description Change:
Complex variables, Cauchy-Riemann conditions, Cauchy integral formula, Taylor and Laurent expansions, residue theorem, contour integrals and applications. Fourier and Laplace transforms with applications. Green's functions. [Offered: W]

Rationale:
Some content is removed as it's covered in either a new probability and statistics course (PHYS 267) or in other program statistic course requirements (STAT courses), and other content is added from PHYS 364 (Green's function). The description is updated to account for these changes that will be effective September 1, 2022.

Current Catalog Information

PHYS 365 (0.50) LEC Mathematical Physics 2
Introduction to probability and statistics. Complex variables, Cauchy-Riemann conditions, Cauchy integral formula, Taylor and Laurent expansions, residue theorem, contour integrals and applications. Fourier and Laplace transforms with applications. [Offered: W]
No Special Consent Required
Requisites:
Prereq: MATH 227, 228 or AMATH 250 or 251; Honours Physics, Chemical Physics, Physics and Astronomy, Life Physics and Materials and Nanosciences students only. Antireq: AMATH 332

Effective 01-SEP-2020

Component Change:
LEC, TUT

Rationale:
A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered. A tutorial component will be
added to PHYS 365 effective September 1, 2020, and further changes to the course are planned for September 1, 2022.

Current Catalog Information
PHYS 370L (0.25) LAB Astronomy Laboratory 1
- Selected experiments in astronomy. [Offered: W]
- No Special Consent Required
- Prerequisites: Prereq: PHYS 270L

Effective 01-SEP-2023
Requisite Change: Prereq: PHYS 267, 270L
Rationale: Material covered in the new PHYS 267 course will provide students with techniques that will help them be more successful in this upper year lab. PHYS 267 is added as a prerequisite effective Sept. 1, 2023.

Current Catalog Information
PHYS 375 (0.50) LEC Stars
- Stellar distances, masses, ages. Stellar interiors and atmospheres, star formation and evolution. Supernovae, white dwarfs, neutron stars, black holes. [Offered: W]
- No Special Consent Required
- Prerequisites: Prereq: PHYS 112 or 122 and two of PHYS 234, 241, 242, 256, 258/358, 263, 275, AMATH 271

Effective 01-SEP-2020
Component Change: LEC, TUT
Rationale: A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.

Current Catalog Information
PHYS 380 (0.50) LEC Molecular and Cellular Biophysics
- Cell structure and molecular composition; intermolecular interactions and hydration; protein structure and function; cytoskeletal filaments; DNA structure, packing and chromosomes; rate equations and biological dynamics (e.g., cytoskeletal polymerization); self-assembly; cell membranes; action potentials and biological electricity; molecular motors; cell motility. [Recommended PHYS 280/BIOL 280.
- Offered: F, S]
- No Special Consent Required
- Prerequisites: Prereq: PHYS 112 or 122; CHEM 123

Effective 01-SEP-2020
Component Change: LEC
Requisite Change: Prereq: PHYS 112 or 122; CHEM 123 or 125
Rationale: CHEM 125 is added as an optional prerequisite and a TUT component is added to this core physics course. A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.
PHYS 383 (0.50) LEC Medical Physics
Applications of physics in medicine. The course will address basic concepts of medical imaging, nuclear medicine and radiation isotopes, radiation therapy and biomedical laser applications. Nuclear structure and binding energy. Nuclear decays, radioactivity and nuclear reactions. Interaction of radiation with matter. [Offered: W]
No Special Consent Required
Requisites: Prereq: PHYS 112 or 122; one of MATH 118, 119, 128, 138, 148; PHYS 280/BIOL 280

Effective 01-SEP-2020
Component Change: LEC, TUT
Rationale: A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.

Current Catalog Information
PHYS 395 (0.50) LEC Biophysics of Therapeutic Methods
The effect of radiation of various kinds on cells and tissues; elements of radiobiology and photobiology; molecular mechanisms of radiation-induced DNA damage and cell death, repair of radiation damage, dose-response relationships; tumor radiobiology and therapies, radiotherapy, photodynamic therapy, combination therapies; radiosensitizers and photosensitizers for cancer therapies; transdisciplinary advances in physical methods (ultrafast laser and ultrasound techniques) for biomedical applications. [Note: PHYS 380 is recommended. Offered: W even years]
No Special Consent Required
Requisites: Prereq: One of PHYS 112, 122, 125, ECE 106, One of BIOL 130, 239, CHEM 123, PHARM 141, PHYS 280/BIOL 280, PHYS 380; Level at least 3A Science, Mathematics or Engineering students.

Effective 01-SEP-2020
Component Change: LEC, TUT
Requisite Change: Prereq: One of PHYS 112, 122, 125, ECE 106, One of BIOL 130, 239, CHEM 123, 125, PHARM 141, PHYS 280/BIOL 280, PHYS 380; Level at least 3A Science, Mathematics or Engineering students.
Rationale: CHEM 125 is added as an optional prerequisite and a TUT component is added to this core physics course. A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.

Current Catalog Information
PHYS 396 (0.50) LEC Biophysics of Imaging
Introduction to imaging concepts in biophysics with emphasis on the interrelationship between the physics principles of an imaging modality and the associated image reconstruction; methods for imaging at macroscopic to microscopic scales; computed tomography, magnetic resonance imaging, ultrasound, PET, optical imaging, optical and
fluorescence microscopy, scanning probe microscopy (AFM, STM), optical tweezers, electron microscopy. [Note: PHYS 380 recommended. Offered: W odd years]

No Special Consent Required
Requisites : Prereq: One of PHYS 112, 122, 125, ECE 106; One of MATH 128, 138, 148, (SYDE 111, 112); One of PHYS 224, 233, 234, 242, 256, 280, 380, ECE 209, 370, 375, NE 232, 241, SYDE 283, AMATH 231, 373, CS 473, CHEM 209, 356; Level at least 3A SCI, MATH or ENG stdnts

Effective 01-SEP-2020
Component Change: LEC, TUT
Rationale : A tutorial component is being added to Year Two and Three core physics courses that lacked one to assist student learning. Attention to scheduling and student workload has been considered.

Current Catalog Information
PHYS 435 (0.50) LEC, TUT Current Topics in Condensed Matter Physics
Physics pertaining to collective and emergent phenomena in condensed matter systems. Examples of topics to be covered include: magnetism, superconductivity, heavy Fermion systems, quantum hall effect, protein folding, membranes, DNA physics, polymer physics, Modern experimental and theoretical techniques. [Offered: W]
No Special Consent Required
Requisites : Prereq: PHYS 335, 359; PHYS 334 or AMATH 373

Effective 01-SEP-2020
Component Change: LEC
Rationale : A TUT component is being removed from all non-core physics courses to devote resources to tutorials for core physics courses. The TUT for this course is therefore removed.

Current Catalog Information
PHYS 468 (0.50) LEC, TUT Introduction to the Implementation of Quantum Information Processing
Photonic quantum computing, Superconducting qubits, NMR, Ion Trap quantum computing, Atomic quantum computing. [Offered: W]
No Special Consent Required
Requisites : Prereq: CO 481/CS 467/PHYS 467 or PHYS 334

Effective 01-SEP-2020
Component Change: LEC
Rationale : A TUT component is being removed from all non-core physics courses to devote resources to tutorials for core physics courses. The TUT for this course is therefore removed.

COURSE INACTIVATIONS (for approval)

Chemistry

Effective 01-SEP-2020
**CHEM 100 (0.00) Introduction to Chemical Sciences**

Rationale: The content of this course will be merged with the tutorial instruction for CHEM 121 and CHEM 125.

Effective 01-SEP-2020

**CHEM 101 (0.00) Introduction to Biochemical Sciences**

Rationale: The content of this course will be merged with the tutorial instruction for CHEM 121 and CHEM 125.

Effective 01-SEP-2020

**CHEM 239 (0.50) Introduction to Biological Systems**

Rationale: This course was to be offered to UW students from the University of Bordeaux, the partner institution for Honours Chemistry, Biobased Specialization program, but no instructor is available. Material in this course is already covered in other CHEM and BIOL courses at UW, therefore, CHEM 239 is no longer needed.

**Physics & Astronomy**

**Effective 01-SEP-2021**

**PHYS 270 (0.50) Astronomical Observations, Instrumentation and Data Analysis**

Rationale: A new probability, statistics and data analysis course, PHYS 267, being added to the Honours Physics and Honours Physics and Astronomy programs, overlaps to some extent with PHYS 270, which is required course for the Honours Physics and Astronomy program. Both courses are not necessary as requirements, so PHYS 270 will become inactive effective September 1, 2021.

**Dean of Science Office**

**Effective 01-SEP-2020**

**SCI 240 (0.50) Science of Forensics and Criminalistics**

Rationale: This course has not yet been offered and there is no foreseeable capacity to offer it in the near future, therefore, it is being inactivated.
COURSE CHANGES  (for approval)

Physics & Astronomy

Current Catalog Information

PHYS  454  ( 0.50 )  LEC  Quantum Theory 2
The Hilbert space of states, observables, and time evolution. Feynman path integral
and Greens functions. Approximation methods. Co-ordinate transformations, angular
momentum, and spin. The relation between symmetries and conservation laws. Density
matrix, Ehrenfest theorem, and decoherence. Multiparticle quantum mechanics. Bell
inequality and basics of quantum computing. [Offered: F]

No Special Consent Required
Requisites :  Prereq: AMATH 373 or PHYS 334
Cross-listed as:  AMATH 473
Effective  01-SEP-2020
Component Change:  LEC, TUT
Rationale :
A TUT component is added to this cross-listed course (PHYS 454/AMATH 473).
This course covers advanced topics in mathematical physics (advanced
quantum theory) and the number of students taking those courses keeps
increasing. Students in this course are enrolled in a variety of Math
(Mathematical Physics, Applied Mathematics, and Pure Mathematics), Science
(Honours Physics, Mathematical Physics, Astrophysics, etc.), Pure
Mathematics (Math), and Engineering plans. A tutorial will help address the
diversity of student back grounds regarding mathematical methods. This
change is driven by the Faculty of Mathematics and supported by the Physics
and Astronomy.

Current Catalog Information

PHYS  476  ( 0.50 )  LEC  Introduction to General Relativity
Tensor analysis. Curved space-time and the Einstein field equations. The
Schwarzschild solution and applications. The Friedmann-Robertson-Walker cosmological
models. [Offered: W]

No Special Consent Required
Requisites :  Prereq: One of AMATH 261, 271, PHYS 263; AMATH 231 or MATH 227; Level at
least 4A in Mathematics or Science
Cross-listed as:  AMATH 475
Effective  01-SEP-2020
Component Change:  LEC, TUT
Rationale :
A TUT component is added to this cross-listed course (PHYS 476/AMATH 475).
This course covers advanced topics in mathematical physics (general
relativity) and the number of students taking those courses keeps
increasing. Students in this course are enrolled in a variety of Math
(Mathematical Physics, Applied Mathematics, and Pure Mathematics), Science (Honours Physics, Mathematical Physics, Astrophysics, etc.), Pure Mathematics (Math), and Engineering plans. A tutorial will help address the diversity of student backgrounds regarding mathematical methods. This change is driven by the Faculty of Mathematics and supported by the Physics and Astronomy.
Memorandum

To: Senate Undergraduate Council
From: Faculty of Science
Date: August 12, 2019 (for September 2019 SUC meeting)
Re: Motion to amendment the following plan: Honours Science and Aviation (Physics Specialization), in the 2018-2019 Calendar

The following requirement changes were approved at the September 2017 SUC. Unfortunately, the ‘Recommended Sequence’ changes do not accurately represent the requirements. Only 1.0 PHYS elective unit at the 300-level or higher is required. Changes to the sequence to reflect the requirement changes, incorrectly show 1.5 total PHYS elective units at 300-level or higher, all of them in Year Four. This motion is to amend the Year Four fall sequence to remove the 0.5 unit PHYS elective requirement at the 300-level or higher. This is required for the 2018-2019 Calendar only, as this specialization is no longer offered in the 2019-2020 Calendar.

Honours Science and Aviation (Physics Specialization)

Advisors: See Faculty of Science, academic advisors.

Continuation in the Science and Aviation, Physics Specialization program requires a cumulative overall average of 65% and a cumulative Science average of 65%. Flight training courses offered through the Waterloo Wellington Flight Centre (WWFC) are not included in any cumulative average calculations. Instead, students receive credit (CR) for each course they successfully complete.

Successful completion of this program requires:

\[ 21.0 \text{ units} \]

- 6.25 PHYS units: PHYS 121, PHYS 131L, PHYS 122, PHYS 132L, PHYS 124, PHYS 234, PHYS 236, PHYS 242, PHYS 242L, PHYS 256, PHYS 256L, PHYS 263, PHYS 342, PHYS 360A, and PHYS 360B
- 3.25 additional PHYS elective units distributed as follows:
  - 0.5 lecture unit at 200-level or higher
  - 1.0 lecture unit at 300-level or higher
  - 0.25 lab unit any level
  - 1.0 lecture unit any level
- 6.0 AVIA units: AVIA 100, AVIA 101, AVIA 102, AVIA 203, AVIA 204, AVIA 205, AVIA 306, AVIA 307, AVIA 310, AVIA 320 and AVIA 408
- 2.5 MATH units: MATH 114, MATH 127, MATH 128, MATH 227, and MATH 228
- 0.5 STAT unit: STAT 202
- 1.0 GEOG unit: GEOG 181 and GEOG 309
0.5 GEOG unit chosen from: GEOG 271 or GEOG 281
0.5 Program elective unit chosen from: ENGL 210F, FR 151, GEOG 310, GEOG 371, GEOG 381, PHIL 145, PHIL 215, PHYS 275, PHYS 280, PHYS 391/PHYS 391L, PHYS 392/PHYS 392L, SCI 206, and SCI 238
0.5 SCCOM unit: SCCOM 100

2. Completion of the English Language Proficiency Requirement

Additional Program conditions:
1. AVIA 101, 102, 203, 204, 205, 306, 307 and 408 are the Professional Pilot Program flight training courses offered by and assessed through the WWFC. All other AVIA courses are offered and assessed by Waterloo.
2. The passing grade in each WWFC flight training course is 70%. Credit must be obtained in each course to progress to the next one. Normally, students can repeat each course only once, if there is a failed first attempt.
3. A maximum of 2.0 failed units is permitted for all Waterloo courses.

Notes
1. Alternative Program electives may be substituted with permission from the program advisor.
2. PHYS electives must be selected so that prerequisites are met.

Recommended Course Sequence

**Year One**

**Fall**
- AVIA 100 Introduction to Aviation
- GEOG 181 Principles of GIScience
- MATH 114 Linear Algebra for Science
- MATH 127 Calculus 1 for the Sciences
- PHYS 121 Mechanics
- PHYS 131L Mechanics Laboratory

**Year One Winter**
- AVIA 101 Professional Pilot Program Course I (0.75 unit)
- MATH 128 Calculus 2 for the Sciences
- PHYS 122 Waves, Electricity and Magnetism
- PHYS 132L Waves, Electricity and Magnetism Laboratory
- PHYS 124 Modern Physics
- SCCOM 100 Communication in the Sciences

**Year One Spring**
- AVIA 102 Professional Pilot Program Course II (0.5 unit)

**Year Two**

**Fall**
- AVIA 203 Professional Pilot Program Course III (0.5 unit)
- GEOG 271 Earth from Space Using Remote Sensing
  - or GEOG 281 Advanced Geographic Information Systems (GIS)
- MATH 227 Calculus 3 for Honours Physics
- MATH 228 Differential Equations for Physics and Chemistry
- PHYS 236 Computational Physics 1
Year Two Winter
AVIA 204 Professional Pilot Program Course IV (0.75 unit)
PHYS 234 Quantum Physics 1
PHYS 242 Electricity and Magnetism 1
PHYS 242L Electricity and Magnetism Lab
PHYS 263 Classical Mechanics and Special Relativity

Year Two Spring
AVIA 205 Professional Pilot Program Course V (0.5 unit)

Year Three
Fall
AVIA 306 Professional Pilot Program Course VI (0.75 unit)
AVIA 310 Human Factors in Aviation
PHYS 256 Geometrical and Physical Optics
PHYS 256L Optics Lab
One PHYS elective (0.5 unit)
STAT 202 Introductory Statistics for Scientists

Year Three Winter
AVIA 307 Professional Pilot Program Course VII (0.75 unit)
AVIA 310 Human Factors in Aviation
AVIA 320 Aviation Safety
GEOG 271 Earth from Space Using Remote Sensing
   or GEOG 281 Advanced Geographic Information Systems (GIS)
One 200- 300- or 400-level PHYS elective (0.5 unit)
One 300- or 400-level PHYS elective (0.5 unit)

Year Three Spring
AVIA 408 Professional Pilot Program Course VIII (0.5 unit)

Year Four
Fall
GEOG 309 Physical Climatology
PHYS 342 Electricity and Magnetism 2
PHYS 360A Modern Physics Laboratory 1
STAT 202 Introductory Statistics for Scientists
One PHYS elective (0.5 unit)
One 300- or 400-level PHYS elective (0.5 unit) ←This should not be part of YR 4 sequence
One Program elective (0.5 unit)

Year Four Winter
PHYS 342 Electricity and Magnetism 2
PHYS 360B Modern Physics Laboratory 2
Two One 300- or 400-level PHYS electives (1.0 0.5 unit)
One PHYS elective (0.5 unit)
One PHYS lab elective (0.25 unit)
One Program elective (0.5 unit)
Memorandum

To: Senate Undergraduate Council
From: Faculty of Science
Date: August 16, 2019 (for September 2019 SUC meeting)
Re: Motion to amendment the Medical Physiology Minor for 2020-2021 Calendar

The following changes to the Medical Physiology Minor are being put forward to September SUC, to coincide with the same changes to this Minor, being put forward by the Faculty of Applied Health Studies:

Medical Physiology Minor

The Biology and Kinesiology Departments have complementary strengths in medical sciences. The Medical Physiology Minor is designed to assist students pursuing health professional schools, biomedical graduate programs, or health-related careers.

The Medical Physiology Minor is available to students in all Honours and General plans.

Successful completion of this minor requires:

1. 5.0 units distributed as follows:
   - 1.0 BIOL unit: BIOL 239 and BIOL 373
   - 1.0 BIOL unit chosen from: BIOL 240, BIOL 341, BIOL 355, BIOL 376, BIOL 444, BIOL 473 and BIOL 476
   - 1.0 KIN unit: KIN 406, KIN 404 and KIN 408
   - 1.0 KIN unit chosen from: KIN 301, KIN 343, KIN 356, KIN 310/HLTH 310, KIN 402, KIN 404, KIN 406, KIN 407, KIN 416, and KIN 429
   - 0.5 PHIL unit: PHIL 226 or PHIL 319J
   - 0.5 PSYCH unit chosen from: PSYCH 207, PSYCH 261, PSYCH 307, and PSYCH 335

2. An overall average of 60% in the above courses.

Additional conditions:

1. A failed second attempt of a required course will result in removal from the minor. No third attempts are allowed for core required courses.

2. Normally, a maximum of 2.5 units (5.0 courses) obtained on a Letter of Permission Form or by transfer credit from another institution may be applied toward fulfilment of this minor. The department offering a required course must first deem the replacement course equivalent (this assessment includes relevant prerequisites).
Notes

1. A Medical Physiology Minor will not be awarded with a Biology Minor.
2. BIOL 130, BIOL 273, and PSYCH 101 are prerequisites for one or more of this minor’s required courses; therefore students must have taken them previously.
3. Admission requirements vary greatly among professional schools. Students should consult schools directly when choosing courses to satisfy admissions requirements.
4. Students interested in entering a health professional school should consider taking additional physical science courses (e.g., CHEM 120, CHEM 123, CHEM 266, CHEM 267, PHYS 111, PHYS 112), which may help them prepare for standardized admission examinations (e.g. MCAT, OAT, etc.).

Rationale: This is a joint submission, between the Departments of Biology and Kinesiology.

BIOL 240 is removed from BIOL elective list because students in Biomedical Sciences, who frequently request this minor, are already required to complete BIOL 239, BIOL 240 and BIOL 373 as part of their program. This change forces the select 1.0 units of BIOL courses outside the requirements for this program. The “Failed second attempt” is a program condition for all Biology programs and should extend to the minor as well. The Medical Physiology minor will not be awarded with a Biology minor as it would constitute two minors offered from the same department.

KIN 404 replaces KIN 406 as a required course because KIN 404 (Physiology of obesity and diabetes) is more fundamental to Medical Physiology. KIN 406 (Physiology of Muscle Aging and Disease) is added to the KIN elective list. KIN 402 is removed from the list of KIN electives because students enrolled in the minor have limited access to this course which is only offered every other year. KIN 343 (Micronutrient Metabolism) and KIN 356 (Sensory Systems Neuroscience) are also added to the list of KIN electives because they are appropriate medical physiology courses.
Memorandum

To: Senate Undergraduate Council
From: University Registrar
Date: August 26, 2019
Re: 50% of courses must be in average

Effective date: September 1, 2020

Motion and rationale: To align faculty rules related to the minimum number of courses with numeric grades being counted towards an average for a given credential (i.e., academic plan or program) by creating harmonized text and removing related faculty-specific text. The faculties of Engineering and Mathematics did not have this rule previously, but they are in agreement to add it now.

This rule will be implemented as of September 1, 2020, for all undergraduate students.

New Calendar text:
Section of Calendar: University Policies, Guidelines, and Academic Regulations
Page title: 50% Rule

At least 50% of the academic course units required to be awarded a degree, major, minor, option, or specialization must have numeric grades that are included in its average(s).

Current (2019-2020 Undergraduate Calendar) faculty-specific text to be removed as follows:

AHS: http://ugradcalendar.uwaterloo.ca/page/AHS-Grades-and-Academic-Standing

Numeric Grading Requirement

Numeric grading is required for at least 50% of the academic course units in a Faculty of Applied Health Sciences’ major, minor, option, and specialization, and those course units must be included in the overall average.
Arts: http://ugradcalendar.uwaterloo.ca/page/ARTS-Admission-Transfer-Credit

Calculation of Plan Average(s)

Courses used to fulfil the Residency Requirement must be graded on a numerical basis (and have received a passing grade), be in the average, and include:
- at least half the total number of academic course units required for each degree, major, minor, or diploma;
- at least 6.5 academic course units (13 courses) in Arts subjects for a Four-Year Liberal Studies degree;
- at least four academic course units (eight courses) in Arts subjects for a Three-Year Liberal Studies degree.

Environment: http://ugradcalendar.uwaterloo.ca/page/ENV-Internal-and-External-Transfer-Credits

Minimum Course Requirement for Calculation of Plan Averages

Transfer credits, whether internal or external, are not used in plan cumulative major and overall average calculations. Each academic plan requires a minimum number of courses which must be included in the calculation of the cumulative overall and major averages:
- Bachelor of Environmental Studies Honours: 10.0 units, of which 5.0 units must qualify for inclusion in the calculation of the cumulative major average.
- Bachelor of Knowledge Integration: 10.5 units, of which 5.5 units must qualify for inclusion in the calculation of the cumulative major average.
- Bachelor of Environmental Studies Three-Year General: 7.5 units, of which 3.0 units must qualify for inclusion in the calculation of the cumulative major average.

These requirements may affect the total number of transfer credits assigned.

Students are advised to refer to their academic plan sections in this Calendar, or contact their academic advisors, for degree and cumulative major and overall average requirements for their plan or intended plan.

Notes

1. The School of Planning may grant a maximum of 5.0 units at time of admission from an external accredited post-secondary institution.
2. Geography and Aviation maximum transfer credit allowance includes flight training requirements.

Science (Psychology): http://ugradcalendar.uwaterloo.ca/page/SCI-Honours-Psychology-BSc-Regular-and-Coop1

Note #12: Transfer students should note the transfer credit maximums listed on the Faculty of Science Admission page, and at least half of the PSYCH courses must be taken at the University of Waterloo with a numeric grade.
## Academic Calendar Dates, 2020/21

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<td>April 5 (M)</td>
<td>July 26 (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>for Jan 4 (M)</td>
<td>for May 24 (M)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>April 6 (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>for Apr 2 (F schedule)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>July 27 (T)</td>
</tr>
<tr>
<td>Pre-Examination Study Day(s)</td>
<td>Dec. 8 (T)</td>
<td>Apr. 7, 8 (W,R)</td>
<td>July 28, 29 (W,R)</td>
</tr>
<tr>
<td>Examinations Begin</td>
<td>Dec. 9 (W)</td>
<td>Apr. 9 (F)</td>
<td>July 30 (F)</td>
</tr>
<tr>
<td>Online Class Examination Days</td>
<td>Dec. 11, 12 (F,S)</td>
<td>Apr. 9, 10 (F,S)</td>
<td>Aug. 6, 7 (F,S)</td>
</tr>
<tr>
<td>Examinations on Sunday</td>
<td>Dec. 13 (U)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Examinations End (including Emergency Day)</td>
<td>Dec. 23 (W)</td>
<td>Apr. 24 (S)</td>
<td>Aug. 14 (S)</td>
</tr>
<tr>
<td>Co-operative Work Term Ends</td>
<td>Dec. 24 (R)</td>
<td>Apr. 23 (F)</td>
<td>Aug. 20 (F)</td>
</tr>
<tr>
<td>Teaching days</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Pre-examination Study Day(s)</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Examination days</td>
<td>13 (+1 Emergency Day)</td>
<td>13 (+1 Emergency Day)</td>
<td>11 (+1 Emergency Day)</td>
</tr>
</tbody>
</table>

**Symbols and abbreviations:**
(M) Monday, (T) Tuesday, (W) Wednesday, (R) Thursday, (F) Friday, (S) Saturday, (U) Sunday, N/A – Not Applicable
Guidelines for Determining Academic Calendar of Dates

The following are principles and guidelines either formally agreed upon by Senate or adopted as common practice in determining the dates for the academic year.

1. That the practice of setting dates for each academic year continues to be an annual exercise.

2. That there be no fewer than 60 teaching days (12 weeks) in a term. A clear rationale for fewer than 60 teaching days must be communicated to Senate at the time calendar dates are approved. In calculating teaching days in a term, Saturdays, Sundays, and statutory or University holidays are excluded.

3. That attention be given to balancing the number of meets in courses. Where an imbalance may occur because of statutory holidays, the class schedule for a day different than the calendar day can be used to balance the number of course meets.

4. That Fall Convocation be the Friday and Saturday that fall in the third full week (beginning Sunday) of October.

5. That Spring Convocation be the Tuesday to Saturday in the second full week (beginning Sunday) in June.

6. That the Reading Weeks occur in all Faculties and must begin on the Tuesday following Thanksgiving in October and the Tuesday following Family Day in February.

7. That Fall Term classes in September begin on the Wednesday following the Labour Day holiday. **Exception:** The Fall Term begins on Tuesday, September 8th when Labour Day is September 7th.

8. That the start date for Winter Term be set as follows:
   - If January 1st is a Sunday, then start of classes is Wednesday, January 4th.
   - If January 1st is a Monday, then start of classes is Wednesday, January 3rd.
   - If January 1st is a Tuesday, then start of classes is Monday, January 7th.
   - If January 1st is a Wednesday, then start of classes is Monday, January 6th.
   - If January 1st is a Thursday, then start of classes is Monday, January 5th.
   - If January 1st is a Friday, then start of classes is Tuesday, January 5th.
   - If January 1st is a Saturday, then start of classes is Wednesday, January 5th.

9. The start date for Spring Term be set as follows:
   - If May 1st is a Sunday, then start of classes is Monday, May 2nd.
   - If May 1st is a Monday, then start of classes is Monday, May 1st.
   - If May 1st is a Tuesday, then start of classes is Tuesday, May 1st.
   - If May 1st is a Wednesday, then start of classes is Wednesday, May 1st.
   - If May 1st is a Thursday, then start of classes is Monday, May 5th.
   - If May 1st is a Friday, then start of classes is Monday, May 4th.
   - If May 1st is a Saturday, then start of classes is Monday, May 3rd.

10. That there be no fewer than one pre-examination study day and when possible, two pre-examination study days (excluding Saturday, Sunday, and holidays) between the end of classes and the beginning of examinations. A clear rationale for using fewer than 2 days or Saturday,
Sunday, and holidays as pre-examination study days, must be communicated to Senate at the time calendar dates are approved.

11. That there be no fewer than 13 examination days in the Fall and Winter Terms, and 11 examination days in the Spring Term. In addition, one Emergency Day with no scheduled examinations is added to the end of the examination period.

12. In calculating examination days, Saturdays which fall within the period are included, whereas Sundays and statutory or University holidays are excluded.

   **Exceptions:**
   Examinations will not be scheduled on the Saturday following Good Friday when that day falls within the examination schedule or the Saturday of the Civic Day weekend. The first Sunday within the examination period may be used when required to accommodate the prescribed number of examination days in the Fall Term.

13. That in the Fall Term no examinations be scheduled beyond December 22\textsuperscript{nd}. The Emergency Day cannot be scheduled beyond December 23\textsuperscript{rd}.

14. That Online Course Examination Days in each term be the first consecutive Friday and Saturday in the examination period.

15. Grades due dates for on campus courses are normally scheduled seven days from the date of the final examination. Grades for Online (Centre for Extended Learning) courses that have a scheduled final examination are due on the last day of the grades submission period. Grades for all courses without a scheduled final examination are normally due 14 days after the start of examinations.

16. Co-op work terms are expected to be 16 week in duration. Actual start and end dates may vary depending on employer or student requirements in consultation with Co-operative Education.

Prepared by:
C. Newell Kelly, Registrar
June, 2019
Rationale for Exceptions:

Rule 10b

... A clear rationale for using fewer than 2 days or Saturday, Sunday, and holidays as pre-examination study days, must be communicated to Senate at the time calendar dates are approved.

Rule 12

... The first Sunday within the examination period may be used when required to accommodate the prescribed number of examination days in the Fall Term.

Rationale: By introducing a Fall Reading Week (October 12-16), and also because the term does not begin until September 8th, the number of study days had to be reduced to one day in order to ensure the number of required teaching days. A Sunday was also added to the examination period.
The following new course has been approved by the Co-operative Education Council on June 26, 2019 and is being submitted for consideration and approval by Senate Undergraduate Council at its meeting of September 10, 2019.
NEW COURSES (for approval)

Interdisciplinary Studies

Effective 01-SEPT-2020

PD 19 ( 0.50 ) LEC Tactics for Workplace Success

An introduction to strategies for success in the workplace and lifelong learning for co-op engineering students. Students explore the role of professional skills in the workplace, a model for self-reflection, a framework of co-operative education, and strategies to make the most of workplace opportunities and challenges. Topics include professional skills, strategies for workplace success, co-operative education, common workplace issues, typical corporate structures, work term planning, and effective self reflection.

[Note: Course will be graded on a CR/NCR basis.]

Course Attributes: Only offered Online
Requisites: Engineering students only
Rationale: Following a review completed by the WatPD Engineering Curriculum Committee, it was recommended that a new course be created for students which focuses on the purpose and nature of co-operative education, the purpose and nature of professional development, and which provides students with strategies for addressing commonly faced first work term problems.

End of Report
Handling of Final Assessment Reports & Two-Year Progress Reports related to academic program reviews

Introduction
Waterloo’s Senate Undergraduate Council (SUC) and Senate Graduate and Research Council (SGRC) have a duty to consider all aspects relating to the academic quality of undergraduate studies and graduate studies within the University. As described in Waterloo’s Institutional Quality Assurance Process (IQAP), documentation emerging from the cyclical program review process includes:

- **Final Assessment Report**, which summarizes the self-study, external reviewers’ report, program response, and implementation plan, and
- **Two-Year Progress Report**, which reports on progress related to the implementation plan.

Final Assessment Reports (FARs), require two SUC or SGRC members to review the report, whereas, Two-Year Progress Reports only require one SUC or SGRC member, although at the SUC/SGRC Chair’s discretion, a second reviewer may be sought. In order to ensure that student representatives have the opportunity to review each report, the FEDS VP, Academic and GSA, President receive these documents in advance for information. Any questions or concerns they might have can be raised and addressed, if needed, prior to the report being approved at SUC/SGRC. This review process is coordinated by the Quality Assurance (QA) Office.

To promote transparency and foster integrity in the review process, reviewers should not be members of the Faculty or Affiliated and Federated Institutions of Waterloo (AFIW) from which the report originates.

Assessment
Reviewers will consider a series of guiding questions (see below) in arriving at their recommendation for revision or approval to SUC or SGRC. Before reporting to SUC or SGRC, reviewers will ask questions and share their observations, as well as any concerns they have identified with the report, to the Quality Assurance Office, who will then connect with the Chair or Director of the program. The FEDS and GSA representative will also receive these reports for information prior to submission to SUC/SGRC.

The Quality Assurance Office will ensure that any revisions to the reports are completed by the Chair or Director of the program, prior to the QA Office submitting the report for approval at a SUC or SGRC.

### Does the Final Assessment Report:

1) Include a credible implementation plan that not only addresses the substantive issues identified from the program review process but also identifies clearly:

- What actions will follow from specific recommendations?
- Who will be responsible for acting on those recommendations?
- Who will be responsible for providing resources?
- Priorities for implementation and realistic timelines for initiating and monitoring actions?

2) Provide a rationale as to why a recommendation(s) will not be pursued?
The program Chair or Director (or their chosen delegate) will attend the SUC or SGRC meeting to address any questions or concerns that might arise during SUC/SGRC.

SUC’s and SGRC’s responsibility will be to focus on the overall credibility and feasibility of the report and the proposed plan of action – seeking to uncover, for example, unexplained disjunctions between the reviewers’ recommendations and the program’s response – as opposed to the minutiae of course content and curriculum structure.

A Final Assessment Report or Two-Year Progress Report that is approved by a majority vote of SUC/SGRC will be submitted to Senate for information. Should the discussion at SUC or SGRC reveal issues of concern that require revision, the Quality Assurance Office will work with the program Chair or Director to address the concern(s). If minor revisions are needed, the report will be edited and then it will proceed to Senate for information without re-approval from SUC/SGRC; however, any major revisions will require SUC/SGRC review and approval.

**Status of Reports under Review**
A summary of the status of all reports under review, including reports for which the QA Office is seeking reviewers, can be found at the following link:
https://uwaterloo.ca/academic-program-reviews/status-reports-under-review
Final Assessment Report
Mathematics/Business Administration, Mathematics/Chartered Professional Accountancy, Mathematics/Financial Analysis and Risk Management (BMath)
May 2019

Summary of the Program Review:
In accordance with the University Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the Bachelor of Mathematics in Mathematics/Business Administration, Mathematics/Chartered Professional Accountancy (CPA), and Mathematics/Financial Analysis and Risk Management (FARM) delivered by the Faculty of Mathematics. Together, these programs are commonly referred to as Math Business and Accounting Programs (MBAP). A self-study (Volume I) for the programs was submitted to the Associate Vice-President, Academic on July 1, 2016. This self-study presented the program descriptions and learning outcomes, an analytical assessment of the programs, including the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). The CVs for full-time faculty members associated with each program were included in Volume II of the self-study.

Two arm’s-length external reviewers were selected from Volume III of the self-study. Dr. Mohammad Ahsanullah, Professor of Information Systems and Supply Chain Management, Rider University, and Dr. Mahmoud Zarepour, Professor of Mathematics and Statistics, University of Ottawa were ranked and selected by the Associate Vice-President, Academic, as well as, one internal reviewer, Dr. Anna Esselment, an Associate Professor in Political Science.

Reviewers appraised the self-study documentation and conducted a site visit to the University on December 1st and 2nd, 2016. The visit included interviews with the Associate Vice-President, Academic; Dean of Mathematics; Associate Dean of Mathematics; Chairs and Directors of the Departments supporting the programs being reviewed; faculty members; staff, and meetings with a group of current undergraduate students. The reviewers also met with a representative from the library, and Co-operative Education.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers’ report and the program response.
Program characteristics:

**Bachelor of Mathematics in Business Administration (BMath)**
The Math/Business Administration program is offered by the Faculty of Mathematics, in co-operation with various academic units from other faculties at the University of Waterloo (Waterloo) and the School of Business and Economics at Wilfrid Laurier University (Laurier). This program provides an opportunity to combine courses in actuarial science, computer science, optimization, and statistics with courses in accounting, business, economics, human resource management, and management sciences. Graduates are well prepared to use sophisticated analytical techniques in the solution of business-related problems and adapt to the rapidly changing modern business environment.

**Bachelor of Mathematics in Chartered Professional Accountancy (CPA)**
The Math/CPA program is offered by the Faculty of Mathematics, in co-operation with the School of Accounting and Finance. This program combines mathematics with accounting and business-related disciplines while giving students the opportunity to gain up to 16 months of CPA-approved work-experience through co-op work terms.

The Honours Mathematics/CPA plan provides an opportunity for studies in areas of mathematics including actuarial science, computer science, optimization, and statistics combined with an extensive professionally oriented sequence of accounting courses. Graduates are well prepared to play a leading role in the increasingly important development and utilization of computer-based accounting information systems, the analysis of the information provided by such systems and the subsequent decision-making processes, and allocation of resources so crucial to an organization's success in the modern business world.

**Bachelor of Mathematics in Financial Analysis and Risk Management (FARM)**
The Math/FARM program offered by the Faculty of Mathematics, with required business courses being taught by professors in the School of Business and Economics at Wilfrid Laurier University. It is designed for students who are interested in working in finance, banking, insurance, or industrial firms in financial analysis or risk management. The two specializations available, Chartered Financial Analyst (CFA) and Professional Risk Management (PRM), provide excellent preparation for the required professional examinations necessary for those designations.
Summary of strengths, challenges and weaknesses based on self-study:

Bachelor of Mathematics in Business Administration (BMath)

Strengths
- Program Success: The program has a long history with many successful graduates. It continues to be in high demand, drawing a consistent number of high quality applicants from around the world.
- Uniqueness of Employability: The combination of math and business is a program that is unique to Waterloo, from a North American perspective. The program is well received by employers, with high co-op placement and employment rates; it provides great flexibility for students’ job applicability, with employment capacity in all areas of business (finance, marketing, HR, IT, etc.).

Challenges
- Perception: There is a perception that the program is for academically challenged students; it is seen as second-tier behind other programs offered by the Faculty of Mathematics.

Weaknesses
- Community: There are no social programs nor a student association for students enrolled in the program.

Bachelor of Mathematics in Chartered Professional Accountancy (CPA)

Strengths
- Employability: Students gain up to 16 months of quality work experience and are provided a direct pathway to CPA designation, resulting in a mathematical and quantitative background that is highly desired by employers.
- Quality of Students: Math/CPA has the reputation of an elite program, and continues to attract a large number of exceptional students. It has one of the most competitive admission processes at Waterloo, requiring high school averages in the low- to mid-90’s.

Challenges
- Continuous Improvement: Ensuring that Math/CPA continues to meet the evolving goals, objectives, and standards of the Faculty of Mathematics, the School of Accounting and Finance and the accreditation authority, CPA Canada.
- Communication: Maintaining constant open communication and co-operation between SAF and the Faculty of Mathematics to ensure consistency of CPA-related information, content, and opportunities provided to students in the AFM and Math/CPA programs.
Weaknesses

- Rigidity: The high number of required courses allows for no unrestricted electives and little flexibility in students’ schedules. Students may pursue most Faculty of Mathematics minors, but are not able to pursue minors or additional plans outside the Faculty without taking extra courses and/or additional academic terms.

Bachelor of Mathematics in Financial Analysis and Risk Management (FARM)

Strengths

- Community: Many students in the program are passionate about and are strong advocates for the program, since many are generally interested in a career in the field. Student clubs are well attended and supported by the student body. There is a strong connection between the faculty and the FARM Student Association (FARMSA); the Program Director is the sponsor for the club and regularly consults with the club’s executive.

- Co-operative Education: There is a high proportion of students in the co-op program who are considered to be excellent or outstanding by their co-op employers, a figure that continues to increase since the program’s inception.

Challenges

- Perception: The program has been almost too successful in building buzz amongst parents and influencers in the lives of applicants, such that many students apply without an interest in the subject matter. The pressure to make money supersedes the student’s need to have a personally fulfilling career.

Summary of key findings from the external reviewers:

In general, these programs are distinctive in the sense that students graduate with a degree in Mathematics, but have also taken a heavy load of business courses. Students who graduate from this program appear to be well equipped to pursue employment in their field. It is therefore clear that these programs are not only well known to employers but also prepare their graduates through a rigorous and unique curriculum.
Program response to external reviewer recommendations:

Recommendations

1. It is highly recommended that the Faculty takes the matter pertaining to the Mathematics and Business administration programs into serious consideration. The Faculty must pursue formalizing the unit in some fashion. This could best be achieved by transforming it into its own academic unit or department, or perhaps as a division of another department. Considering the uniqueness of these multidisciplinary programs, the Department of Mathematics and Business Administration could have an integrated complement of faculty members, some of whom would be dedicated to teaching (or teaching tenure track stream) and others who would both teach and research in the field of math and business. Hiring research-based professors (even as cross-appointed faculty) would elevate the stature of the program within the Faculty, but would also open opportunities to introduce graduate-level programs. The cross-appointed faculty will also link the unit with research faculty members and magnify the role this unit plays in the Faculty.

Response

The prior undergraduate review also mentioned about an academic home of MBAP and recommended considering that it be placed under the auspices of an academic department. This hasn’t taken place largely because the size of present MBAP makes this move problematic. It is larger than any department in the Faculty. Furthermore, Math Business and Accounting Programs (MBAP) currently doesn’t have the research-oriented basis for it to be considered an academic department.

In order to provide the necessary structure for the Math Business group to effectively fulfill its mandate, the creation of a division for Mathematics in Business and Finance will be considered. To involve associated research faculty members, an initial phase could follow the model taken with the Centre for Computational Mathematics in Industry and Commerce. The best idea would be to develop a core group of associated faculty joint or cross appointments from Pure Mathematics, Applied Mathematics, Combinatorics and Optimization, Computer Science as well as Statistics and Actuarial Science that would build some strength in the research area and would enable MBAP to offer graduate programs further raising its already high profile.

There has been ongoing discussions about the future of Math Business. There are currently four possible directions proposed. Active consultation is taking place between the Dean, the senior administration within the Math Faculty, as well as faculty and staff in the current Math Business program. It is unclear at this time which proposal will be the direction the faculty takes, or the timeline involved.
2. If the Mathematics Business unit was more formalized, the opportunity to transform the definite-lecturer/continuing lecturer role into teaching tenure track appointments would present itself. This would provide employment security to those members of the Mathematics and Business programs, but in keeping with their primary roles as teaching faculty. This would also place more emphasis on the expectation that excellence in teaching is highly valued in the program.

Response
Most MBAP faculty members hold definite-term contracts. The MBAP program recognizes the value of these lecturers. Any changes to the employment status of these lecturers is governed and restricted by Policies 76 and 77. Currently there is a university level policy review committee looking at these two policies. It is unknown when this review committee will propose changes.

3. The Mathematics and Business Accounting programs should expand its advisory capacity within the unit, perhaps with full-time staff advisors to share the load with faculty advisors. Given that the students raised the issue of long lines to see their faculty advisor, then creating more capacity to assist students within the degree would also address some of those concerns that were brought up to our attention during the review.

Response
As a result of this program review, the program has revised and discussed our academic advising activities. A full time staff member has been hired and the program has made adjustments to improve the service we provide. The new staff member provided point of contact with students for student engagement and student success initiatives as well as with external partnerships, events, and accreditation. As a result, the FARM program (Risk Management Specialization) has been fully accredited by the Professional Risk Manager’s International Association (PRMIA), and FARM current and past students are exempt from PRM Exam I and PRM Exam II, which both shortens PRM designation period and offers significant savings for those seeking that designation. He also successfully completed University of Waterloo Global Markets Simulation Program with StockTrak which offers students unique exposure to practice their classroom knowledge in real time world of finance, investment, banking, and other industries by extensively using industry standard technology.

4. Departments with courses taught within the Mathematics Business and Accounting unit must be more flexible about slight modification of course content that better suits the pedagogical requirements of the students receiving that content, and of the instructor who is delivering the material.

Response
May 2019
MBAP agrees that the programs would benefit from further participation by faculty members in other Math departments. The MBAP Director and the program committee will take the lead in developing a mechanism that would appropriately manage teaching contributions to the programs to ensure that all courses are taught in a more subject-oriented setting by faculty members.

5. Where other departments are intractable about the opportunity for tailoring content within their owned courses for the Mathematics Business stream, the Mathematics and Business programs should be permitted to develop more of its own courses where pedagogical reasons are compelling.

Response
MBAP cautiously endorses this recommendation. The unit currently offers six COMM and three MATBUS courses for Mathematics Business students. Starting the Fall 2017 term, a new tax course (COMM 433) will also be offered. One very fundamental philosophy of the Math Business programs has been the need to integrate business and mathematics in the classroom. However, there are very few opportunities to create unique course versions as the departments would not support the creation of the MATBUS courses, for example, Statistics or ACTSC to teach to Math Faculty students. The discussion came about because there are many students who want to do Statistics or Actuarial Science majors as part of Math Business programs. As Statistics or Actuarial Science majors, these students should be exposed to the same courses as other students doing the majors. By doing the major, they are indicating an interest that goes beyond other Math Business students. There are also problems with substitutions that create packages of courses that are not true to either degree. It is definitely worth to discuss these courses in the near future with the eventual goal of enabling MBAP to create those courses and possibility offer above mentioned majors.

Over the next year the MBAP program committee will investigate this recommendation to determine if or how it can be implemented.

6. Where possible, the Mathematics and Business programs should identify courses that could be offered online. This could provide assistance for scheduling purposes, and it would also provide an opportunity for students on co-op to more easily take one academic course (co-op students are permitted to take one academic course per work term without Faculty permission; more than one course requires the permission of employer). The online course offerings may also help to have a conflict-free schedules in future for a possible error in scheduling. Moreover, some related financial glossaries can be considered in their communication courses which students are required to take in this unit.

Response
MBAP strongly endorses the reviewers’ recommendation. The Faculty of Mathematics is currently working on the introduction of fully online degree program for Math/FARM students, which complements and advances the reviewers’ recommendation. The program will look into the number of students taking online classes but in general though, online enrolments are really climbing. With respect to pedagogical efficacy, dashboards will be built that measure the relative online versus in-class performance by students. Click level data will be examined to observe actual (versus self-reported) student behaviour and will correlate that with performance. It is expected that a research group will also be bringing forward specific proposals in the not so distant future.

7. The Faculty of Mathematics should review how it markets and/or informs incoming international students about the co-op program so that all students who enter into Mathematics are fully apprised of the co-op opportunity.

Response
The MBAP Director meets regularly with the Undergraduate Recruitment and International teams of the Faculty. The Programs are strongly committed to continuing these efforts. They will work with the team to review the activities of the team and address any perceived needs. Co-operative and Experiential Education will also be contacted to identify skills that Math Business students need so that international students are aware of them.

8. The Faculty should review how it communicates to students (especially international students) regarding the required minimum academic averages to stay in their respective programs and plans.

Response
The University of Waterloo’s Undergraduate Studies Academic Calendar specifies the rules that determine a student’s academic standing. A student’s standing determines whether a student is able to proceed in the Faculty or in their chosen plan, how many courses they are able to take in the next term, etc. However, the Faculty of Mathematics computes several averages (CAV, TAV, MAV, SMAV) that are used to determine a student’s standing within the Faculty. MBAP usually informs new students about those averages during students’ orientation programs to help ensure a successful transition into university. The Programs will make sure that students (especially international) who missed orientation programs for some reason are sent the required information via their program advisors.
## Implementation Plan:

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Proposed Actions</th>
<th>Responsibility for Leading and Resourcing (if applicable) the Actions</th>
<th>Timeline for addressing Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Faculty must pursue formalizing the unit in some fashion.</td>
<td>The issue is currently under discussion with the Dean, the senior administration within the Math Faculty, as well as faculty and staff in the current Math Business program.</td>
<td>Dean’s Office, MBAP Director, Unit Heads in the Faculty of Mathematics</td>
<td>December 2019 – In progress</td>
</tr>
<tr>
<td>2. Transforming the definite-lecturer/continuing lecturer role into teaching tenure track appointments.</td>
<td>The issue is currently under discussion with the Dean.</td>
<td>MPAP Director, Dean, Vice President Academic</td>
<td>December 2018 - DONE</td>
</tr>
<tr>
<td>3. The Mathematics Business and Accounting programs should expand its advisory capacity within the unit.</td>
<td>Review academic advising activities with faculty members and student representatives.</td>
<td>MBAP director leads the efforts, Associate Dean allocates resources</td>
<td>Spring/Fall 2017 - DONE</td>
</tr>
<tr>
<td>4. Departments with courses taught within the Mathematics Business and Accounting unit must be more flexible about slight modification of course content that better suits the pedagogical requirements of the students receiving that content, and of the instructor who is delivering the material.</td>
<td>MBAP and program committee to follow up and create a mechanism for such modifications</td>
<td>MBAP Director</td>
<td>December 2018 - DONE</td>
</tr>
</tbody>
</table>
5. Where other departments are intractable about the opportunity for tailoring content within their owned courses for the Mathematics Business stream, the Mathematics and Business programs should be permitted to develop more of its own courses where pedagogical reasons are compelling.

| MBAP has and continues to discuss this matter internally. The issue has been discussed with the Program Committees of STATS and ACTSC |
| MBAP Director, MBAP Program Committee members, SAS Chair, SAS Program Committee Chairs |
| 2018-2019 |

6. Where possible, the Mathematics and Business programs should identify courses that could be offered online.

| Developing online version of courses for FARM program |
| Assistant Dean Online Instruction |
| 2018/2019 –All Math core courses are available in online mode and more courses are under development |

7. The Faculty of Mathematics should review how it markets and/or informs incoming international students about the co-op program so that all students who enter into Mathematics are fully apprised of the co-op opportunity.

| The issue will be discussed with Associated Dean Admissions and Outreach. |
| MBAP Director, Associate Dean Admissions and Outreach Undergraduate Recruitment and International Office |
| 2018/2019 |

8. The Faculty should review how it communicates to students (especially international students) regarding the required minimum academic averages to stay in their respective programs and plans.

| The issue will be discussed with Associated Dean for Co-op. |
| MBAP Director, Associate Dean for Co-op, Co-op Office |
| 2018/2019 |

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for monitoring the Implementation Plan.
Date of next program review: 2022-2023

Signatures of Approval:

Chair/Director

August 02, 2018

AFIW Administrative Dean/Head (For AFIW programs only)

2018-08-09

Faculty Dean

June 5, 2019

Associate Vice-President, Academic
(For undergraduate and augmented programs)

Associate Vice-President, Graduate Studies and Postdoctoral Affairs
(For graduate and augmented programs)
MEMORANDUM

January 8, 2019

Re: Quality Assurance (Academic Programs)

The Math Faculty endorses the Final Assessment Report for the Mathematical Studies program. I have met recently with the Associate Dean Undergraduate who oversees this program and discussed in detail many of the issues in this report. I am satisfied with the proposed actions to the reviewers’ recommendations.

Regards,

Stephen M. Watt
Dean, Faculty of Mathematics
Executive Summary

External reviewers found that the Mathematical Studies program (BMath) delivered by the Faculty of Mathematics was in good standing, but there were some concerns.

“The Mathematical Studies program ... successfully prepares students for careers in business, teaching, or public service. However, although the program is important to the Faculty (for student retention), it is clear that the program has been neglected by the Faculty. The program is in need of a Director who can address long-standing issues.”

A total of 6 recommendations were provided by the reviewers. The majority of these recommendations were aimed at improving the perception and purpose of the program. In response, the program created a plan outlining the specific actions proposed to address each recommendation as well as a timeline for implementation. The next cyclical review for this program is scheduled for 2022-2023.

Enrollment over the past three years

<table>
<thead>
<tr>
<th>Year</th>
<th>Honours</th>
<th>Honours Co-op</th>
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<td>2015-16</td>
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<td>2014-15</td>
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Background

In accordance with the University of Waterloo’s Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response of the Bachelor of Mathematics in Mathematical Studies delivered by the Faculty of Mathematics. A self-study (Volume I, II, III) was submitted to the Associate Vice-President, Academic on October 6, 2017. The self-study (Volume I) presented the program descriptions and learning outcomes, an analytical assessment of the programs, including the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). Appended to Volume I were the course outlines for all courses in the program. The CVs for each faculty member with a key role in the delivery of the program was included in Volume II of the self-study.
From Volume III, two arm’s-length external reviewers were selected by the Associate Vice-President, Academic: Dr. Timothy Sibbald, Associate Professor in the Schulich School of Education, Nipissing University, and Dr. Gerda de Vries, Professor in the Department of Mathematical and Statistical Sciences, University of Alberta.

Reviewers appraised the self-study documentation and conducted a site visit to the University on November 16 and 17, 2017. An internal reviewer from the University of Waterloo, Dr. Eric Helleiner, Professor of Political Science, was selected to accompany the external reviewers. The visit included interviews with the Vice-President Academic and Provost; Associate Vice-President, Academic; Dean of Mathematics; Associate Dean, Undergraduate Studies of Mathematics; Director of Mathematics Teaching, Faculty members, staff and current undergraduate students. The review team also had an opportunity to meet with representatives from the Library and Co-operative Education, and tour the facilities.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers’ report and the program response.

Program characteristics
The Mathematical Studies (BMath) program is meant for students whose mathematical interests are broadly based. Its high degree of flexibility makes it suitable for those who wish to design a course of study that suits their individual tastes. Under this plan, there is ample scope for students to obtain a minor in an area of mathematics or a minor from another Faculty. With judicious course selections, graduates of Mathematical Studies can confidently pursue careers in business, teaching, or public service.

Summary of strengths, challenges and weaknesses based on self-study
Strengths
- Mathematical Studies is more flexible than other plan in Mathematics
- Students are prepared for successful careers in business, teaching, or public service, as well as other areas
- Helpful for retention of students who have failed more than four courses since this program allows students to fail up to 8 courses, unlike all other majors in the Faculty
- Academic advisors are an important resource and extremely supportive

Challenges
- The plan lacks a Director who has the time to take care of the plan
- There is a stigma of Mathematical Studies being the easiest plan in the Faculty and that students are “not good enough” for other plans
- The Mathematical Studies plan is viewed as a low priority by some faculty
• Forced entry into the plan can be traumatic for students
• Cohesion amongst students can be improved
• More student mental health support is needed

Weaknesses
• Students do not always have access to as wide a range of courses as they would like
• Scheduling seems to restrict the course selection further
• Co-op is effective but there are not many jobs targeted to these students
• There is a lack of functional space due to the growing university population

Summary of key findings from the external reviewers
The Mathematical Studies program is in good standing. It successfully prepares students for careers in business, teaching, or public service. However, although the program is important to the Faculty (for student retention), it is clear that the program has been neglected by the Faculty. The program is in need of a Director who can address long-standing issues. If the Faculty wishes the program to continue and thrive, changes are necessary. The necessary changes can happen only if the program has an advocate in the form of a Director with sufficient time and authority.

Program response to external reviewers’ recommendations

Recommendations

1. We strongly recommend the appointment of a Director for the Mathematical Studies program. The Director needs to be someone who has the time and authority to evolve the program, solve problems (for example, to work with departments to resolve simple course scheduling conflicts or to resolve course sequencing issues), and advocate for students in the program.

Response
This plan consists of three components: 1) Mathematical Studies core, 2) a selection of ten 300- and 400-level Faculty of Mathematics courses and 3) other courses. To be successful, the Director must be able to oversee changes to the Mathematical Studies core and the creation and modification of upper-level courses offered from the school and four departments in the Faculty.

The Associate Dean Undergraduate Studies (ADUG) oversees changes to Faculty of Mathematics core requirements of academic plans and is thus the person best positioned to lead changes to the Mathematical Studies core. At present, the ADUG also assumes the position of Director of Mathematical Studies. Unfortunately, the ADUG does not interact as frequently with the Mathematical Studies students as the plan’s advisors, thus the ADUG may not fully appreciate some challenges faced by students in this plan.
In the past, the ADUG has asked the units to create courses that are of interest to a non-specialist audience, and some courses have been created, but perhaps not enough.

We propose to form a Mathematical Studies Committee, which consists of the following:

- Mathematical Studies advisors (presently there are three);
- Several students in the plan;
- Assistant Dean of Students; and
- Associate Dean, Undergraduate Studies who will chair the committee

This committee will meet regularly to discuss the plan and how it can, and should, be improved.

2. The stigmatization of students in this program and the program itself needs to be addressed. We recognize that this will be a challenge since the institution promotes high-performing students while many students in the Mathematical Studies program are there because of low averages or exceeding the maximum number of failed/excluded courses for departmental programs.

**Response**

As will be addressed in Recommendation 3, the program will attempt to remove the plan’s stigma by celebrating its graduates in a public setting. Also, the Mathematical Studies Committee will investigate how we can further remove the stigmatization of students in this plan.

Student Mental Health on campus is an important issue, as is apparent from the President’s Advisory Committee on Student Mental Health (PAC-SMH) whose 2017 report includes 36 recommendations. The Faculty of Mathematics has also created a committee for Student Wellbeing, chaired by the Vice-Dean of Mathematics. Because students enrolled in other Faculty of Mathematics baccalaureate plans are forced into Mathematical Studies if they earn more than four failures, students in Mathematical Studies may need more support than what is typical across other plans.

As a result of the PAC-SMH efforts, there is going to be more support for all students on campus. In particular, Faculty of Mathematics’ students will benefit from: 1) two new academic advisors who advise Mathematical Studies students and 2) a second counsellor situated in the Mathematics Undergraduate Office (MUO). Combined, these steps should help students in Mathematical Studies to obtain more counselling and academic support when needed.
3. To aid with the removal of the stigma, we recommend that the Faculty reviews its Calendar entry and promotional materials for the program to highlight the opportunities that students have to personalize this program (for example by adding the Business Specialization and/or a Minor). Celebrating successful students in the program (especially those who may have struggled at the outset) should also help.

Response
Mathematical Studies is described in current brochures distributed to students interested in doing undergraduate studies in the Faculty of Mathematics. The brochures indicate that this plan is the most flexible of all Faculty plans and gives students a broad education in mathematics. It also mentions that there is a possibility for specialization in Business. The new Mathematical Studies Committee is working on revising this text.

To celebrate successful students who have graduated from Mathematical Studies, the program hosted a Mathematical Studies Career Panel discussion November 7, 2018. To do this, several graduates from the plan were invited to talk to students currently in the plan and answer their questions about career options for the future. The Mathematical Studies Committee will consider holding this event on an annual basis.

4. The Faculty may wish to consider making the Mathematical Studies program the point of entry for all students, from which students can launch into departmental programs if they so desire.

Response
The Mathematics Undergraduate Affairs Committee (UAC) has decided to form a committee that will discuss the possibility of having all BMath students start in a plan that is either Mathematical Studies or similar to Mathematical Studies. The plan is to discuss the various pros and cons of making this change based on how it would impact the Faculty. The committee first met in November 2018. At UAC, there was support for this idea but there were also some concerns. In particular, would an unintended/undesirable message be sent to students, if we accept students into a program that allows for a greater number of fails than all other Faculty programs? The next step is to discuss the logistics of this change with the Registrar’s Office.

It is recognized that if direct entry into Mathematical Studies were available, it would perhaps remove some of the stigmatization that is currently associated with this plan. However, there are some concerns that need to be discussed by the Faculty before a decision can be made. It is not clear that this change will remove the trauma of students who fail out of another academic plan, or that it sends the right message to incoming students.
5. It will be a worthwhile endeavor for the Faculty to review the prerequisite structure of its courses. Are there unintended or outdated barriers to certain courses that can be removed? Perhaps some courses can have multiple entry points (for example, either a specific specialist course or a certain combination of non-specialist courses). Alternatively, a prerequisite waiver system (whereby students gain permission to take a certain course upon approval by the instructor and program Director) might address issues surrounding course sequencing.

Response
One advantage of the Mathematical Studies plan is that it allows students to take some non-specialist courses in their core, if they are not able to successfully complete the specialist version. As previously mentioned, this degree of flexibility early on has the disadvantage that it restricts the options of the subsequent courses the students can take.

UAC is the body that deals with changes to courses in general, and prerequisites in particular. Each academic unit understands their courses the best and brings suggested changes to the Committee, so that they can be discussed Faculty-wide. This committee works continuously to update and improve the courses and programs offered by the Faculty. UAC is very effective in evolving the curriculum but it is recognized that there may be less interest given to the non-specialist courses. The proposed Mathematical Studies Committee mentioned above is the first committee that will discuss these limitations and how they might be overcome with consultation with the different units.

6. We recommend that the Faculty invests in getting to know the students in the Mathematical Studies program, and evolve its curriculum accordingly. How did the students arrive in the program? What needs do the different constituencies have? We expect that the needs of students who purposely choose the program for its flexibility are different than the needs of students who are forced into the program due to low averages or exceeding the maximum number of failed/excluded courses for departmental programs. Likewise, the needs of students in the program who started in the Faculty may be different than the needs of students who transferred from another Faculty. For students who were forced into the program, are there support systems that can and should be put in place to help them adjust and succeed?

Response
The academic advisors for Mathematical Studies are the ones who have the most contact with these students and know the students the best. Unfortunately, to date, there has not been a discussion with these advisors about the Mathematical Studies students and this is something that we will change.
The proposed Mathematical Studies Committee will create a means through which the advisors and the students can more easily voice their concerns about Mathematical Studies and important issues going on with these students. This would be a valuable opportunity to learn about the two different study streams of Mathematical Studies and how student needs might differ.

The Mathematical Studies program has started working with the Student Success Office (SSO) to track students throughout their undergraduate career. Part of this is to better understand what factors have helped to contribute to their success but also to learn what we can do differently to better support our students. The Faculty of Mathematics plans on profiling the Mathematical Studies students to see what can be done differently to make their undergraduate education more successful.
<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Proposed Actions</th>
<th>Responsibility for Leading and Resourcing (if applicable) the Actions</th>
<th>Timeline for addressing Recommendations</th>
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</table>
| **1.** We strongly recommend the appointment of a Director for the Mathematical Studies (MS) plan. | Form a Mathematical Studies Committee that will meet periodically to discuss what needs to be done to maintain and improve the plan. This committee will consist of the following:  
• MS advisors (presently there are three)  
• Several students in the plan  
• Assistant Dean of Students  
• ADUG (chair) | ADUG | Committee formed November 2018 (Completed) |
| **2.** The stigmatization of students in this plan and the plan itself needs to be addressed. |  
1. Remove the stigma that appears to exist in MS by celebrating the success stories of previous graduates. See recommendation 3.  
2. The MS committee will investigate this issue in more detail.  
3. Give more support to students who are not able to stay in the plan of their choice. In the last year we have hired two new | ADUG and MS Committee | MS Career Panel November 7 2018 (Completed)  
MS Committee to discuss (Ongoing)  
Two advisors and counsellor arrived 2018 (Completed) |
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<th>academic advisors and a second counsellor in the MUO.</th>
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<tr>
<td>3.</td>
<td>To aid with the removal of the stigma, we recommend that the Faculty reviews its calendar entry and promotional materials for the plan to highlight the opportunities that students have to personalize this plan.</td>
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<tr>
<td></td>
<td>Recruitment brochures already advertise the flexibility in the Mathematical Studies plan but the text has recently been updated.</td>
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<td></td>
<td>Organized a Mathematical Studies Career Panel where alumni shared their experiences and answered questions of the current students.</td>
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<tr>
<td></td>
<td>MS Committee</td>
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<tr>
<td></td>
<td>November 7, 2018 (Completed)</td>
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| 4. | The Faculty may wish to consider making the Mathematical Studies plan the point of entry for all students, from which students can launch into departmental plans if they so desire. |
|   | UAC will discuss the advantages and disadvantages of having direct entry of all Math students into Mathematical Studies. |
|   | Mathematics UAC | July 2020 |

| 5. | It will be a worthwhile endeavour for the Faculty to review the prerequisite structure of its courses. Are there unintended or outdated barriers to certain courses that can be removed? Perhaps some courses can have multiple entry points (for example, either a specific specialist course or a certain combination of non-specialist courses). Alternatively, a |
|   | The new Mathematical Studies Committee will discuss this with the different units to see whether the prerequisites for the courses can be changed. |
|   | MS committee | Ongoing |
prerequisite waiver system (whereby students gain permission to take a certain course upon approval by the instructor and plan Director) might address issues surrounding course sequencing.

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<td>6.</td>
<td>We recommend that the Faculty invests in getting to know the students in the Mathematical Studies plan, and evolve its curriculum accordingly. How did the students arrive in the plan? What needs do the different constituencies have? We expect that the needs of students who purposely choose the plan for its flexibility are different than the needs of students who are forced into the plan due to low averages or exceeding the maximum number of failed/excluded courses in departmental plans. Likewise, the needs of students in the plan who started the Faculty may be different than the needs of students who transferred from another Faculty. For students who were forced into the plan, are there support systems that can and should be put in place to help them adjust and succeed?</td>
<td>The Mathematical Studies Committee consists of the academic advisors of the plan as well as students. This will create dialogue whereby the needs of the students can be heard. The SSO will look at the distribution of students in this plan to better understand how students end up in the plan and what factors most contribute to their success.</td>
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The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for monitoring the Implementation Plan.
Date of next program review

<table>
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<tr>
<th>Date</th>
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Signatures of Approval

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<tr>
<td>Chair/Director</td>
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<tr>
<td>AFIW Administrative Dean/Head (For AFIW programs only)</td>
<td>Date</td>
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<tr>
<td></td>
<td>2019-01-09</td>
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Note: AFIW programs fall under the Faculty of ARTS; however, the Dean does not have fiscal control nor authority over staffing and administration of the program.

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<tr>
<td>Associate Vice-President, Academic (For undergraduate and augmented programs)</td>
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Final Assessment Report  
General Science, Honours Science and Joint Honours Science & Arts Major (BSc)  
July 2019

Summary of the Program Review:
In accordance with the University’s Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response of the Science programs (General Science BSc, Honours Science BSc, Joint Honours BSc) delivered by the Faculty of Science. A self-study (Volume I) was submitted to the Associate Vice-President, Academic on September 15, 2017. The self-study presented the program descriptions and learning outcomes, an analytical assessment of these programs, including the data collected from student focus groups along with the standard data package prepared by the Office of Institutional Analysis & Planning (IAP). The CVs for the four Associate Deans and resumes for full-time staff in the Science Undergraduate Office were included in Volume II of the self-study.

Two arm’s-length external reviewers were selected from Volume III of the self-study. Dr. Lisa Carter, Dean (Science and Technology), Athabasca University, and Dr. Peter Hollings, Professor of Science and Environmental Studies, Lakehead University were ranked and selected by the selected by the Associate Vice-President, Academic. One internal reviewer, Dr. Lorne Dawson, Professor of Sociology and Legal Studies was selected to accompany the external reviewers.

Reviewers appraised the self-study documentation and conducted a site visit to the University on December 5-6, 2017. The visit included interviews with the Associate Vice-President, Academic; Dean of Science; Science Associate Dean, Undergraduate; Science Associate Dean Co-op and Computing; Science Associate Dean, Student Relations; Science Associate Dean, International Programs, and a number of faculty members, staff and current students. The review team also had an opportunity to visit teaching rooms, undergraduate laboratories, student study and club spaces, and meet with representatives from the library.

This final assessment report is based on information extracted, in many cases verbatim, from the self-study, the external reviewers’ report and the program response.

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1 The Faculty of Science offers 20 honours BSc majors; this review refers to one BSc major: Honours Science.
Program characteristics:
These programs offer students the opportunity to tailor their studies into the subject area(s) of their choice (i.e., BIOL, CHEM, EARTH, MNS, PHYS, and/or SCI), obtain hands-on lab training, and prepare for the next step in their career path. General Science provides a viable path to complete a Science BSc degree for students who are not suited to an Honours program. The Honours Science BSc program prepares students for further training in graduate studies or professional schools, such as medicine, optometry and pharmacy.

General Science (BSc)
During the review period, there were an average of over 350 students enrolled in the three-year General Science program each Fall term, yet only an average of four students choose this program each year from the start of their university studies. Most students are enrolled in this program as a result of an academic standing that moves them involuntarily to General Science. The small number of students starting in this program aim to complete the degree online. The only requirement difference for students completing the degree online is that they do not have to complete lab courses.

Honours Science (BSc)
During the review period, there were an average of over 700 students enrolled in the four-year Honours Science program each Fall term. Honours Science students can take some online courses, but they cannot complete the degree online because of the lack of senior science courses online and the lab training requirement. Students who complete a sufficient amount of any UWaterloo honours Science BSc major before completing the UWaterloo’s Doctor of Optometry or Doctor of Pharmacy programs are awarded the Honours Science BSc degree with their professional degree to recognize their pre-professional science training.

Joint Honours Science and Arts Major BSc (Joint Honours)
Features of this program include the ability to complete an Honours Science BSc program and the departmental requirements for an Arts major. These students may encounter greater unit requirements than for an honours Science BSc program. In the past seven years, only four students have completed the Joint Honours Science and Arts Major BSc degree.
Summary of strengths, challenges and weaknesses based on self-study

Strengths

The General Science and Honours Science BSc programs both have several strengths. These programs:

- are purposefully designed to support student choice. This flexibility allows students to build their knowledge, skills and judgment, while meeting requirements and fulfilling interests
- allow students to readily add Science and non-Science minors through the BSc program's flexible design
- have strong support for program advising that has developed in the past year as academic advisors now ‘own a program’, thereby becoming a champion and advocate for the program and its students
- provide a worthwhile educational experience and overall satisfaction with choosing UWaterloo, according to student feedback data
- allow opportunities for students to develop professional skills, explore their career options, and, as of Fall 2017, market themselves to employers and school selection committees by completing the EDGE certificate
- allow students to encounter a notable female representation among instructors in life science-based courses

Strengths of the Honours Science program include:

- a strong foundation for students planning to pursue professional school or graduate school, allowing for a personalized plan of interest
- enabling students to complete a joint program in non-science subjects to personalize their training at a deeper level
- providing students enrolled in any honours Science BSc major before completing their UWaterloo’s Doctor of Optometry or Doctor of Pharmacy programs, an opportunity to receive the Honours Science BSc degree with their professional degree to recognize their pre-professional Science training

Strengths of the General Science program include:

- allowing students challenged by capacity (health, intellect, time, finances) to complete a university degree in science
- affording an opportunity for students entering professional school at another university to obtain a UWaterloo degree for their pre-professional training
- providing a shorter route than a four-year degree to certain subsequent post-secondary training opportunities
Challenges
Identified challenges include:
- A proportion of students in these programs would prefer to complete a different honours Science BSc major (with higher program averages, greater unit counts and program-specific courses)
- A notable proportion of General Science students face barriers to their academic success (e.g., on-going health issues)
- There is no cohort-based student club for these students (unlike department-based programs within the Faculty of Science)
- The varied interest and reasons for entering the programs makes it more challenging to engage in community and cohort building
- A notable number of Faculty of Science departmental faculty view the General Science and Honours Science students as ‘second-class citizens’. This view proves challenging when advocating for students accessing high-demand lectures and labs
- The Faculty of Science needs to continue focusing attention on quality faculty hires that continue to improve the representation of women on faculty in currently underrepresented departments (Chemistry, Earth and Environmental Sciences, and Physics and Astronomy)

Weaknesses of programs
Identified weaknesses include:
- Honours Science students can complete their degree without any 400-level science courses
- Some General Science students pursue this degree, disappointed that they could not meet their initial honours program requirements
- International students may view the General Science and Honours Science programs negatively if they expect a more structured curriculum that is more subject-specific. This may be particularly problematic for students who involuntarily enter these programs

Summary of key findings from the external reviewers:
The reviewers’ evaluated the three programs addressed in the self-study, with an emphasis on the General Science and Honours Science degrees. The reviewers found that the programs are largely in good standing and the top priority for improvement is related to issues around communication and awareness building, such as the need to convey more information about the opportunities that are available to students in each program.
Program response to external reviewer recommendations:

Recommendations

1. **Need for improvement of conveying and integrating information at all levels: website, Faculty of Science, service department pages:** The reviewers suggest that improving the profile of the General Science program would have a significant impact on enrolment, while better advertising of the Honours Science program and engagement with the students will help build a sense of community.

Response

A review of all Science undergraduate webpages has begun; the anticipated outcome is a content update and reorganization to more effectively inform students about their programs, co-op, funding and awards, international exchange, student support, and student life.

A Faculty of Science webpage dedicated to General Science BSc students is being created within the Science Undergraduate Office site. It will include information such as:

- Course pre-requisite trees for science subject courses to assist General Science students with course selection
- Tips on completing minors in science and other common subjects
- Career planning and post-graduate programs as well as links to internal sites such as ‘Career View Mirror, Science Edition’ and external sites, such as the Government of Canada’s [National Occupation Classification](#) (NOC)

A similar webpage is being created for Honours Science BSc students. These webpages will have some different foci (e.g., graduate school options will appear on the Honours Science webpage). For students enrolled in these two programs, these webpages will support them with academic and post-graduate information, as well as enhance their sense of community. Consultations with the [Centre for Career Action](#) and the [Student Success Office](#) will help inform webpage development.

The vast majority of students (~97%) enter the General Science BSc program involuntarily. Realistic, positive communication about their academic and career options is important. The program-focused webpage development is not expected to impact enrolment numbers in the General Science program; however, it will impact student support. The current email communications sent to students entering either the General Science or Honours Science programs will be revised to include a link to the appropriate program webpage.
The Faculty of Science will continue to support students who enter the General Science BSc program whether voluntarily or involuntarily (the former, typically because they are completing the degree online or have received an offer from an external health professional school). A dedicated academic advisor, such as the Student Success Officer and Academic Advisor-Programs Specialist, will continue to provide support for students in each of these programs; this level of support was notably enhanced in 2016.

The Faculty of Science has no plans to make the General Science BSc program accessible to high school students through OUAC because the Faculty’s marketing and recruitment priorities seek students interested in honours Science BSc study. Science recruitment resources already promote the Honours Science BSc major at the same level as its other honours Science BSc majors.

2. Strengthen online course delivery as integral to program offerings in The Faculty of Science: The reviewers recommend a two-pronged approach: a) training of faculty in course delivery methodologies; b) facilitation of prompt and nimble development of courses.

Response
Bolstering the slate of online course offerings will assist all Faculty of Science students and it will be particularly beneficial to students attempting to complete the General Science BSc program online (The Faculty of Science currently offers 18 science online courses). Discussions with the Dean and the departments will occur, with the goal of incrementally increasing online course offerings, although fiscal and human resourcing will likely be the determining steps, particularly in an era where Faculties and academic support units are adjusting to the Waterloo Budget Model. Opportunities to obtain e-Campus Ontario funding will also be pursued. The Centre for Extended Learning (CEL) also offers excellent support for the development and delivery of online courses. During the 2018/2019 academic year, one online course was added (BIOL 359). The inactivation of two online courses in 2018/2019 (BIOL 130 and BIOL 373) were not net losses because they had not been offered in several years. To date, no commitments within Science have been made to develop additional online courses.

3. Provide program pathways that are inclusive of all students, including access to labs, course, and 400 level courses that are distinguished from 300 level courses: Developing pathways that can be used as examples by students to guide them in their course selection will help resolve some of the challenges posed by the flexibility of the program. Members of the advising team have already developed informal examples and it is
recommended that theses be formalized and made available through the Waterloo website.

Response

Flexibility is a key feature of the General Science and Honours Science BSc programs. This is a desirable attribute for the majority of students and a successful recruitment feature of the Honours Science program. While there is no plan to change the degree of flexibility of these programs, helping students make good decisions is a priority. These students already seek help from their program academic advisor; however, the previously mentioned new course pre-requisite trees for each subject (BIOL, CHEM, EARTH, MNS, PHYS) will help students understand the implications of whether they can or should take a course (e.g., if a course is a pre-requisite for a desired senior course, then they should plan to take the pre-requisite). Pre-requisite trees are complex in some subject areas, thus attention is being given to how they are visually represented. Initial plans are to present the trees on paper; further work will be needed to adapt them for accessible web use.

The Honours Science BSc program has included a requirement to complete: 4.0 lecture units at 300- or 400-level. Approval was obtained to change this requirement as of 2019/2020 to:

- 4.0 lecture units at 300- or 400-level, with 1.0 unit being at the 400-level

This change will ensure Honours Science students have successfully completed senior science training (during the review period, 87% of students completed at least one 400-level science course so this requirement will not notably increase the difficulty of the program yet it will bring it in line with many other Honours Baccalaureate programs).

The reviewers also suggested that the lab requirements be increased in both programs. This recommendation is not supported for the following reasons:

- The labs are resource-intensive and departments are at capacity
- While students in these programs must complete Year One laboratory courses in two Science subjects and can only count a limited number of lab courses toward their degree (1.0 unit for General Science and 2.0 units for Honours Science), a majority of students complete additional laboratory training. This happens because students:
  - Take laboratory courses out of interest
  - Complete laboratory training as part of other honours Science BSc majors before entering the General Science or Honours Science programs
Choose lab-embedded courses (i.e., ones with both a lecture (LEC) and laboratory (LAB) component). These LEC/LAB courses are not immediately visible on the degree audit or transcript.

- In a review of 2017 graduates in these two programs, the number of standalone or lab-embedded courses taken beyond the Year One lab courses was determined. There were 359 course enrolments among the 71 General Science graduates and 1,182 course enrolments among the 210 Honours Science graduates; these data indicate that, on average, graduates completed 5.5 additional lab-embedded or standalone lab courses (5.1 General Science; 5.9 Honours Science).

The Faculty of Science believes the students in these programs are obtaining sufficient laboratory training, thus additional laboratory requirements are not needed. In addition, the current requirements allow for the intended flexibility sought by the Faculty and the students in these programs; students choose the lab training that works for their skills and needs.

4. **Enrich the student experience for Canadian and international students to develop a community of learners:** Encouraging greater interaction between Canadian and international students will enrich the experience for both groups. Perhaps consider involving Canadian undergraduates in the English language training taken by international students before commencing their program in order to better integrate the two groups.

**Response**

The Student Engagement Officer and the Academic Advisor, International Students, along with the Manager of Faculty Relations from the Student Success Office (SSO) will consider activities that facilitate interactions among domestic and international science students. Possible opportunities include: creating domestic student volunteer opportunities during the [English For Academic Success (EFAS)](English For Academic Success (EFAS)) program for China-partner students; expanding or revising the Faculty of Science’s [‘Study Buddy’ program](Study Buddy) for international science students; and mixing domestic and international students in the new 25-seat [‘Communication in the Sciences’](Communication in the Sciences) course that began in Fall 2018. The Fall 2018 and Winter 2019 offerings of this course are being studied in numerous ways (e.g., course grades, course grades relative to term grades, pass/fail rates, instructor reports of interaction, according to student citizenship status). Some initial key observations are:

- Only 1.4% of Science students failed the course, with no trend according to citizenship status.
The average course grade according to citizenship was: Domestic 81, Permanent Resident 79, and Study Permit 77 (the difference between domestic and study permit students was statistically significant, yet in all three cohorts, the course grade raised their overall term average).

Numerous instructors reported productive cross-citizenship interactions during class.

One way to facilitate volunteer participation is to count this activity toward an EDGE certificate for students in regular programs (e.g., General Science and Honours Science). This possibility will be explored with EDGE administrators.

The Science Transition Coach has been a new resource in the past 18 months to help students adjust to life at a Canadian university. An international Science graduate student is employed by the Science Undergraduate Office to provide part-time help to international Science Year One students.

5. **Manage the student experience from admission to graduation by integrating functions in many areas currently available:** This process is already ongoing but continually working to integrate the efforts of the different groups working with students will improve the experience. Advising groups across campus meet monthly, but there are opportunities for more integration with the Library and the Writing and Communication Centre.

**Response**

The Faculty of Science’s Student Success Officer and the Academic Advisor-Programs Specialist will consult with the Student Success Office’s Faculty Relations Manager (FRM) to facilitate positive student experiences for General Science and Honours Science BSc students. The academic advisors for these programs already encourage students to connect with support units on campus. The new program-specific webpages will list the initiatives that are developed. Of note, Science-specific SSO workshops already garner better attendance than non-Faculty specific workshops, suggesting Faculty of Science students benefit from these support workshops.

The December 2018 creation of the Science Student Information Specialist position is helping Science strategically enhance student services. This position is primarily responsible for tracking and analyzing information related to Science students, including admissions, matriculation, academic progression, and graduation for the purpose of teaching, learning, and administrative strategic planning regarding undergraduate studies in the Faculty of Science. In addition, the Student Success Office and the Science Student Success Officer are developing targeted additional supports in the 1B term for at-risk Science students who have received a conditional or failed (FLG or FLH) standing in 1A
(many of these students have been involuntarily moved into the General Science or Honours Science BSc academic plan).
Planning is underway for a Fall 2019 pilot of a student support hub in the Science Undergraduate Office where a variety of guest service supports will be embedded a few hours per week (e.g., UW Mates, SSO Peer Success Coach, Science Coach, and CCA Career Advisor).
Finally, current renovations will allow Science-embedded counsellors from Counselling Services to move into the Science Undergraduate Office in Fall 2019; this move will provide more privacy for Science students seeking this service because the waiting area will no longer be in a major public corridor.
### Implementation Plan:

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Proposed Actions</th>
<th>Responsibility for Leading and Resourcing (if applicable) the Actions</th>
<th>Timeline for addressing Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Need for improvement of conveying and integrating information at all levels: website, Faculty of Science, service department pages</td>
<td>Develop new program-specific webpages</td>
<td>Science Manager, Academic Advising</td>
<td>Goal: Complete end of Spring 2019</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>An initial content update and reorganization of all Science UG webpages occurred by the end of Winter 2019. Work on program-specific pages for the reviewed programs is in progress, with an estimated completion date by the end of Winter 2020.</td>
</tr>
<tr>
<td>2. Strengthen online course delivery as integral to program offerings in the Faculty of Science</td>
<td>Initiate incremental increase in online Science course offerings</td>
<td>Associate Dean of Science, Undergraduate Studies (in consultation with Dean and Science department chairs)</td>
<td>Goal: 1 course/18 months</td>
</tr>
<tr>
<td>3. Provide program pathways that are inclusive of all students, including access to labs, course, and 400 level courses that are distinguished from 300 level courses.</td>
<td>Develop pre-requisite trees (for program-specific webpages)</td>
<td>Science Manager, Academic Advising</td>
<td>Goal: Complete paper version by end of Spring 2019 (discussions begun for creating an online, accessible version).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Associate Dean of Science, Undergraduate Studies</td>
<td>Goal: Incorporated into 2019-20 calendar year</td>
</tr>
<tr>
<td>Goal</td>
<td>Description</td>
<td>Action</td>
<td>Responsible</td>
</tr>
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<tr>
<td>4.</td>
<td>Enrich the student experience for Canadian and international students to develop a community of learners.</td>
<td>Add 400 level course requirement to Honours Science program</td>
<td>Investigate increased opportunities for domestic and international student interactions (e.g., volunteer, EDGE credit).</td>
</tr>
<tr>
<td>5.</td>
<td>Manage the student experience from admission to graduation by integrating functions in many areas currently available.</td>
<td>Investigate increased opportunities for positive student experiences.</td>
<td>Associate Dean of Science, Undergraduate Studies</td>
</tr>
</tbody>
</table>

The Associate Dean of Science, Undergraduate Studies, in consultation with the Dean of the Faculty shall be responsible for monitoring the Implementation Plan.
Date of next program review: ____________________________ 2024-2025

Date

Signatures of Approval:

[Signature]

Associate Dean of Science, Undergraduate Studies

Date

AFIW Administrative Dean/Head (For AFIW programs only)

Date

[Signature]

Faculty Dean

Date

March 2019

Associate Vice-President, Academic
(For undergraduate and augmented programs)

Date

Associate Vice-President, Graduate Studies and Postdoctoral Affairs
(For graduate and augmented programs)

Date
June 5, 2018

To: Quality Assurance Office


Significant progress has been made to implement the recommendations of the reviewers, with many of the recommendations currently in progress or completed.

In particular, the department has -

- Changed Statistics for Health into a Biostatistics program, which better serves the needs of our students (Recommendation 3).
- Provided an exit survey to outgoing undergraduate students (Recommendation 4).

Some projects that are currently ongoing are -

- Decrease class sizes (Recommendation 1). This will not be an easy or fast problem to solve.
- Find more space (Recommendation 2). This again will not be an easy or fast problem to solve.
- Implement a capstone course (Recommendation 5). This is currently implemented at a small scale. It is expected that this will slowly be increased over time, although to expand this to all students would require significantly more resources than the faculty has.
- Career paths for lecturers (Recommendation 6). This is something that faculty is very aware of, and very interested in, but has little control over. It is hoped with the re-write of Policy 76 that some of the issues will be resolved.

The recommendation to hire our own (Recommendation 7) was not implemented, as it was felt that the current policy was a good policy. This was mentioned in the initial response to the reviewers’ recommendations.

The last recommendation, to diversity the undergraduate student body (Recommendation 8), is currently being worked on at the faculty level. Although some progress has been made, this is something that the faculty will continue to work on for the foreseeable future.

Stephen M. Watt
Dean, Faculty of Mathematics
Two-Year Progress Report
Bachelor of Mathematics in Statistics, Statistics for Health, Actuarial Science, or Mathematical Finance (BMath)
June 2019

Background:

The most recent BMATH (Actuarial Science/Mathematical Finance/Statistics/Statistics for Health) self-study was submitted July 20, 2016 and the site visit occurred August 9-10th, 2016. The review team’s report was received on November 2, 2016, and the program’s response and implementation plan were submitted on February 4, 2017.

The Dean of Mathematics indicated his endorsement of the plan on January 4, 2018. The Final Assessment Report was approved at Senate Undergraduate Council on September 11, 2018 and at Senate on October 15, 2018.

The program reviewers were very positive about our programs. We repeat the program reviewers’ executive summary below.

“In summary, we find all four programs to be very impressive in delivering quality education to top caliber students and producing graduates in high demand. Common strengths among all programs included outstanding leadership, faculty members, administrative support, and students. In particular, Professor Stefan Steiner is doing an outstanding job as Chair of the Department of Statistics and Actuarial Science in leading and guiding the various programs to achieve excellence in teaching, research and administration. The programs provide the necessary breadth of foundational courses to help students prepare for many careers in industry, as well as those intending to do advanced studies. The co-op program, which provides students gainful practical industry experience, was itself very impressive with strong positive reviews from both the students and employers. This highly successful co-op program provides a fairly unique experience for the students enrolled in these four programs.”

Progress on Implementation Plan:
Below are listed all of the reviewers’ recommendations and the program’s progress on implementation.
1. Large class sizes. This is a result of the increased popularity (which is a good thing) of the programs and courses. However, this inhibits the optimal learning experience in these programs as the large class sizes make it very difficult, if not impossible, for the students to do projects (and an appropriate amount of applied work) which is an essential part of these programs and helps to solidify the theoretical and methodological knowledge gained from the courses. The only solution we [the reviewers] can see to reducing class size—particularly critical at the fourth year level—is the hiring of additional tenure-stream faculty and lecturers. In so doing, the balance of these two will be important to keep in mind: It seemed fairly reasonable at present with 42 tenure-stream faculty and 9 lecturers.

**Status: in progress**

**Details:** In the last number of years we have been able to hire more faculty. In particular, including individuals we hired this year but who have not yet arrived, we have increased our tenure/tenure-track complement to 49 faculty. We have also hired an additional lecturer and now have 10 long-term lecturers. With this increase in teaching resources we have been able to make progress in reducing some of the large class sizes, especially at the the upper year level. Median class sizes in ACTSC and STAT labelled courses have decreased by about 20-25% when comparing 2018 and 2015 although we still have the largest median class sizes in the Math faculty. Looking at the data, we see the least improvement for STAT courses at the third year level, where the median class size is 113 for courses taught in 2018. As new resources become available, we plan to make reducing third year STAT class sizes a priority.

2. Space implications. As is common with many universities, space is limited and a valued commodity. The Department of Statistics and Actuarial Science is practically out of space. Given further expected growth, which is essential to the well-being of each program (and is currently planned), future space needs will have to be addressed urgently. These include both office space for new faculty members and suitably-sized classroom space.

**Status: in progress**

**Details:** Space is indeed very tight in the Department. Unfortunately, the hoped-for Math 4 building has not yet been approved. In the meantime, we have tried to make better use of our existing space and have also been allocated some offices in the MC building. We recently renovated some space we previously used for Master’s students and created a versatile space for up to 16 visitors. In addition, we have moved some retired faculty into shared space and are in the process of creating a new office in an empty space in our M3 building. These
changes will allow us to accommodate our expected needs for the next year. Assuming we continue to grow in the years ahead, which seems reasonable given our growth in undergraduate student numbers and the university’s new budget model, we will soon be at capacity again.

3. Re-evaluate the goals and mission of the Bachelor of Mathematics in Statistics for Health. As discussed earlier in the report, it would be good to reassess the currently under-enrolled program in Statistics for Health. The current emphasis is on healthcare systems and includes numerous business courses. A more popular emphasis might be to frame it as more of a 'biostatistics' program with standard statistics courses, specific methodological courses for health data (e.g., courses on analysis of survival and longitudinal data), a few public health courses (e.g., epidemiology), and maybe one or two 'biology' courses. This recommended change in program emphasis may help with the low enrollment and should not require the introduction of many (if any) courses: Many (if not all) of these needed courses are already in place and being offered by the department. Attention should also be given to the number of required courses, since presently that number is large.

**Status: completed**

**Details:** We redesigned the Statistics for Health program into a Biostatistics program. The changes result in a new program that has a stronger technical foundation and should appeal to Math students. The new program admitted its first students in Fall 2018.

4. Exit and follow-up surveys for graduates. A powerful way to market programs is to 'advertise' successful student placements, whether it be attractive positions in industry or enrollment in top graduate programs. The current tracking and monitoring of graduating students appears inadequate. Implementation of a formal exit survey would be a good start. Such a survey might collect information on: student satisfaction with the program, ways in which the program might get even better, plans for after graduation (i.e., job position, graduate school enrollment), and sustainable contact information. The latter pieces of information could be kept in a database and updated going forward. This will have the dual benefits of 'advertising' the success of the graduates for these programs, which will help the continued recruitment of top students, and for development, including identification of donors for endowed fellowships, chairs, etc.

**Status: completed**
Details: We implemented this suggestion. Beginning at the end of the Winter term in 2017, all our graduating students are given an online exit survey.

5. Introduce capstone courses for all programs. Capstone courses would be an important and attractive addition to all three programs to partially offset the problem caused by large advanced undergraduate courses and to provide an important project-based (case study) course in a small class size setting. We do understand, however, that to undertake this initiative, additional faculty would need to be hired or a reallocation of current resources would be required given the large numbers of fourth-year students across the programs.

Status: in progress

Details: Starting in 2017 we now offer a capstone course (*ACTSC 468*) for students in our Actuarial Science program. This course has limited enrolment because it involves case studies and student presentations, etc. We are keen to also offer a capstone course for Statistics and Mathematical Finance students. However, the main constraint here, as pointed out by the reviewers, is the lack of resources, especially when many of our other 4th year courses often have enrolments of over 100 students. To date we have not been able to offer a capstone style course for Statistics or Mathematical Finance students. In the last few years we have instead used our new teaching resources to reduce class sizes for our existing courses especially those at the third or fourth year level.

6. Career paths for lecturers. In discussion with a subset of the lecturers, it was apparent that they feel that the process for promotion from a term-to-term hire to a permanent continuing position is unclear. Further orientation and support from the administration of the department for the lecturers on this issue would help to alleviate career tension for the Lecturers currently on a term-to-term basis. A model such as an initial 2-year appointment, a subsequent 3-4-year appointment, and then promotion to Continuing Lecturer would be worth exploring. Some consideration of reduced teaching when preparing new courses would also be worth discussing.

Status: in progress

Details: This is not an issue that is completely under the control of the Department or even the Faculty. There is a university committee looking at revising Policy 76 surrounding appointments and lecturers. However, progress has been slow. In the meantime, within the faculty we have adopted an informal approach to provide lecturers with more clarity on career progression. We aim to follow the approach of tenure-track faculty as closely as makes
sense. In particular, for all our recently hired lecturers we have given them three year contracts that are eligible once for renewal. At the end of these two contracts (6 years) they will be considered for continuing lecturer status.

7. Consider hiring Waterloo Actuarial Science PhDs. For the Actuarial Science program, hiring top faculty is challenging given the small number of strong Actuarial Science graduate programs in existence. On top of this, many of the top PhD’s come from the graduate program at Waterloo. The policy of not hiring one’s own graduates, which in general is a good policy, may restrict the necessary growth and maintenance of strength of the Actuarial Science program going forward.

**Status: incomplete**

**Details:** It is challenging hiring in the area of Actuarial Science. The field is relative small and PhD graduates have good career prospects in industry. Our current policy prohibits hiring our own PhD students in either Statistics or Actuarial Science unless they have been away for at least two years. This is consistent with university guidelines as provided by the Provost and also the direction supported by the Dean of the Faculty of Mathematics. So, we are able to hire our own graduates but only after they have been away for some time. We feel this is a good policy both for us and for our graduating students who benefit from seeing how things are done at other universities. In the past, considering our own students immediately after graduation has caused internal divisions that took a long time to heal. In addition, since this policy has been in effect, we have made some excellent hires. Since we are one of the top universities in the world for actuarial science we are attractive to many of the best recent PhD graduates from all over the world.

8. Increase diversity in enrollments. International students are predominantly from China. To increase diversity and to reduce the risk of that one market diminishing, it will be important to tap other markets (e.g., the Indian subcontinent). The department should explore the best options to do this. For example, there may be opportunities to leverage current university programs/partnerships to target potential students from other countries.

**Status: in progress**

**Details:** The Faculty of Math is acutely aware of our lack of diversity in international students and actively recruits in a number of countries around the world. We recently engaged a full time recruiter for India. We hope that in the future, our recruitment in other countries will be more effective. The Statistics and Actuarial Science department does not directly control admission into our programs since they are all second year entry. All our students apply to
the Honours Mathematics program at the University of Waterloo. Only after they have proven their ability in first year can they enroll as a major in one of our programs. As such, we have much less control over recruitment than some other Math faculty programs.

Explain any circumstances that have altered the original implementation plan:

n/a

Address any significant developments or initiatives that have arisen since the program review process, or that were not contemplated during the review:

Together with the School of Computer Science we have developed a joint degree in Data Science. The first students enrolled in this program in Fall 2017.
### Updated Implementation Plan:

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Reduce class sizes, particularly in fourth year courses</strong></td>
<td>Hire more faculty</td>
<td>Chair/Dean</td>
<td>In progress. 2017-future</td>
</tr>
<tr>
<td>2. <strong>Address future space needs (i.e., office space for new hires and suitably sized classroom space)</strong></td>
<td>New fourth Math building proposed</td>
<td>Dean</td>
<td>In progress. Groundbreaking possibly in 2020</td>
</tr>
<tr>
<td>3. <strong>Reevaluate the goals of the Statistics for Health program</strong></td>
<td>Change the program into a degree in biostatistics</td>
<td>Steve Drekic, Assoc. Chair Undergraduate Studies</td>
<td>Complete. Program changes approved in time for Fall 2018 admission.</td>
</tr>
<tr>
<td>4. <strong>A subcommittee of faculty who teach the relevant courses has been struck to review program and required courses</strong></td>
<td>Design and implement survey for our graduating students</td>
<td>Carlos Mendes, Administrative Officer SAS</td>
<td>Complete. Started April 2017 and continuing</td>
</tr>
<tr>
<td>5. <strong>Introduce capstone courses</strong></td>
<td>Develop and offer capstone course for actuarial science students</td>
<td>Christiane Lemieux/David Landriault, Assoc. Chair Actuarial Science</td>
<td>In progress. First offering of capstone course for actuarial science students Winter 2017, scheduled for Winter term in future</td>
</tr>
<tr>
<td>6. <strong>Further career path orientation and support from the administration of the program for lecturers</strong></td>
<td>Develop two streams of lecturers – those with 3 year contracts that could lead to continuing lecturer positions and those with shorter 2 year contracts with no path to continuing lecturer</td>
<td>Chair, Dean</td>
<td>In progress. Implemented in an informal way. University policy review is underway, but completion time is not known.</td>
</tr>
</tbody>
</table>
Consider hiring Waterloo Actuarial Science PhDs (Current university policy prohibits hiring our own PhD students in either Statistics or Actuarial Science unless they have been away for at least two years)

| Current approach: Approach Waterloo Actuarial Science PhDs two years past graduation |
| Chair |
| Recommendation not supported by Dean and Provost. We plan to continue with our current approach. |

Increase diversity in enrollments (Statistics and Actuarial Science does not directly control admission into their programs since they are all second year entry. All students apply to the Honours Mathematics program at the University of Waterloo. Only after they have proven their ability in first year can they enroll as a major in one of our programs)

| The Math faculty is working to increase diversity through recruiting trips to a variety of locations and through hiring a recruiting officer for India. |
| Serge D’Alessio, Math Faculty, Associate Dean Undergraduate Admissions and Outreach |
| In progress and ongoing. |

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for monitoring the Implementation Plan.

Report on anything else you believe is appropriate to bring to Senate concerning this program:

N/A
Date of next program review: 2022-2023

Signatures of Approval:

Chair/Director

May 15, 2018

Faculty or Administrative Dean

March 21, 2019

Associate Vice-President, Academic
(For undergraduate and augmented programs)

Date

Associate Provost, Graduate Studies
(For Graduate and augment programs)

Date

June 2015
Checklist for SUC/SGRC Reviewer Feedback
Quality Assurance Office


Name of Reviewer: Katherine Acheson

Date: 5/23/2019

Does the Two-Year Progress Report:

1. Clearly describe progress achieved on the various action items in the implementation plan? ☒ Yes ☐ No

2. Explain convincingly any circumstances that would have altered the original implementation plan? ☒ Yes ☐ No

3. For items that are behind schedule, propose an amended implementation schedule that is reasonable and credible? ☒ Yes ☐ No

4. Address significant developments or initiatives that have arisen since the program review process, or that were not contemplated by the program review process? ☒ Yes ☐ No

General Comments

This is a good report that reports good progress on all the proposals to address recommendations. It does seem a bit delayed, but that’s not unusual.

Requested Revisions

In track changes in the document.