FACULTY OF SCIENCE

COUNCIL OF THE FACULTY OF SCIENCE

Notice of Meeting
Tuesday, December 10, 2019
at 3:00pm – 4:30pm
306 Lumbers

Agenda

1. Call to Order and Approval of Agenda
2. Chair's Remarks (January meeting change)
3. Approval of Minutes of November 12, 2019
4. Business Arising
5. Inquiries and Communications
   - Senate Synopsis of meetings held on November 28, 2019.
6. Dean's Report to Council
7. Associate Deans' and Head of Bethune College Remarks
8. Reports from Science Representatives on Senate Committees

   8.1 Presentation by Professor Robert Tsushima on Faculty consultations for York University's next University Academic Plan (UAP).
9. Reports from Standing Committees of Council

   9.1 Executive Committee
   - Call for nominations - vacancies report on the Standing Committees of FSc Council (items for action)

   9.2 Curriculum Committee (Consent agenda items)
10. Other Business

    10.1 Proposed Changes to the FSc Rules of Council – to add Graduate Program Committee
    10.2 Discussion and vote on the Graduate Program Committee
    10.3 Presentation by Ruth Koleszar-Green, PhD: presentation on the Indigenous Framework for York: A Guide to Action which is a strategic document that is over seen by Provost Philipps

FACULTY OF SCIENCE

COUNCIL OF THE FACULTY OF SCIENCE

Minutes
Tuesday, November 12, 2019
at 3:00pm – 4:30pm
306 Lumbers

Attendance: M. H. Armour (Chair), EJ Janse vanRensburg, R. McLaren, P. Potvin, T. Baumgartner, M. Xu, J. Amanatides, M. McCall, D. Hossain, M. Hough, S. Domenikos, R. Metcalfe, V. Pavri, J. Steeves, S. Connor, T. VandenBoer, P. Wilson, J. M. Heffernan, H. Akbari, R. Omar, F. Calingo, C. Bergevin, V. Saridakis, P. Lakin-Thomas, R. Tsushima, A. Mills, T. Kirchner, S. Siyakatshana (Assistant Secretary)

Guests: B. Sheeller, V. Gotchen & J. Cevallos

1. **Call to Order and Approval of Agenda**

   The Chair of Council, M. H. Armour called the meeting to order and the Agenda was adopted with one slight change; The presentation on Budget Consultation by the Provost was brought up to be the first agenda item.

   However, for purposes of these Minutes, the item will appear as itemized on the Agenda.

2. **Chair's Remarks**

   There was no Chair's remarks.

3. Approval of Minutes of October 8, 2019

A motion was moved, seconded and carried to approve the Minutes.

4. Business Arising

There was no Business Arising.

5. Inquiries and Communications

Council noted the Senate Synopsis of a meeting held on October 24, 2019.

6. Dean's Report to Council

The Dean, EJ Janse van Rensburg reported that the third class of twelve Carswell Scholars – six PhD students from Science and six students from Lassonde attended a luncheon with Allan Carswell and the Deans of Science and Lassonde, where they outlined the scope of their research.

He reported on the Science Unplugged event which he said was well attended.

He reported that York University was ranked among Ontario's top five and Canada's top ten universities for our mathematics programs.

Congratulations;

- Chris Caputo, Tier II Canada Research Chair (Chemistry), received the 2019 Petro-Canada Young Innovator Award. Chris is also the recipient of the 2018 John Charles Polanyi Prize.
- Cora Young and Trevor VandenBoer (Chemistry) received $440,000 over four years from Environment and Climate Change Canada for their project "Assessing the Atmospheric Transport and Deposition of Ionogenic Contaminants Impacting Whale Habitats."
- PhD students Tanushree Tiwari and Kathleen Dogantzis (supervised by Amro Zayed, Biology) received the 2019 CanadianPAm-Costco Scholar Fellowship.
- YorkU Magazine featured Thomas Baumgartner's and Chris Caputo's (Chemistry) development of a new fluorescence-based method for accurately determining the strength of a range of Lewis acids.

In the Media;

- Bridget Stutchbury (Biology) spoke to CTV News about the installation of new window coverings on some York University buildings and how they will help prevent bird deaths on campus.
- Dawn Bazely (Biology) spoke to the *CBC News* about how an archive of photos and research of plants and animals in Manitoba's tundra are now available online.
- Patricia Lakin-Thomas (Biology) co-authored an opinion piece in *The Globe and Mail* about why standard time is healthier than daylight savings time. She also spoke to various national and local media outlets on this topic, including *CBC News*, *CTV News*, *Global News*, *CP24*, and more.
- The Faculty of Science at York University and Toronto Public Library Present to be held on November 13 & November 18, 2019. H. Kouyoumdjian and D. Jackson to give talks.

Upcoming events;

- November 16 & November 17, 2019: Fall Campus Day
- Honours and Awards Ceremony to be held on January 29, 2020.
- President's Staff Recognition Awards, deadline January 10, 2020 at 4:30pm.

7. Associate Deans' and Head of Bethune College Remarks

On behalf of Associate Dean Gerald Audette, the Dean, reminded faculty members on the upcoming CV exercise deadline of November 15, 2019.

Associate Dean Jennifer Steeves reminded faculty members on the Call for Nominations for the President Research Awards, deadline November 22, 2019.

8. Reports from Science Representatives on Senate Committees

There were no reports.

9. Reports from Standing Committees of Council

9.1 Executive Committee

9.1.1 Ratification for nominations on the Standing Committee of Council

A motion was moved, seconded and carried to approve the nominations.

9.1.2 Call for nominations - vacancies report on the Standing Committees of FSc Council

Council noted the vacancies report on the Standing Committees of Council.

9.2 Curriculum Committee

The consent agenda items were deemed approved.

10. Other Business

11.1 Graduate Program Committee

Associate Dean Jennifer Steeves informed Council that the Faculty of Graduate Studies had gotten rid of one of their approval mechanisms for changes to curriculum at graduate level and they have suggested that Faculties have at Council level a Graduate Program Committee that would approve course changes to the graduate curriculum. From Council the curriculum items will be forwarded to the ASCP for approval,

Council questioned on how graduate representation would be selected. The general consensus was that the graduate students would control the selection process. The vote on the matter was postponed to the next Faculty Council.

11.2 Membership call: Human Participants Review Committee (HPRC)

Faculty members were asked to send their nominations to Sibonile Siyakatshana.

11.3 Faculty Budget consultation - Rhonda Lenton, President and Vice-Chancellor
Lisa Philipps, Provost and Vice-President Academic
Carol McAulay, Vice-President Finance & Administration

Lisa Phillips introduced her presentation by giving a brief update on the review of the Sharp budget model. She asked Council members to also provide their feedback on how the Sharp budget model was working. She added that efforts were underway to accelerate addressing the deferred maintenance.

Please click on the link below to review the full power point presentation;

updated Budget Consultation, Fall 2019 Final - November 12 2019.pdf

A robust discussion ensued after the Provost's presentation. Faculty members expressed their concern on the lack of adequate classroom space and higher quality student classrooms which are well furnished. They noted that lack of adequate space for students also compromised the academic integrity. A student caucus representative also expressed disappointment at the lack of equipment management by the university as she attested that classes were always disrupted due to nonfunctioning equipment.

Faculty members also expressed concern that the Teaching Commons does not consult Science faculty on their needs in order to make sure that their efforts meet the faculty needs.

Faculty members also noted that there had been some disputes among faculty over space and they appealed to university central office to intervene.

Furthermore, faculty members expressed concern at the restrictive quota for hiring for the international graduate program and yet faculty members brought in substantial amounts of research money to the Faculty. They expressed their desire to have faculty members benefit directly from the large amounts of research funds that they bring to the faculty. In addition, they questioned as to why faculty researchers were not allowed to utilize the money and bring in enhanced international graduate packages.

In her response, Lisa stated that, the Faculty, had the leeway to allocate the money at their disposal; However, she added that the challenge has always been on how to administer the funds. Lisa Philips promised to look into the domestic component and get back to the Faculty.

11.4 United Way Campaign for 2019

M. H. Armour drew Council's attention to the one page document regarding the United Way Campaign for 2019.

Meeting adjourned.

M. H. Armour, Chair of Council

S. Siyakatshana, Assistant Secretary of Council

The Senate of York University

Synopsis

The 661st Meeting of Senate held on Thursday, November 28, 2019

Remarks

The Chair, Professor Franck van Breugel of the Lassonde School of Engineering, welcomed Senators to the meeting. Senate Executive member Professor Lisa Farley served as Acting Vice-Chair in the absence of Senator Macpherson.

President Rhonda Lenton addressed the November 20 protest in Vari Hall that emerged in response to a student organized panel discussion on the topic of anti-Semitism. Significant safety planning ahead of the event enabled it to proceed, consistent with the University's Statement of Policy on Free Speech. President Lenton expressed her disappointment at the behaviour displayed at the protest, and condemned acts of violence on all York campuses. In response to the events of November 20, the President has tasked the Offices of the Vice-President Equity, People and Culture, and Vice-Provost Students to undertake a comprehensive review of the incident, and to make recommendations to ensure alignment of York's processes with best practices.

Other comments made by the President included the following:

- an update on the Strategic Mandate Agreement (SMA3) negotiations with the provincial government and the plan to gather Senate's input on the draft SMA3 document at the December meeting
- the reengagement of planning for Markham Centre Campus
- congratulations to the incoming Vice-President Research and Innovation, Dr. Amir Asif, and University Secretary, Pascal Robichaud, and expressions of appreciation to Rui Wang and Cheryl Underhill for providing continuity in those roles on an interim basis

The monthly "Kudos" report on the achievements of members of the York community can be accessed with other documentation for the meeting.

Inquiries and Communications

The Academic Colleague to the Council of Ontario Universities (COU), Professor Andrea Davis, reported on the discussions at the COU meetings of September, which focused on exploring areas in which universities could demonstrate thought leadership in the public sphere. Drawing on strategic and academic plans, several common priorities on which universities could be thought leaders were identified, including environmental sustainability and reconciliation and indigenization. Colleagues also received updates on COU's Affiliate Review and the provincial government's engagement process for SMA3.

The Senate of York University

Synopsis

Reports

Under the auspices of the Academic Policy, Planning and Research Committee, Associate Vice-President Haig-Brown presented the Vice-President Research and Innovation Annual Report on behalf of Vice-President Wang.

Approvals

On the recommendation of its Executive Committee, Senate approved:

- the election of Professor Mario Roy (Glendon) as Vice-Chair/Chair-elect of Senate beginning 1 January 2020
- the disestablishment of the Faculty Council, Faculty of Environmental Studies, effective 31 December 2019, contingent upon the approval of the new Faculty by Senate and the Board of Governors

On the recommendation of its Academic Policy, Planning and Research Committee, Senate approved the:

- establishment of the provisionally named Faculty of Urban and Environmental Change comprising the Faculty of Environmental Studies and the Department of Geography, Faculty of Liberal Arts & Professional Studies, to commence operations 1 January 2020, with a full launch on 1 September 2020
- disestablishment of the Faculty of Environmental Studies, effective 31 August 2020
- transfer of the constituent academic programs and curricula from the Faculty of Environmental Studies to the new Faculty of Urban and Environmental Change, effective 1 September 2020
- disestablishment of the Department of Geography, LA&PS, effective 31 August 2020
- transfer of the constituent academic programs and curricula from the Department of Geography, LA&PS, to the new Faculty of Urban and Environmental Change, effective 1 September 2020

Senate approved the recommendations of its Academic Standards, Curriculum and Pedagogy Committee to:

- change the admission and degree requirements for the MASc and PhD programs in Mechanical Engineering, Graduate Program in Mechanical Engineering, Lassonde School of Engineering / Faculty of Graduate Studies, effective FW 2020-2021
- change the degree requirements for the MA and PhD programs in Health, Graduate Program in Health, Faculty of Health / Faculty of Graduate Studies, effective FW 2019-2020

The Senate of York University

Synopsis

Executive (Professor Lisa Farley, Acting Vice-Chair)

The Executive Committee gave Notice of Statutory Motion for revisions to the York University Rules of Senate relating to the membership of the Academic Standards, Curriculum and Pedagogy Committee, and nomination guidelines and criteria.

The Executive Committee facilitated a discussion on the question of whether there is a need to review at this time the Principles Governing a Presidential Search. An electronic survey will be conducted following the Senate meeting to allow Senators to reflect on the discussion and to share their opinion on the question.

The Executive Committee's information items included the following:

- approval of the Lassonde School of Engineering's nominee to the Executive Committee
- approval of members of Senate Committees nominated by student Senators
- its review of Faculty Council rules and procedures of the School of the Arts, Media, Performance & Design
- additions to the pool of prospective honorary degree recipients and the renewal of candidates currently residing in the pool
- confirmation that a December meeting of Senate will be held on Thursday 12 December at 3:00 pm

Academic Policy, Planning and Research (Professor Carl Ehrlich, Chair)

APPRC provided Notice of Statutory Motion for the establishment of a School of Global Health in the Faculty of Health, effective 1 July 2020, and the transfer of the BA and BSc degree programs in Global Health from the Dean's Office, Faculty of Health, to the School of Global Health, Faculty of Health, effective 1 July 2020.

APPRC reported on the following information items:

- its reflections on the Vice-President Research and Innovation Annual Report
- an update on the University Academic Plan renewal process, with a consultation to be held at Senate during the December meeting

Academic Standards, Curriculum and Pedagogy (Professor Kim Michasiw, Chair)

ASCP's information items included the following minor changes to calendar copy and admission and degree requirements.

The Senate of York University

Synopsis

Faculty of Science

Minor changes to calendar copy for the Biomedical Sciences stream within the BSc (Honours) program in Biology, Department of Biology

Minor changes to calendar copy for the BA and BSc programs in Applied Mathematics, Mathematics Education, Mathematics, and Statistics, Department of Mathematics and Statistics

Faculty of Graduate Studies

Minor change to degree requirements for the Master of Accounting program, Schulich School of Business

Minor changes to French language proficiency requirements for the Master's program in Public and International Affairs, School of Public and International Affairs, Glendon

Tenure and Promotions, Tenure and Promotions Appeals (Professor Thomas Baumgartner, Co-Chair)

Professor Baumgartner spoke to the Committee's Annual Report for 2018-2019.

Additional Information about this Meeting

Please refer to the full Senate agenda and supplementary material posted online with the Thursday, November 28, 2019 meeting for details about these items.

http://secretariat.info.yorku.ca/senate/meeting-agendas-and-synopses/

December Meeting of Senate

Senate's next meeting will be held at 3:00 p.m. on **Thursday, December 12, 2019.**

2019-2020 FSc Report on vacancies for Senate and FSc Standing Committees

Outstanding Vacancies				
Committee on Research and Awards	1 vacancy member - STS department			
Curriculum Committee	2 vacancies Members at Large			
Student Representatives - few outstanding vacancies				
Committee	**Rules of Faculty Council - membership**	**Meeting time / Membership**	**Term From**	**To**
Senate	According to the York University Secretariat based on the Senate Rules and Procedures governing the size and composition of Senate, the Faculty of Science shall have twelve members, including a minimum of two Chairs. According to The Rules of Council (Science), Faculty representation shall include the Director of Natural Science, three Department Chairs, and terms shall be for	As per Senate website		
	Dean, Ex officio	EJ Janse vanRensburg	Designated	
	Member at large	G. Audette	Designated	2022
	Member at large	VACANT	2019	2020
	Member at large	J. Lazenby, Department of STS	2019	2022
	Member at large	T. Baumgartner, Chemistry	2018	2021
	Member at large	B. Pietro, Chemistry	2019	2022
	Member at large	P. Lakin-Thomas, Biology	2019	2022
	Member at large	D. Wilson, Chemistry	2018	2021
	Department Chair	R. Tsushima, Biology	2018	2021
	Department Chair	R. Fournier, Chemistry	2019	2022
	Department Chair	P. Szeptycki, Mathematics & Statistics	2019	2022
	Director of NATS	J. Clark	Designated	
	Student representative	Robert Cheung	2018	2021
	Student representative	Romina Noormohammadi	2019	2022
FSc Reps on Senate Committees				
Senate Executive	1 member from FSc	Paul Szeptycki	2018	2020
Academic Policy, Planning and Research Committee (APPRC)	1 member from FSc	R. Tsushima, Biology	2017	2020
Sub-Committee on Honorary Degrees & Cerem	1 member from FSc	W. Liu, Math & Statistics	2017	2020
Executive Committee	The Executive Committee shall be chaired by the Chair of Council and include the Vice-Chair of Council, the Secretary of Council, and one member elected from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy, and Science and Technology Studies/Natural Science, the Dean of the Faculty of Science (*ex officio*), one student member of Council, and one of the staff members elected to Council.	The Executive Committee will normally meet the first Tuesday of each month (September to May) from 1:30 pm - 3:00 pm in LUM 305B		
	Chair of Council	M. H. Armour	2019	2020
	Vice-Chair of Council	C. Storry	2019	2020
	Dean, Ex officio	EJ Janse vanRensburg	Designated	
	Asst. Dean - SEM & SEP	A. Mun	Designated	
	Office of the Dean, staff representative	M. Hough	2019	2020
	Undergraduate Student Rep	VACANCY	2019	2020
	Biology	A. Hilliker	2018	2021
	Chemistry	S. Krylov	2019	2022
	Math & Stats	N. Madras	2019	2022
	Physics & Astronomy	R. Lewis	2019	2020
	STS	R. Metcalfe	2019	2022
APPC	The Academic Policy and Planning Committee shall include the Dean or designate (*ex officio*), the Master of Norman Bethune College and one member elected from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy, and Science and Technology Studies/Natural Science, one student member of Council, and one of the staff members elected to Council.	APPC will normally meet the last Thursday of each month (September to April) from 9:00 am - 10:30 am		
	Associate Dean, Faculty Affairs, Ex officio	G. Audette	Designated	
	Head of Bethune College	J. Amanatides	Designated	
	Undergraduate Student Rep	R. Omar (Fall) R. Patel (Winter)	2019	2020
	Elected staff representative	M. Xu	2019	2020
	Biology, also representing STS	J. Clark	2019	2022
	Chemistry	R. McLaren	2019	2022
	Math & Stats	J. Heffernan	2019	2022
	Physics & Astronomy	J. Zylberberg	2019	2020
	STS	VACANCY (represented by J. Clark)	2019	2022
Curriculum Committee	The Curriculum Committee shall include the Dean and an Associate Dean (ex officio), the Chair or nominee from each teaching Division or Department, three members elected by Council and two student members of Council.	The Curriculum Committee will normally meet every last Tuesday of each month (September to April) from 1:30 pm - 3:00 pm		
	Member at Large	J. Clark	2019	2022
	Member at Large	VACANCY	2019	2022
	Dean, Ex officio	EJ Janse van Rensburg	Designated	
	Associate Dean - Students, Ex officio	A. Mills	Designated	
	Undergraduate Student Rep (two vacancies)	2 VACANCIES	2019	2020
	Biology	S. Connor	2019	2022
	Chemistry	P. Potvin	2019	2022
	Math & Stats	J. Grigull (Fall) M. Chen (Winter)	2019	2022
	Physics & Astronomy	P. Hall	2019	2020
	STS	E. Hamm	2019	2022
	Member at Large	VACANCY	2019	2022
CEAS	The Committee on Examinations and Academic Standards shall consist of an Associate Dean (*ex officio*), five members elected by Council from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy and Science and Technology Studies/Natural Science, and one student member of Council.	CEAS will normally meet every alternate Wed / Thurs from 1:00 - 3:00 pm year round.		

2019-2020 FSc Report on vacancies for Senate and FSc Standing Committees

****Outstanding Vacancies****				
Committee on Research and Awards	1 vacancy member - STS department			
Curriculum Committee	2 vacancies Members at Large			
Student Representatives - few outstanding vacancies				
Committee	**Rules of Faculty Council - membership**	**Meeting time / Membership**	**Term From**	**To**
	In addition to the above membership of the committee, Council shall elect an alternate member from each of the Departments specified above. The alternate member shall be the person polling the next highest number of votes to those elected to the committee from each Department. The alternate for the student member will be selected by the Science Student Caucus from one of its Members at Large. An alternate can only vote in the event that first elected members are not in attendance.			
	Associate Dean - Students, Ex officio	A. Mills	Designated	
	Undergraduate Student Rep	VACANCY	2019	2020
	Undergraduate Student Rep	VACANCY	2019	2020
	Biology	C. Jang/ALT B. Schwartz	2019	2022
	Chemistry	D. Jackson (2020) / R. McLaren	2017/2020	2020/2023
	Math & Stats	M. Chen /ALT. Y. Fu	2019	2022
	Physics & Astronomy	S. Tulin/ALT. S. Jerzak	2019	2020
	STS	J. Lazenby/VACANCY	2019	2022
Petitions	The Petitions Committee for the purpose of hearing student petitions shall consist of an Associate Dean (*ex officio*), six members of Council, and two student members of Council. The Committee may divide the workload by splitting the Committee membership into two panels of four people each. A quorum shall consist of either (a) two faculty voting faculty members and one student member or (b) three voting faculty members.	Each panel meets once a month on Wednesday or Thursday from 2:30 pm - 4:00 pm		
	Associate Dean, Ex officio	A. Mills	Designated	
	Undergraduate Student Rep	A. Qayyum	2019	2020
	Undergraduate Student Rep	VACANCY	2019	2020
	Member at Large	I. Raguimov	2019	2022
	Biology	A. Hilliker	2017	2020
	Chemistry	W. J. Pietro	2019	2022
	Physics & Astronomy	D. Harris (F), S. Rastgoo (W)	2019	2020
	Math & Stats	Y. Gao	2019	2022
	STS	S. P. Domenikos	2019	2022
	Member at Large	P. Peskun	2017	2020
SRC T & P Committee	The Committee on Tenure and Promotions shall consist of one currently tenured member from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy and Science and Technology Studies/Natural Science elected by Council, and one student member of Council. No member of the Committee shall be a member of another Tenure and Promotions Committee at any time during their tenure on this committee. In addition to the above membership of the committee, Council shall elect an alternate member from each of the Units mandated above. The alternate member shall be the person polling the next highest number of votes to those elected to the committee from each Department. The alternate for the student member shall be selected by the Science Student Caucus from one of its Members-at-Large on an annual basis. An alternate can only vote in the event that existing members are not in attendance.	SRC T & P Committee will normally meet the last Friday of each month (September to May) from 9:00 am - 11:00 am in LUM 305B		
	Associate Dean - Faculty, Ex officio	J. Steeves	Designated	
	Undergraduate Student Rep	F. Calingo (Fall)	2019	2020
	Biology	J. Clark / ALT - V. Saridakis	2017	2020
	Chemistry	D. Wilson/ALT - V. Tsoukanova	2019	2020/2022
	Physics & Astronomy	M. George/ALT S. Menary	2019	2022
	Math & Stats	A. Wong (Fall) S. Wang (Winter) ALT D. Liang	2019	2022
	STS	D. Lungu/ALT Vacancy	2018	2021
CoTL	Currently, the Committee on Teaching and Learning shall consist of a minimum of two Faculty members from each department, the Associate Dean – Students, one Librarian, one staff member, one undergraduate student, and two graduate students, in addition to other members invited as provided for by the Rules. Graduate students and staff nominees will indicate their interest in serving on the committee in writing to the committee, who will then approve by majority vote.	CoTL normally meets every third Thursday of each month (September to May) from 10:00 am - 11:30 am		
	Associate Dean - Students, Ex officio	A. Mills		
	Graduate Student Representative	Snezhana Kirusheva	2018	2020
	Graduate Student Representative	Amanda Liczner	2018	2020
	Undergraduate Student Rep	H. Kwon	2019	2020
	Steacie Librarian	Ilo-Katryn Maimets	Designated	
	IT Representative	V. Gotcheva	Designated	
	Teaching Commons Rep	Y. Su	Designated	
	Staff representative, Elected	D. Hossain	2019	2020
	Biology	T. Kelly	2017	2020
	Biology	S. Connor (to replace C. Bucking for 1yr)	2019	2020
	Chemistry	H. Kouyoumjian	2017	2020
	Chemistry	C. Caputo	2018	2021
	Physics & Astronomy	E. Hyde (Fall, starting November 1st)	2019	2020
	Physics & Astronomy	N. Bozorgnia (Winter)	2019	2020
	Math & Stats	A. Chow	2017	2020
	Math & Stats	W. Liu	2018	2021
	STS	R. Marushia	2019	2022

2019-2020 FSc Report on vacancies for Senate and FSc Standing Committees

****Outstanding Vacancies****				
Committee on Research and Awards	1 vacancy member - STS department			
Curriculum Committee	2 vacancies Members at Large			
Student Representatives - few outstanding vacancies				
Committee	**Rules of Faculty Council - membership**	**Meeting time / Membership**	**Term From**	**To**
Committee on Research & Awards	The Committee on Research and Awards shall consist of one member elected by Council from each of Biology, Chemistry, Mathematics and Statistics, Science and Technology Studies/Natural Science, and Physics and Astronomy, one student member of Council and an Associate Dean (*ex officio*) who will serve as the Chair.	The Research & Awards Committee will meet when grants and awards need to be adjudicated.		
	Associate Dean - Research & Graduate Education, ex officio	Jennifer Steeves	Designated	
	Undergraduate Student Rep	VACANCY	2019	2020
	Biology	R. Kwong	2017	2020
	Chemistry	S. Morin	2019	2022
	Physics & Astronomy	C. David	2019	2020
	Math & Stats	Huaiping Zhu	2019	2022
	STS	VACANCY	2019	2022
Appeals	The Appeals Committee for the purpose of hearing student appeals shall consist of four elected faculty members from Science units, an Associate Dean (*ex officio*) and two student members of Council. A quorum shall consist of either (a) two faculty members and one student member or (b) three faculty members.	Meeting is held once a month and times are polled by the Committee Secretary.		
	Associate Dean - Research & Graduate Education, ex officio	Jennifer Steeves	Designated	
	Undergraduate Student Rep	A. Gideon	2019	2020
	Undergraduate Student Rep	R. Noormohammadi	2019	2020
	Member at Large	R. Fournier	2019	2022
	Biology	L. Donaldson	2017	2020
	Chemistry	M. Hempstead	2017	2020
	Physics & Astronomy	W. van Wijngaarden	2019	2020
	Math & Stats	A. Pietrowski	2018	2022
	STS	M.H. Armour	2018	2022

2019-2020 FSc Report on vacancies for Senate and FSc Standing Committees

Outstanding Vacancies				
Senate	1 vacancy Member at Large			
Committee on Research and Awards	1 vacancy member - STS department			
Curriculum Committee	2 vacancies Members at Large			
Student Representatives - few outstanding vacancies				

Committee	Rules of Faculty Council - membership	Meeting time / Membership	Term From	Term To
Senate	According to the York University Secretariat based on the Senate Rules and Procedures governing the size and composition of Senate, the Faculty of Science shall have twelve members, including a minimum of two Chairs. According to The Rules of Council (Science), Faculty representation shall include the Director of Natural Science, three Department Chairs, and terms shall be for	As per Senate website		
	Dean, Ex officio	EJ Janse vanRensburg	Designated	
	Member at large	G. Audette	Designated	2022
	Member at large	VACANT	2019	2020
	Member at large	J. Lazenby, Department of STS	2019	2022
	Member at large	T. Baumgartner, Chemistry	2018	2021
	Member at large	B. Pietro, Chemistry	2019	2022
	Member at large	P. Lakin-Thomas, Biology	2019	2022
	Member at large	D. Wilson, Chemistry	2018	2021
	Department Chair	R. Tsushima, Biology	2018	2021
	Department Chair	R. Fournier, Chemistry	2019	2022
	Department Chair	P. Szeptycki, Mathematics & Statistics	2019	2022
	Director of NATS	J. Clark	Designated	
	Student representative	Robert Cheung	2018	2021
	Student representative	Romina Noormohammadi	2019	2022
FSc Reps on Senate Committees				
Senate Executive	1 member from FSc	Paul Szeptycki	2018	2020
Academic Policy, Planning and Research Committee (APPRC)	1 member from FSc	R. Tsushima, Biology	2017	2020
Sub-Committee on Honorary Degrees & Cerem	1 member from FSc	W. Liu, Math & Statistics	2017	2020
Executive Committee	The Executive Committee shall be chaired by the Chair of Council and include the Vice-Chair of Council, the Secretary of Council, and one member elected from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy, and Science and Technology Studies/Natural Science, the Dean of the Faculty of Science (*ex officio*), one student member of Council, and one of the staff members elected to Council.	The Executive Committee will normally meet the first Tuesday of each month (September to May) from 1:30 pm - 3:00 pm in LUM 305B		
	Chair of Council	M. H. Armour	2019	2020
	Vice-Chair of Council	C. Storry	2019	2020
	Dean, Ex officio	EJ Janse vanRensburg	Designated	
	Asst. Dean - SEM & SEP	A. Mun	Designated	
	Office of the Dean, staff representative	M. Hough	2019	2020
	Undergraduate Student Rep	VACANCY	2019	2020
	Biology	A. Hilliker	2018	2021
	Chemistry	S. Krylov	2019	2022
	Math & Stats	N. Madras	2019	2022
	Physics & Astronomy	R. Lewis	2019	2020
	STS	R. Metcalfe	2019	2022
APPC	The Academic Policy and Planning Committee shall include the Dean or designate (*ex officio*), the Master of Norman Bethune College and one member elected from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy, and Science and Technology Studies/Natural Science, one student member of Council, and one of the staff members elected to Council.	APPC will normally meet the last Thursday of each month (September to April) from 9:00 am - 10:30 am		
	Associate Dean, Faculty Affairs, Ex officio	G. Audette	Designated	
	Head of Bethune College	J. Amanatides	Designated	
	Undergraduate Student Rep	R. Omar (Fall) R. Patel (Winter)	2019	2020
	Elected staff representative	M. Xu	2019	2020
	Biology, also representing STS	J. Clark	2019	2022
	Chemistry	R. McLaren	2019	2022
	Math & Stats	J. Heffernan	2019	2022
	Physics & Astronomy	J. Zylberberg	2019	2020
	STS	VACANCY (represented by J. Clark)	2019	2022
Curriculum Committee	The Curriculum Committee shall include the Dean and an Associate Dean (ex officio), the Chair or nominee from each teaching Division or Department, three members elected by Council and two student members of Council.	The Curriculum Committee will normally meet every last Tuesday of each month (September to April) from 1:30 pm - 3:00 pm		
	Member at Large	J. Clark	2019	2022
	Member at Large	VACANCY	2019	2022
	Dean, Ex officio	EJ Janse van Rensburg	Designated	
	Associate Dean - Students, Ex officio	A. Mills	Designated	
	Undergraduate Student Rep (two vacancies)	2 VACANCIES	2019	2020
	Biology	S. Connor	2019	2022
	Chemistry	P. Potvin	2019	2022
	Math & Stats	J. Grigull (Fall) M. Chen (Winter)	2019	2022
	Physics & Astronomy	P. Hall	2019	2020
	STS	E. Hamm	2019	2022
	Member at Large	VACANCY	2019	2022
CEAS	The Committee on Examinations and Academic Standards shall consist of an Associate Dean (*ex officio*), five members elected by Council from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy and Science and Technology Studies/Natural Science, and one student member of Council.	CEAS will normally meet every alternate Wed / Thurs from 1:00 - 3:00 pm year round.		

2019-2020 FSc Report on vacancies for Senate and FSc Standing Committees

Outstanding Vacancies	
Senate	1 vacancy Member at Large
Committee on Research and Awards	1 vacancy member - STS department
Curriculum Committee	2 vacancies Members at Large
Student Representatives - few outstanding vacancies	

Committee	Rules of Faculty Council - membership	Meeting time / Membership	Term From	Term To
	In addition to the above membership of the committee, Council shall elect an alternate member from each of the Departments specified above. The alternate member shall be the person polling the next highest number of votes to those elected to the committee from each Department. The alternate for the student member will be selected by the Science Student Caucus from one of its Members at Large. An alternate can only vote in the event that first elected members are not in attendance.			
	Associate Dean - Students, Ex officio	A. Mills	Designated	
	Undergraduate Student Rep	VACANCY	2019	2020
	Undergraduate Student Rep	VACANCY	2019	2020
	Biology	C. Jang/ALT B. Schwartz	2019	2022
	Chemistry	D. Jackson (2020) / R. McLaren	2017/2020	2020/2023
	Math & Stats	M. Chen /ALT. Y. Fu	2019	2022
	Physics & Astronomy	S. Tulin/ALT. S. Jerzak	2019	2020
	STS	J. Lazenby/VACANCY	2019	2022
Petitions	The Petitions Committee for the purpose of hearing student petitions shall consist of an Associate Dean (*ex officio*), six members of Council, and two student members of Council. The Committee may divide the workload by splitting the Committee membership into two panels of four people each. A quorum shall consist of either (a) two faculty voting faculty members and one student member or (b) three voting faculty members.	Each panel meets once a month on Wednesday or Thursday from 2:30 pm - 4:00 pm		
	Associate Dean, Ex officio	A. Mills	Designated	
	Undergraduate Student Rep	A. Qayyum	2019	2020
	Undergraduate Student Rep	VACANCY	2019	2020
	Member at Large	I. Raguimov	2019	2022
	Biology	A. Hilliker	2017	2020
	Chemistry	W. J. Pietro	2019	2022
	Physics & Astronomy	D. Harris (F), S. Rastgoo (W)	2019	2020
	Math & Stats	Y. Gao	2019	2022
	STS	S. P. Domenikos	2019	2022
	Member at Large	P. Peskun	2017	2020
SRC T & P Committee	The Committee on Tenure and Promotions shall consist of one currently tenured member from each of Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy and Science and Technology Studies/Natural Science elected by Council, and one student member of Council. No member of the Committee shall be a member of another Tenure and Promotions Committee at any time during their tenure on this committee. In addition to the above membership of the committee, Council shall elect an alternate member from each of the Units mandated above. The alternate member shall be the person polling the next highest number of votes to those elected to the committee from each Department. The alternate for the student member shall be selected by the Science Student Caucus from one of its Members-at-Large on an annual basis. An alternate can only vote in the event that existing members are not in attendance.	SRC T & P Committee will normally meet the last Friday of each month (September to May) from 9:00 am - 11:00 am in LUM 305B		
	Associate Dean - Faculty, Ex officio	J. Steeves	Designated	
	Undergraduate Student Rep	F. Calingo (Fall)	2019	2020
	Biology	J. Clark / ALT - V. Saridakis	2017	2020
	Chemistry	D. Wilson/ALT - V. Tsoukanova	2019	2020/2022
	Physics & Astronomy	M. George/ALT S. Menary	2019	2022
	Math & Stats	A. Wong (Fall) S. Wang (Winter) ALT D. Liang	2019	2022
	STS	D. Lungu/ALT Vacancy	2018	2021
CoTL	Currently, the Committee on Teaching and Learning shall consist of a minimum of two Faculty members from each department, the Associate Dean – Students, one Librarian, one staff member, one undergraduate student, and two graduate students, in addition to other members invited as provided for by the Rules. Graduate students and staff nominees will indicate their interest in serving on the committee in writing to the committee, who will then approve by majority vote.	CoTL normally meets every third Thursday of each month (September to May) from 10:00 am - 11:30 am		
	Associate Dean - Students, Ex officio	A. Mills		
	Graduate Student Representative	Snezhana Kirusheva	2018	2020
	Graduate Student Representative	Amanda Liczner	2018	2020
	Undergraduate Student Rep	H. Kwon	2019	2020
	Steacie Librarian	Ilo-Katryn Maimets	Designated	
	IT Representative	V. Gotcheva	Designated	
	Teaching Commons Rep	Y. Su	Designated	
	Staff representative, Elected	D. Hossain	2019	2020
	Biology	T. Kelly	2017	2020
	Biology	S. Connor (to replace C. Bucking for 1yr)	2019	2020
	Chemistry	H. Kouyoumjian	2017	2020
	Chemistry	C. Caputo	2018	2021
	Physics & Astronomy	E. Hyde (Fall, starting November 1st)	2019	2020
	Physics & Astronomy	N. Bozorgnia (Winter)	2019	2020
	Math & Stats	A. Chow	2017	2020
	Math & Stats	W. Liu	2018	2021
	STS	R. Marushia	2019	2022

2019-2020 FSc Report on vacancies for Senate and FSc Standing Committees

Outstanding Vacancies				
Senate	1 vacancy Member at Large			
Committee on Research and Awards	1 vacancy member - STS department			
Curriculum Committee	2 vacancies Members at Large			
Student Representatives - few outstanding vacancies				

Committee	Rules of Faculty Council - membership	Meeting time / Membership	Term From	Term To
Committee on Research & Awards	The Committee on Research and Awards shall consist of one member elected by Council from each of Biology, Chemistry, Mathematics and Statistics, Science and Technology Studies/Natural Science, and Physics and Astronomy, one student member of Council and an Associate Dean (*ex officio*) who will serve as the Chair.	The Research & Awards Committee will meet when grants and awards need to be adjudicated.		
	Associate Dean - Research & Graduate Education, ex officio	Jennifer Steeves	Designated	
	Undergraduate Student Rep	VACANCY	2019	2020
	Biology	R. Kwong	2017	2020
	Chemistry	S. Morin	2019	2022
	Physics & Astronomy	C. David	2019	2020
	Math & Stats	Huaiping Zhu	2019	2022
	STS	VACANCY	2019	2022
Appeals	The Appeals Committee for the purpose of hearing student appeals shall consist of four elected faculty members from Science units, an Associate Dean (*ex officio*) and two student members of Council. A quorum shall consist of either (a) two faculty members and one student member or (b) three faculty members.	Meeting is held once a month and times are polled by the Committee Secretary.		
	Associate Dean - Research & Graduate Education, ex officio	Jennifer Steeves	Designated	
	Undergraduate Student Rep	A. Gideon	2019	2020
	Undergraduate Student Rep	R. Noormohammadi	2019	2020
	Member at Large	R. Fournier	2019	2022
	Biology	L. Donaldson	2017	2020
	Chemistry	M. Hempstead	2017	2020
	Physics & Astronomy	W. van Wijngaarden	2019	2020
	Math & Stats	A. Pietrowski	2018	2022
	STS	M.H. Armour	2018	2022

York University

COUNCIL OF THE FACULTY OF SCIENCE

Report of the Science Curriculum Committee

November 2019

The Faculty of Science Curriculum Committee has reviewed proposals for changes to course information and degree requirements and recommends to the Executive Committee that the following changes be submitted to Council for approval.

Details regarding these proposals (and regarding other minor changes to Calendar/Repository course descriptions and prerequisites which were approved by the Committee but are not reported here) are included in the working papers of November 26, 2019, meeting of the Curriculum Committee, which are on file for your inspection in the Office of the Dean, with all members of the Curriculum Committee or by contacting the Secretary of the Committee at tinar@yorku.ca

Consent Agenda

December 4, 2019

Course Name and Course Code	Type of change	Status
Biology Internship Work Term - SC/BIOL 3901 0.0 SC/BIOL 3902 0.0 SC/BIOL 3903 0.0 SC/BIOL 3904 0.0	New course	Approved
Population Ecology - SC/BIOL 3171 3.0	New course	Approved
Community Ecology - SC/BIOL 3172 3.0	New course	Approved
Biology, iBSc Biology and Environmental Biology	Change in calendar description: update of general education requirement.	Approved
Sensory Systems - SC/BIOL 3380 3.0	New course	Approved
Chemistry Internship Work Term - SC/CHEM 3901 0.0 SC/CHEM 3902 0.0 SC/CHEM 3903 0.0 SC/CHEM 3904 0.0	New course	Approved
Biochemistry Internship Work Term - SC/BCHM 3901 0.0 SC/BCHM 3902 0.0 SC/BCHM 3903 0.0 SC/BCHM 3904 0.0	New course	Approved
Environmental Chemistry - SC/CHEM 3061 3.0	New course	Approved
Topics of Materials Sciences - SC/CHEM 4090 3.0	Change in perquisites: addition SC/CHEM 3021 3.0 SC/CHEM 3030 3.0	Approved
Specialized Honours BSC Chemistry – Pharmaceutical and Biological Chemistry stream -	Change in calendar description: Addition to a restricted list of upper level courses.	Approved
Chemical Biology - SC/CHEM 4052 3.0	New course	Approved
Principles of Risk Management and Insurance - SC/MATH 1280 3.0	New course	Approved
Mathematics for the Life and Social Sciences – SC/MATH 1505 6.0	Change in course format/mode of delivery: Adding tutorial sessions	Approved
Biophysics program	Change in Calendar: updating calendar to reflect the split in 3 credit physics course.	Approved
Physics and Astronomy programs and streams	Change in Calendar: updating calendar to reflect the split in 3 credit physics course.	Approved

STS program, Bachelor, Honours and Specialized Honours programs -	Change in Calendar: updating calendar to reflect the split in 3 credit physics course.	Approved

Note: Resource implications for the following courses have been approved by APPC:

- MATH 1505
- BIOL 3171
- BIOL 3172
- CHEM 3061
- CHEM 4052

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science
Department: Indicate department and course prefix (e.g. Languages, GER)	Biology (BIOL)
Date of Submission:	October 11, 2019
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	BIOL 3901, 3902, 3903, 3904
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	0.0
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Biology Internship Work Term
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Biology Internship Work Term

With every new course proposal it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters
(approximately 300 words including spaces and punctuation).

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

Qualified Honours or Specialized Honours students gain relevant work experience as an integrated complement to their academic studies, reflected in the requirements of a learning agreement and work term report. Students are required to register in this course for each four month work term, with the maximum number of work term courses being four (i.e. 16 months). Students in this course are assigned a Faculty Supervisor/Committee. During the course, students are expected to work at least 480 hours for the employer. Enrollment is by permission only.

Prerequisites: Criteria for permission include:
1. A cumulative GPA and a major GPA of at least 7.5;
2. Completion of a minimum of 84 credits overall, including at least 24 BIOL credits.
3. Enrolled full-time in the Honours or Specialized Honours program in Biology or Environmental Biology prior to beginning the internship;
4. Student has not been absent for more than two consecutive years as a full-time student from their Honours or Specialized Honours degree studies;
5. Upon enrolling in this course student has a minimum of 9 credits remaining toward their Honours or Specialized Honours degree and must return as a full-time student for at least one academic term to complete their degree after completion of their final work term.

Note: This is a pass/fail course, which does not count for degree credit. Registration in BIOL 3901/2/3/4 0.00 provides a record on the transcript for each work term.

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

Qualified Honours or Specialized Honours students gain relevant work experience as an integrated complement to their academic studies, reflected in the requirements of a learning agreement and work term report. Students are required to register in this course for each four month work term, with the maximum number of work term courses being four (i.e. 16 months). Students in this course are assigned a Faculty Supervisor/Committee. During the course, students are expected to work at least 480 hours for the employer. Enrollment is by permission only.

Prerequisites: Criteria for permission include:
1. A cumulative GPA and a major GPA of at least 7.5;
2. Completion of a minimum of 84 credits overall, including at least 24 BIOL credits.
3. Enrolled full-time in the Honours or Specialized Honours program in Biology or Environmenatl Biology prior to beginning the internship;
4. Student has not been absent for more than two consecutive years as a full-time student from their Honours or Specialized Honours degree studies;
5. Upon enrolling in this course student has a minimum of 9 credits remaining toward their Honours or Specialized Honours degree and must return as a full-time student for at least one academic term to complete their degree after completion of their final work term.

Note: This is a pass/fail course, which does not count for degree credit. Registration in BIOL 3901/2/3/4 0.00 provides a record on the transcript for each work term.

The expected learning outcomes of experiential learning based on work experiences and the reflection on those work experiences in subsequent academic learning include:

- Demonstrate the ability to integrate theoretical/academic knowledge with workplace practice;
- Apply the relevant academic learning to the workplace;
- Develop career goals and improve the ability to manage career planning;
- Develop a professional network with employers and peer employees
- Determine strengths and weaknesses in communication and enhance interpersonal skills;
- Underline the Importance of lifelong learning skills.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

Any student who is enrolled in the an Honours or Specialized Honours program offered by the Department of Biology who also undertakes a Biology internship position will be enrolled in the course BIOL 3901/3902/3903/3904 Internship Work Term for each academic term of their Internship. At the end of each academic term, the student will submit a Work Term Report and a Supervisor Evaluation. This experience is understood to be a 0-credit optional endeavor. Students enter into this arrangement because they see value in critically applying their classroom learning in an industry setting. The course is a 0-credit course because there is minimal faculty oversight of the academic learning outcomes of the experience. The Biology Faculty liaison to the intern will receive the Work Term Reports that are submitted by students in BIOL 3901/3902/3903/3904 at the end of each academic term and assign each a grade of Pass or Fail.

The grade and the experience are acknowledged on the transcript. This course shall be mounted each term starting in the Fall 2020 term.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1) This course shall be mounted each term starting in Fall 2020.
2) Teaching competence is not applicable; The Biology liaison position can be filled by any faculty member who is currently associated with the Department of Biology.
3) The Biology Faculty Liaison to the intern shall be determined, but this individual will be selected from among the faculty affiliated with the Biology programs.
4) An overall of four contact hours are anticipated with the Faculty Liaison to monitor and provide advice to the intern during their internship.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Work Term Report with employer review or evaluation (100%); Pass or Fail.

Work Term Report will be graded by the supervisor appointed for each student.

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

Given the unique nature of the 0.0 credit course, no academic reading list is applicable.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

Student work terms in internship positions will take place at the employers' work place location;

The Faculty of Science Experiential Education Coordinator will provide assistance to students to connect them to potential employers. The course will only be offered in years when this position (The Faculty of Science Experiential Education Coordinator or an equivalent position) is filled.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

The industrial experience provided by the internship program can broaden students' knowledge and let them apply their knowledge into real applications. The internship experience can boost their chance of finding future employment.

Expected enrollment: 4-6 students/year.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science
Department: Indicate department and course prefix (e.g. Languages, GER)	Biology (BIOL)
Date of Submission:	
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	BIOL 3171
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3.00
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Population Ecology
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Population Ecology

With every new course proposal, it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters
(approximately 300 words including spaces and punctuation).

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

Using lectures and labs, this course explores the dynamic and changing field of population ecology, focusing primarily on demographic traits of populations and patterns of population growth and change. Topics to be investigated include temporal and spatial dynamics of populations; constraints on the distributions of populations; patterns of population growth and regulation; density dependence and density independence; vital statistics and life history biology; age and sex structure of populations; meta-populations and dispersal; and the genetic attributes of populations.

Labs provide experiential exposure to several of the topics developed in lectures.

Two lecture hours and three lab hours per week.

Pre-requisites: SC/BIOL 2050 4.00 and SC/BIOL 2060 3.00

Course Credit Exclusion: SC/BIOL 3170 3.00

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

A. Course Outcomes and Learning Objectives

By the end of this course, students will be able to:

Area 1. Fundamental Understanding:

- Use terminology appropriate to the field of population ecology
- Distinguish different models of growth
- Recognize the main parameters and major formulae for modelling population growth
- Derive the formula and employ the formula for mark-recapture analysis
- Distinguish between r- and K-selected traits and connect them to life history strategies and growth patterns
- Apply the principles of population ecology to issues of conservation
- Interpret population patterns in terms of evolutionary selective forces and evolutionary mechanisms applicable to small populations
- Contrast different forces generating patterns of dispersal and spatial distribution
- Employ genetic tools to study population processes
- Extend population ecology fundamentals to the concept of meta-populations
- Apply population ecology principles to wildlife management challenges
- Use natural history knowledge

Area 2. Critical Thinking Skills

- Employ case studies as exemplars of biological concepts
- Draw generalized concepts from the results of particular scientific studies or experiments (inductive reasoning)
- Present arguments that explain evolutionary phenomena such as life history trait diversity
- Apply course content to new data sets
- Employ metaphors for conveying the principles of population ecology
- Assess the effectiveness of experimental designs in answering questions about population dynamics

Area 3. Problem Solving Skills

- Apply principles from the scientific literature to new fact situations
- Employ diverse field or lab methods for collecting data that are sought to address particular demographic questions

Area 4. Effective Communication

- On tests and exams, clearly construct written answers to questions and clearly construct written explanations or arguments for scenarios or fact situations
- In a mock conference format, present and defend research analyses

Area 5. Lab and Field Skills

- Execute procedures determined to collect data to test an hypothesis related to population ecology
- Analyze lab- or field-generated data in order to evaluate a population ecology hypothesis
- Summarize the findings from lab or field studies and communicate orally or in writing

B. Selected Topics by Week

In each week, case studies are to exemplify theoretical analyses.

Week #1 - Review of key tools
Introductory material includes a primer based on broad learning outcomes from second-year Ecology that are key to the sub-discipline of Population Ecology. This review includes the principles of natural selection, a summary of the concept of ecological scales, as well as a review of the ecology lexicon as it relates to Population Ecology.

Week #2 - Life history biology - 1
Life history biology sets Population Ecology in an evolutionary framework. Survival and reproductive challenges involve trade-offs that are reflected in population attributes. The trade-offs include reproduction versus survival, as well as current versus future reproduction.

Week #3 – Life history biology – 2
Life history evolution is a response to variation in the environment, as well as opportunities in complex communities. Life history analysis considers key attributes of species that affect population growth and structure, including age at maturity, relative investment in size and number of offspring, and life history attributes that affect population recruitment.

Week #4 - Distribution and spatial structure of populations
Populations are limited by ecologically suitable habitats, and niche modelling is used to assist in predicting these spatial patterns. Social interactions also affect the dispersion of species, including periods of dispersal by recruits into populations.

Week #5 - Population growth
Growth usually begins with exponential growth as an unregulated pattern of growth based on density independence and evolutionary principles. This is followed with the introduction of density dependence and the consequent development of logistic growth and the sigmoid growth curve. This pattern is then connected back to Life History biology.

Week #6 - Working with Life Tables
Life tables are introduced as a tool for analyzing population age structure and sex structure. Using vital statistics including data related to birth and death rates, these tables are used to generate age structure "pyramids", and they are also used to calculate population parameters including the intrinsic rate of increase, rate of survivorship, rate of mortality, recruitment success, and generation time.

Week #7 – Populations whose size cycles on a regular basis
One feature of some populations, especially at high latitudes, is that the population size vacillates on a regular basis between very high and very low densities. The natural history of such organisms is considered, as are the drivers and regulators of these cyclic patterns.

Week #8 - Patterns of Dispersal
Populations fluctuate around a carrying capacity, and when populations exceed the carrying capacity, juveniles are challenged to find a place in the population. One significant option for juveniles is dispersal, although that has attendant risks which may vary with sex. Dispersal patterns link sub-populations and also effect range growth when conditions are favourable.

Week #9 - Structure of populations
Age structure is influenced by life history biology and in turn it influences diverse aspects of demography, including population growth rate. Sex structure is sometimes minimal, but in many cases where there are drivers of uneven sex ratios, sex structure has important population implications. Genetic structure of populations varies with patterns of dispersal and with the degree of connection between sub-populations.

Week #10 – Sub-population considerations
Meta-populations are discrete sub-populations linked by movements of individuals, and they display various degrees of linkage depending upon landscape features and inherent powers of dispersal. Meta-populations are usually characterized as being "patchy", and this leads to an analysis of sources, sinks, and traps.

Week #11 – Challenges for small populations
Small populations are subject to unique challenges related to stochastic processes and to genetic constraints associated with low diversity, including the risks associated with inbreeding. Allee Effects are considered in contrast to density dependence. Genetic tools are employed to assist in the analysis of small population viability.

Week #12 – Special topics in Population Ecology
This material is likely to vary from offering to offering. Two examples are: (a) Special considerations for the population regulation of migrants, and (b) The impact of territoriality and other social factors on population regulation.

Laboratories

Labs are designed to develop practical skills in the analysis of key population ecology concepts and will cover the following topics:

1. *Population dispersal* using mark-recapture methodologies. *Cepaea* snails on or near campus can be used effectively to generate a dataset by the students, using two sequential weeks in the field. (3 weeks)

2. *Population growth and regulation* using a virtual lab designed by SimBio. (1 week)

3. *Density dependence and density independence* using Seed Beetle *Vigna radiata* propagation in the lab over the semester. (4 weeks, interspersed among other labs)

4. *Vital statistics and life history biology* using gravestone information from Beechwood Cemetery on Jane Street. (2 weeks)

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course supports the achievement of learning objectives by means of face-to-face communication with the Course Director during lecture hours and with TAs during weekly lab sessions. Lectures may be designed on, or partly on, a flipped classroom model. The use of case studies in lecture material, as well as supplemental articles provided on a course website, will supplement the theoretical material. Lab sessions will include collaborative work among peers and will collectively constitute classroom-focused experiential education.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1. This 3-credit, 12-week course will be offered once a year, preferably in the fall or winter term, but preferably not in the same term as BIOL 3172 3.00 *Community Ecology*, which is a companion course.

2. This course could be taught by at least three faculty members.

3. Dr. Alex Mills has taught the parent course, BIOL 3170 *Population and Community Ecology*, several times, including once (2011-12) when it was *Population Ecology* only. Dr. Mark Vicari has also taught the parent course multiple times, including as recently as the Fall of 2019. Dr. Birgit Schwarz was hired in the Biology Department in 2019, and she would also have the depth of experience to teach *Population Ecology*. Finally, there is a current search (2019-20) for a new Field Biology hire in the Department of Biology, and it is highly likely that that person could teach *Population Ecology*.

4. Two lecture hours per week and three lab hours per week, as well as at least one office hour per week for the Course Director.

5. On average, students will be required to do about two hours of preparation per week for each class.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery, please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Assessment Breakdown

15% Midterm 1
15% Midterm 2
10% In-class activities (personal response systems, worksheets, mini-quizzes, 1-minute presentations, etc.)
30% Laboratories
30% Final Exam

Mid-term tests and the Final Exam will be invigilated written exams composed primarily of questions requiring either short written answers or more substantive long written answers. They may also include some multiple choice questions. Exams will be designed to thoroughly assess students' depth and breadth of knowledge of the course topics, including the assessment of outcomes set out in Areas 1 through 4 in the Course Outcomes and Learning Objectives, above. Demonstration of comprehension, analysis, and application of concepts will be assessed by longer-answer questions.

In-class activities will incentivize and enhance student engagement and participation, providing opportunities to practice listening, self-discipline, collaboration, analysis, and effective communication in real time. They support all of the learning objectives.
Labs will typically involve multiple week research-based work; for instance, setting up the data collection system in the first week, collecting data in the second week, and pooling and analyzing data in the third week. Lab grades will be based on execution, effective collaboration, analysis, written, oral, and poster presentation, and indirectly for time management skills.

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

There are numerous comprehensive textbooks for Population Ecology, should the Course Director choose to include a course text. Some Course Directors might use such a text as a required text, while for others, it may be recommended, or several copies could be purchased and placed on Library Reserve. Here are two examples of such texts:

Rockwood, L.L. 2015. *Introduction to Population Ecology, 2nd ed.* Wiley-Blackwell, 378 pp.

Vandermeer, J.H. and D.E. Goldberg. 2013. *Population Ecology: First Principles, 2nd ed.* Princeton University Press, 288 pp.

It is highly likely that the Course Director will provide readings mounted on the course website. These would include examples from the primary literature, especially peer-reviewed research articles that would constitute case studies. At times, the predecessor course, BIOL 3170, was taught using such primary resources. For example:

Bossuyt, B. 2017. Genetic rescue in an isolated meta-population of a naturally fragmented plant species, *Parnassia palustris*. *Conservation Biology* 21(3): 832.

Brashares, J.S., J.R. Werner, and A.R.E. Sinclair. 2010. Social "meltdown" in the demise of an island endemic: Allee effects and the Vancouver Island marmot. *Journal of Animal Ecology* 79: 965.

Cooper, N.W., et al. 2009. Density-dependent age at first reproduction in the eastern kingbird. *Oikos* 118: 413.

Garland, T. 2014. Trade-offs. *Current Biology* 24(2): R60.

Jorgensen, C., et al. 2007. Managing evolving fish stocks. *Science* 318 (Nov 23): 1247-1248.

Monaghan, P. and R.G. Nager. 1997. Why don't birds lay more eggs? *Trends in Ecology and Evolution* 12(7): 270.

Patrick, D.A. et al. 2008. Terrestrial habitat selection and strong density-dependent mortality in recently metamorphosed amphibians. *Ecology* 89(8): 2563.

Sillett, T.S. and R.T. Holmes. 2002. Variation in survivorship of a migratory songbird throughout its annual cycle. *Journal of Animal Ecology* 71: 296.

Wauters, L.A., et al. 2004. Within-sex density dependence and population dynamics of red squirrels *Sciurus vulgaris*. *Journal of Animal Ecology* 73: 11.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

This course does not require resources outside of (a) classroom space, (b) laboratory space, and (c) TA hours to run the labs. This course (BIOL 3171 3.00) is one of two courses intended to replace the current course BIOL 3170 3.00, which has two hours of lecture and three hours of labs, just as this one proposes. The second course to replace BIOL 3170 is BIOL 3172 3.00. It will not have a lab, so the net additional burden on lab facilities and lab TA hours by replacing BIOL 3170 with BIOL 3171 and BIOL 3172 is zero.

There will, however, be tutorial TA hours in the BIOL 3172 course, so there will be a net increase in TA hours when comparing 3170 with the 3171 / 3172 pair.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

There is a two-part rationale for proposing a *Population Ecology* course.

The first part is that the number of ecology-evolution offerings at the senior level at York is relatively small. Students sometimes report that they have difficulty finding enough options to complete their degree programs. When compared with other Ontario universities with robust ecology-evolution programs, York falls short in terms of offering courses in a variety of ecology sub-disciplines (e.g. Population, Community, Behavioural, Ecosystem). The existing BIOL 3170 3.00 *Population and Community Ecology* is our only active ecology sub-discipline course.

Second, it is unusual to cover both *Population Ecology* and *Community Ecology* in a single one-semester course. The subjects are really too large to be covered in this way at the 3000-level.

So, by replacing BIOL 3170 3.00 *Population and Community Ecology* with BIOL 3171 3.00 *Population Ecology* (this proposal) and BIOL 3172 3.00 *Community Ecology* (a companion proposal), we are according a more appropriate number of credits for the two subjects (6, rather than 3) and simultaneously, we are offering more options for students in the following: (a) Biology, who are pursuing an ecology-evolution curriculum, (b) Environmental Biology, and (b) Environmental Science in the existing life sciences stream or in the proposed conservation science stream.

The expected enrolment cap in this course is 72 students, which will allow for three lab sections. In fall 2019, there are two lab sections in BIOL 3170, although in the past there have been cases with three lab sections.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

FS Resource Implications Form **Unit:** _____ **Date:** _____

		Course(s) Created X or Modified to □ (check one)		Course(s) Retired □ or Modified from □
Complete Course Designation		**Population Ecology BIOL 3171 3.00**		
Enrolment (Estimate)		72		
Number of:	**Lecture Sections:**	One		
	Lab Sections:	Two (48 or fewer students) or three (48 to 72 students)		
	Tutorial Sections:	None		
Number of:	**Course Coordinators (Tutor 1):**	None		
	Lab Demonstrators (Tutor 2):	Three (approximately 200 hours total)		
	Mark/Graders (Tutor 3):	One, if enrollments exceed 50 students		
Prerequisites (P) Corequisites (C) Credit Exclusions (E)		BIOL 2050 4.00 Ecology (P) BIOL 2060 3.00 Statistics for Biologists (P) BIOL 3170 3.00 Population & Community Ecology 3.00 (E)		
For which degree program is this required (if applicable)?		Not required, but will be 3000-level science credits in Biology, Environmental Biology, and likely Environmental Science (Conservation stream)		
Other resource implications (please specify)		This course is one of two courses intended to replace the current course BIOL 3170 3.00, which has two hours of lecture and three hours of labs (2 or 3 sections), just as this one (BIOL 3171) proposes.		
Reason(s) for creation/ modification/ retirement		Currently, we teach population and community ecology in one 3-credit course with 2 lecture hours and 3 lab hours (BIOL 3170). If the two new courses are approved, we will teach the material in two 3-credit courses with 5 lecture hours (total), 3 lab hours (BIOL 3171)) and one tutorial hour (BIOL 3172). This will improve content outcomes and will double the number of choices for students interested in this area. Most universities treat these two subjects in two separate courses (e.g. Toronto, Western, Guelph).		

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science
Department: Indicate department and course prefix (e.g. Languages, GER)	Biology (BIOL)
Date of Submission:	
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	BIOL 3172
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3.00
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Community Ecology
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Community Ecology

With every new course proposal, it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters
(approximately 300 words including spaces and punctuation).

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

Using lectures and tutorials, this course explores the many ways that species interact over diverse spatial and temporal scales. Major themes include scales of interaction; mutualistic and antagonistic relationships; communities as co-evolved relationships; community assembly, structure, and stability; responses to disruptions; ecological succession; measures of diversity; and methods for assessing the correlation between animal species distributions with plant species distributions.

Three lecture hours and one tutorial hour per week.

Pre-requisites: SC/BIOL 2050 4.00 and SC/BIOL 2060 3.00

Course Credit Exclusion: SC/BIOL 3170 3.00

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

A. Course Outcomes and Learning Objectives

By the end of this course, students will be able to:

Area 1. Fundamental Understanding:

- Use terminology appropriate to the field of community ecology
- Contrast antagonistic and mutualistic species interactions
- Differentiate among consumption (predation, herbivory, parasitism), competition, mutualism, and commensalism
- Building upon growth models for populations, develop mathematical models that incorporate the effects of other species on population growth, such as Lotka-Volterra formulae
- Recognize key conceptual ideas central to Community Ecology, such as the competitive exclusion principle
- Using fundamental principles from evolutionary biology, demonstrate an understanding of co-evolution, including the identification of biotic factors as selective forces
- Demonstrate a knowledge of the effects of other species on population dynamics
- Apply the principles of community ecology to issues of conservation
- Distinguish between the view that community development is random, as in Hubbell's Neutral Theory of Biodiversity, and the view that communities develop in a predictable, orderly manner
- Identify and contrast different types of community succession, including the events that trigger succession
- Compare the effects on community structure when disturbances are minor and infrequent on one hand, and major and recurrent on the other
- Apply community ecology principles to wildlife management challenges
- Use natural history knowledge

Area 2. Critical Thinking Skills

- Employ case studies as exemplars of community ecology concepts
- Draw generalized concepts from the results of particular scientific studies or experiments (inductive reasoning)
- Present arguments that explain evolutionary phenomena such as co-evolutionary consequences of long-term species interactions
- Apply course content to new data sets
- Employ metaphors for conveying the principles of community ecology
- Assess the effectiveness of experimental designs in answering questions about ecological succession or the debate between neutral and non-random mechanisms of community development

Area 3. Problem Solving Skills

- Accept a position regarding a contentious theory in community ecology and formulate the argument in favour of that position
- Apply principles from the scientific literature to new fact situations
- Consider diverse field or lab methods for collecting data and apply appropriate methodologies to particular questions related to community ecology

Area 4. Effective Communication

- On tests and exams, clearly construct written answers to questions and clearly construct written explanations or arguments for scenarios or fact situations
- In tutorials, effectively summarize information verbally and facilitate discussion
- In tutorials, effectively defend a position regarding a principle of community ecology, including assembling research in support

Area 5. Analytical Skills

- Analyze data generated in community ecology research in order to reveal patterns of interaction or influence
- Apply multivariate statistics to community ecology datasets

B. Selected Topics by Week

Each week, case studies are used to exemplify theoretical analyses. Tutorials focus on particular questions related to lecture material for that week, or on case studies that are useful in the analysis of community ecology concepts or controversies.

Week #1 - Review of fundamentals and introduction
Introductory material includes a primer reviewing key concepts from second-year Ecology that are key to the sub-discipline of Community Ecology, including models of community structure and categories of species interactions. Properties of communities and interacting processes are introduced. Week 1 also includes a geography summary to facilitate understanding that relies on large spatial scales.

Week #2 – Interspecific competition 1
Contrasting intraspecific competition, interspecific competition is modelled. Direct and indirect classes of competition are contrasted, including the concepts of interference and exploitative competition. Asymmetric

competition, scramble competition, resource partitioning, and the competitive exclusion principle are investigated.

Week #3 – Interspecific Competition 2
Interspecific competition is a large subject, and the continuation of its treatment includes a thorough consideration of guilds, including guild structure in niche space. Local extinction and re-contact are also treated, as is the impact of life history traits on competitive ability. Finally, competition attributes in marine, freshwater, and terrestrial systems are compared.

Week #4 – Consumption 1
Predation, herbivory, and parasitism are compared and contrasted. Examples from marine, freshwater, and terrestrial environments are considered. Topics that are investigated include inducible defenses, trade-offs between competitive efficiencies and consumption defenses, functional response, and examples from cases of biological control. The Lotka-Volterra equations are constructed.

Week #5 – Consumption 2
Trophic interactions and food webs are the broad topics for Week 5. Food web models and experiments are reviewed. Top-down and bottom-up arguments about regulation are reviewed. Topics that are investigated are specialist-generalist considerations, omnivory, interaction strength, intraguild predation, predation that generates apparent competition, trophic cascades, and web resilience.

Week #6 – Mutualism
Types of mutualisms are reviewed, and are distinguished from commensalisms. Indirect and direct mutualisms are contrasted, as are obligate and facultative mutualisms. Special attention is given to nutritional or energetic mutualism. Pollination systems are used as a case study to illustrate diverse attributes of mutualistic relationships.

Week #7 – Spatial scale
Relationships among species operate on different spatial scales and the dynamics vary accordingly. Communities are usually considered on small spatial scales, such as in the context of habitat selection, but metacommunities constitute another level of consideration. Patchy or fragmented landscapes affect species interactions differently from contiguous landscapes. The island biogeography model is introduced for later development. Macroecology is introduced as a sub-discipline used to explain statistical patterns of abundance, distribution, and diversity.

Week #8 – Temporal scale in real time
Temporal scale is investigated through a variety of related sub-topics: Ephemeral and seasonal communities, special problems faced by migrant communities (e.g. temperate-tropical resource competition), Holling patterns of predator-prey relations, community responses to invasive aliens, and the relationship between life history traits and community stability.

Week #9 – Temporal scale in evolutionary time
The role of species interactions in evolutionary time is investigated by considering biological agents as selective forces. Both antagonistic and mutualistic species interactions are considered as players in generating co-evolutionary patterns. Current phenotypic patterns are considered in light of past selective environments (e.g., character displacement). Drivers of latitudinal gradients in community diversity are considered.

Week #10 – Community measurement
Communities are characterized on the basis of composition (species), structure, or function (roles and processes). There are many methods for determining community diversity based on species and relative abundance. Richness, diversity, and evenness are employed using case studies, and one or more index of diversity (e.g. Shannon Index or Simpson Index) is developed. We also distinguish among alpha, beta, and gamma diversity. Multivariate statistical tools are introduced.

Week #11 – Plant succession
The study of plant succession has had an interesting history which is where this section begins. It moves on to consider the following topics: priority effects, assembly rules, neutral theory of biodiversity, island biogeography model, case studies (fire succession, post-glacial succession, e.g.), disturbance-dependent communities, and effects on animals.

Week #12 – Applied Community Ecology
Most communities have been dramatically affected by anthropogenic changes and this is the concluding subject of the course. Wildlife management in the community context, community restoration, optimal design for community preservation, biocontrol of invasive species, and management of multispecies fisheries are among the possible subjects.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course supports the achievement of learning objectives by means of face-to-face communication with the Course Director during lecture hours and with TAs during weekly tutorials. Lectures may be designed on, or partly on, a flipped classroom model. The use of case studies in lecture material, as well as supplemental articles provided on a course website, will supplement the theoretical material. Tutorials will focus on particular issues related to the lecture material for the same week, and students will take turns leading and presenting material during tutorial sessions.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1. This 3-credit, 12-week course will be offered once a year, preferably in the fall or winter term, but preferably not in the same term as BIOL 3171 3.00 *Population Ecology*, which is a companion course.

2. This course could be taught by at least three faculty members.

3. Dr. Alex Mills has taught the parent course, BIOL 3170 *Population and Community Ecology*, several times. Dr. Mark Vicari has also taught the parent course multiple times, including as recently as the Fall of 2019, and his area of research historically has been in community ecology. Dr. Birgit Schwarz was hired in the Biology Department in 2019, and she would also have the depth of experience to teach *Community Ecology*. Finally, there is a current search (2019-20) for a new Field Biology hire in the Department of Biology, and it is highly likely that that person could also teach *Community Ecology*.

4. Three lecture hours per week and one one-hour tutorial per week, as well as at least one office hour per week for the Course Director.

5. On average, students will be required to do about two hours of preparation per week for each class.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Assessment Breakdown

15% Midterm Test 1
15% Midterm Test 2
15% In-class activities (personal response systems, worksheets, mini-quizzes, 1-minute presentations, etc.)
25% Tutorials
30% Final Exam

Mid-term tests and the Final Exam will be invigilated written exams composed primarily of questions requiring either short written answers or more substantive long written answers. They may also include some multiple choice questions. Exams will be designed to thoroughly assess students' depth and breadth of knowledge of the course topics, including the assessment of outcomes set out in Areas 1 through 4 in the Course Outcomes and Learning Objectives, above. Demonstration of comprehension, analysis, and application of concepts will be assessed by longer-answer questions.

In-class activities will incentivize and enhance student engagement and participation, providing opportunities to practice listening, self-discipline, collaboration, analysis, and effective communication in real time. They support all of the learning objectives.

Tutorial sessions will be based on assigned readings such as peer-reviewed papers or opinion pieces on some subject where there are diverse opinions (e.g. the neutral theory of biodiversity). Students will be expected to participate in all tutorial discussions (i.e. weekly) and participation will therefore form part of the grade (10%). However, there will be one or more cases where a student (1/2 hour), or pairs of students (whole hour), will lead the session by presenting a summary of the subject material and by facilitating group discussion (15%).

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

There are numerous comprehensive textbooks for Community Ecology, should the Course Director choose to include a course text. Some Course Directors might use such a text as a required text, while for others, it may be recommended, or several copies could be purchased and placed on Library Reserve. Here are two examples of such texts:

Morin, P.J. 2011. Community Ecology, 2nd Ed. Wiley-Blackwell, 418 pp.

Mittelbach, G.G., and B.J. McGill. 2019. Community Ecology, 2nd ed. Oxford University Press, 448 pp.

It is highly likely that the Course Director will provide readings mounted on the course website. These would include examples from the primary literature, especially peer-reviewed research articles that would constitute case studies. (At times, the predecessor course, BIOL 3170, was taught using such primary resources.) For example:

Boettner, G.H., J.S. Elkinton, and C.J. Boettner. 2010. Effects of a biological control introduction on three nontarget native species of Saturniid moths. *Conservation Biology* 14(6): 1798.

Faillace, C.A., and P.J. Morin. 2019. Evolution alters post-invasion temporal dynamics in experimental communities. Journal of Animal Ecology 88:TBD.

McCauley, S.J., L. Rowe, and M.-J. Fortin. 2011. The deadly effects of "non-lethal" predators. *Ecology* 92(11): 2043.

Moeller, H.V., M.G. Neubert, and M.D. Johnson. 2019. Intraguild predation enables coexistence of competing phytoplankton in a well-mixed water column. Ecology 100:TBD.

Reebs, S. 2009. Shrew Loo. *Natural History*, Sept. 2009, p. 10.

Shea, K., and P. Chesson. 2002. Community ecology theory as a framework for biological invasions. *Trends in Ecology and Evolution* 17(4): 170.

Sugio, A., et al. 2011. Phytoplasma protein effector SAP11 enhances insect vector reproduction by manipulating plant development and defense hormone biosynthesis. *Proceedings of the National Academy of Science, USA* 108(48) :E1254.

Violle, C., et al. 2012. The return of variance: intraspecific variability in community ecology. *Trends in Ecology and Evolution* 27(4): 244.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

This course does not require resources outside of (a) classroom space and (b) TA hours to run and grade the tutorial sessions. Assuming there are three tutorials per week (one contact hour each), TA hours are estimated to be 135, covering preparation, contact hours, and grading.

This course (BIOL 3172 3.00) is one of two courses intended to replace the current course BIOL 3170 3.00, which has two hours of lecture and three hours of labs. The second course to replace BIOL 3170 is BIOL 3171 3.00, which also has two lecture hours and one 3-hour lab per week. So, the net additional burden on lab facilities by replacing BIOL 3170 with BIOL 3171 and BIOL 3172 is zero, although there will be an increased requirement for TA hours.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

There is a two-part rationale for proposing a *Community Ecology* course.

The first part is that the number of ecology-evolution offerings at the senior level at York is relatively small. Students sometimes report that they have difficulty finding enough options to complete their degree programs. When compared with other Ontario universities with robust ecology-evolution programs, York falls short in terms of offering courses in a variety of ecology sub-disciplines (e.g. Population, Community, Behavioural, Ecosystem). The existing BIOL 3170 3.00 *Population and Community Ecology* is our only active ecology sub-discipline course.

Second, it is unusual to cover both *Population Ecology* and *Community Ecology* in a single one-semester course. The subjects are really too large to be covered in this way at the 3000-level.

So, by replacing BIOL 3170 3.00 *Population and Community Ecology* with BIOL 3172 3.00 *Community Ecology* (this proposal) and BIOL 3171 3.00 *Population Ecology* (a companion proposal), we are according a more appropriate number of credits for the two subjects (6, rather than 3) and simultaneously, we are offering more options for students in the following areas: (a) Biology, who are pursuing an ecology-evolution curriculum, (b) Environmental Biology, and (b) Environmental Science in the existing life sciences stream or in the proposed conservation science stream.

The expected enrolment cap in this course is 72 students, which will allow for three 24-person tutorial sections.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

FS Resource Implications Form **Unit: Biology** **Date: November 26, 2019**

		Course(s) Created X or Modified to ☐ (check one)		Course(s) Retired ☐ or Modified from ☐
Complete Course Designation		**Community Ecology BIOL 3172 3.00**		
Enrolment (Estimate)		72		
Number of:	**Lecture Sections:**	One		
	Lab Sections:	None		
	Tutorial Sections:	Two or three		
Number of:	**Course Coordinators (Tutor 1):**	Tutorial leaders (approximately 135 hours total)		
	Lab Demonstrators (Tutor 2):	None		
	Mark/Graders (Tutor 3):	One, if enrollments exceed 50 students		
Prerequisites (P) Corequisites (C) Credit Exclusions (E)		BIOL 2050 4.00 Ecology (P) BIOL 2060 3.00 Statistics for Biologists (P) BIOL 3170 3.00 Population & Community Ecology 3.00 (E)		
For which degree program is this required (if applicable)?		Not required, but will be 3000-level science credits in Biology, Environmental Biology, and likely Environmental Science (Conservation stream)		
Other resource implications (please specify)		This course is one of two courses intended to replace the current course BIOL 3170 3.00, which has two hours of lecture and three hours of labs (2 or 3 sections). BIOL 3171 will have that same structure. BIOL 3172 will be three lecture hours and one tutorial hour per week.		
Reason(s) for creation/ modification/ retirement		Currently, we teach population and community ecology in one 3-credit course with 2 lecture hours and 3 lab hours. If the two new courses are approved, we will teach the material in two 3-credit courses with 5 lecture hours (total), 3 lab hours (BIOL 3171) and one tutorial hour (BIOL 3172). This will improve content outcomes and will double the number of choices for students interested in this area. Most universities treat these two subjects in two separate courses (e.g. Toronto, Western, Guelph).		

Non-Major Modification Program Changes

1. Programs:
   Biology, iBSc Biology
   Environmental Biology

2. Degree Designation:
   BSc Biology (Bachelor)
   Specialized Honours Biology;
   Specialized Honours Biology, Biomedical Science Stream;
   Specialized Honours Biology, Biotechnology Stream;
   Honours Major Biology;
   Honours Major Biology; Biomedical Science Stream
   Honours Major/Minor with Biology major;
   Honours Major/Minor with Biology major, Biomedical Science Stream;

   iBSc Specialized Honours Biology
   iBSc Honour Major Biology
   iBSc Honour Major Biology, Biomedical Science Stream
   iBSc Honours Major/Minor, Biology Major
   iBSc Honours Major/Minor, Biology Major, Biomedical Science Stream

   BSc Environmental Biology (Bachelor)
   BSc Honours Major Environmental Biology
   BSc Honours Double Major Environmental Biology
   BSc Honours Major/Minor, Environmental Biology Major

3. Type of Modification: update of General Education requirements

4. Effective Date: FW20

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5. State what the changes are

   update to Physics requirement to specifically include newer and equivalent course versions

6. Provide the rationale for the proposed changes that is rooted in the program learning outcomes.

   no effect on learning outcomes

7. Provide an updated mapping of the program requirements to the program learning outcomes to illustrate how the proposed requirements will support the achievement of program learning objectives.

no change in mapping

8. If relevant, summarize the consultation undertaken with relevant academic units, including commentary on the impact of the proposed changes on other programs. Provide individual statements from the relevant program(s) confirming consultation and their support.

9. Describe any resource implications and how they are being addressed (e.g., through a reallocation of existing resources). If new/additional resources are required, provide a statement from the relevant Dean(s)/Principal confirming resources will be in place to implement the changes.

   none

10. Provide a summary of how students currently enrolled in the program will be accommodated.

    Current students will be able to use the newer Physics courses to meet their General Education and Science Breadth degree requirements.

11. Provide as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar.

    (see following pages)

IOLOGY
ROGRAM

Change From:	Change To:
The program core (24 credits) is defined as: • SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00; • SC/BIOL 2070 3.00 or any three of SC/BIOL 2010 4.00, SC/BIOL 2030 4.00, SC/BIOL 2050 4.00. Both SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 may replace one of these three biology courses; • additional courses from the following for a total of at least 18 2000-level credits: SC/BIOL 2010 4.00, SC/BIOL 2020 3.00, SC/BIOL 2021 3.00, SC/BIOL 2030 4.00, SC/BIOL 2040 3.00, SC/BIOL 2050 4.00, SC/BIOL 2060 3.00, SC/BIOL 2070 3.00, both SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00. **Bachelor Program** A. General education: • non-science requirement: 12 credits; • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: ~~six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020	The program core (24 credits) is defined as: • SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00; • SC/BIOL 2070 3.00 or any three of SC/BIOL 2010 4.00, SC/BIOL 2030 4.00, SC/BIOL 2050 4.00. Both SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 may replace one of these three biology courses; • additional courses from the following for a total of at least 18 2000-level credits: SC/BIOL 2010 4.00, SC/BIOL 2020 3.00, SC/BIOL 2021 3.00, SC/BIOL 2030 4.00, SC/BIOL 2040 3.00, SC/BIOL 2050 4.00, SC/BIOL 2060 3.00, SC/BIOL 2070 3.00, both SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00. **Bachelor Program** A. General education: • non-science requirement: 12 credits; • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420

3.00 and SC/CHEM 2020 3.00) ~~or~~ SC/PHYS 1410 6.00, SC/PHYS 1420 6.00 ~~or~~ SC/PHYS 1010 6.00.	6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00**.
...	...
Honours Programs	**Honours Programs**
SPECIALIZED HONOURS PROGRAM	**SPECIALIZED HONOURS PROGRAM**
Students may follow a stream in biology, biomedical science or biotechnology.	Students may follow a stream in biology, biomedical science or biotechnology.
A. General education:	A. General education:
• non-science requirement: 12 credits; • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: ~~six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00) ~~or~~ SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 ~~or~~ SC/PHYS 1010 6.00. Note that the biomedical science and biotechnology streams require specific courses (see below).	• non-science requirement: 12 credits; • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00**. Note that the biomedical science and biotechnology streams require specific courses (see below).

B. Major requirements: **Biology Stream** • The program core, as specified above (24 credits); • SC/BIOL 3100 2.00, SC/BIOL 4000 8.00 or SC/BIOL 4000 3.00; • additional credits from biology courses, as required for an overall total of at least 68 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level. **Biomedical Science Stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • one of SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 ~~or~~ HH/PSYC 1010 6.00; … **Biotechnology Stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; ~~SC/PHYS 1410 6.00;~~	B. Major requirements: **Biology Stream** • The program core, as specified above (24 credits); • SC/BIOL 3100 2.00, SC/BIOL 4000 8.00 or SC/BIOL 4000 3.00; • additional credits from biology courses, as required for an overall total of at least 68 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level. **Biomedical Science Stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00**; HH/PSYC 1010 6.00; … **Biotechnology Stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • **One of:** SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and**

...	**SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.**
	...
HONOURS MAJOR PROGRAM (BSC) In addition to the Biology Honours Major, students may follow a stream in biomedical science.	**HONOURS MAJOR PROGRAM (BSC)** In addition to the Biology Honours Major, students may follow a stream in biomedical science.
Biology Honours Major A. General education: • non-science requirement: 12 credits; • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: ~~six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00) ~~or~~ SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 or SC/PHYS 1010 6.00. Note that the biomedical science stream requires specific courses (see below).	**Biology Honours Major** A. General education: • non-science requirement: 12 credits; • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.** Note that the biomedical science stream requires specific courses (see below).

B. Major requirements: **Biology stream** • The program core, as specified above (24 credits); • additional credits from biology courses, as required, for an overall total of at least 51 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level. **Biomedical Science Stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • one of SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 ~~or~~ HH/PSYC 1010 6.00; … **HONOURS DOUBLE MAJOR PROGRAM** All Honours BSc degree candidates should consult departmental advisers as early as possible concerning course requirements for particular Honours Double Major programs. Possible subject combinations for Honours Double Major BSc degree programs are	B. Major requirements: **Biology stream** • The program core, as specified above (24 credits); • additional credits from biology courses, as required, for an overall total of at least 51 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level. **Biomedical Science Stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00**; HH/PSYC 1010 6.00; … **HONOURS DOUBLE MAJOR PROGRAM** All Honours BSc degree candidates should consult departmental advisers as early as possible concerning course requirements for particular Honours Double Major programs. Possible subject combinations for Honours Double Major BSc degree programs are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate

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Undergraduate Degree and Certificate Programs section. Students may follow a stream within the Honours Major/Minor program in Biomedical Science (stream requirements are listed under the Biology Honours Major program). This stream may be combined with other approved science minors. A. General education: • non-science requirement: 12 credits; • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: ~~six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00) ~~or~~ SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 ~~or~~ SC/PHYS 1010 6.00. B. Major requirements: **Biology stream** • the program core as specified above (24 credits);	Undergraduate Degree and Certificate Programs section. Students may follow a stream within the Honours Major/Minor program in Biomedical Science (stream requirements are listed under the Biology Honours Major program). This stream may be combined with other approved science minors. A. General education: • non-science requirement: 12 credits; • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.** B. Major requirements: **Biology stream** • the program core as specified above (24 credits);

• additional credits from biology courses, as required, for an overall total of at least 51 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level. • The course requirements for the minor. **Biomedical Science Stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • one of SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00 or HH/PSYC 1010 6.00; ...	• additional credits from biology courses, as required, for an overall total of at least 51 credits from biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level. • The course requirements for the minor. **Biomedical Science Stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00**; HH/PSYC 1010 6.00; ...
INTERNATIONAL BACHELOR OF SCIENCE All Honours iBSc degree candidates must complete an international component in addition to the normal requirements of biology and the BSc. For further information about the international Bachelor of Science, refer to the International Bachelor of Arts and International Bachelor of Science in the Faculty of Science programs of study section. **SPECIALIZED HONOURS IN BIOLOGY (HONOURS IBSC)**	**INTERNATIONAL BACHELOR OF SCIENCE** All Honours iBSc degree candidates must complete an international component in addition to the normal requirements of biology and the BSc. For further information about the international Bachelor of Science, refer to the International Bachelor of Arts and International Bachelor of Science in the Faculty of Science programs of study section. **SPECIALIZED HONOURS IN BIOLOGY (HONOURS IBSC)**

A. General education: • non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component); • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: ~~six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00) ~~or~~ SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 ~~or~~ SC/PHYS 1010 6.00. …	A. General education: • non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component); • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.** …
HONOURS MAJOR PROGRAM (IBSC) Students may follow a stream within the Honours Major program in biomedical science. A. General education: • non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component). • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013	**HONOURS MAJOR PROGRAM (IBSC)** Students may follow a stream within the Honours Major program in biomedical science. A. General education: • non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component).

3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: ~~six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00) ~~or~~ SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 or SC/PHYS 1010 6.00.	• mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00.**
…	…
B. Major requirements:	B. Major requirements:
Biology stream • the program core as specified above (24 credits); • additional credits from biology courses, as required, for an overall total of at least 45 credits from biology courses (42 credits if SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 are chosen in the core);	**Biology stream** • the program core as specified above (24 credits); • additional credits from biology courses, as required, for an overall total of at least 45 credits from biology courses (42 credits if SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 are chosen in the core);
Biomedical Science Stream (iBSc) • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • one of SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 ~~or~~ HH/PSYC 1010 6.00;	**Biomedical Science Stream (iBSc)** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00;

…	• one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00**; HH/PSYC 1010 6.00;
HONOURS MAJOR/MINOR PROGRAM (IBSC) Students may follow a stream within the Honours Major/Minor program in biomedical science (stream requirements are listed under the Biology Honours Major program). This stream may be combined with other approved science minors. A. General Education: • non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component); • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00 • foundational science: ~~six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00), ~~or~~ SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 ~~or~~ SC/PHYS 1010 6.00	… **HONOURS MAJOR/MINOR PROGRAM (IBSC)** Students may follow a stream within the Honours Major/Minor program in biomedical science (stream requirements are listed under the Biology Honours Major program). This stream may be combined with other approved science minors. A. General Education: • non-science requirement: 12 credits (may be satisfied in whole or part by courses in the international component); • mathematics: SC/MATH 1505 6.00, or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00 • foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00;

B. Major requirements: **Biology stream** • the program core as specified above (24 credits); • additional credits from biology courses, as required, for an overall total of at least 45 credits from biology courses (42 if SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 are chosen in the core), including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level; • the course requirements for the minor. **Biomedical science stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • one of SC/PHYS 1410 6.00 ~~or~~ SC/PHYS 1420 6.00 ~~or~~ HH/PSYC 1010 6.00; …	SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00** B. Major requirements: **Biology stream** • the program core as specified above (24 credits); • additional credits from biology courses, as required, for an overall total of at least 45 credits from biology courses (42 if SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 are chosen in the core), including at least 18 credits at the 3000 or higher level, of which at least 12 credits are at the 4000 level; • the course requirements for the minor. **Biomedical science stream** • SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00; • one of SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00**; HH/PSYC 1010 6.00;

ENVIRONMENTAL BIOLOGY PROGRAM **Program Core** The program core (35 or 36 credits) is defined as: • SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00; • SC/ENVB 2050 4.00; • SC/BIOL 2060 3.00; • SC/BIOL 2070 3.00 or SC/BIOL 2010 4.00; SC/BIOL 2030 4.00 (both SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 may replace one of the two 4 credit biology courses); • additional courses as required for a total of at least 18 2000-level credits chosen from the following: o SC/BIOL 2010 4.00, o SC/BIOL 2020 3.00 (cross-listed to: SC/BCHM 2020 3.00), o SC/BIOL 2021 3.00 (cross-listed to: SC/BCHM 2021 3.00), o SC/BIOL 2030 4.00, o SC/BIOL 2040 3.00,	... **ENVIRONMENTAL BIOLOGY PROGRAM** **Program Core** The program core (35 or 36 credits) is defined as: • SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00; • SC/ENVB 2050 4.00; • SC/BIOL 2060 3.00; • SC/BIOL 2070 3.00 or SC/BIOL 2010 4.00; SC/BIOL 2030 4.00 (both SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 may replace one of the two 4 credit biology courses); • additional courses as required for a total of at least 18 2000-level credits chosen from the following: o SC/BIOL 2010 4.00, o SC/BIOL 2020 3.00 (cross-listed to: SC/BCHM 2020 3.00), o SC/BIOL 2021 3.00 (cross-listed to: SC/BCHM 2021 3.00),

○ SC/BIOL 2070 3.00, ○ SC/CHEM 2020 3.00, ○ SC/CHEM 2021 3.00; • SC/ENVB 3001 2.00 (cross-listed to: SC/BIOL 3001 2.00) or SC/ENVB 3001 3.00 (cross-listed to: SC/BIOL 3001 3.00); • SC/ENVB 3170 3.00; • SC/ENVB 4245 3.00 (cross-listed to: SC/BIOL 4245 3.00); • SC/BIOL 4255 3.00 (cross-listed to: ES/ENVS 4111 3.00). **Note:** both SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 are required as prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00 if they are chosen in the program core. **Bachelor Program** A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses; • mathematics: SC/MATH 1505 6.00 or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00;	○ SC/BIOL 2030 4.00, ○ SC/BIOL 2040 3.00, ○ SC/BIOL 2070 3.00, ○ SC/CHEM 2020 3.00, ○ SC/CHEM 2021 3.00; • SC/ENVB 3001 2.00 (cross-listed to: SC/BIOL 3001 2.00) or SC/ENVB 3001 3.00 (cross-listed to: SC/BIOL 3001 3.00); • SC/ENVB 3170 3.00; • SC/ENVB 4245 3.00 (cross-listed to: SC/BIOL 4245 3.00); • SC/BIOL 4255 3.00 (cross-listed to: ES/ENVS 4111 3.00). **Note:** both SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 are required as prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00 if they are chosen in the program core. **Bachelor Program** A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses;

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…	…
Honours Programs **HONOURS MAJOR PROGRAM** A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses; • mathematics: SC/MATH 1505 6.00 or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00. (**Note**: students intending to combine environmental biology with applied mathematics, chemistry, computer science, earth and atmospheric science, mathematics,	**Honours Programs** **HONOURS MAJOR PROGRAM** A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses; • mathematics: SC/MATH 1505 6.00 or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00. (**Note**: students intending

mathematics for education, physics and astronomy or statistics should not take SC/MATH 1505 6.00.); • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: ~~six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00), SC/PHYS 1410 6.00, SC/PHYS 1420 6.00 ~~or~~ SC/PHYS 1010 6.00. **Note:** both SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 are required as prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00 in the program core. ... **HONOURS DOUBLE MAJOR PROGRAM** All BSc Honours degree candidates should consult departmental advisors as early as possible concerning course requirements for particular Honours Double Major programs. Possible subject combinations for BSc Honours Double Major degree programs are listed in the Undergraduate Degree and	to combine environmental biology with applied mathematics, chemistry, computer science, earth and atmospheric science, mathematics, mathematics for education, physics and astronomy or statistics should not take SC/MATH 1505 6.00.); • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00** **Note:** both SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 are required as prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00 in the program core. ... **HONOURS DOUBLE MAJOR PROGRAM** All BSc Honours degree candidates should consult departmental advisors as early as possible concerning course requirements for particular Honours Double Major programs.

Certificate Programs section of the Faculty Rules. A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses: • mathematics: SC/MATH 1505 6.00 or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00. (Note: students intending to combine environmental biology with applied mathematics, chemistry, computer science, earth and atmospheric science, mathematics, mathematics for education, physics and astronomy or statistics should not take SC/MATH 1505 6.00.); • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: ~~six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00), SC/PHYS 1410 6.00, SC/PHYS 1420 6.00 ~~or~~ SC/PHYS 1010 6.00. ...	Possible subject combinations for BSc Honours Double Major degree programs are listed in the Undergraduate Degree and Certificate Programs section of the Faculty Rules. A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses: • mathematics: SC/MATH 1505 6.00 or six credits from SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1025 3.00. (Note: students intending to combine environmental biology with applied mathematics, chemistry, computer science, earth and atmospheric science, mathematics, mathematics for education, physics and astronomy or statistics should not take SC/MATH 1505 6.00.); • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS 1540 3.00; • foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011**

	3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00
HONOURS MAJOR/MINOR PROGRAM	…
An Honours Major in environmental biology may be combined with an Honours Minor in another subject area in a BSc Honours Major/Minor degree program. Possible subject combinations are listed in the Undergraduate Degree and Certificate Programs section of the Faculty Rules.	**HONOURS MAJOR/MINOR PROGRAM**
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• foundational science~~: six credits from~~ SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00), SC/PHYS 1410 6.00, SC/PHYS 1420 6.00 ~~or~~ SC/PHYS 1010 6.00. ...	• foundational science: **one of** SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00 (prerequisites for SC/BIOL 2020 3.00 and SC/CHEM 2020 3.00); SC/PHYS 1410 6.00; SC/PHYS 1420 6.00; SC/PHYS 1010 6.00; **SC/ISCI 1310 6.00; SC/PHYS 1411 3.00 and SC/PHYS 1412 3.00; SC/PHYS 1421 3.00 and SC/PHYS 1422 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00; SC/ISCI 1301 3.00 and SC/ISCI 1302 3.00** ...

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Faculty of Science
Department: Indicate department and course prefix (e.g. Languages, GER)	BIOL
Date of Submission:	Sept. 9, 2019
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	3380
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3.0
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Sensory Systems
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Sensory Systems

With every new course proposal, it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters
(approximately 300 words including spaces and punctuation).

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

This course explores sensory systems in humans, animals and machines, and how they are used to control action, behavior and physiological state.

Students learn about the various ways in which an agent can exploit physical energies such as light, sound, and chemical signals to serve their species-specific needs. Adopting a comparative approach, the course focuses on highly specialized sensory systems and unusual, often surprising solutions to sensory challenges.

Sensory systems are explored with respect to the function, the principles of the underlying information processing, and their physiological implementation in the organism. To understand the value of specialized sensory systems, the course also discusses the context in which sensory systems are used, and the constraints that may limit their evolution.

Technical solutions to sensory problems in robotics are discussed and compared to those invented by natural evolution.

Theories covered include Bayesian Inference, Ideal Observer Theory, and Control Theory. Discussion of original literature and examples that showcase the reality of empirical science are used whenever appropriate.

Prerequisites: BIOL 3060 4.0 or PSYC 2220 3.0

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

This course explores sensory systems in humans, animals and machines, and how they control action, behavior and physiological state. Adopting a comparative approach, we focus on highly specialized sensory systems and unusual, often surprising solutions to sensory challenges.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

This course looks at specialized sensory systems of agents, such as humans, animals, and machines. Its aim is to explore the sensory mechanisms themselves, but also the functions they fulfill. Each sensory system may be approached on three levels of analysis:

- Functional: What is the specific problem an agent is faced with?
- Algorithmic: What are the principles and constraints that frame a solution?
- Implementation: How is the solution obtained (evolution) and implemented (physiology)?

In that context, Bayesian Inference, Signal Detection Theory, and Control Theory will be explored. The agent's interaction with the world that eventually provide the nervous system with a representation that becomes the agent's "reality" are discussed.

In this course, students develop specialized knowledge in sensory systems of humans, animals, and machines, providing the foundation for subsequent more advanced courses and potential thesis work.

1) Potential topics include:

Visual acuity
- What limits visual acuity?
- What are the different ways to form an image?
- Discussion of various types of eyes

Eye movements
- Types and functions of eye movements
- Sensorimotor control of eye movements
- Active vision: Movements of eye, head, and body

Stereopsis and motion parallax
- Binocular fusion and the control of vergence
- Cue integration for depth perception
- Motion parallax and stereopsis in virtual reality

Colour vision
- Colour vision systems in mammals, birds and invertebrates
- Colorimetry

Polarization vision
- Navigation in bees and ants
- Polarization detectors in the eye

Magnetoreception
- Theories of magnetoreception
- Magnetoreception in migrating birds

Directional hearing
- The various ways to detect the direction of a sound

Echolocation
- Physics of echolocation
- Echolocation in bats, cetaceans, and humans

Tactile specialists
- Tactile foveation in the star-nosed mole

Control theory
- Feedback and feedforward control
- PID controllers
- The vestibular-ocular reflex

Bayesian inference
- Likelihood and prior probability
- Visual-tactile cue integration
- Perceptual decision making

Consciousness and contingencies
- Sensorimotor contingency theory
- Can a robot have consciousness?

What can we possibly know?
- Philosophy of perception
- What is "Reality"?

2) Course Learning Objectives:
   - Provide an overview of specialized sensory systems in humans, animals and machines, and how they are used to control action, behavior and physiological state.
   - Facilitate case study exercises to explore organisms' interaction with the world.
   - Facilitate reviews of original literature to explore and apply theoretical terms and concepts to the reality of empirical science.

3) Expected Learning Outcomes:
   Students who have passed this course are expected to be able to:
   - Describe the function of the specialized sensory mechanisms (such as visual acuity, eye movements and stereopsis) in humans and how they are used to control action, behavior and physiological state.
   - Describe alternative solutions to similar problems in a variety of animals.
   - List evolutionary and physical constraints that lead to these solutions.
   - Evaluate technical solutions to sensory problems in robotics and automation.
   - Explain how sensory processes are integrated into control structures to result in functional systems.
   - Analyze published literature, including experimental data, about specialized sensory systems.
   - Extract and communicate key concepts from original, empirical literature both orally and in writing.

- Defend scientific theories related to specialized sensory mechanism with logical reasoning.
- Compare theoretical terms and concepts related to specialized sensory mechanism to the reality of empirical science.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course will be scheduled as two 90 minute classes per week. One class each week is planned as a lecture format where course content on sensory systems will be discussed, reviewed and investigated, led by the course director.

The other class each week will incorporate more activity-based learning, such as group discussions, assignments, think-pair-share, case studies, in-class demonstrations, etc. **The extent and type of these activities depends critically on enrollment numbers.**

Class time will be used to review, discuss, investigate and critically think about specialized sensory systems. Students will have the opportunity to discuss and participate in debates centered on empirical research in specialized sensory system topics. In-class activities during the lecture will offer students the opportunity to engage with their peers in groups.

Students will have the opportunity to develop transferable skills such as

- analyzing published literature,
- communicating scientific concepts and theories concisely,
- thinking critically and defending scientific theories with logical reasoning
- working successfully with their peers

Activities and weekly writing opportunities will offer a means to integrate and make connections between materials, deepen understanding, reflect on learning and offer opportunities to discuss and review key course concepts.

Technology-Enhanced Learning:

Technology will be used to provide students with a diversity of means to review and learn course content. TED talks given by influential thinkers in the field are used to stimulate and motivate discussion, e.g.:

- https://www.ted.com/talks/donald_hoffman_do_we_see_reality_as_it_is?
- https://www.ted.com/talks/david_eagleman_can_we_create_new_senses_for_humans?

Online simulation tools will be used to run simple simulations and demonstrations:

- https://www.falstad.com/fourier/
- https://michaelbach.de/fract/index.html

Students will also have access to a Learning Management System (Moodle) site where these videos, simulations and demonstrations will be available for later review.

The learning management system (Moodle) will also be used to build a forum for the students to engage together online. The Moodle course will be the space where students can submit in-class assignments (quizzes and written assignments), discuss case studies, ask questions, and engage with their peers.

Students will have access to a variety of technological tools designed to support their academic work, including tools for document creation, editing, reviewing and sharing tools, reference management, collaboration tools, and/or information dissemination.

Please note, this course could also be offered in a flipped or blended format, where online lectures/videos are available for students to engage with the course material.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1. One section of the course will be offered each year in the Winter term (as BIOL3060 is a prerequisite).
2. When first offered, Niko Troje, would most likely teach the course. In future years, other neuroscience faculty may teach the course.
3. Other neuroscience faculty, such as Christopher Bergevin, Steven Connor and Georg Zoidl are capable of being the course director.
4. The course is being proposed to hold scheduled contact hours twice weekly for 1.5 hours per session.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Students will be evaluated on the following:

- Short quizzes applied during every class: (25%)
- Written assignments (such as short answer questions) completed regularly throughout the course, either in-class or online: (25%)
- Final exam (50%)

Quizzes will be designed to assess understanding of key concepts, student readiness for class (such as reading completion) as well as encourage attendance and participation.

Written assignments may vary in nature but will typically be one or more short answer questions designed to assess various course learning outcomes. Examples might include assessing understanding of course concepts, critical analysis or interpretation of part of a research paper following a group discussion, reflecting on the outcome of a case study exercise, identifying the main research question behind an assigned reading, etc.

The final exam will consist of multiple-choice questions that are similar to the in-class quizzes and written answer questions similar to those applied throughout the course.

The final exam will be held during the scheduled exam-time period.

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate

Each sensory system topic will be covered by original research article (s). The papers will be shared online with hyperlinks in the course learning management system (e.g., Moodle) course.

- Mascalzoni, E., & Regolin, L. (2011). Animal visual perception. Wiley Interdisciplinary Reviews: Cognitive Science, 2(1), 106-116.
- Carr, C. E., & Christensen-Dalsgaard, J. (2016). Evolutionary trends in directional hearing. Current opinion in neurobiology, 40, 111-117.
- Fay, R. R., & Feng, A. S. (1987). Mechanisms for directional hearing among nonmammalian vertebrates. In Directional hearing (pp. 179-213). Springer, New York, NY.
- Catania, K. C., & Remple, F. E. (2004). Tactile foveation in the star-nosed mole. Brain, behavior and evolution, 63(1), 1-12.
- Schwiegerling, J. (2000). Theoretical limits to visual performance. Survey of ophthalmology, 45(2), 139-146.
- Wehner, R. (2001). Polarization vision–a uniform sensory capacity? Journal of Experimental Biology, 204(14), 2589-2596.
- Land, M. F., & Nilsson, D. E. (2012). Animal eyes. Oxford University Press.

students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

- O'Regan, J. K. (2012). How to build a robot that is conscious and feels. Minds and Machines, 22(2), 117-136.
- Endler, J. A. (2012). Bowerbirds, art and aesthetics: Are bowerbirds artists and do they have an aesthetic sense?. Communicative & integrative biology, 5(3), 281-283.
- Goettker, A., Braun, D. I., Schütz, A. C., & Gegenfurtner, K. R. (2018). Execution of saccadic eye movements affects speed perception. Proceedings of the National Academy of Sciences, 115(9), 2240-2245.
- Simpson, J. I., & Graf, W. (1981). Eye-muscle geometry and compensatory eye movements in lateral-eyed and frontal-eyed animals. Annals of the New York Academy of Sciences, 374(1), 20-30.
- Heesy, C. P. (2009). Seeing in stereo: the ecology and evolution of primate binocular vision and stereopsis. Evolutionary Anthropology: Issues, News, and Reviews, 18(1), 21-35.
- Jacobs, G. H. (2009). Evolution of colour vision in mammals. Philosophical Transactions of the Royal Society B: Biological Sciences, 364(1531), 2957-2967.
- Knill, D. C., Kersten, D., & Yuille, A. (1996). Introduction: A Bayesian formulation of visual perception. Perception as Bayesian inference, 1, 1-21.
- Scott, S. H. (2004). Optimal feedback control and the neural basis of volitional motor control. Nature Reviews Neuroscience, 5(7), 532.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

No specific resources are required for this course. A classroom that allows students to work in small groups is preferred, either at small tables or a regular lecture hall with continuous writing surfaces.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

The only way for an animal to communicate with the outside world is through sensory input (afferent connections), on the one hand, and by means of motor output (efferent connections), on the other hand. The sensorimotor contingencies, that is, regularities in the relations between afferent and efferent signals is all there is for an organism to infer the nature and the state of the world.

The main function of the nervous system is to make such inferences. Understanding how this is done is essential towards a full understanding of the nervous system. This course would therefore serve as an elective for students in the newly developed Neuroscience degree program, and contributes to the educational objectives of the Neuroscience major.

The course is offered as a 3rd year level course.

In the Biology undergraduate program, the course builds upon BIOL3060 and and connects acquired knowledge about sensory physiology back into the realm of function and behavior. For that reason, it should be scheduled for the Winter term.

The course will also be of interest to students heading for the BBCS graduate program the Department of Psychology as it allows them to further knowledge acquired in PYSC 2220 (Sensation and Perception I) and PYSC 3270 (Sensation and Perception II).

This course contributes to the educational objectives of the two Faculties (Health and Science) involved in the Neuroscience program, and contributes a Biology course to the Behavioural and Cognitive Neuroscience stream of that program. It fills the gap between the introductory courses on the 2nd year level and 4th year seminar courses. So far, there is no other Biology contribution to the Neuroscience program on the 3rd year level.

The course has no thematic overlap with BIOL 4370 which is providing the cellular and molecular basics of neurophysiology. It is also only marginally overlapping with BIOL 4380 which dedicates only two weeks to the discussion of sensory systems. The focus there is on basic physiology of vision (one week) and audition (another week). In contrast, the current course concentrates mostly on functional, computational, and algorithmic aspects of sensory systems. In order to do so, teaching is focused on specializations and exceptions rather than studying the norm.

The expected enrollment for the course is 100 students.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science
Department: Indicate department and course prefix (e.g. Languages, GER)	Chemistry
Date of Submission:	Oct. 22, 2019
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	CHEM 3901, 3902, 3903, 3904
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	0.0
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Chemistry Internship Work Term
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Chemistry Internship Work Term

With every new course proposal it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters *(approximately 300 words including spaces and punctuation).*

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

Qualified Honours or Specialized Honours students gain relevant work experience as an integrated complement to their academic studies, reflected in the requirements of a learning agreement and work term report. Students are required to register in this course for each four month work term, with the maximum number of work term courses being four (i.e. 16 months). Students in this course are assigned a Faculty Supervisor/Committee. During the course, students are expected to work at least 480 hours for the employer.

Prerequisites: Enrollment is by permission only. Criteria for permission include:
1. that students have a cumulative GPA and an average GPA in chemistry courses of at least 7.5;
2. completion of CHEM 3000 and CHEM 3001, and a minimum of 84 credits overall;
3. that students are enrolled full-time in the Honours or Specialized Honours program prior to beginning their internship;
4. that students have not been absent for more than two consecutive years as a full-time student from their Honours or Specialized Honours degree studies;
5. that upon enrolling in this course students have a minimum of 9 credits remaining toward their Honours or Specialized Honours degree and need to return as a full-time student for at least one academic term to complete their degree after completion of their final work term.

Note: This is a pass/fail course, which does not count for degree credit. Registration in CHEM 3901/2/3/4 0.00 provides a record on the transcript for each work term.

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

Qualified Honours or Specialized Honours students gain relevant work experience as an integrated complement to their academic studies, reflected in the requirements of a learning agreement and work term report. Students are required to register in this course for each four month work term, with the maximum number of work term courses being four (i.e. 16 months). Students in this course are assigned a Faculty Supervisor/Committee. During the course, students are expected to work at least 480 hours for the employer.

Prerequisites: Enrollment Is by permission only. Criteria for permission include:
1. that students have a cumulative GPA and an average GPA in chemistry courses of at least 7.5;
2. completion of CHEM 3000 and CHEM 3001, and a minimum of 84 credits overall;
3. that students are enrolled full-time in the Honours or Specialized Honours program prior to beginning their internship.
4. that students have not been absent for more than two consecutive years as a full-time student from their Honours or Specialized Honours degree studies;
5. that upon enrolling in this course students have a minimum of 9 credits remaining toward their Honours or Specialized Honours degree and need to return as a full-time student for at least one academic term to complete their degree after completion of their final work term.

Note: This is a pass/fail course, which does not count for degree credit. Registration in CHEM 3901/2/3/4 0.00 provides a record on the transcript for each work term. Students are required to register in this course in each academic term of their internship work term.

The expected learning outcomes of experiential learning based on work experiences and the reflection on those work experiences in subsequent academic learning include:

- Demonstrate the ability to integrate theoretical/academic knowledge with workplace practice;
- Apply the relevant academic learning to the workplace;
- Develop career goals and improve the ability to manage career planning;
- Develop a professional network with employers and peer employees;
- Determine strengths and weaknesses in communication and enhance interpersonal skills;
- Underline the Importance of lifelong learning skills.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

Any student who is enrolled in the an Honours or Specialized Honours program offered by the Department of Chemistry who also undertakes a Chemistry internship position will be enrolled in the course CHEM 3001/3902/3903/3904 Internship Work Term for each academic term of their Internship. At the end of each academic term, the student will submit a Work Term Report and a Supervisor Evaluation. This experience is understood to be a 0-credit optional endeavor. Students enter into this arrangement because they see value in critically applying their classroom learning in an industry setting. The course is a 0-credit course because there is minimal faculty oversight of the academic learning outcomes of the experience. The Chemistry Faculty liaison to the intern will receive the Work Term Reports that are submitted by students in CHEM 3001/3902/3903/3904 at the end of each academic term and assign each a grade of Pass or Fail.

The grade and the experience are acknowledged on the transcript. This course shall be mounted each term starting in the Fall 2020 term.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1) This course shall be mounted each term starting in the Fall 2020.
2) Teaching competence is not applicable; The Chemistry liaison position can be filled by any faculty member who is currently associated with the Department of Chemistry.
3) The Chemistry Faculty Liaison to the intern shall be determined, but this individual will be selected from among the faculty affiliated with the Chemistry programs.
4) An overall of four contact hours are anticipated with the Faculty Liaison to monitor and provide advice to the intern during their internship.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Work Term Report with employer review or evaluation (100%); Pass or Fail.

Work Term Report will be graded by the faculty liaison appointed for each student.

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

Given the unique nature of the 0.0 credit course, no academic reading list is applicable.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

Student work terms in internship positions will take place at the employers' work place location.

The Faculty of Science Experiential Education Coordinator will provide assistance to students to connect them to potential employers.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

The industrial experience provided by the internship program can broaden students' knowledge and let them apply their knowledge to real applications. The internship experience can boost their chance of finding future employment.

Expected enrollment: 4-6 students/year.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science
Department: Indicate department and course prefix (e.g. Languages, GER)	Biology and Chemistry
Date of Submission:	October 11, 2019
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	BCHM 3901, 3902, 3903, 3904
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	0.0
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Biology Internship Work Term
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Biochemistry Internship Work Term

With every new course proposal it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

Brief Course Description:

Maximum 2000 characters
(approximately 300 words including spaces and punctuation).

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

Qualified Honours or Specialized Honours students gain relevant work experience as an integrated complement to their academic studies, reflected in the requirements of a learning agreement and work term report. Students are required to register in this course for each four month work term, with the maximum number of work term courses being four (i.e. 16 months). Students in this course are assigned a Faculty Supervisor/Committee. During the course, students are expected to work at least 480 hours for the employer. Enrollment is by permission only.

Prerequisites: Criteria for permission include:
1. A cumulative GPA and a major GPA of at least 7.5;
2. Completion of a minimum of 84 credits overall, including a minimum of 40 credits in BCHM, BIOL and CHEM courses;
3. Enrolled full-time in the Honours or Specialized Honours program in Biochemistry prior to beginning the internship;
4. Student has not been absent for more than two consecutive years as a full-time student from their Honours or Specialized Honours degree studies;
5. Upon enrolling in this course student has a minimum of 9 credits remaining toward their Honours or Specialized Honours degree and must return as a full-time student for at least one academic term to complete their degree after completion of their final work term.

Note: This is a pass/fail course, which does not count for degree credit. Registration in BCHM 3901/2/3/4 0.00 provides a record on the transcript for each work term.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

Qualified Honours or Specialized Honours students gain relevant work experience as an integrated complement to their academic studies, reflected in the requirements of a learning agreement and work term report. Students are required to register in this course for each four month work term, with the maximum number of work term courses being four (i.e. 16 months). Students in this course are assigned a Faculty Supervisor/Committee. During the course, students are expected to work at least 480 hours for the employer. Enrollment is by permission only.

Prerequisites: Criteria for permission include:
1. A cumulative GPA and a major GPA of at least 7.5;
2. Completion of a minimum of 84 credits overall, including a minimum of 40 credits in BCHM, BIOL and CHEM courses;
3. Enrolled full-time in the Honours or Specialized Honours program in Biochemistry prior to beginning the internship;
4. Student has not been absent for more than two consecutive years as a full-time student from their Honours or Specialized Honours degree studies;
5. Upon enrolling in this course student has a minimum of 9 credits remaining toward their Honours or Specialized Honours degree and must return as a full-time student for at least one academic term to complete their degree after completion of their final work term.

Note: This is a pass/fail course, which does not count for degree credit. Registration in BCHM 3901/2/3/4 0.00 provides a record on the transcript for each work term.

The expected learning outcomes of experiential learning based on work experiences and the reflection on those work experiences in subsequent academic learning include:

- Demonstrate the ability to integrate theoretical/academic knowledge with workplace practice;
- Apply the relevant academic learning to the workplace;
- Develop career goals and improve the ability to manage career planning;
- Develop a professional network with employers and peer employees;
- Determine strengths and weaknesses in communication and enhance interpersonal skills;
- Underline the Importance of lifelong learning skills.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

Any student who is enrolled in the an Honours or Specialized Honours program in Biochemistry who also undertakes a Biochemistry Internship position will be enrolled in the course BCHM 3901/3902/3903/3904 Internship Work Term for each academic term of their Internship. At the end of each academic term, the student will submit a Work Term Report and a Supervisor Evaluation. This experience is understood to be a 0-credit optional endeavor. Students enter into this arrangement because they see value in critically applying their classroom learning in an industry setting. The course is a 0-credit course because there is minimal faculty oversight of the academic learning outcomes of the experience. The Biochemistry Faculty liaison to the intern will receive the Work Term Reports that are submitted by students in BCHM 3901/3902/3903/3904 at the end of each academic term and assign each a grade of Pass or Fail.

The grade and the experience are acknowledged on the transcript. This course shall be mounted each term starting in the Fall 2020 term.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1) This course shall be mounted each term starting in Fall 2020.
2) Teaching competence is not applicable; the Biochemistry liaison position can be filled by any faculty member who is currently associated with the Department of Biology or Chemistry
3) The Biochemistry Faculty Liaison to the intern shall be determined, but this individual will be selected from among the faculty affiliated with the Biochemistry programs.
4) An overall of four contact hours are anticipated with the Faculty Liaison to monitor and provide advice to the intern during their internship.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Work Term Report with employer review or evaluation (100%); Pass or Fail.

Work Term Report will be graded by the supervisor appointed for each student.

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

Given the unique nature of the 0.0 credit course, no academic reading list is applicable.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

Student work terms in internship positions will take place at the employers' work place location.

The Faculty of Science Experiential Education Coordinator will provide assistance to students to connect them to potential employers.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

The industrial experience provided by the internship program can broaden students' knowledge and let them apply their knowledge into real applications. The internship experience can boost their chance of finding future employment.

Expected enrollment: 4-6 students/year.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science

Department: Indicate department and course prefix (e.g. Languages, GER)	Chemistry (CHEM)	**Date of Submission:**	November 11, 2019

Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	3061	**Var:**	**Academic Credit Weight:** Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3

Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Environmental chemistry
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Environmental chemistry

With every new course proposal it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters *(approximately 300 words including spaces and punctuation).*

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

This course introduces students to mechanisms underlying chemical sources and fate in the environment. The reactions and partitioning of organic and inorganic compounds will be discussed on a molecular level allowing students to understand and predict chemical fate and distribution. Critical environmental processes that determine the fate of organic pollutants, including abiotic oxidation and reduction reactions, as well as biological processing, will be examined. The biogeochemical cycles and reactions that determine the environmental fate of metals will be described. The chemistry driving important environmental issues, including ocean acidification, pollutant transport, and bioaccumulation will also be addressed. Students will gain an appreciation for and become familiar with the current state of understanding of the chemical mechanisms in the environment.

Prerequisite: CHEM 2021

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

This course examines the sources and fate of chemicals in the environment, including reactions and partitioning of organic and inorganic compounds. Topics include abiotic and biotic reactions of organic pollutants, biogeochemical cycles of metals, ocean acidification, pollutant transport, and bioaccumulation.

Prerequisite: CHEM 2021

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

This course will be comprised of four major topics.
1. **Introduction**. This topic will include: (i) chemical composition of the major environmental spheres in which reactions can occur (atmosphere, hydrosphere, and lithosphere); and (ii) an overview of the sources of major inorganic and organic environmental pollutants.
2. **Aqueous chemistry of inorganic pollutants**. This topic will include: (i) chemical speciation of inorganic chemicals in fresh and ocean water; (ii) biogeochemistry of metals in aqueous systems; (iii) sediment chemistry; and (iv) ocean acidification.
3. **Reactions of organic pollutants**. This topic will include: (i) direct photolysis; (ii) sources of aqueous oxidants; (iii) indirect photolysis; (iv) hydrolysis; (v) reduction; (vi) microbial degradation; and (vii) fate in plants and animals.
4. **Distribution of organic pollutants**. This topic will include: (i) solubility; (ii) bioconcentration and bioaccumulation; (iii) volatility; (iv) sorption; (v) transport; and (vi) simple fate and transport models.

Learning objectives
Upon successful completion of the course, students will be able to:

- Predict the distribution and fate of organic and inorganic chemicals in the environment.
- Explain the molecular-level chemistry underlying important processes of environmental concern.
- Critically read and analyze peer-reviewed literature in environmental chemistry.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course will be delivered in the traditional lecture format. Assignments will be based on the current peer-reviewed literature and will encourage the development of critical reading skills, while enhancing an understanding of the course material. A midterm and final exam will test the students' learning of the course content.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1. This course would be offered every year or every other year, depending on student interest.

2. This course could be taught by 4 current departmental members: Cora Young, Trevor VandenBoer, Rob McLaren, and Derek Jackson.

3. The course is likely to be taught in the first instance by Cora Young.

4. The students will attend 3 h of lecture per week. It is expected they will devote another 3 h per week to private study.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Assignments: 40 %
Midterm exam: 20 %
Exam: 40 %

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

Suggested text:
Schwarzenbach, R.P., Gschwend, P.M., Imboden, D.M. Environmental Organic Chemistry, 3rd Ed. 2016 Wiley ISBN: 978-1-118-76723-8.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

A lecture room with standard audio-visual equipment is required to deliver this course.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

This course complements an existing departmental offering of atmospheric chemistry (CHEM 3060) by giving students background in the chemistry occurring in other environmental reservoirs besides the atmosphere (hydrosphere, biosphere and soils), with an emphasis on reaction chemistry. This will provide a fundamental background for students pursuing a career in government or environmental industries and a broader perspective for those who pursue a career in other aspects of chemistry.
This course does not overlap with an existing course in biology, Environmental Contaminants: Impacts on Organisms and Ecosystems (BIOL 4720). Although some topics may appear similar at a superficial level, this course will focus on molecular-level reactions and processes that require second-year chemistry prerequisites. No chemistry beyond first year is required for BIOL 4720.
This course also does not overlap with courses under development for NATS. These courses are designed for non-science majors and not comparable to this proposed course.

Expected enrollment in the course: 40-50. Currently there are 50-60 enrolled in 3060 on an annual basis; we might expect similar interest as CHEM 3060, but an overall drop in enrolment if both these courses are offered in a year. We would request that CHEM 3061 be offered in the other term compared to CHEM 3060, such that students wishing to specialize in Environmental Chemistry can take both courses.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

STEACIE SCIENCE & ENGINEERING LIBRARY
YORK UNIVERSITY

MEMORANDUM

To:	Dr. Pierre G. Potvin, Undergraduate Program Director, Chemistry
From:	Minglu Wang, Research Data Management Librarian
Re:	CHEM 3061 – Environmental Chemistry
Date:	November 13, 2019

I have reviewed the course proposal and bibliography for **CHEM 3061 – Environmental Chemistry** and can state that the York University Libraries have the required resources to support this graduate level course.

Please be aware that the library offers the following services to help students with their research:

- A librarian is also available for individual consultations, both face-to-face and online, with students to help them find the materials they need for their projects.
- A librarian can create a custom workshop tailored to the course. Content can include both introductory and in-depth instruction on searching for chemical information in SciFinder, Reaxys, Web of Science, Scopus, and elsewhere. Reference management using software such as Mendeley and Zotero can also be introduced.
- A custom online research guide tailored to the course can be created upon request.

An electronic copy of the following suggested reading in the course bibliography has been ordered and will be available in the library:

Schwarzenbach, R.P., Gschwend, P.M., Imboden, D.M. Environmental Organic Chemistry, 3rd Ed. 2016 Wiley ISBN: 978-1-118-76723-8.

If you would like copies of this book to be placed on reserve at the library for students' use, please place a reserve request by visiting reserves.library.yorku.ca. For more information about course reserves, please visit: http://www.library.yorku.ca/web/ask-services/facultyinstructor-support/places-items-on-reserve/.

The following electronic resources licensed by the library may be of help to the students in this course:

- **SciFinder**
- **Reaxys**
- **Web of Science**
- **Scopus**

STEACIE SCIENCE & ENGINEERING LIBRARY
YORK UNIVERSITY

MEMORANDUM

A more complete listing of resources is available at the following Research Guide:

- Chemistry: http://researchguides.library.yorku.ca/chemistry

Please note that the Steacie Library has extensive collections of books and reference materials that are relevant to this course.

In summary, I state that we are well positioned to support this course. If you have any questions, please do not hesitate to contact me.

Sincerely,

Minglu Wang, Research Data Management Librarian
Steacie Science & Engineering Library
416-736-2100 x40075 mingluwa@yorku.ca

FS Resource Implications Form **Unit: _Chemistry____** **Date: __Nov_14_2019__**

		Course(s) Created X or Modified to ☐ (check one)		Course(s) Retired ☐ or Modified from ☐
Complete Course Designation		SC/CHEM 3061 3.00		
Enrolment (Estimate or Last Offering)		50		
Number of:	**Lecture Sections:**	1		
	Lab Sections:	0		
	Tutorial Sections:	0		
Number of:	**Course Coordinators (Tutor 1):**	1		
	Lab Demonstrators (Tutor 2):	0		
	Mark/Graders (Tutor 3):	1		
Prerequisites (P) Corequisites (C) Credit Exclusions (E)		SC/CHEM 2021		
For which degree program is this required (if applicable)?		none		
Other resource implications (please specify)		none		
Reason(s) for creation/ modification/ retirement		Broadening and modernizing upper-year offerings, addressing student interest.		

Changes to Existing Course

Faculty:

Department: CHEMISTRY

Date of Submission:

Course Number: SC/CHEM 4090 3.0

Effective Session: W 2021

Course Title: Topics in Materials Sciences

Type of Change:

- [x] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [ ] in title (max. 40 characters for short title)
- [ ] in Calendar description (max. 40 words or 200 characters)
- [ ] other (please specify):
- [ ] in cross-listing
- [ ] in degree credit exclusion(s)
- [ ] regularize course (from Special Topics)
- [ ] in course format/mode of delivery *
- [ ] retire/expire course

Change From:	**To:**
SC/CHEM 4090 3.0 Topics in Materials Sciences Structure-property relationships in materials, using examples of materials used in electronics, alternative energy sources, life sciences and polymer sciences, etc. One term. Three credits. Prerequisites: ~~SC/CHEM 3010 3~~.0, SC/CHEM 3031 3.0	Exploring the chemistry behind novel materials relevant to electronics, alternative energy sources, life sciences and polymer sciences. One term. Three credits. Prerequisites: **SC/CHEM 3021 3.0 and SC/CHEM 3030 3.0**; SC/CHEM 3031 3.0 **is strongly recommended.**

Rationale: These pre-requisites better reflect the topics covered by the instructor.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised 'Course Design' and 'Method of Instruction" information.

Non-Major Modification Program Changes

1. Program: Chemistry

2. Degree Designation: Specialized Honours BSc Chemistry – Pharmaceutical and Biological Chemistry stream

3. Type of Modification: change to degree requirements

4. Effective Date: FW20

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5. State what the changes are

   Addition of an option to a restricted list of upper-level course options.

6. Provide the rationale for the proposed changes that is rooted in the program learning outcomes.

   The restricted list of course options seeks to broaden students' awareness and knowledge in Pharmaceutical and Biological Chemistry by exposing them to a specialized aspect of their choosing. Lengthening the list will simply provide an additional pathway to meeting some of the current Program Learning Outcomes:

   - gain in-depth knowledge in a chosen sub-discipline (PLO Ib′ and Id″);
   - develop an awareness of current research frontiers in that sub-discipline (PLO Ie″);
   - creatively delve into a relevant research topic (PLO IIa′ and IIIb″);
   - practice written and oral presentation skills (PLO IVa″).

   [PLO numbers refer to those in the 2014 CPR]

7. Provide an updated mapping of the program requirements to the program learning outcomes to illustrate how the proposed requirements will support the achievement of program learning objectives.

   No change to the curriculum map will be needed.

8. If relevant, summarize the consultation undertaken with relevant academic units, including commentary on the impact of the proposed changes on other programs. Provide individual statements from the relevant program(s) confirming consultation and their support.

   No impacts on other programs as a result of this change.

9. Describe any resource implications and how they are being addressed (e.g., through a reallocation of existing resources). If new/additional resources are required, provide a statement from the relevant Dean(s)/Principal confirming resources will be in place to implement the changes.

   No resource implications.

10. Provide a summary of how students currently enrolled in the program will be

accommodated.

Current students will enjoy the same access as new students.

11. Provide as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar.

    (see attached)

Current Calendar Copy

SPECIALIZED HONOURS PROGRAM STREAM IN PHARMACEUTICAL AND BIOLOGICAL CHEMISTRY

[...]

B. Major requirements:

- the program core, as specified above (28 credits);
- SC/BIOL 1000 3.00; SC/BIOL 1001 3.00;
- SC/BIOL 2040 3.00; SC/BIOL 2070 3.00; one of SC/CHEM 2050 4.00 or SC/BCHM 2020 3.00 or SC/BIOL 2020 3.00; SC/BCHM 2021 3.00 or SC/BIOL 2021 3.00;
- SC/CHEM 3011 3.00; SC/CHEM 3020 3.00; SC/CHEM 3030 3.00; SC/CHEM 3050 3.00; SC/CHEM 3051 3.00; SC/CHEM 3071 3.00 or SC/CHEM 3075 3.00; SC/CHEM 3080 4.00;
- SC/CHEM 4000 8.00; SC/CHEM 4050 3.00; SC/CHEM 4051 3.00 or SC/CHEM 4021 3.00;
- at least three additional credits chosen from SC/CHEM 3021 3.00, SC/CHEM 4051 3.00, SC/BIOL 3110 3.00, SC/BIOL 4151 3.00.

Proposed Calendar Copy

SPECIALIZED HONOURS PROGRAM STREAM IN PHARMACEUTICAL AND BIOLOGICAL CHEMISTRY

[...]

B. Major requirements:

- the program core, as specified above (28 credits);
- SC/BIOL 1000 3.00; SC/BIOL 1001 3.00;
- SC/BIOL 2040 3.00; SC/BIOL 2070 3.00; one of SC/CHEM 2050 4.00 or SC/BCHM 2020 3.00 or SC/BIOL 2020 3.00; SC/BCHM 2021 3.00 or SC/BIOL 2021 3.00;
- SC/CHEM 3011 3.00; SC/CHEM 3020 3.00; SC/CHEM 3030 3.00; SC/CHEM 3050 3.00; SC/CHEM 3051 3.00; SC/CHEM 3071 3.00 or SC/CHEM 3075 3.00; SC/CHEM 3080 4.00;
- SC/CHEM 4000 8.00; SC/CHEM 4050 3.00;
- SC/CHEM 4051 3.00 **or SC/CHEM 4052 3.00** or SC/CHEM 4021 3.00;
- at least three additional credits chosen from SC/CHEM 3021 3.00, SC/CHEM 4051 3.00, **SC/CHEM 4052 3.00,** SC/BIOL 3110 3.00, SC/BIOL 4151 3.00.

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science
Department: Indicate department and course prefix (e.g. Languages, GER)	Chemistry
Date of Submission:	
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	4052/5052
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Chemical Biology
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Chemical Biology

With every new course proposal it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters *(approximately 300 words including spaces and punctuation).*

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

This course introduces students to the fundamentals of chemical biology, which focuses on the use of chemistry to study, probe, re-engineer, and exploit biological systems. The course explains how chemistry can be used in biological applications, including the profiling of the transcriptome and proteome; the interference of genes, transcripts and protein function; the tracking of transcripts and proteins in vivo using bioconjugation technologies; the measurement of protein activity in vivo; the synthesis of large libraries of chemicals and their screening for function using state-of-the-art technologies such as combinatorial chemistry and DNA-encoded synthesis; the use of chemical probes to determine biomolecular interaction in cells; the use and re-engineering of biosynthetic machinery to synthesize new drugs; the re-engineering of biological systems to generate proteins bearing unnatural amino acids; and the use of CRISPR-cas9 machinery to edit the genome, transcriptome, and epitranscriptome. The course will introduce students to critical evaluation of literature in chemical biology, and familiarize students with recent advances in the field.

Prerequisites: SC/CHEM 3021 3.0, and SC/CHEM 2050 4.0 or SC/BCHM 2020 3.0 or SC/BIOL 2020 3.0

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

The course introduces students to the concept of using chemistry to study, probe, re-engineer, and exploit biological systems. The use of chemical biology tools to effect change at the genomic, transcriptomic, proteomic and metabolomic level is discussed.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

The course will cover the following topics:

- An overview of replication, transcription, and translation from an organic chemistry viewpoint, including the physical organic chemistry of how DNA is packaged; the molecular basis of DNA replication and differences between eukaryotes and bacteria; the molecular basis and roles of telomers and the dynamics in health and disease; the molecular basis of transcription and the roles and distinction between different RNA polymerases; the post-transcriptional modification in bacteria and eukaryotes, including transcript slicing; and the molecular basis of translation.
- A discussion of sub-cellular organization, including each organelle and its implication in human disease; the peptide tagging system for localizations of proteins to specific organelles; chaperone proteins and the unfolded protein response and its implication in treating human disease; targeting of checkpoints during cell division for cancer therapy; cell penetrating peptides, and their use in chemical biology.
- Basics of recombinant protein expression, including the T7 expression system among other more recent developments. The use of Gibson assembly to generate fusion genes toward the expression of fusion proteins is also discussed. Culturing of cells, different cell lines and strains, and their uses in specific expression applications is described.
- An overview of methods to quantify nucleic acids and protein levels, including fundamentals of PCR and RT-PCR, and how they are applied to quantitative PCR analysis; DNA microarray technologies and their applications to transcriptional profiling of diseases in humans; a general overview of the organic chemistry of chemical DNA synthesis; and the use of transcriptional profiling to diagnose and predict the prognosis of cancer
- Introduction to model organisms and their limitations/advantages are described. The concept of "Forward" and "Reverse" genetics is introduced. The molecular rationale and preparation of knockout mice are described in detail and highlighted through literature examples of knockout studies in Forward genetics. RNA interference, including the history of the discovery, the molecular basis of the phenomenon, and its application to treat human disease are also discussed. Chemical genetics, and its Forward and Reverse variants are introduced including drug screens from the literature and industry.
- A brief overview of fluorescence is followed by discussion of fluorophores used in chemical biology including the organic chemistry used to selectively and non-selectively attach fluorophores to DNA, RNA, and proteins; immunofluorescence and its applications to study biomolecules, including the concept of epitope tagging; targeting specific biomolecules or organelles using specifically localized organic dyes; green fluorescent protein (GFP), the molecular basis of its fluorescence, the ability to genetically engineer GFP to enable other colours, and its uses

in chemical biology; "spinach" RNA and its derivatives, the molecular basis of its fluorescence, and its application to study RNA in vivo; and the physics of Förster Resonance Energy Transfer (FRET) and its application to study biological systems.

- A discussion of how to characterize biomolecular interactions, including methods such as fluorescence perturbation, fluorescence polarization; surface plasmon resonance, isothermal titration calorimetry, mass spectrometry, nuclear magnetic resonance, microscale thermophoresis, and biolayer interferometry. Photoaffinity labelling, including the mechanism of photoreactive species is discussed, including literature examples of its use in drug discovery. The concept of bioconjugation in introduced, with specific examples of "click" chemistry, such as Staudinger ligation, azide-alkyne 3+2 cycloadditions, and Native Chemical Ligation.
- Concepts in combinatorial chemistry as applied to drug discovery is introduced. Topics include solid-phase chemical synthesis, split-and-pool synthesis, and parallel solution-phase synthesis aided through solid-supported reagents. Principles of library construction are discussed with literature examples, such as focused libraries and diversity-oriented synthesis.
- Advances in high-throughput screening of combinatorial libraries is described including the principles and molecular basis behind developing and using high-throughput screening assays for biological function. The generation of small-molecule microarrays and their application to the detection of biomolecular interactions is described and highlighted through literature examples.
- The identification of unknown biological targets of small-molecule drugs is discussed in the context of several drug examples, including Lyrica, Tacrolimus, Trapoxin, (-)-FR182877, Bistramide A, Withaferin A, and Diazonamide A. The methods used in affinity pulldown from serum and protein identification are described.
- An overview of natural products in comparison with total chemical synthesis, with discussion of semi-synthesis of natural products from sustainable sources. The mechanism and molecular basis of polyketide synthesis is described in detail including how to read the polyketides synthetic code and re-engineer the synthetic code to generate unnatural/designer polyketides. Non-ribosomal peptide synthesis is introduced.
- Introduction to ribozymes, riboswitches, and aptamers, including the known ribozymes with discussion of their mechanism of action and structure. The "RNA World" hypothesis is introduced in the context of ribozyme, riboswitches, aptamers, and the ribosome. The concept of Systematic Evolution of Exponential Enrichment to evolve ribozymes and aptamers is further discussed in detail.
- The concept of DNA-encoded libraries, including their synthesis by combinatorial chemistry and their screening to discover drugs is discussed in detail including examples from the literature and

pharmaceutical companies. Limitations and advantages of the technology are critically evaluated.

- Unnatural amino acid incorporation into proteins is discussed, first in the context of chemical tools that site-specifically label amino acids, and then in the context of evolving and re-engineering the natural translation system to incorporate un-natural amino acids. The molecular basis of the evolution of the biomachinery, and the design of artificial codon sets is discussed. The evolutionary implication of an expanded genetic code is evaluated.
- Biomolecule display technologies are introduced, including phage display, ribosomal display, mRNA display, and DNA display. Limitations and advantages of each technology are discussed in the context of ligand/drug discovery and ability to survey chemical space.
- The concept of affinity-based protein profiling (ABPP) is introduced and critically compared with transcriptional profiling. The design and synthesis of ABPP probes are demonstrated through targeting different protein classes. The implementation of ABPP probes to survey the activity of the whole proteome is highlighted through literature examples and the use of the technology to diagnose and predict the prognosis of human disease are highlighted.
- Epigenetics and epitranscriptomics are discussed, including different epigenetic markers on DNA and RNA, how they are dynamically maintained through methylation and demethylation enzymes, methods to quantify the markers, and methods to site-specifically detect the markers by new sequencing technologies. The implication of these markers in human disease and the possibility to use drugs to target epitranscriptomic and epigenetic markers is discussed.
- An Introduction to CRISPR-cas9 system, including its discovery in prokaryotes and its redesign to use in genome engineering. Burgeoning new adaptations/re-engineering of the CRISPR-cas9 system that enable point-mutation editing is highlighted, including the use of the system to enable mRNA knockdown and site-specific demethylation of the epitranscriptome. The use of this new technology in humans, and its ethical implications is highlighted.

Learning Objectives:
Upon successful completion of the course, students will be able to:

- Describe and discuss chemical biology tools to study, perturb, and exploit living systems
- Discuss methods to target organelles and biomolecules in vitro or in vivo
- Discuss methods to determine biomolecular interaction in vitro and in vivo

- Critically analyze readouts from chemical biology technologies, such as transcriptional profiling or activity-based protein profiling.
- Discuss approaches to design and screen large libraries of small molecules or biomolecules for a desired function, such as binding or catalysis.
- Discuss approaches at the genomic, transcriptomic, and proteomic levels to treat human disease, and their strengths and weaknesses.
- Critically discuss the chemical biology scientific literature.
- Devise a methodologically sound and original research project based in chemical biology.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course will be formatted as both a lecture and a group discussion. An assigned recent research article that builds upon the concepts taught during the previous class will be discussed at the beginning of the class, followed by the lecture. The class will have a midterm and a final exam. Each student will be tasked with writing an original research proposal using the technologies discussed in the class. The proposal will be guided by one-on-one consultations with the instructor, to help develop the idea/proposal. The proposal is subjected to a double-blind peer review to encourage fair, yet critical, peer evaluation. Students are evaluated on their peer review and proposal. The final class (more if necessary) is devoted to presentations of the proposal to help develop science communication skills. In the event of large class sizes, proposals and presentations will be assigned in groups.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

This course will be offered every year beginning Fall of 2020.

One member of the Department is currently competent to teach all aspects of this course.

Prof. Ryan Hili will teach this course.

The students will have 3 h of lecture per week, and it is expected that they will devote at least 3 h per week to private study.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Midterm: 20%
Research Proposal: 20%
Research Presentation: 20%
Peer review: 10%
Final Exam: 30%

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

No textbook is required for the course.

Suggested readings (available at Steacie Library):

Stuart L. Schreiber, Tarun M. Kapoor and Günther Wess (Eds). Chemical biology : from small molecules to systems biology and drug design. 1st Edition. Wiley-VCH. 2007 (QP 514.2 C4556 2007)

Herbert Waldmann, Petra Janning (Eds.) Chemical biology: a practical course. 1st Edition. Wiley-VCH. 2004 (QD 415.3 W35 2004)

Jeffrey M. Craig and Nicholas C. Wong (Eds) Epigenetics : a reference manual. 1st Edition, Caister Academic Press. 2011 (QH 450 E654 2011)

Jennifer A. Doudna, Erik J. Sontheimer (Eds) The Use of CRISPR/Cas9, ZFNs, and TALENs in Generating Site-Specific Genome Alterations. Elsevier Ltd., 2014 (eBook ISBN 0128013346)

Andrea Trabocchi, Sesto Fiorentino (Eds). Diversity-oriented synthesis : basics and applications in organic synthesis, drug discovery, and chemical biology. Wiley. 2013 (QD 262 D58 2013)

No additional readings for graduate students. Graduate student will be expected to survey the literature for reviews and primary sources on topics in the course – a critical skill for graduate students to hone.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

A standard Audio-Visual System will be used for projection of MS-Power Point slides. A chalkboard or whiteboard is also necessary.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

This course is very important for undergraduate and graduate chemistry students, as its interdisciplinary nature at the interface of chemistry and biology demonstrates how their education can be applied beyond their field and allow them to pursue career paths as chemists in the biologically focused industries, such as the pharmaceutical and biomedical industries.

The course builds from SC/CHEM 3051 3.0 and complements SC/CHEM 4051 3.0. There is partial overlap at the beginning of the course with both courses, in order to calibrate students as chemical biologists – focusing on the physical organic chemistry of biomacromolecules and other cellular components. There is no overlap beyond this.

The expected enrolment in the course is 20 students.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

STEACIE SCIENCE & ENGINEERING LIBRARY
YORK UNIVERSITY

MEMORANDUM

To:	Dr. Pierre G. Potvin, Graduate Program Director, Chemistry
From:	Minglu Wang, Research Data Management Librarian
Re:	CHEM 4052/5052 – Chemical Biology
Date:	October 22, 2019

I have reviewed the course proposal and bibliography for **CHEM 4052/5052 – Chemical Biology** and can state that the York University Libraries have the required resources to support this graduate level course.

Please be aware that the library offers the following services to help students with their research:

- A librarian is also available for individual consultations, both face-to-face and online, with students to help them find the materials they need for their projects.
- A librarian can create a custom workshop tailored to the course. Content can include both introductory and in-depth instruction on searching for chemical information in SciFinder, Reaxys, Web of Science, Scopus, and elsewhere. Reference management using software such as Mendeley and Zotero can also be introduced.
- A custom online research guide tailored to the course can be created upon request.

The following suggested readings in the course bibliography are currently available in the library:

Stuart L. Schreiber, Tarun M. Kapoor and Günther Wess (Eds). *Chemical biology: from small molecules to systems biology and drug design.* 1st Edition. Wiley-VCH. 2007 (QP 514.2 C4556 2007)

Herbert Waldmann, Petra Janning (Eds.) *Chemical biology: a practical course.* 1st Edition. Wiley-VCH. 2004 (QD 415.3 W35 2004)

Jeffrey M. Craig and Nicholas C. Wong (Eds) *Epigenetics: a reference manual.* 1st Edition, Caister Academic Press. 2011 (QH 450 E654 2011)

Jennifer A. Doudna, Erik J. Sontheimer (Eds) *The Use of CRISPR/Cas9, ZFNs, and TALENs in Generating Site-Specific Genome Alterations.* Elsevier Ltd., 2014 (eBook ISBN 0128013346)

STEACIE SCIENCE & ENGINEERING LIBRARY
YORK UNIVERSITY

MEMORANDUM

Andrea Trabocchi, Sesto Fiorentino (Eds). *Diversity-oriented synthesis: basics and applications in organic synthesis, drug discovery, and chemical biology*. Wiley. 2013 (QD 262 D58 2013)

If you would like copies of these books to be placed on reserve at the library for students' use, please place a reserve request by visiting reserves.library.yorku.ca. For more information about course reserves, please visit: http://www.library.yorku.ca/web/ask-services/facultyinstructor-support/places-items-on-reserve/.

The following electronic resources licensed by the library may be of help to the students in this course:

- **SciFinder**
- **Reaxys**
- **Web of Science**
- **Scopus**

A more complete listing of resources is available at the following Research Guide:

- Chemistry: http://researchguides.library.yorku.ca/chemistry

Please note that the Steacie Library has extensive collections of books and reference materials that are relevant to this course.

In summary, I state that we are well positioned to support this course. If you have any questions, please do not hesitate to contact me.

Sincerely,

Minglu Wang, Research Data Management Librarian
Steacie Science & Engineering Library
416-736-2100 x40075 mingluwa@yorku.ca

FS Resource Implications Form **Unit: __Chemistry_____** **Date: __10/22/2019__**

		Course(s) Created X or Modified to ☐ (check one)		Course(s) Retired ☐ or Modified from ☐
Complete Course Designation		SC/CHEM 4052 3.0		
Enrolment (Estimate or Last Offering)		20		
Number of:	**Lecture Sections:**	1		
	Lab Sections:	0		
	Tutorial Sections:	0		
Number of:	**Course Coordinators (Tutor 1):**	1		
	Lab Demonstrators (Tutor 2):	0		
	Mark/Graders (Tutor 3):	0		
Prerequisites (P) Corequisites (C) Credit Exclusions (E)		CHEM 3021 3.0 and CHEM 2050 4.0 or BIOL 2020 3.0 or BCHM 2020 3.0		
For which degree program is this required (if applicable)?		None; one of a restricted list of options in the Spec. Hon. BSc Chemistry – Pharmaceutical & Biological Chemistry Stream		
Other resource implications (please specify)		none		
Reason(s) for creation/ modification/ retirement		To match what is now taught as a different course. To modernize the 4th-year offerings.		

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	FSc / MATH
Department: Indicate department and course prefix (e.g. Languages, GER)	MATH
Date of Submission:	
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	1280
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Principles of Risk Management and Insurance
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Risk Management and Insurance

With every new course proposal it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters
(approximately 300 words including spaces and punctuation).

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

This course deals with the notion of risk and the ways to manage it, by exploring the general framework of risk management for businesses, individuals and societies, and by focusing on the role of insurance as a risk transfer mechanism. More specifically, the course categorizes and studies those risks that are associated with financial markets (liquidity risk, pricing risk, credit risk, among other financial risks) as well as those risks that arise from operations of an enterprise, regulations, digital transformation, the impacts of the environment or a catastrophe (among other non-financial risks). Also, the course examines in detail the various aspects of the insurance mechanism as a route to manage some of the aforementioned risks. The course combines classical lectures with biweekly presentations by visiting risk professionals, thus immersing the students into theory and practice of modern risk management.

Prerequisites:

None

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

This course offers an introduction to the ubiquitous presence of risk in society, the available risk management mechanisms, and related public policy issues. The course starts with the general notion of risk management, and it then focuses on insurance with its role of a risk transfer mechanism in modern risk management.

The course covers topics such as the concept of risk, risk assessment and evaluation, principles of risk management, nature of the insurance device, and specific insurance types such as life, health, personal property, liability, and homeowners insurance. The course is designed with experiential education in mind to offer students first-hand experience on practical aspects of concepts learned in class. Frequent in-class visitors, case studies, and experiments will be used to engage students with the material and provide opportunities for interaction and networking with seasoned professionals in the field of risk management and insurance.

The course is introductory and targets a broad audience without prior knowledge or experience in the field of risk management. Accordingly, the learning outcomes detailed below are broadly consistent with the first four levels of Bloom's cognitive taxonomy: remember, understand, apply, and analyze.

Remember

Upon successfully completing the course, the student should be able to

- ***Describe***
  - major types of financial and non-financial risks
  - the objectives and steps in the risk management process
  - the requirements of an insurable risk from the viewpoint of a private insurer
  - the major types of insurance
  - the steps in the process of settling a claim
  - the common types of deductibles that appear in insurance contracts
  - the financial impact of premature death on the different types of families
  - the basic characteristics of term life insurance, ordinary life insurance, whole life insurance, and current assumption life insurance
  - the suggestions to follow when purchasing life insurance
  - the basic characteristics of a fixed annuity, variable annuity, and equity-indexed annuity
  - the key characteristics of long-term care insurance, disability-income insurance contracts, and supplementary health insurance
  - the basic characteristics of group term life insurance
  - the basic features of private retirement plans
  - the liability coverage in the personal auto policy

- ***Identify***
  - major pure risks associated with financial insecurity
  - major insurable and uninsurable risks in our society
  - basic parts of any insurance contract
  - major homeowners policies for homeowners, condominium owners, and returns and exclusions that apply to their coverages
  - the parties that are insured for liability coverage under a personal auto policy and major factors that determine the cost of auto insurance to consumers
  - the major liability loss exposures of business firms
- ***Discuss***
  - how risk is a burden to society
  - how life insurance premiums are calculated

Understand

Upon successfully completing the course, the student should be able to

Explain

- the meaning of risk
- the major methods of handling risk
- the law of large numbers and its implications for risk management and insurance
- the major risk control techniques
- the major risk-financing techniques
- the basic characteristics of insurance
- the social benefits and social costs of insurance
- the steps in the underwriting process
- the reasons for reinsurance and the various types of reinsurance treaties
- the importance of insurance company investments and identify the various types of investments of insurers
- how coinsurance works in a property insurance contract
- how losses are paid when more than one insurance contract covers the same loss
- the needs approach for estimating the amount of life insurance to own
- the interest-adjusted surrender cost index and net payment cost index for determining the cost of life insurance
- the underwriting principles followed in group insurance
- the insured's duties after a loss occurs
- the personal liability coverage
- the suggestions that consumers should follow when shopping for different types of insurance
- duties imposed on the insured after an accident or loss
- explain the basic provisions in the different insurance contracts

Apply

- apply the principles of risk management to a personal risk management program
- given a specific loss situation, explain whether the insurance policy would cover the loss

Analyze

- distinguish between pure risk, speculative risk, and enterprise risk
- distinguish between defined-contribution and defined-benefit retirement plans
- how a business income loss is determined under the business income coverage form

The course will be mandatory for Actuarial Majors in the Department of Mathematics, FSc. Also, it is a core requirement for the Diploma in Risk and Insurance Management offered by the Risk and Insurance Studies Centre at York. Students can also use the course as a building block in their preparation for the Risk and Insurance Management Society's (RIMS) Certified Risk Management Professional examination (RIMS-CRMP certificate) as well as examinations for related designations such as Associate in Risk Management (ARM) and/or Canadian Risk Management (CRM).

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course will have the traditional three-hour-per-week lecture component. The uniqueness of the course lays in the involvement of a variety of seasoned risk professionals from Financial Services, which are to visit and present biweekly, sharing their knowledge, enthusiasm and view of risk management and insurance with the students. The course is going to use various case-studies and experiments, which along with the aforementioned visitors are presumably going to impact students' engagement favorably.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1) every year, 3 lectures per week
2) five in Math and Stats
3) Ed Furman, Alexey Kuznetsov, Tom Salisbury, two new hires that are to start July 2020

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

15% home assignments
35% midterm examination
50% final examination

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

Textbook:

Rejda, G.E. and McNamara, M.J. *Principles of Risk Management and Insurance*. Pearson, 13th Edition.

Recommended reading:

O'Neil, C. *Weapons of Math Destruction*. Crown Books.

Shrader-Frechette, K. *Risk Analysis and Scientific Method: Methodological and Ethical Problems with Evaluating Societal Hazards.* D.Reidel Publishing Company.

Other Resources: A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain **COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.**	Risk and Insurance Studies Centre will be providing the required in kind / in cash support to ensure the involvement of the guest speakers from the risk management and insurance sector. Also, it seems that the Spencer Educational Foundation is going to be involved as well.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

Actuarial Science (AS) Program in Math and Stats, FSc.

AS has been quite successful in that the satellite internships have been providing students with the much-desired real-world experience, thus complementing the theoretical insights delivered by the intensive rigorous curriculum. As a result, the 2018 alumni have been mostly placed in Actuarial Analyst positions in various businesses (e.g., Mercer, Sun Life, Canada Life, RBC Insurance, Aviva, to name just a few). The weakness of the program remains its in-depth focus on separate aspects of insurance business in particular and quantitative risk management in general, while the big picture is rarely mentioned. Thus, it is not uncommon for the graduates of the program to miss the forest for the trees. The proposed course will become a mandatory course for AS majors, and it will address the just-mentioned problem by providing a comprehensive and overarching discussion of the principles of risk management and insurance. The course is vital for educating high-quality risk professionals, and, importantly, it furnishes York students with a presumable competitive advantage, as many actuarial science programs do not boast similar courses in the corresponding curricula.

Diploma in Risk and Insurance Management (DRIM)

The course is a core requirement of DRIM, a diploma offered by the Risk and Insurance Studies Centre at York. DRIM is supported by the Academic Innovation Fund Tier 1 grant of the Office of Associate Vice President Teaching and Learning

Students can also use the course as a building block in their preparation for the Risk and Insurance Management Society's Certified Risk Management Professional examination (RIMS-CRMP certificate) as well as for
examinations for related designations such as Associate in Risk Management (and/or Canadian Risk Management (CRM).

We have not been able to find a similar course within various undergraduate program curricula currently available at York.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

Library statement for MATH 1280 (Principles of Risk Management and Insurance)

William Denton

13 November 2019 (revised version)

I have reviewed the course proposal and the supporting bibliography and can state that York University Libraries (YUL) has the required resources to support this undergraduate-level course, based on the following availability of materials:

- books (print and online), encyclopædias and handbooks,
- journals (print and online), databases and other electronic resources,
- access to all YUL holdings, and to other libraries through interlibrary loan, and
- ongoing purchases of new resources based on course requirements.

The one textbook listed in the bibliography is *Principles of Risk Management and Insurance* (13th edition), by G.E. Rejda and M.J. McNamara (Pearson, 2019, ISBN 9780134082578, in hardcover). We do not have this in our collection, but, if the course is approved, I will buy a copy. However, the regular edition would cost $326.65! We are all familiar with the outrageous prices publishers put on textbooks, and this is a great example. What's more, we are unable to buy access to the electronic version of the book, because the publisher wants to sell that to students individually. If we get the book it should be put on reserve (by using our reserves system); if more than one copy is needed perhaps an instructor can lend us a personal copy.

I encourage all instructors to investigate open educational resources and consider how they might be used here in the future. If anyone is interested we have librarians who are experts on the subjects and would be happy to discuss them.

The Libraries already has both of the recommended readings, but there are mild warnings about each. K.S. Shrader-Frechette's *Risk Analysis and Scientific Method: Methodological and Ethical Problems with Evaluating Societal Hazards*

(Dordrecht: D. Reidel Publishing, 1985) is long out of print and if it were lost then finding another copy might not be easy. Cathy O'Neil's excellent *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy* (New York: Crown, 2016) is a justifiably popular title, and we have three copies, but publisher restrictions (designed to make them more money, from public libraries) mean that we cannot buy an electronic version.

The course description says, "The course covers topics such as the concept of risk, risk assessment and evaluation, principles of risk management, nature of the insurance device, and specific insurance types such as life, health, personal property, liability, and homeowners insurance." YUL has many books and other resources on these subjects, all of which can be found through the library catalogue. Students in this area will benefit from collection development already done by business librarians, for both books and journals.

We have research guides for mathematics and business that offer general help.

This subject area may require additional resources. Collection development is an ongoing process based on a commitment to developing library resources that are in alignment with the university's curricular and research activities. Additional resources in these fields can be purchased for the library. Please forward any requests for purchase to me.

Librarians also provide library research skills and information literacy workshops to students on topics including:

- formulating search strategies in different databases,
- evaluating information sources, and
- research and citation management programs such as Mendeley and Zotero.

York University Libraries is well positioned to support this undergraduate course.

Respectfully submitted,

William Denton <wdenton@yorku.ca>
Associate Librarian
102N Steacie Science and Engineering Library, x20006

Changes to Existing Course

Faculty: Science

Department: Mathematics & Statistics

Date of Submission: Nov 18, 2019

Course Number: 1505 6.00

Effective Session: Fall 2020

Course Title: Mathematics for the Life and Social Sciences

Type of Change:

- [ ] in pre-requisite(s)/co-requisite(s)
- [ ] in course number/level
- [ ] in credit value
- [ ] in title (max. 40 characters for short title)
- [ ] in Calendar description (max. 40 words or 200 characters)
- [ ] other (please specify):
- [ ] in cross-listing
- [ ] in degree credit exclusion(s)
- [ ] regularize course (from Special Topics)
- [x] in course format/mode of delivery *
- [ ] retire/expire course

Change From:	To:
There are currently no tutorials in Math 1505.	Each section of Math 1505 is to have weekly mandatory 60minute tutorials during the first half of the course. There is no technology component needed for this change.

Rationale:

Math 1505 is a large service course with an annual enrolment of about 2000 students (across the fall/winter and SU terms). The majority of the students in this course are in a Biology, Kinesiology or Psychology program. This is a required course for BSc programs and will satisfy their six-credit math requirement. Unfortunately, over the last few years we have seen high withdrawal and failure rates in this course. A primary reason for this is that students lack the proper high school preparation necessary for success in Math 1505. The addition of tutorials in the first half of the course will offer time to review/re-teach vital prerequisite material that will be needed for math1505. We will also have quizzes in tutorials to ensure students are keeping up with tutorial content.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised 'Course Design' and 'Method of Instruction" information.

FS Resource Implications Form **Unit: _MATH/STAT_** **Date: __Nov 25, 2019___**

		Course(s) Created ☐ or Modified to X (check one)	Course(s) Retired ☐ or Modified from X
Complete Course Designation			MATH 1505 6.00 Mathematics for the Life and Social Sciences
Enrolment (Estimate or Last Offering)		About 1500 students spread over 6 sections	About 1500 students spread over 8 sections
Number of:	Lecture Sections:	6	8
	Lab Sections:	0	0
	Tutorial Sections:	Currently M1505 has no tutorials, but we wish to change this to at least 3 tutorials per section.	Currently no tutorials
Number of:	Course Coordinators (Tutor 1):	A faculty member will coordinator the tutorials across all sections.	
	Lab Demonstrators (Tutor 2):		
	Mark/Graders (Tutor 3):	We will need at least 18 tutorial leaders for 18 tutorial sections.	
Prerequisites (P) Corequisites (C) Credit Exclusions (E)			P: 12U Advanced Functions (MHF4U) or equivalent, or SC/MATH 1510 6.00 C: not applicable E: SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1530 3.00, SC/MATH 1540 3.00, SC/MATH 1550 6.00, GL/MATH/MODR 1930 3.00, GL/MATH/MODR 1940 3.00, AP/ECON 1530 3.00, AP/ECON 1540, SC/ISCI 1401 3.00, SC/ISCI 1402 3.00, SC/ISCI 1410 6.00.
For which degree program is this required (if applicable)?			Science degree requirement for Biology, Kinesiology and Psychology majors.
Other resource implications (please specify)		Rooms for tutorials will be needed, and time/resources related to this. Extra demands on Undergraduate Program Assistant's time for both scheduling and student interactions.	

Reason(s) for creation/ modification/ retirement	Math 1505 is a large service course with an annual enrolment of about 1500 students (across the fall/winter). The majority of the students in this course are in a Biology, Kinesiology or Psychology program. This is a required course for BSc programs and will satisfy their six-credit math requirement. Unfortunately, over the last few years we have seen high withdrawal and failure rates in this course. A primary reason for this is that students lack the proper high school preparation necessary for success in Math 1505. The addition of tutorials in the first half of the course will offer time to review/re-teach vital prerequisite material that will be needed for math1505. We will also have quizzes in tutorials to ensure students are keeping up with tutorial content.	

Program Proposal

1. Program:

   PHYS (Physics and Astronomy)

   BPHS (Biophysics)

2. Degree Designation:

   BSc in Physics and Astronomy (Astronomy and Astrophysics Stream)
   BSc in Physics and Astronomy (Physics Stream)
   Honours BSc in Physics and Astronomy (Astronomy and Astrophysics Stream)
   Honours BSc in Physics and Astronomy (Physics Stream)
   Specialized Honours BSc in Physics and Astronomy (Applied Physics Stream)
   Specialized Honours BSc in Physics and Astronomy (Astronomy and Astrophysics Stream)
   Specialized Honours BSc in Physics and Astronomy (Physics Stream)
   Specialized Honours BSc in Physics and Astronomy (Space Science Stream)

   Specialized Honours BSc in Biophysics

3. Type of Modification:

   Changes to program requirements.

4. Effective Date:

   Fall 2020

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5. Provide a general description of the proposed changes to the program.

   The 6-credit, year-long first-year courses PHYS 1010, 1410 and 1420 have each been split into two 3-credit, one-semester courses (PHYS 1011+1012; PHYS 1411+1412; PHYS 1421+1422). Calendar copy is being updated to include these courses now that they are to be offered starting in the 2020-2021 academic year.

6. Provide the rationale for the proposed changes that is rooted in the program learning outcomes.

   No change to learning outcomes. Math pre- and co-requisites will be easier to enforce with 3-credit courses. Students will be able to make adjustments to their schedule as desired or needed (due to high marks or low marks in their physics course) after only one semester.

7. Provide an updated mapping of the program requirements to the program learning outcomes to illustrate how the proposed requirements will support the achievement of program learning objectives. If changes to the admission requirements are being proposed, comment on the appropriateness of the revised requirements to the achievement of the program learning outcomes.

   No change in mapping of program requirements to program learning outcomes.

8. If relevant, summarize the consultation undertaken with relevant academic units, including commentary on the impact of the proposed changes on other programs. Provide individual statements from the relevant program(s) confirming consultation and their support.

   Other departments in the Faculty of Science, the Faculty of Health, and the Lassonde School of Engineering were consulted when these courses were proposed last year.

9. Describe any resource implications and how they are being addressed (e.g., through a reallocation of existing resources). If new/additional resources are required, provide a statement from the relevant Dean(s)/Principal confirming resources will be in place to implement the changes.

   No resource implications.

10. Provide a summary of how students currently enrolled in the program will be accommodated.

    The course requirements explicitly still allow the current 6-credit first-year PHYS courses to be used to satisfy requirements.

11. Provide as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar.

    See attached.

Proposed Changes to the Program-Specific Degree Requirements of the Biophysics, Faculty of Science, Program in the Academic Calendar

Rationale:

- Update to Physics requirement to specifically include newer and equivalent course versions.

Change from	Changes	Change to
This is an interdisciplinary Specialized Honours program, offered by the Department of Physics and Astronomy, requiring coursework and practical experience in physics, biology, chemistry, mathematics and computer science. The focus of the program is on applying laws and methods of physics to understand biological processes. The program core (73 credits) is defined as: SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00; SC/BIOL 2020 3.00; SC/BIOL 2021 3.00; SC/BIOL 2040 3.00; SC/BIOL 2070 3.00; SC/BPHS 2090 3.00; SC/BPHS 3090 3.00; SC/BPHS 4090 3.00; SC/CHEM 1000 3.00; SC/CHEM 1001 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00 with a grade of C or higher; SC/PHYS 2010 3.00; SC/PHYS 2020 3.00; SC/PHYS 2030 3.00; SC/PHYS 2060 3.00; SC/PHYS 2213 3.00; SC/PHYS 3030 3.00; SC/PHYS 3040 6.00; SC/PHYS 4061 3.00. Specialized Honours Program A. General education: non-science requirement: 12	This is an interdisciplinary Specialized Honours program, offered by the Department of Physics and Astronomy, requiring coursework and practical experience in physics, biology, chemistry, mathematics and computer science. The focus of the program is on applying laws and methods of physics to understand biological processes. The program core (73 credits) is defined as: SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00; SC/BIOL 2020 3.00; SC/BIOL 2021 3.00; SC/BIOL 2040 3.00; SC/BIOL 2070 3.00; SC/BPHS 2090 3.00; SC/BPHS 3090 3.00; SC/BPHS 4090 3.00; SC/CHEM 1000 3.00; SC/CHEM 1001 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00; ~~SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00 with a grade of C or higher;~~ SC/PHYS 2010 3.00; SC/PHYS 2020 3.00; SC/PHYS 2030 3.00; SC/PHYS 2060 3.00; SC/PHYS 2213 3.00; SC/PHYS 3030 3.00; SC/PHYS 3040 6.00; SC/PHYS 4061 3.00. Specialized Honours Program A. General education: non-science requirement: 12	This is an interdisciplinary Specialized Honours program, offered by the Department of Physics and Astronomy, requiring coursework and practical experience in physics, biology, chemistry, mathematics and computer science. The focus of the program is on applying laws and methods of physics to understand biological processes. The program core (73 credits) is defined as: SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00; SC/BIOL 2020 3.00; SC/BIOL 2021 3.00; SC/BIOL 2040 3.00; SC/BIOL 2070 3.00; SC/BPHS 2090 3.00; SC/BPHS 3090 3.00; SC/BPHS 4090 3.00; SC/CHEM 1000 3.00; SC/CHEM 1001 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00, or one of SC/PHYS 1411 3.00 or SC/PHYS 1421 3.00 or SC/PHYS 1800 3.00 or SC/ISCI 1301 3.00, and one of SC/PHYS 1412 3.00 or SC/PHYS 1422 3.00 or SC/PHYS 1801 3.00 or SC/ISCI 1302 3.00 with a grade of C or higher, or SC/PHYS 1010 6.00, or one of SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00 or SC/ISCI 1310 6.00 with a grade of C or higher; SC/PHYS 2010 3.00; SC/PHYS 2020 3.00; SC/PHYS 2030 3.00; SC/PHYS 2060 3.00; SC/PHYS 2213

credits; mathematics: SC/MATH 1013 3.00 and SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: satisfied within the major requirements. B. Major requirements: the program core (73 credits) Additional courses: at least nine credits from: SC/PHYS 2040 3.00, SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3050 3.00, SC/PHYS 3090 3.00, SC/PHYS 3150 3.00, SC/PHYS 3220 3.00, SC/PHYS 3320 3.00, SC/PHYS 4010 3.00, SC/PHYS 4011 3.00, SC/PHYS 4020 3.00, SC/PHYS 4040 3.00, SC/PHYS 4050 3.00, SC/PHYS 4120 3.00; at least 15 credits from: SC/BIOL 2030 4.00, SC/BIOL 3010 3.00, SC/BIOL 3051 3.00, SC/BIOL 3060 4.00, SC/BIOL 3110 3.00, SC/BIOL 3120 3.00, SC/BIOL 3130 3.00, SC/BIOL 3150 4.00, SC/BIOL 3155 3.00, SC/BIOL 4030 3.00, SC/BIOL 4061 3.00, SC/BIOL 4141 3.00, SC/BIOL 4150 3.00, SC/BIOL 4151 3.00, SC/BIOL 4160 3.00, SC/BIOL 4380 3.00, SC/BPHS 4310 3.00, SC/CHEM 2020 3.00, SC/CHEM 2021 3.00, SC/CHEM 4092 3.00, SC/CHEM 4093 3.00, HH/KINE 2031 3.00, HH/KINE 3012	credits; mathematics: SC/MATH 1013 3.00 and SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: satisfied within the major requirements. B. Major requirements: the program core (73 credits) Additional courses: at least nine credits from: SC/PHYS 2040 3.00, SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3050 3.00, SC/PHYS 3090 3.00, SC/PHYS 3150 3.00, SC/PHYS 3220 3.00, SC/PHYS 3320 3.00, SC/PHYS 4010 3.00, SC/PHYS 4011 3.00, SC/PHYS 4020 3.00, SC/PHYS 4040 3.00, SC/PHYS 4050 3.00, SC/PHYS 4120 3.00; at least 15 credits from: SC/BIOL 2030 4.00, SC/BIOL 3010 3.00, SC/BIOL 3051 3.00, SC/BIOL 3060 4.00, SC/BIOL 3110 3.00, SC/BIOL 3120 3.00, SC/BIOL 3130 3.00, SC/BIOL 3150 4.00, SC/BIOL 3155 3.00, SC/BIOL 4030 3.00, SC/BIOL 4061 3.00, SC/BIOL 4141 3.00, SC/BIOL 4150 3.00, SC/BIOL 4151 3.00, SC/BIOL 4160 3.00, SC/BIOL 4380 3.00, SC/BPHS 4310 3.00, SC/CHEM 2020 3.00, SC/CHEM 2021 3.00, SC/CHEM 4092 3.00, SC/CHEM 4093 3.00, HH/KINE 2031 3.00, HH/KINE 3012	3.00; SC/PHYS 3030 3.00; SC/PHYS 3040 6.00; SC/PHYS 4061 3.00. Specialized Honours Program A. General education: non-science requirement: 12 credits; mathematics: SC/MATH 1013 3.00 and SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: satisfied within the major requirements. B. Major requirements: the program core (73 credits) Additional courses: at least nine credits from: SC/PHYS 2040 3.00, SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3050 3.00, SC/PHYS 3090 3.00, SC/PHYS 3150 3.00, SC/PHYS 3220 3.00, SC/PHYS 3320 3.00, SC/PHYS 4010 3.00, SC/PHYS 4011 3.00, SC/PHYS 4020 3.00, SC/PHYS 4040 3.00, SC/PHYS 4050 3.00, SC/PHYS 4120 3.00; at least 15 credits from: SC/BIOL 2030 4.00, SC/BIOL 3010 3.00, SC/BIOL 3051 3.00, SC/BIOL 3060 4.00, SC/BIOL 3110 3.00, SC/BIOL 3120 3.00, SC/BIOL 3130 3.00, SC/BIOL 3150 4.00, SC/BIOL 3155 3.00, SC/BIOL 4030 3.00, SC/BIOL 4061 3.00, SC/BIOL 4141 3.00, SC/BIOL 4150 3.00, SC/BIOL 4151

3.00, HH/KINE 4455 3.00, HH/KINE 4470 3.00. C. Science breadth: satisfied by above requirements. D. Upper level requirements: at least 42 credits at the 3000 or higher level, including at least 12 major credits at the 4000 level. E. Additional elective credits, as required for an overall total of at least 120 credits. F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.	3.00, HH/KINE 4455 3.00, HH/KINE 4470 3.00. C. Science breadth: satisfied by above requirements. D. Upper level requirements: at least 42 credits at the 3000 or higher level, including at least 12 major credits at the 4000 level. E. Additional elective credits, as required for an overall total of at least 120 credits. F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.	3.00, SC/BIOL 4160 3.00, SC/BIOL 4380 3.00, SC/BPHS 4310 3.00, SC/CHEM 2020 3.00, SC/CHEM 2021 3.00, SC/CHEM 4092 3.00, SC/CHEM 4093 3.00, HH/KINE 2031 3.00, HH/KINE 3012 3.00, HH/KINE 4455 3.00, HH/KINE 4470 3.00. C. Science breadth: satisfied by above requirements. D. Upper level requirements: at least 42 credits at the 3000 or higher level, including at least 12 major credits at the 4000 level. E. Additional elective credits, as required for an overall total of at least 120 credits. F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

Proposed Changes to the Program-Specific Degree Requirements of the Physics and Astronomy, Faculty of Science, Program in the Academic Calendar

Rationale:

- Update to Physics requirement to specifically include newer and equivalent course versions.

Change from	Changes	Change to
In addition to the programs defined below, the Department of Physics and Astronomy also offers a Specialized Honours BSc degree stream in space science whose degree requirements are specified in a separate entry in the Faculty of Science Programs of Study section.	In addition to the programs defined below, the Department of Physics and Astronomy also offers a Specialized Honours BSc degree stream in space science whose degree requirements are specified in a separate entry in the Faculty of Science Programs of Study section.	In addition to the programs defined below, the Department of Physics and Astronomy also offers a Specialized Honours BSc degree stream in space science whose degree requirements are specified in a separate entry in the Faculty of Science Programs of Study section.
Program Core The program core is defined to be (24 credits): ~~SC/PHYS 1010 6.00~~; SC/PHYS 2010 3.00; SC/PHYS 2020 3.00; SC/PHYS 2040 3.00; SC/PHYS 2060 3.00; SC/PHYS 3040 6.00. (Note: all program core courses require mathematics prerequisites or corequisites.)	Program Core The program core is defined to be (24 credits): ~~SC/PHYS 1010 6.00~~; SC/PHYS 2010 3.00; SC/PHYS 2020 3.00; SC/PHYS 2040 3.00; SC/PHYS 2060 3.00; SC/PHYS 3040 6.00. (Note: all program core courses require mathematics prerequisites or corequisites.)	Program Core The program core is defined to be (24 credits): SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00, or SC/PHYS 1010 6.00; SC/PHYS 2010 3.00; SC/PHYS 2020 3.00; SC/PHYS 2040 3.00; SC/PHYS 2060 3.00; SC/PHYS 3040 6.00. (Note: all program core courses require mathematics prerequisites or corequisites.)
Bachelor Program Students may follow a stream emphasizing physics or astronomy and astrophysics.	Bachelor Program Students may follow a stream emphasizing physics or astronomy and astrophysics.	Bachelor Program Students may follow a stream emphasizing physics or astronomy and astrophysics.
A. General education: non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.	A. General education: non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.	A. General education: non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.
B. Major requirements: Physics Stream	B. Major requirements: Physics Stream	B. Major requirements: Physics Stream

SC/MATH 1025 3.00; the program core, as specified above (24 credits, including 6 credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3090 3.00; SC/PHYS 3220 3.00; SC/PHYS 4061 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00; six credits from: SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00. Astronomy and Astrophysics Stream SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including 6 credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from: SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4270 4.00. C. Science breadth: satisfied by above requirements. D. Upper level requirements: a minimum of 18 credits at the 3000 level or above. E. Additional elective credits, as required for a total of 90 credits. F. Standing requirement: a minimum overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BSc degree (bachelor program).	SC/MATH 1025 3.00; the program core, as specified above (24 credits, including 6 credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3090 3.00; SC/PHYS 3220 3.00; SC/PHYS 4061 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00; six credits from: SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00. Astronomy and Astrophysics Stream SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including 6 credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from: SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4270 4.00. C. Science breadth: satisfied by above requirements. D. Upper level requirements: a minimum of 18 credits at the 3000 level or above. E. Additional elective credits, as required for a total of 90 credits. F. Standing requirement: a minimum overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BSc degree (bachelor program).	SC/MATH 1025 3.00; the program core, as specified above (24 credits, including 6 credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3090 3.00; SC/PHYS 3220 3.00; SC/PHYS 4061 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00; six credits from: SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00. Astronomy and Astrophysics Stream SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including 6 credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from: SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4270 4.00. C. Science breadth: satisfied by above requirements. D. Upper level requirements: a minimum of 18 credits at the 3000 level or above. E. Additional elective credits, as required for a total of 90 credits. F. Standing requirement: a minimum overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BSc degree (bachelor program).

Honours Programs	Honours Programs	Honours Programs
SPECIALIZED HONOURS PROGRAM Students may follow a stream emphasizing physics, applied physics or astronomy and astrophysics.	*SPECIALIZED HONOURS PROGRAM* Students may follow a stream emphasizing physics, applied physics or astronomy and astrophysics.	*SPECIALIZED HONOURS PROGRAM* Students may follow a stream emphasizing physics, applied physics or astronomy and astrophysics.
A. General education:	A. General education:	A. General education:
non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.	non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.	non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.
B. Major requirements:	B. Major requirements:	B. Major requirements:
Physics Stream	Physics Stream	Physics Stream
SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 3090 3.00, SC/PHYS 3220 3.00; SC/PHYS 4010 3.00; SC/PHYS 4020 3.00; SC/PHYS 4061 3.00; two of SC/PHYS 4011 3.00, SC/PHYS 4040 3.00, SC/PHYS 4050 3.00; six credits from SC/PHYS 4062 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00; three additional credits in PHYS courses at the 3000 level or higher.	SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 3090 3.00, SC/PHYS 3220 3.00; SC/PHYS 4010 3.00; SC/PHYS 4020 3.00; SC/PHYS 4061 3.00; two of SC/PHYS 4011 3.00, SC/PHYS 4040 3.00, SC/PHYS 4050 3.00; six credits from SC/PHYS 4062 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00; three additional credits in PHYS courses at the 3000 level or higher.	SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 3090 3.00, SC/PHYS 3220 3.00; SC/PHYS 4010 3.00; SC/PHYS 4020 3.00; SC/PHYS 4061 3.00; two of SC/PHYS 4011 3.00, SC/PHYS 4040 3.00, SC/PHYS 4050 3.00; six credits from SC/PHYS 4062 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00; three additional credits in PHYS courses at the 3000 level or higher.
Applied Physics Stream	Applied Physics Stream	Applied Physics Stream
SC/MATH 1025 3.00; the program core, as specified above (24 credits including six	SC/MATH 1025 3.00; the program core, as specified above (24 credits including six	SC/MATH 1025 3.00; the program core, as specified above (24 credits including six

credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 3050 3.00; SC/PHYS 3090 3.00; SC/PHYS 3150 3.00; SC/PHYS 3220 3.00; SC/PHYS 4010 3.00; SC/PHYS 4020 3.00; SC/PHYS 4050 3.00; SC/PHYS 4061 3.00; six credits from SC/PHYS 4062 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00 nine credits from SC/MATH 3241 3.00, SC/PHYS 3250 3.00, SC/PHYS 3280 3.00, SC/PHYS 4120 3.00, SC/PHYS 4250 3.00, or SC/PHYS 4310 3.00.	credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 3050 3.00; SC/PHYS 3090 3.00; SC/PHYS 3150 3.00; SC/PHYS 3220 3.00; SC/PHYS 4010 3.00; SC/PHYS 4020 3.00; SC/PHYS 4050 3.00; SC/PHYS 4061 3.00; six credits from SC/PHYS 4062 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00 nine credits from SC/MATH 3241 3.00, SC/PHYS 3250 3.00, SC/PHYS 3280 3.00, SC/PHYS 4120 3.00, SC/PHYS 4250 3.00, or SC/PHYS 4310 3.00.	credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 3050 3.00; SC/PHYS 3090 3.00; SC/PHYS 3150 3.00; SC/PHYS 3220 3.00; SC/PHYS 4010 3.00; SC/PHYS 4020 3.00; SC/PHYS 4050 3.00; SC/PHYS 4061 3.00; six credits from SC/PHYS 4062 3.00 or SC/PHYS 4210 3.00 or SC/PHYS 4211 3.00 nine credits from SC/MATH 3241 3.00, SC/PHYS 3250 3.00, SC/PHYS 3280 3.00, SC/PHYS 4120 3.00, SC/PHYS 4250 3.00, or SC/PHYS 4310 3.00.
Astronomy and Astrophysics Stream SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 3070 3.00; SC/PHYS 3090 3.00; SC/PHYS 3220 3.00; SC/PHYS 4010 3.00; SC/PHYS 4020 3.00; SC/PHYS 4061 3.00; SC/PHYS 4070 3.00; SC/PHYS 4170 3.00; SC/PHYS 4270 4.00; one of SC/PHYS 4011 3.00, SC/PHYS 4040 3.00, SC/PHYS 4050 3.00 or SC/PHYS 4120 3.00; one of SC/PHYS 3280 3.00, SC/PHYS 4060 3.00, SC/PHYS 4330	Astronomy and Astrophysics Stream SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 3070 3.00; SC/PHYS 3090 3.00; SC/PHYS 3220 3.00; SC/PHYS 4010 3.00; SC/PHYS 4020 3.00; SC/PHYS 4061 3.00; SC/PHYS 4070 3.00; SC/PHYS 4170 3.00; SC/PHYS 4270 4.00; one of SC/PHYS 4011 3.00, SC/PHYS 4040 3.00, SC/PHYS 4050 3.00 or SC/PHYS 4120 3.00; one of SC/PHYS 3280 3.00, SC/PHYS 4060 3.00, SC/PHYS 4330	Astronomy and Astrophysics Stream SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/MATH 2015 3.00; SC/MATH 2271 3.00; SC/PHYS 2030 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3010 3.00; SC/PHYS 3020 3.00; SC/PHYS 3030 3.00; SC/PHYS 3070 3.00; SC/PHYS 3090 3.00; SC/PHYS 3220 3.00; SC/PHYS 4010 3.00; SC/PHYS 4020 3.00; SC/PHYS 4061 3.00; SC/PHYS 4070 3.00; SC/PHYS 4170 3.00; SC/PHYS 4270 4.00; one of SC/PHYS 4011 3.00, SC/PHYS 4040 3.00, SC/PHYS 4050 3.00 or SC/PHYS 4120 3.00; one of SC/PHYS 3280 3.00, SC/PHYS 4060 3.00, SC/PHYS 4330

3.00, LE/ESSE 4110 3.00 (cross-listed to: SC/PHYS 4110 3.00), or LE/ESSE 4630 3.00; three additional credits from PHYS, ESSE or MATH courses at the 3000 level or higher. C. Science breadth: satisfied by above requirements. D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required for a total of 120 credits. F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. *HONOURS MAJOR, HONOURS DOUBLE MAJOR AND HONOURS MAJOR/MINOR PROGRAMS* An Honours Major in physics and astronomy may be taken stand-alone or combined with an Honours Major in another subject area in an Honours Double Major BSc degree program, or with an Honours Minor in another subject area in an Honours Major/Minor BSc degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. Students should consult with a departmental advisor to plan their studies in order to meet the requirements for both majors and their prerequisites.	3.00, LE/ESSE 4110 3.00 (cross-listed to: SC/PHYS 4110 3.00), or LE/ESSE 4630 3.00; three additional credits from PHYS, ESSE or MATH courses at the 3000 level or higher. C. Science breadth: satisfied by above requirements. D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required for a total of 120 credits. F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. *HONOURS MAJOR, HONOURS DOUBLE MAJOR AND HONOURS MAJOR/MINOR PROGRAMS* An Honours Major in physics and astronomy may be taken stand-alone or combined with an Honours Major in another subject area in an Honours Double Major BSc degree program, or with an Honours Minor in another subject area in an Honours Major/Minor BSc degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. Students should consult with a departmental advisor to plan their studies in order to meet the requirements for both majors and their prerequisites.	3.00, LE/ESSE 4110 3.00 (cross-listed to: SC/PHYS 4110 3.00), or LE/ESSE 4630 3.00; three additional credits from PHYS, ESSE or MATH courses at the 3000 level or higher. C. Science breadth: satisfied by above requirements. D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required for a total of 120 credits. F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. *HONOURS MAJOR, HONOURS DOUBLE MAJOR AND HONOURS MAJOR/MINOR PROGRAMS* An Honours Major in physics and astronomy may be taken stand-alone or combined with an Honours Major in another subject area in an Honours Double Major BSc degree program, or with an Honours Minor in another subject area in an Honours Major/Minor BSc degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. Students should consult with a departmental advisor to plan their studies in order to meet the requirements for both majors and their prerequisites.

Note: if the other major or the minor is biology or environmental biology, the foundational science requirement will be met by taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 and ~~SC/PHYS 1010 6.00.~~	**Note:** if the other major or the minor is biology or environmental biology, the foundational science requirement will be met by taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 and ~~SC/PHYS 1010 6.00.~~	**Note:** if the other major or the minor is biology or environmental biology, the foundational science requirement will be met by taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, and SC/PHYS 1011 3.00 and SC/PHYS 1012 3.00, or SC/PHYS 1010 6.00.
HONOURS MAJOR Students may follow a stream emphasizing physics or astronomy and astrophysics.	*HONOURS MAJOR* Students may follow a stream emphasizing physics or astronomy and astrophysics.	*HONOURS MAJOR* Students may follow a stream emphasizing physics or astronomy and astrophysics.
A. General education:	A. General education:	A. General education:
non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.	non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.	non-science: 12 credits; mathematics: SC/MATH 1013 3.00; SC/MATH 1014 3.00; computer science: LE/EECS 1541 3.00; foundational science: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00.
B. Major requirements:	B. Major requirements:	B. Major requirements:
Physics Stream	Physics Stream	Physics Stream
SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4061 3.00; at least nine credits from PHYS courses at the 4000 level, for an overall total of at least 48 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.	SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4061 3.00; at least nine credits from PHYS courses at the 4000 level, for an overall total of at least 48 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.	SC/MATH 1025 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4061 3.00; at least nine credits from PHYS courses at the 4000 level, for an overall total of at least 48 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs.
Astronomy and Astrophysics Stream	Astronomy and Astrophysics Stream	Astronomy and Astrophysics

SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4270 4.00; eight additional credits in PHYS at the 4000 level for an overall total of at least 54 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs. **Note:** the following courses are required as prerequisites or corequisites for the courses above: SC/MATH 1013 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. C. Science breadth: a total of 24 credits in science disciplines outside the major, of which at least three credits must be at the 2000 level or above (satisfied by the above requirements). D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required for a total of 120 credits. F. Standing requirement: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and	SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4270 4.00; eight additional credits in PHYS at the 4000 level for an overall total of at least 54 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs. **Note:** the following courses are required as prerequisites or corequisites for the courses above: SC/MATH 1013 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. C. Science breadth: a total of 24 credits in science disciplines outside the major, of which at least three credits must be at the 2000 level or above (satisfied by the above requirements). D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required for a total of 120 credits. F. Standing requirement: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and	Stream SC/MATH 1025 3.00; SC/PHYS 1070 3.00; the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; six credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00; SC/PHYS 4270 4.00; eight additional credits in PHYS at the 4000 level for an overall total of at least 54 credits from PHYS courses; the requirements for the second major or the minor, in Honours Double Major or Honours Major/Minor BSc programs. **Note:** the following courses are required as prerequisites or corequisites for the courses above: SC/MATH 1013 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. C. Science breadth: a total of 24 credits in science disciplines outside the major, of which at least three credits must be at the 2000 level or above (satisfied by the above requirements). D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required for a total of 120 credits. F. Standing requirement: to graduate in an Honours program requires successful completion of all Faculty requirements and

a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed, subject to the exception in the following note. In addition, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed is required to graduate in an Honours Double Major program where biology is the other major. *HONOURS MINOR* Students may follow a stream in physics or a stream in astronomy in the minor subject area. **Note:** the following courses are required as prerequisites or corequisites for the courses below: SC/MATH 1013 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. Physics Stream the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; three credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00 for an overall total of 33 credits from PHYS courses. Astronomy and Astrophysics Stream the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 1070 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3070 3.00 or SC/PHYS 4270 4.00; three credits from SC/PHYS 3010	a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed, subject to the exception in the following note. In addition, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed is required to graduate in an Honours Double Major program where biology is the other major. *HONOURS MINOR* Students may follow a stream in physics or a stream in astronomy in the minor subject area. **Note:** the following courses are required as prerequisites or corequisites for the courses below: SC/MATH 1013 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. Physics Stream the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; three credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00 for an overall total of 33 credits from PHYS courses. Astronomy and Astrophysics Stream the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 1070 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3070 3.00 or SC/PHYS 4270 4.00; three credits from SC/PHYS 3010	departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed, subject to the exception in the following note. In addition, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed is required to graduate in an Honours Double Major program where biology is the other major. *HONOURS MINOR* Students may follow a stream in physics or a stream in astronomy in the minor subject area. **Note:** the following courses are required as prerequisites or corequisites for the courses below: SC/MATH 1013 3.00; SC/MATH 1014 3.00; SC/MATH 1025 3.00; SC/MATH 2015 3.00; SC/MATH 2271 3.00. Physics Stream the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 2213 3.00; SC/PHYS 3220 3.00; three credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00 for an overall total of 33 credits from PHYS courses. Astronomy and Astrophysics Stream the program core, as specified above (24 credits including six credits at the 3000 level); SC/PHYS 1070 3.00; SC/PHYS 2070 3.00; SC/PHYS 2213 3.00; SC/PHYS 3070 3.00 or SC/PHYS 4270 4.00;

3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00.for an overall total of at least 39 credits from PHYS courses.	3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00.for an overall total of at least 39 credits from PHYS courses.	three credits from SC/PHYS 3010 3.00, SC/PHYS 3020 3.00, SC/PHYS 3030 3.00, SC/PHYS 3090 3.00.for an overall total of at least 39 credits from PHYS courses.

Program Proposal

1. Program:

   Science and Technology Studies (Faculty of Science)

2. Degree Designation:

   BSc in Science and Technology Studies
   Honours BSc in Science and Technology Studies
   Specialized Honours BSc in Science and Technology Studies

3. Type of Modification:

   Changes to program requirements.

4. Effective Date:

   Fall 2020

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5. Provide a general description of the proposed changes to the program.

   Update to Physics requirement to specifically include newer and equivalent course versions.

6. Provide the rationale for the proposed changes that is rooted in the program learning outcomes.

   No change to learning outcomes.

7. Provide an updated mapping of the program requirements to the program learning outcomes to illustrate how the proposed requirements will support the achievement of program learning objectives. If changes to the admission requirements are being proposed, comment on the appropriateness of the revised requirements to the achievement of the program learning outcomes.

   No change in mapping of program requirements to program learning outcomes.

8. If relevant, summarize the consultation undertaken with relevant academic units, including commentary on the impact of the proposed changes on other programs. Provide individual statements from the relevant program(s) confirming consultation and their support.

   These changes are the result of consultation with the Physics and Astronomy Department.

9. Describe any resource implications and how they are being addressed (e.g., through a

reallocation of existing resources). If new/additional resources are required, provide a statement from the relevant Dean(s)/Principal confirming resources will be in place to implement the changes.

No resource implications.

10. Provide a summary of how students currently enrolled in the program will be accommodated.

    The course requirements specifically still allow the current 6-credit first-year PHYS courses to be used to satisfy requirements.

11. Provide as an appendix a side-by-side comparison of the existing and proposed program requirements as they will appear in the Undergraduate or Graduate Calendar.

    See attached.

Proposed Changes to the Program-Specific Degree Requirements of the Science and Technology Studies, Faculty of Science, Program in the Academic Calendar

Rationale:

- Update to Physics requirement to specifically include newer and equivalent course versions.

Change from	**Changes**	**Change to**
STS Program Core The program core (12 credits) is defined as: SC/STS 2411 3.00; one of SC/STS 2010 3.00 (cross-listed to AP/HIST 2810 3.00) **or** SC/STS 2210 3.00 (cross-listed to AP/HIST 2822 3.00); SC/STS 4501 6.00.	STS Program Core The program core (12 credits) is defined as: SC/STS 2411 3.00; one of SC/STS 2010 3.00 (cross-listed to AP/HIST 2810 3.00) **or** SC/STS 2210 3.00 (cross-listed to AP/HIST 2822 3.00); SC/STS 4501 6.00.	STS Program Core The program core (12 credits) is defined as: SC/STS 2411 3.00; one of SC/STS 2010 3.00 (cross-listed to AP/HIST 2810 3.00) **or** SC/STS 2210 3.00 (cross-listed to AP/HIST 2822 3.00); SC/STS 4501 6.00.
Bachelor of Arts Programs All BA and Honours BA degree candidates, in accordance with their declared programs, must comply with general regulations specified in the Faculty of Science *Regulations Governing Undergraduate Degree Requirements* section of the *Faculty Rules* and, in so doing, must also satisfy the course, credit and standing requirements specified below.	Bachelor of Arts Programs All BA and Honours BA degree candidates, in accordance with their declared programs, must comply with general regulations specified in the Faculty of Science *Regulations Governing Undergraduate Degree Requirements* section of the *Faculty Rules* and, in so doing, must also satisfy the course, credit and standing requirements specified below.	Bachelor of Arts Programs All BA and Honours BA degree candidates, in accordance with their declared programs, must comply with general regulations specified in the Faculty of Science *Regulations Governing Undergraduate Degree Requirements* section of the *Faculty Rules* and, in so doing, must also satisfy the course, credit and standing requirements specified below.
BA BACHELOR PROGRAM (90 CREDITS) **To graduate in a bachelor program:** A minimum cumulative overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BA degree (bachelor program).	*BA BACHELOR PROGRAM (90 CREDITS)* **To graduate in a bachelor program:** A minimum cumulative overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BA degree (bachelor program).	*BA BACHELOR PROGRAM (90 CREDITS)* **To graduate in a bachelor program:** A minimum cumulative overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BA degree (bachelor program).
Major credits: students will take at least 30 credits in science and technology studies, including: the STS program core (12 credits, see above); 18 additional credits chosen from the science and technology studies	**Major credits:** students will take at least 30 credits in science and technology studies, including: the STS program core (12 credits, see above); 18 additional credits chosen from the science and technology studies	**Major credits:** students will take at least 30 credits in science and technology studies, including: the STS program core (12 credits, see above); 18 additional credits chosen from the science and technology studies

list of courses. **Note:** at least 12 credits in the major at the 3000 level or above. **Upper-level credits**: at least 18 credits at the 3000 or 4000 level. **Credits outside the major**: at least 18 credits. *BA HONOURS PROGRAMS (120 CREDITS)* To graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. Honours Major BA **Major credits:** students will take at least 48 credits in science and technology studies, including: the STS program core (12 credits, see above); 36 additional credits chosen from the science and technology studies list of courses, including at least six credits at the 4000 level. **Note:** at least 12 credits in the major at the 4000 level. **Upper-level credits**: at least 18 credits at the 3000 or 4000 level, including at least 18 credits at the 4000 level. **Credits outside the major**: at least 18 credits. (Note: students who are completing a double major or major/minor are deemed to have fulfilled this requirement.) Honours Double Major and Honours Major/Minor Programs	list of courses. **Note:** at least 12 credits in the major at the 3000 level or above. **Upper-level credits**: at least 18 credits at the 3000 or 4000 level. **Credits outside the major**: at least 18 credits. *BA HONOURS PROGRAMS (120 CREDITS)* To graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. Honours Major BA **Major credits:** students will take at least 48 credits in science and technology studies, including: the STS program core (12 credits, see above); 36 additional credits chosen from the science and technology studies list of courses, including at least six credits at the 4000 level. **Note:** at least 12 credits in the major at the 4000 level. **Upper-level credits**: at least 18 credits at the 3000 or 4000 level, including at least 18 credits at the 4000 level. **Credits outside the major**: at least 18 credits. (Note: students who are completing a double major or major/minor are deemed to have fulfilled this requirement.) Honours Double Major and Honours Major/Minor Programs	list of courses. **Note:** at least 12 credits in the major at the 3000 level or above. **Upper-level credits**: at least 18 credits at the 3000 or 4000 level. **Credits outside the major**: at least 18 credits. *BA HONOURS PROGRAMS (120 CREDITS)* To graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. Honours Major BA **Major credits:** students will take at least 48 credits in science and technology studies, including: the STS program core (12 credits, see above); 36 additional credits chosen from the science and technology studies list of courses, including at least six credits at the 4000 level. **Note:** at least 12 credits in the major at the 4000 level. **Upper-level credits**: at least 18 credits at the 3000 or 4000 level, including at least 18 credits at the 4000 level. **Credits outside the major**: at least 18 credits. (Note: students who are completing a double major or major/minor are deemed to have fulfilled this requirement.) Honours Double Major and Honours Major/Minor Programs

The following Honours Major in science and technology studies may be combined with an Honours Major in another subject area in a BA Double Major degree program, or with an Honours Minor in another subject area in an Honours Major/Minor BA degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. **Note:** in a double major program, a course may count only once toward major credit. **Major credits:** students will take at least 42 credits in science and technology studies, including: the STS program core (12 credits, see above); 30 additional credits chosen from the science and technology studies list of courses, including at least six credits at the 4000 level. **Note:** at least 12 credits in the major at the 4000 level. Honours Double Major Interdisciplinary (Linked) BA Science and Technology Studies may be linked with any Honours Double Major Interdisciplinary BA program in the Faculty of Liberal Arts and Professional Studies. Students must take at least 36 credits in science and technology studies and at least 36 credits in the interdisciplinary program. Courses taken to meet the science and technology studies requirements cannot also be used to meet the requirements of the interdisciplinary program. Students in these interdisciplinary programs must take a total of at least 18 credits at the 4000 level, including	The following Honours Major in science and technology studies may be combined with an Honours Major in another subject area in a BA Double Major degree program, or with an Honours Minor in another subject area in an Honours Major/Minor BA degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. **Note:** in a double major program, a course may count only once toward major credit. **Major credits:** students will take at least 42 credits in science and technology studies, including: the STS program core (12 credits, see above); 30 additional credits chosen from the science and technology studies list of courses, including at least six credits at the 4000 level. **Note:** at least 12 credits in the major at the 4000 level. Honours Double Major Interdisciplinary (Linked) BA Science and Technology Studies may be linked with any Honours Double Major Interdisciplinary BA program in the Faculty of Liberal Arts and Professional Studies. Students must take at least 36 credits in science and technology studies and at least 36 credits in the interdisciplinary program. Courses taken to meet the science and technology studies requirements cannot also be used to meet the requirements of the interdisciplinary program. Students in these interdisciplinary programs must take a total of at least 18 credits at the 4000 level, including	The following Honours Major in science and technology studies may be combined with an Honours Major in another subject area in a BA Double Major degree program, or with an Honours Minor in another subject area in an Honours Major/Minor BA degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. **Note:** in a double major program, a course may count only once toward major credit. **Major credits:** students will take at least 42 credits in science and technology studies, including: the STS program core (12 credits, see above); 30 additional credits chosen from the science and technology studies list of courses, including at least six credits at the 4000 level. **Note:** at least 12 credits in the major at the 4000 level. Honours Double Major Interdisciplinary (Linked) BA Science and Technology Studies may be linked with any Honours Double Major Interdisciplinary BA program in the Faculty of Liberal Arts and Professional Studies. Students must take at least 36 credits in science and technology studies and at least 36 credits in the interdisciplinary program. Courses taken to meet the science and technology studies requirements cannot also be used to meet the requirements of the interdisciplinary program. Students in these interdisciplinary programs must take a total of at least 18 credits at the 4000 level, including

at least 12 credits science and technology studies and six credits in the interdisciplinary program. For further details of requirements, refer to the listings for specific Honours Double Major Interdisciplinary BA programs. **Note:** in a double major program, a course may count only once toward major credit. **Major credits:** the 36 credits in science and technology studies must include the following: the STS program core (12 credits, see above); 24 additional credits chosen from the science and technology studies list of courses, including at least six credits at the 4000 level. **Note:** at least 12 credits in the major at the 4000 level. Honours Minor BA The following Honours Minor program may be combined with any approved Honours BA Major program that offers a major/minor option in the Faculty of Environmental Studies, the Faculty of Health, the Faculty of Liberal Arts and Professional Studies, the Faculty of Science, the Lassonde School of Engineering, or the School of the Arts, Media, Performance and Design. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. **Note:** in a major/minor program, a course may count only once toward major credit. **Major credits:** students must compelte at least 30 credits in	at least 12 credits science and technology studies and six credits in the interdisciplinary program. For further details of requirements, refer to the listings for specific Honours Double Major Interdisciplinary BA programs. **Note:** in a double major program, a course may count only once toward major credit. **Major credits:** the 36 credits in science and technology studies must include the following: the STS program core (12 credits, see above); 24 additional credits chosen from the science and technology studies list of courses, including at least six credits at the 4000 level. **Note:** at least 12 credits in the major at the 4000 level. Honours Minor BA The following Honours Minor program may be combined with any approved Honours BA Major program that offers a major/minor option in the Faculty of Environmental Studies, the Faculty of Health, the Faculty of Liberal Arts and Professional Studies, the Faculty of Science, the Lassonde School of Engineering, or the School of the Arts, Media, Performance and Design. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. **Note:** in a major/minor program, a course may count only once toward major credit. **Major credits:** students must ~~compelte~~ at least 30 credits in	at least 12 credits science and technology studies and six credits in the interdisciplinary program. For further details of requirements, refer to the listings for specific Honours Double Major Interdisciplinary BA programs. **Note:** in a double major program, a course may count only once toward major credit. **Major credits:** the 36 credits in science and technology studies must include the following: the STS program core (12 credits, see above); 24 additional credits chosen from the science and technology studies list of courses, including at least six credits at the 4000 level. **Note:** at least 12 credits in the major at the 4000 level. Honours Minor BA The following Honours Minor program may be combined with any approved Honours BA Major program that offers a major/minor option in the Faculty of Environmental Studies, the Faculty of Health, the Faculty of Liberal Arts and Professional Studies, the Faculty of Science, the Lassonde School of Engineering, or the School of the Arts, Media, Performance and Design. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. **Note:** in a major/minor program, a course may count only once toward major credit. **Major credits:** students must complete at least 30 credits in

science and technology studies, including: the STS program core (12 credits, see above); 18 additional credits chosen from the science and technology studies list of courses. **Note:** at least six credits in the minor must be at the 4000 level. Bachelor of Science Programs *BACHELOR PROGRAM (90 CREDITS)* A. General Education: non-science requirement: 12 credits; mathematics: six credits from: SC/MATH 1505 6.00, SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1021 3.00, SC/MATH 1025 3.00; (note that SC/MATH 1013 3.00 and SC/MATH 1300 3.00 are course credit exclusions, as are SC/MATH 1014 3.00 and SC/MATH 1310 3.00); computer science: three credits from LE/EECS 1520 3.00, LE/EECS 1530 3.00, LE/EECS 1540 3.00 or LE/EECS 1020 3.00; foundational science: six credits from: SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, SC/CHEM 1000 3.00, SC/CHEM 1001 3.00, SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00. B. Major requirements: the program core as specified above (12 credits);	science and technology studies, including: the STS program core (12 credits, see above); 18 additional credits chosen from the science and technology studies list of courses. **Note:** at least six credits in the minor must be at the 4000 level. Bachelor of Science Programs *BACHELOR PROGRAM (90 CREDITS)* A. General Education: non-science requirement: 12 credits; mathematics: six credits from: SC/MATH 1505 6.00, SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1021 3.00, SC/MATH 1025 3.00; (note that SC/MATH 1013 3.00 and SC/MATH 1300 3.00 are course credit exclusions, as are SC/MATH 1014 3.00 and SC/MATH 1310 3.00); computer science: three credits from LE/EECS 1520 3.00, LE/EECS 1530 3.00, LE/EECS 1540 3.00 or LE/EECS 1020 3.00; foundational science: six credits from: SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, SC/CHEM 1000 3.00, SC/CHEM 1001 3.00, ~~SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00.~~ B. Major requirements: the program core as specified above (12 credits);	science and technology studies, including: the STS program core (12 credits, see above); 18 additional credits chosen from the science and technology studies list of courses. **Note:** at least six credits in the minor must be at the 4000 level. Bachelor of Science Programs *BACHELOR PROGRAM (90 CREDITS)* A. General Education: non-science requirement: 12 credits; mathematics: six credits from: SC/MATH 1505 6.00, SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1021 3.00, SC/MATH 1025 3.00; (note that SC/MATH 1013 3.00 and SC/MATH 1300 3.00 are course credit exclusions, as are SC/MATH 1014 3.00 and SC/MATH 1310 3.00); computer science: three credits from LE/EECS 1520 3.00, LE/EECS 1530 3.00, LE/EECS 1540 3.00 or LE/EECS 1020 3.00; foundational science: six credits from: SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, SC/CHEM 1000 3.00, SC/CHEM 1001 3.00, SC/PHYS 1011 3.00 or SC/PHYS 1411 3.00 or SC/PHYS 1421 3.00 or SC/PHYS 1800 3.00, SC/PHYS 1012 3.00 or SC/PHYS 1412 3.00 or SC/PHYS 1422 3.00 or SC/PHYS 1801 3.00, or SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00.

an additional 18 credits from the approved science and technology studies major courses including at least 12 major credits at the 3000 level or above, for a total of a minimum of 30 credits from science and technology studies major courses, at least 18 science credits at the 2000 level or higher non-science and technology studies major courses. C. Science breadth: satisfied within the major requirements. D. Upper level requirements: a minimum of 18 credits at the 3000 level or above. E. Additional credits, as required, for an overall total of 90 credits. F. Standing requirements: a minimum overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BSc degree (bachelor program). *HONOURS PROGRAMS* Specialized Honours Program A. General education: non-science requirement: 12 credits; mathematics: six credits from: SC/MATH 1505 6.00, SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1021 3.00, SC/MATH 1025 3.00; (note that SC/MATH 1013 3.00 and SC/MATH 1300 3.00 are course credit exclusions, as are SC/MATH 1014 3.00 and SC/MATH 1310 3.00); computer science: three credits from LE/EECS 1520	an additional 18 credits from the approved science and technology studies major courses including at least 12 major credits at the 3000 level or above, for a total of a minimum of 30 credits from science and technology studies major courses, at least 18 science credits at the 2000 level or higher non-science and technology studies major courses. C. Science breadth: satisfied within the major requirements. D. Upper level requirements: a minimum of 18 credits at the 3000 level or above. E. Additional credits, as required, for an overall total of 90 credits. F. Standing requirements: a minimum overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BSc degree (bachelor program). *HONOURS PROGRAMS* Specialized Honours Program A. General education: non-science requirement: 12 credits; mathematics: six credits from: SC/MATH 1505 6.00, SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1021 3.00, SC/MATH 1025 3.00; (note that SC/MATH 1013 3.00 and SC/MATH 1300 3.00 are course credit exclusions, as are SC/MATH 1014 3.00 and SC/MATH 1310 3.00); computer science: three credits from LE/EECS 1520	B. Major requirements: the program core as specified above (12 credits); an additional 18 credits from the approved science and technology studies major courses including at least 12 major credits at the 3000 level or above, for a total of a minimum of 30 credits from science and technology studies major courses, at least 18 science credits at the 2000 level or higher non-science and technology studies major courses. C. Science breadth: satisfied within the major requirements. D. Upper level requirements: a minimum of 18 credits at the 3000 level or above. E. Additional credits, as required, for an overall total of 90 credits. F. Standing requirements: a minimum overall grade point average of 4.00 (C) is required in order to be eligible to graduate with a BSc degree (bachelor program). *HONOURS PROGRAMS* Specialized Honours Program A. General education: non-science requirement: 12 credits; mathematics: six credits from: SC/MATH 1505 6.00, SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1021 3.00, SC/MATH 1025 3.00; (note that SC/MATH 1013 3.00 and SC/MATH 1300 3.00 are course credit exclusions, as

3.00, LE/EECS 1530 3.00, LE/EECS 1540 3.00 or LE/EECS 1012 3.00; foundational science: six credits from: SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, SC/CHEM 1000 3.00, SC/CHEM 1001 3.00, SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00. B. Major requirements: the program core as specified above (12 credits); an additional 42 credits from the approved science and technology studies major courses (for a total of 54 science and technology studies credits, including at least 18 credits at the 3000 or higher level, of which at least 12 are at the 4000 level); at least 18 science credits at the 2000 level or higher that are not science and technology studies courses. C. Science breadth: satisfied within the major requirements. D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required, for an overall total of 120 credits. F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 over all courses completed. Honours Double Major and Honours Major/Minor Programs	3.00, LE/EECS 1530 3.00, LE/EECS 1540 3.00 or LE/EECS 1012 3.00; foundational science: six credits from: SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, SC/CHEM 1000 3.00, SC/CHEM 1001 3.00, ~~SC/PHYS 1010~~ ~~6.00 or SC/PHYS 1410~~ ~~6.00 or SC/PHYS 1420 6.00.~~ B. Major requirements: the program core as specified above (12 credits); an additional 42 credits from the approved science and technology studies major courses (for a total of 54 science and technology studies credits, including at least 18 credits at the 3000 or higher level, of which at least 12 are at the 4000 level); at least 18 science credits at the 2000 level or higher that are not science and technology studies courses. C. Science breadth: satisfied within the major requirements. D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required, for an overall total of 120 credits. F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 over all courses completed. Honours Double Major and Honours Major/Minor Programs	are SC/MATH 1014 3.00 and SC/MATH 1310 3.00); computer science: three credits from LE/EECS 1520 3.00, LE/EECS 1530 3.00, LE/EECS 1540 3.00 or LE/EECS 1012 3.00; foundational science: six credits from: SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, SC/CHEM 1000 3.00, SC/CHEM 1001 3.00, SC/PHYS 1011 3.00 or SC/PHYS 1411 3.00 or SC/PHYS 1421 3.00 or SC/PHYS 1800 3.00, SC/PHYS 1012 3.00 or SC/PHYS 1412 3.00 or SC/PHYS 1422 3.00 or SC/PHYS 1801 3.00, or SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00. B. Major requirements: the program core as specified above (12 credits); an additional 42 credits from the approved science and technology studies major courses (for a total of 54 science and technology studies credits, including at least 18 credits at the 3000 or higher level, of which at least 12 are at the 4000 level); at least 18 science credits at the 2000 level or higher that are not science and technology studies courses. C. Science breadth: satisfied within the major requirements. D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required, for an overall total of 120 credits.

An Honours Major in science and technology studies may be combined with an Honours Major in another subject area in a BSc Double Major degree program, or with an Honours Minor in another subject area in an Honours Major/Minor BSc degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. Students should consult with a departmental adviser to plan their studies in order to meet the program requirements for both majors and their prerequisites. A. General education: non-science requirement: 12 credits; mathematics: six credits from: SC/MATH 1505 6.00, SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1021 3.00, SC/MATH 1025 3.00; (note that SC/MATH 1013 3.00 and SC/MATH 1300 3.00 are course credit exclusions, as are SC/MATH 1014 3.00 and SC/MATH 1310 3.00); computer science: three credits from LE/EECS 1520 3.00, LE/EECS 1530 3.00, LE/EECS 1540 3.00 or LE/EECS 1012 3.00; foundational science: six credits from: SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, SC/CHEM 1000 3.00, SC/CHEM 1001 3.00, SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00.	An Honours Major in science and technology studies may be combined with an Honours Major in another subject area in a BSc Double Major degree program, or with an Honours Minor in another subject area in an Honours Major/Minor BSc degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. Students should consult with a departmental adviser to plan their studies in order to meet the program requirements for both majors and their prerequisites. A. General education: non-science requirement: 12 credits; mathematics: six credits from: SC/MATH 1505 6.00, SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1021 3.00, SC/MATH 1025 3.00; (note that SC/MATH 1013 3.00 and SC/MATH 1300 3.00 are course credit exclusions, as are SC/MATH 1014 3.00 and SC/MATH 1310 3.00); computer science: three credits from LE/EECS 1520 3.00, LE/EECS 1530 3.00, LE/EECS 1540 3.00 or LE/EECS 1012 3.00; foundational science: six credits from: SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, SC/CHEM 1000 3.00, SC/CHEM 1001 3.00, ~~SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00.~~	F. Standing requirements: to graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 over all courses completed. Honours Double Major and Honours Major/Minor Programs An Honours Major in science and technology studies may be combined with an Honours Major in another subject area in a BSc Double Major degree program, or with an Honours Minor in another subject area in an Honours Major/Minor BSc degree program. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section. Students should consult with a departmental adviser to plan their studies in order to meet the program requirements for both majors and their prerequisites. A. General education: non-science requirement: 12 credits; mathematics: six credits from: SC/MATH 1505 6.00, SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1021 3.00, SC/MATH 1025 3.00; (note that SC/MATH 1013 3.00 and SC/MATH 1300 3.00 are course credit exclusions, as are SC/MATH 1014 3.00 and SC/MATH 1310 3.00); computer science: three credits from LE/EECS 1520 3.00, LE/EECS 1530

B. Major requirements: the program core as specified above (12 credits); an additional 30 credits from the approved science and technology studies major courses, including at least 18 credits at the 3000 or higher level, of which at least 12 are at the 4000 level, for a total of 42 credits in science and technology studies; at least 18 science credits at the 2000 level or higher level non-science and technology studies courses; Note: would be met if the second major or the minor is in another science discipline; the course requirements for the second major or the minor. C. Science breadth: satisfied by the above requirements. D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional credits, as required, for an overall total of 120 credits. F. Standing requirements: To graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 over all courses completed, subject to the following exception. In addition, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed is required to graduate in the Honours Double Major program where biology is the other major. Honours Minor The program core as specified	B. Major requirements: the program core as specified above (12 credits); an additional 30 credits from the approved science and technology studies major courses, including at least 18 credits at the 3000 or higher level, of which at least 12 are at the 4000 level, for a total of 42 credits in science and technology studies; at least 18 science credits at the 2000 level or higher level non-science and technology studies courses; Note: would be met if the second major or the minor is in another science discipline; the course requirements for the second major or the minor. C. Science breadth: satisfied by the above requirements. D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional credits, as required, for an overall total of 120 credits. F. Standing requirements: To graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses and a minimum cumulative credit-weighted grade point average of 5.00 over all courses completed, subject to the following exception. In addition, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all biology courses completed is required to graduate in the Honours Double Major program where biology is the other major. Honours Minor The program core as specified	3.00, LE/EECS 1540 3.00 or LE/EECS 1012 3.00; foundational science: six credits from: SC/BIOL 1000 3.00, SC/BIOL 1001 3.00, SC/CHEM 1000 3.00, SC/CHEM 1001 3.00, SC/PHYS 1011 3.00 or SC/PHYS 1411 3.00 or SC/PHYS 1421 3.00 or SC/PHYS 1800 3.00, SC/PHYS 1012 3.00 or SC/PHYS 1412 3.00 or SC/PHYS 1422 3.00 or SC/PHYS 1801 3.00, or SC/PHYS 1010 6.00 or SC/PHYS 1410 6.00 or SC/PHYS 1420 6.00. B. Major requirements: the program core as specified above (12 credits); an additional 30 credits from the approved science and technology studies major courses, including at least 18 credits at the 3000 or higher level, of which at least 12 are at the 4000 level, for a total of 42 credits in science and technology studies; at least 18 science credits at the 2000 level or higher level non-science and technology studies courses; Note: would be met if the second major or the minor is in another science discipline; the course requirements for the second major or the minor. C. Science breadth: satisfied by the above requirements. D. Upper level requirements: a minimum of 42 credits at the 3000 level or above. E. Additional credits, as required, for an overall total of 120 credits. F. Standing requirements: To

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to: AP/SOSC 3726 3.00) SC/STS 3730 3.00 SC/STS 3740 3.00 SC/STS 3755 3.00 SC/STS 3760 3.00 SC/STS 3765 3.00 SC/STS 3775 3.00 SC/STS 3780 3.00 SC/STS 3790 3.00 SC/STS 3970 3.00 SC/STS 3975 3.00 SC/STS 4227 3.00 SC/STS 4228 3.00 SC/STS 4230 3.00 SC/STS 4700 3.00 SC/STS 4700 6.00 SC/STS 4710 6.00 SC/STS 4780 3.00 (cross-listed to: AP/HIST 4088 3.00)	to: AP/SOSC 3726 3.00) SC/STS 3730 3.00 SC/STS 3740 3.00 SC/STS 3755 3.00 SC/STS 3760 3.00 SC/STS 3765 3.00 SC/STS 3775 3.00 SC/STS 3780 3.00 SC/STS 3790 3.00 SC/STS 3970 3.00 SC/STS 3975 3.00 SC/STS 4227 3.00 SC/STS 4228 3.00 SC/STS 4230 3.00 SC/STS 4700 3.00 SC/STS 4700 6.00 SC/STS 4710 6.00 SC/STS 4780 3.00 (cross-listed to: AP/HIST 4088 3.00)	*FOR DEGREE TYPE):* SC/STS 2010 3.00 (cross-listed to: AP/HIST 2810 3.00) SC/STS 2110 3.00 (cross-listed to: AP/PHIL 2110 3.00) SC/STS 2210 3.00 (cross-listed to: AP/HIST 2822 3.00) SC/STS 3226 3.00 SC/STS 3400 3.00 SC/STS 3500 3.00 (cross-listed to: AP/SOSC 3500 3.00) SC/STS 3506 3.00 SC/STS 3550 6.00 SC/STS 3561 3.00 (cross-listed to: AP/SOSC 3561 3.00) SC/STS 3600 3.00 SC/STS 3725 3.00 SC/STS 3726 3.00 (cross-listed to: AP/SOSC 3726 3.00) SC/STS 3730 3.00 SC/STS 3740 3.00 SC/STS 3755 3.00 SC/STS 3760 3.00 SC/STS 3765 3.00 SC/STS 3775 3.00 SC/STS 3780 3.00 SC/STS 3790 3.00 SC/STS 3970 3.00 SC/STS 3975 3.00 SC/STS 4227 3.00 SC/STS 4228 3.00 SC/STS 4230 3.00 SC/STS 4700 3.00 SC/STS 4700 6.00 SC/STS 4710 6.00 SC/STS 4780 3.00 (cross-listed to: AP/HIST 4088 3.00)

Changes to Existing Course

Faculty: Science

Department:	Mathematics & Statistics	**Date of Submission:**	Nov 18, 2019
Course Number:	1505 6.00	**Effective Session:**	Fall 2020
Course Title:	Mathematics for the Life and Social Sciences		

Type of Change:

☐	in pre-requisite(s)/co-requisite(s)	☐	in cross-listing
☐	in course number/level	☐	in degree credit exclusion(s)
☐	in credit value	☐	regularize course (from Special Topics)
☐	in title (max. 40 characters for short title)	☒	in course format/mode of delivery *
☐	in Calendar description (max. 40 words or 200 characters)	☐	retire/expire course
☐	other (please specify):	☐	

Change From:	**To:**
There are currently no tutorials in Math 1505.	Each section of Math 1505 is to have weekly mandatory 60minute tutorials during the first half of the course. There is no technology component needed for this change.

Rationale:

Math 1505 is a large service course with an annual enrolment of about 2000 students (across the fall/winter and SU terms). The majority of the students in this course are in a Biology, Kinesiology or Psychology program. This is a required course for BSc programs and will satisfy their six-credit math requirement. Unfortunately, over the last few years we have seen high withdrawal and failure rates in this course. A primary reason for this is that students lack the proper high school preparation necessary for success in Math 1505. The addition of tutorials in the first half of the course will offer time to review/re-teach vital prerequisite material that will be needed for math1505. We will also have quizzes in tutorials to ensure students are keeping up with tutorial content.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department is required.

Note: Since one change (such as a change in year level or credit value) may result in several other changes (e.g., to the course description, evaluation, instruction, bibliography, etc.), please submit as many details as possible. If there are several changes, please feel free to use a New Course Proposal Form in order to ensure that all the required information is included.

* Note: If there is a technology component to the course, a statement is required from ATS indicating whether resources are adequate to support the course. Courses converted from face-to-face to an on-line delivery mode should follow the instructions provided on page 4 of the New Course Proposal Form to provide revised 'Course Design' and 'Method of Instruction" information.

FS Resource Implications Form Unit: _MATH/STAT_ Date: __Nov 25, 2019___

		Course(s) Created ☐ or Modified to X (check one)	Course(s) Retired ☐ or Modified from X
Complete Course Designation			MATH 1505 6.00 Mathematics for the Life and Social Sciences
Enrolment (Estimate or Last Offering)		About 1500 students spread over 6 sections	About 1500 students spread over 8 sections
Number of:	**Lecture Sections:**	6	8
	Lab Sections:	0	0
	Tutorial Sections:	Currently M1505 has no tutorials, but we wish to change this to at least 3 tutorials per section.	Currently no tutorials
Number of:	**Course Coordinators (Tutor 1):**	A faculty member will coordinator the tutorials across all sections.	
	Lab Demonstrators (Tutor 2):		
	Mark/Graders (Tutor 3):	We will need at least 18 tutorial leaders for 18 tutorial sections.	
Prerequisites (P) Corequisites (C) Credit Exclusions (E)			P: 12U Advanced Functions (MHF4U) or equivalent, or SC/MATH 1510 6.00 C: not applicable E: SC/MATH 1013 3.00, SC/MATH 1014 3.00, SC/MATH 1300 3.00, SC/MATH 1310 3.00, SC/MATH 1530 3.00, SC/MATH 1540 3.00, SC/MATH 1550 6.00, GL/MATH/MODR 1930 3.00, GL/MATH/MODR 1940 3.00, AP/ECON 1530 3.00, AP/ECON 1540, SC/ISCI 1401 3.00, SC/ISCI 1402 3.00, SC/ISCI 1410 6.00.
For which degree program is this required (if applicable)?			Science degree requirement for Biology, Kinesiology and Psychology majors.
Other resource implications (please specify)		Rooms for tutorials will be needed, and time/resources related to this. Extra demands on Undergraduate Program Assistant's time for both scheduling and student interactions.	

Reason(s) for creation/ modification/ retirement	Math 1505 is a large service course with an annual enrolment of about 1500 students (across the fall/winter). The majority of the students in this course are in a Biology, Kinesiology or Psychology program. This is a required course for BSc programs and will satisfy their six-credit math requirement. Unfortunately, over the last few years we have seen high withdrawal and failure rates in this course. A primary reason for this is that students lack the proper high school preparation necessary for success in Math 1505. The addition of tutorials in the first half of the course will offer time to review/re-teach vital prerequisite material that will be needed for math1505. We will also have quizzes in tutorials to ensure students are keeping up with tutorial content.	

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science

Department: Indicate department and course prefix (e.g. Languages, GER)	Biology (BIOL)	**Date of Submission:**	

Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	BIOL 3171	**Var:**	**Academic Credit Weight:** Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3.00

Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Population Ecology
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Population Ecology

With every new course proposal, it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters
(approximately 300 words including spaces and punctuation).

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

Using lectures and labs, this course explores the dynamic and changing field of population ecology, focusing primarily on demographic traits of populations and patterns of population growth and change. Topics to be investigated include temporal and spatial dynamics of populations; constraints on the distributions of populations; patterns of population growth and regulation; density dependence and density independence; vital statistics and life history biology; age and sex structure of populations; meta-populations and dispersal; and the genetic attributes of populations.

Labs provide experiential exposure to several of the topics developed in lectures.

Two lecture hours and three lab hours per week.

Pre-requisites: SC/BIOL 2050 4.00 and SC/BIOL 2060 3.00

Course Credit Exclusion: SC/BIOL 3170 3.00

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

A. Course Outcomes and Learning Objectives

By the end of this course, students will be able to:

Area 1. Fundamental Understanding:

- Use terminology appropriate to the field of population ecology
- Distinguish different models of growth
- Recognize the main parameters and major formulae for modelling population growth
- Derive the formula and employ the formula for mark-recapture analysis
- Distinguish between r- and K-selected traits and connect them to life history strategies and growth patterns
- Apply the principles of population ecology to issues of conservation
- Interpret population patterns in terms of evolutionary selective forces and evolutionary mechanisms applicable to small populations
- Contrast different forces generating patterns of dispersal and spatial distribution
- Employ genetic tools to study population processes
- Extend population ecology fundamentals to the concept of meta-populations
- Apply population ecology principles to wildlife management challenges
- Use natural history knowledge

Area 2. Critical Thinking Skills

- Employ case studies as exemplars of biological concepts
- Draw generalized concepts from the results of particular scientific studies or experiments (inductive reasoning)
- Present arguments that explain evolutionary phenomena such as life history trait diversity
- Apply course content to new data sets
- Employ metaphors for conveying the principles of population ecology
- Assess the effectiveness of experimental designs in answering questions about population dynamics

Area 3. Problem Solving Skills

- Apply principles from the scientific literature to new fact situations
- Employ diverse field or lab methods for collecting data that are sought to address particular demographic questions

Area 4. Effective Communication

- On tests and exams, clearly construct written answers to questions and clearly construct written explanations or arguments for scenarios or fact situations
- In a mock conference format, present and defend research analyses

Area 5. Lab and Field Skills

- Execute procedures determined to collect data to test an hypothesis related to population ecology
- Analyze lab- or field-generated data in order to evaluate a population ecology hypothesis
- Summarize the findings from lab or field studies and communicate orally or in writing

B. Selected Topics by Week

In each week, case studies are to exemplify theoretical analyses.

Week #1 - Review of key tools
Introductory material includes a primer based on broad learning outcomes from second-year Ecology that are key to the sub-discipline of Population Ecology. This review includes the principles of natural selection, a summary of the concept of ecological scales, as well as a review of the ecology lexicon as it relates to Population Ecology.

Week #2 - Life history biology - 1
Life history biology sets Population Ecology in an evolutionary framework. Survival and reproductive challenges involve trade-offs that are reflected in population attributes. The trade-offs include reproduction versus survival, as well as current versus future reproduction.

Week #3 – Life history biology – 2
Life history evolution is a response to variation in the environment, as well as opportunities in complex communities. Life history analysis considers key attributes of species that affect population growth and structure, including age at maturity, relative investment in size and number of offspring, and life history attributes that affect population recruitment.

Week #4 - Distribution and spatial structure of populations
Populations are limited by ecologically suitable habitats, and niche modelling is used to assist in predicting these spatial patterns. Social interactions also affect the dispersion of species, including periods of dispersal by recruits into populations.

Week #5 - Population growth
Growth usually begins with exponential growth as an unregulated pattern of growth based on density independence and evolutionary principles. This is followed with the introduction of density dependence and the consequent development of logistic growth and the sigmoid growth curve. This pattern is then connected back to Life History biology.

Week #6 - Working with Life Tables
Life tables are introduced as a tool for analyzing population age structure and sex structure. Using vital statistics including data related to birth and death rates, these tables are used to generate age structure "pyramids", and they are also used to calculate population parameters including the intrinsic rate of increase, rate of survivorship, rate of mortality, recruitment success, and generation time.

Week #7 – Populations whose size cycles on a regular basis
One feature of some populations, especially at high latitudes, is that the population size vacillates on a regular basis between very high and very low densities. The natural history of such organisms is considered, as are the drivers and regulators of these cyclic patterns.

Week #8 - Patterns of Dispersal
Populations fluctuate around a carrying capacity, and when populations exceed the carrying capacity, juveniles are challenged to find a place in the population. One significant option for juveniles is dispersal, although that has attendant risks which may vary with sex. Dispersal patterns link sub-populations and also effect range growth when conditions are favourable.

Week #9 - Structure of populations
Age structure is influenced by life history biology and in turn it influences diverse aspects of demography, including population growth rate. Sex structure is sometimes minimal, but in many cases where there are drivers of uneven sex ratios, sex structure has important population implications. Genetic structure of populations varies with patterns of dispersal and with the degree of connection between sub-populations.

Week #10 – Sub-population considerations
Meta-populations are discrete sub-populations linked by movements of individuals, and they display various degrees of linkage depending upon landscape features and inherent powers of dispersal. Meta-populations are usually characterized as being "patchy", and this leads to an analysis of sources, sinks, and traps.

Week #11 – Challenges for small populations
Small populations are subject to unique challenges related to stochastic processes and to genetic constraints associated with low diversity, including the risks associated with inbreeding. Allee Effects are considered in contrast to density dependence. Genetic tools are employed to assist in the analysis of small population viability.

Week #12 – Special topics in Population Ecology
This material is likely to vary from offering to offering. Two examples are: (a) Special considerations for the population regulation of migrants, and (b) The impact of territoriality and other social factors on population regulation.

Laboratories

Labs are designed to develop practical skills in the analysis of key population ecology concepts and will cover the following topics:

1. *Population dispersal* using mark-recapture methodologies. *Cepaea* snails on or near campus can be used effectively to generate a dataset by the students, using two sequential weeks in the field. (3 weeks)

2. *Population growth and regulation* using a virtual lab designed by SimBio. (1 week)

3. *Density dependence and density independence* using Seed Beetle *Vigna radiata* propagation in the lab over the semester. (4 weeks, interspersed among other labs)

4. *Vital statistics and life history biology* using gravestone information from Beechwood Cemetery on Jane Street. (2 weeks)

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course supports the achievement of learning objectives by means of face-to-face communication with the Course Director during lecture hours and with TAs during weekly lab sessions. Lectures may be designed on, or partly on, a flipped classroom model. The use of case studies in lecture material, as well as supplemental articles provided on a course website, will supplement the theoretical material. Lab sessions will include collaborative work among peers and will collectively constitute classroom-focused experiential education.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1. This 3-credit, 12-week course will be offered once a year, preferably in the fall or winter term, but preferably not in the same term as BIOL 3172 3.00 *Community Ecology*, which is a companion course.

2. This course could be taught by at least three faculty members.

3. Dr. Alex Mills has taught the parent course, BIOL 3170 *Population and Community Ecology*, several times, including once (2011-12) when it was *Population Ecology* only. Dr. Mark Vicari has also taught the parent course multiple times, including as recently as the Fall of 2019. Dr. Birgit Schwarz was hired in the Biology Department in 2019, and she would also have the depth of experience to teach *Population Ecology*. Finally, there is a current search (2019-20) for a new Field Biology hire in the Department of Biology, and it is highly likely that that person could teach *Population Ecology*.

4. Two lecture hours per week and three lab hours per week, as well as at least one office hour per week for the Course Director.

5. On average, students will be required to do about two hours of preparation per week for each class.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery, please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Assessment Breakdown

15% Midterm 1
15% Midterm 2
10% In-class activities (personal response systems, worksheets, mini-quizzes, 1-minute presentations, etc.)
30% Laboratories
30% Final Exam

Mid-term tests and the Final Exam will be invigilated written exams composed primarily of questions requiring either short written answers or more substantive long written answers. They may also include some multiple choice questions. Exams will be designed to thoroughly assess students' depth and breadth of knowledge of the course topics, including the assessment of outcomes set out in Areas 1 through 4 in the Course Outcomes and Learning Objectives, above. Demonstration of comprehension, analysis, and application of concepts will be assessed by longer-answer questions.

In-class activities will incentivize and enhance student engagement and participation, providing opportunities to practice listening, self-discipline, collaboration, analysis, and effective communication in real time. They support all of the learning objectives.
Labs will typically involve multiple week research-based work; for instance, setting up the data collection system in the first week, collecting data in the second week, and pooling and analyzing data in the third week. Lab grades will be based on execution, effective collaboration, analysis, written, oral, and poster presentation, and indirectly for time management skills.

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

There are numerous comprehensive textbooks for Population Ecology, should the Course Director choose to include a course text. Some Course Directors might use such a text as a required text, while for others, it may be recommended, or several copies could be purchased and placed on Library Reserve. Here are two examples of such texts:

Rockwood, L.L. 2015. *Introduction to Population Ecology, 2nd ed.* Wiley-Blackwell, 378 pp.

Vandermeer, J.H. and D.E. Goldberg. 2013. *Population Ecology: First Principles, 2nd ed.* Princeton University Press, 288 pp.

It is highly likely that the Course Director will provide readings mounted on the course website. These would include examples from the primary literature, especially peer-reviewed research articles that would constitute case studies. At times, the predecessor course, BIOL 3170, was taught using such primary resources. For example:

Bossuyt, B. 2017. Genetic rescue in an isolated meta-population of a naturally fragmented plant species, *Parnassia palustris*. *Conservation Biology* 21(3): 832.

Brashares, J.S., J.R. Werner, and A.R.E. Sinclair. 2010. Social "meltdown" in the demise of an island endemic: Allee effects and the Vancouver Island marmot. *Journal of Animal Ecology* 79: 965.

Cooper, N.W., et al. 2009. Density-dependent age at first reproduction in the eastern kingbird. *Oikos* 118: 413.

Garland, T. 2014. Trade-offs. *Current Biology* 24(2): R60.

Jorgensen, C., et al. 2007. Managing evolving fish stocks. *Science* 318 (Nov 23): 1247-1248.

Monaghan, P. and R.G. Nager. 1997. Why don't birds lay more eggs? *Trends in Ecology and Evolution* 12(7): 270.

Patrick, D.A. et al. 2008. Terrestrial habitat selection and strong density-dependent mortality in recently metamorphosed amphibians. *Ecology* 89(8): 2563.

Sillett, T.S. and R.T. Holmes. 2002. Variation in survivorship of a migratory songbird throughout its annual cycle. *Journal of Animal Ecology* 71: 296.

Wauters, L.A., et al. 2004. Within-sex density dependence and population dynamics of red squirrels *Sciurus vulgaris*. *Journal of Animal Ecology* 73: 11.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

This course does not require resources outside of (a) classroom space, (b) laboratory space, and (c) TA hours to run the labs. This course (BIOL 3171 3.00) is one of two courses intended to replace the current course BIOL 3170 3.00, which has two hours of lecture and three hours of labs, just as this one proposes. The second course to replace BIOL 3170 is BIOL 3172 3.00. It will not have a lab, so the net additional burden on lab facilities and lab TA hours by replacing BIOL 3170 with BIOL 3171 and BIOL 3172 is zero.

There will, however, be tutorial TA hours in the BIOL 3172 course, so there will be a net increase in TA hours when comparing 3170 with the 3171 / 3172 pair.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

There is a two-part rationale for proposing a *Population Ecology* course.

The first part is that the number of ecology-evolution offerings at the senior level at York is relatively small. Students sometimes report that they have difficulty finding enough options to complete their degree programs. When compared with other Ontario universities with robust ecology-evolution programs, York falls short in terms of offering courses in a variety of ecology sub-disciplines (e.g. Population, Community, Behavioural, Ecosystem). The existing BIOL 3170 3.00 *Population and Community Ecology* is our only active ecology sub-discipline course.

Second, it is unusual to cover both *Population Ecology* and *Community Ecology* in a single one-semester course. The subjects are really too large to be covered in this way at the 3000-level.

So, by replacing BIOL 3170 3.00 *Population and Community Ecology* with BIOL 3171 3.00 *Population Ecology* (this proposal) and BIOL 3172 3.00 *Community Ecology* (a companion proposal), we are according a more appropriate number of credits for the two subjects (6, rather than 3) and simultaneously, we are offering more options for students in the following: (a) Biology, who are pursuing an ecology-evolution curriculum, (b) Environmental Biology, and (b) Environmental Science in the existing life sciences stream or in the proposed conservation science stream.

The expected enrolment cap in this course is 72 students, which will allow for three lab sections. In fall 2019, there are two lab sections in BIOL 3170, although in the past there have been cases with three lab sections.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	_____	_____	_____
	Signature (Authorizing cross-listing)	Department	Date
Dept:	_____	_____	_____
	Signature (Authorizing cross-listing)	Department	Date
Dept:	_____	_____	_____
	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

FS Resource Implications Form **Unit:** _____ **Date:** _____

		Course(s) Created X or Modified to □ (check one)		Course(s) Retired □ or Modified from □
Complete Course Designation		**Population Ecology BIOL 3171 3.00**		
Enrolment (Estimate)		72		
Number of:	**Lecture Sections:**	One		
	Lab Sections:	Two (48 or fewer students) or three (48 to 72 students)		
	Tutorial Sections:	None		
Number of:	**Course Coordinators (Tutor 1):**	None		
	Lab Demonstrators (Tutor 2):	Three (approximately 200 hours total)		
	Mark/Graders (Tutor 3):	One, if enrollments exceed 50 students		
Prerequisites (P) Corequisites (C) Credit Exclusions (E)		BIOL 2050 4.00 Ecology (P) BIOL 2060 3.00 Statistics for Biologists (P) BIOL 3170 3.00 Population & Community Ecology 3.00 (E)		
For which degree program is this required (if applicable)?		Not required, but will be 3000-level science credits in Biology, Environmental Biology, and likely Environmental Science (Conservation stream)		
Other resource implications (please specify)		This course is one of two courses intended to replace the current course BIOL 3170 3.00, which has two hours of lecture and three hours of labs (2 or 3 sections), just as this one (BIOL 3171) proposes.		
Reason(s) for creation/ modification/ retirement		Currently, we teach population and community ecology in one 3-credit course with 2 lecture hours and 3 lab hours (BIOL 3170). If the two new courses are approved, we will teach the material in two 3-credit courses with 5 lecture hours (total), 3 lab hours (BIOL 3171)) and one tutorial hour (BIOL 3172). This will improve content outcomes and will double the number of choices for students interested in this area. Most universities treat these two subjects in two separate courses (e.g. Toronto, Western, Guelph).		

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science
Department: Indicate department and course prefix (e.g. Languages, GER)	Biology (BIOL)
Date of Submission:	
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	BIOL 3172
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3.00
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Community Ecology
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Community Ecology

With every new course proposal, it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters
(approximately 300 words including spaces and punctuation).

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

Using lectures and tutorials, this course explores the many ways that species interact over diverse spatial and temporal scales. Major themes include scales of interaction; mutualistic and antagonistic relationships; communities as co-evolved relationships; community assembly, structure, and stability; responses to disruptions; ecological succession; measures of diversity; and methods for assessing the correlation between animal species distributions with plant species distributions.

Three lecture hours and one tutorial hour per week.

Pre-requisites: SC/BIOL 2050 4.00 and SC/BIOL 2060 3.00

Course Credit Exclusion: SC/BIOL 3170 3.00

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

A. Course Outcomes and Learning Objectives

By the end of this course, students will be able to:

Area 1. Fundamental Understanding:

- Use terminology appropriate to the field of community ecology
- Contrast antagonistic and mutualistic species interactions
- Differentiate among consumption (predation, herbivory, parasitism), competition, mutualism, and commensalism
- Building upon growth models for populations, develop mathematical models that incorporate the effects of other species on population growth, such as Lotka-Volterra formulae
- Recognize key conceptual ideas central to Community Ecology, such as the competitive exclusion principle
- Using fundamental principles from evolutionary biology, demonstrate an understanding of co-evolution, including the identification of biotic factors as selective forces
- Demonstrate a knowledge of the effects of other species on population dynamics
- Apply the principles of community ecology to issues of conservation
- Distinguish between the view that community development is random, as in Hubbell's Neutral Theory of Biodiversity, and the view that communities develop in a predictable, orderly manner
- Identify and contrast different types of community succession, including the events that trigger succession
- Compare the effects on community structure when disturbances are minor and infrequent on one hand, and major and recurrent on the other
- Apply community ecology principles to wildlife management challenges
- Use natural history knowledge

Area 2. Critical Thinking Skills

- Employ case studies as exemplars of community ecology concepts
- Draw generalized concepts from the results of particular scientific studies or experiments (inductive reasoning)
- Present arguments that explain evolutionary phenomena such as co-evolutionary consequences of long-term species interactions
- Apply course content to new data sets
- Employ metaphors for conveying the principles of community ecology
- Assess the effectiveness of experimental designs in answering questions about ecological succession or the debate between neutral and non-random mechanisms of community development

Area 3. Problem Solving Skills

- Accept a position regarding a contentious theory in community ecology and formulate the argument in favour of that position
- Apply principles from the scientific literature to new fact situations
- Consider diverse field or lab methods for collecting data and apply appropriate methodologies to particular questions related to community ecology

Area 4. Effective Communication

- On tests and exams, clearly construct written answers to questions and clearly construct written explanations or arguments for scenarios or fact situations
- In tutorials, effectively summarize information verbally and facilitate discussion
- In tutorials, effectively defend a position regarding a principle of community ecology, including assembling research in support

Area 5. Analytical Skills

- Analyze data generated in community ecology research in order to reveal patterns of interaction or influence
- Apply multivariate statistics to community ecology datasets

B. Selected Topics by Week

Each week, case studies are used to exemplify theoretical analyses. Tutorials focus on particular questions related to lecture material for that week, or on case studies that are useful in the analysis of community ecology concepts or controversies.

Week #1 - Review of fundamentals and introduction
Introductory material includes a primer reviewing key concepts from second-year Ecology that are key to the sub-discipline of Community Ecology, including models of community structure and categories of species interactions. Properties of communities and interacting processes are introduced. Week 1 also includes a geography summary to facilitate understanding that relies on large spatial scales.

Week #2 – Interspecific competition 1
Contrasting intraspecific competition, interspecific competition is modelled. Direct and indirect classes of competition are contrasted, including the concepts of interference and exploitative competition. Asymmetric

competition, scramble competition, resource partitioning, and the competitive exclusion principle are investigated.

Week #3 – Interspecific Competition 2
Interspecific competition is a large subject, and the continuation of its treatment includes a thorough consideration of guilds, including guild structure in niche space. Local extinction and re-contact are also treated, as is the impact of life history traits on competitive ability. Finally, competition attributes in marine, freshwater, and terrestrial systems are compared.

Week #4 – Consumption 1
Predation, herbivory, and parasitism are compared and contrasted. Examples from marine, freshwater, and terrestrial environments are considered. Topics that are investigated include inducible defenses, trade-offs between competitive efficiencies and consumption defenses, functional response, and examples from cases of biological control. The Lotka-Volterra equations are constructed.

Week #5 – Consumption 2
Trophic interactions and food webs are the broad topics for Week 5. Food web models and experiments are reviewed. Top-down and bottom-up arguments about regulation are reviewed. Topics that are investigated are specialist-generalist considerations, omnivory, interaction strength, intraguild predation, predation that generates apparent competition, trophic cascades, and web resilience.

Week #6 – Mutualism
Types of mutualisms are reviewed, and are distinguished from commensalisms. Indirect and direct mutualisms are contrasted, as are obligate and facultative mutualisms. Special attention is given to nutritional or energetic mutualism. Pollination systems are used as a case study to illustrate diverse attributes of mutualistic relationships.

Week #7 – Spatial scale
Relationships among species operate on different spatial scales and the dynamics vary accordingly. Communities are usually considered on small spatial scales, such as in the context of habitat selection, but metacommunities constitute another level of consideration. Patchy or fragmented landscapes affect species interactions differently from contiguous landscapes. The island biogeography model is introduced for later development. Macroecology is introduced as a sub-discipline used to explain statistical patterns of abundance, distribution, and diversity.

Week #8 – Temporal scale in real time
Temporal scale is investigated through a variety of related sub-topics: Ephemeral and seasonal communities, special problems faced by migrant communities (e.g. temperate-tropical resource competition), Holling patterns of predator-prey relations, community responses to invasive aliens, and the relationship between life history traits and community stability.

Week #9 – Temporal scale in evolutionary time
The role of species interactions in evolutionary time is investigated by considering biological agents as selective forces. Both antagonistic and mutualistic species interactions are considered as players in generating co-evolutionary patterns. Current phenotypic patterns are considered in light of past selective environments (e.g., character displacement). Drivers of latitudinal gradients in community diversity are considered.

Week #10 – Community measurement
Communities are characterized on the basis of composition (species), structure, or function (roles and processes). There are many methods for determining community diversity based on species and relative abundance. Richness, diversity, and evenness are employed using case studies, and one or more index of diversity (e.g. Shannon Index or Simpson Index) is developed. We also distinguish among alpha, beta, and gamma diversity. Multivariate statistical tools are introduced.

Week #11 – Plant succession
The study of plant succession has had an interesting history which is where this section begins. It moves on to consider the following topics: priority effects, assembly rules, neutral theory of biodiversity, island biogeography model, case studies (fire succession, post-glacial succession, e.g.), disturbance-dependent communities, and effects on animals.

Week #12 – Applied Community Ecology
Most communities have been dramatically affected by anthropogenic changes and this is the concluding subject of the course. Wildlife management in the community context, community restoration, optimal design for community preservation, biocontrol of invasive species, and management of multispecies fisheries are among the possible subjects.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course supports the achievement of learning objectives by means of face-to-face communication with the Course Director during lecture hours and with TAs during weekly tutorials. Lectures may be designed on, or partly on, a flipped classroom model. The use of case studies in lecture material, as well as supplemental articles provided on a course website, will supplement the theoretical material. Tutorials will focus on particular issues related to the lecture material for the same week, and students will take turns leading and presenting material during tutorial sessions.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1. This 3-credit, 12-week course will be offered once a year, preferably in the fall or winter term, but preferably not in the same term as BIOL 3171 3.00 *Population Ecology*, which is a companion course.

2. This course could be taught by at least three faculty members.

3. Dr. Alex Mills has taught the parent course, BIOL 3170 *Population and Community Ecology*, several times. Dr. Mark Vicari has also taught the parent course multiple times, including as recently as the Fall of 2019, and his area of research historically has been in community ecology. Dr. Birgit Schwarz was hired in the Biology Department in 2019, and she would also have the depth of experience to teach *Community Ecology*. Finally, there is a current search (2019-20) for a new Field Biology hire in the Department of Biology, and it is highly likely that that person could also teach *Community Ecology*.

4. Three lecture hours per week and one one-hour tutorial per week, as well as at least one office hour per week for the Course Director.

5. On average, students will be required to do about two hours of preparation per week for each class.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Assessment Breakdown

15% Midterm Test 1
15% Midterm Test 2
15% In-class activities (personal response systems, worksheets, mini-quizzes, 1-minute presentations, etc.)
25% Tutorials
30% Final Exam

Mid-term tests and the Final Exam will be invigilated written exams composed primarily of questions requiring either short written answers or more substantive long written answers. They may also include some multiple choice questions. Exams will be designed to thoroughly assess students' depth and breadth of knowledge of the course topics, including the assessment of outcomes set out in Areas 1 through 4 in the Course Outcomes and Learning Objectives, above. Demonstration of comprehension, analysis, and application of concepts will be assessed by longer-answer questions.

In-class activities will incentivize and enhance student engagement and participation, providing opportunities to practice listening, self-discipline, collaboration, analysis, and effective communication in real time. They support all of the learning objectives.

Tutorial sessions will be based on assigned readings such as peer-reviewed papers or opinion pieces on some subject where there are diverse opinions (e.g. the neutral theory of biodiversity). Students will be expected to participate in all tutorial discussions (i.e. weekly) and participation will therefore form part of the grade (10%). However, there will be one or more cases where a student (1/2 hour), or pairs of students (whole hour), will lead the session by presenting a summary of the subject material and by facilitating group discussion (15%).

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

There are numerous comprehensive textbooks for Community Ecology, should the Course Director choose to include a course text. Some Course Directors might use such a text as a required text, while for others, it may be recommended, or several copies could be purchased and placed on Library Reserve. Here are two examples of such texts:

Morin, P.J. 2011. Community Ecology, 2nd Ed. Wiley-Blackwell, 418 pp.

Mittelbach, G.G., and B.J. McGill. 2019. Community Ecology, 2nd ed. Oxford University Press, 448 pp.

It is highly likely that the Course Director will provide readings mounted on the course website. These would include examples from the primary literature, especially peer-reviewed research articles that would constitute case studies. (At times, the predecessor course, BIOL 3170, was taught using such primary resources.) For example:

Boettner, G.H., J.S. Elkinton, and C.J. Boettner. 2010. Effects of a biological control introduction on three nontarget native species of Saturniid moths. *Conservation Biology* 14(6): 1798.

Faillace, C.A., and P.J. Morin. 2019. Evolution alters post-invasion temporal dynamics in experimental communities. Journal of Animal Ecology 88:TBD.

McCauley, S.J., L. Rowe, and M.-J. Fortin. 2011. The deadly effects of "non-lethal" predators. *Ecology* 92(11): 2043.

Moeller, H.V., M.G. Neubert, and M.D. Johnson. 2019. Intraguild predation enables coexistence of competing phytoplankton in a well-mixed water column. Ecology 100:TBD.

Reebs, S. 2009. Shrew Loo. *Natural History*, Sept. 2009, p. 10.

Shea, K., and P. Chesson. 2002. Community ecology theory as a framework for biological invasions. *Trends in Ecology and Evolution* 17(4): 170.

Sugio, A., et al. 2011. Phytoplasma protein effector SAP11 enhances insect vector reproduction by manipulating plant development and defense hormone biosynthesis. *Proceedings of the National Academy of Science, USA* 108(48) :E1254.

Violle, C., et al. 2012. The return of variance: intraspecific variability in community ecology. *Trends in Ecology and Evolution* 27(4): 244.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

This course does not require resources outside of (a) classroom space and (b) TA hours to run and grade the tutorial sessions. Assuming there are three tutorials per week (one contact hour each), TA hours are estimated to be 135, covering preparation, contact hours, and grading.

This course (BIOL 3172 3.00) is one of two courses intended to replace the current course BIOL 3170 3.00, which has two hours of lecture and three hours of labs. The second course to replace BIOL 3170 is BIOL 3171 3.00, which also has two lecture hours and one 3-hour lab per week. So, the net additional burden on lab facilities by replacing BIOL 3170 with BIOL 3171 and BIOL 3172 is zero, although there will be an increased requirement for TA hours.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

There is a two-part rationale for proposing a *Community Ecology* course.

The first part is that the number of ecology-evolution offerings at the senior level at York is relatively small. Students sometimes report that they have difficulty finding enough options to complete their degree programs. When compared with other Ontario universities with robust ecology-evolution programs, York falls short in terms of offering courses in a variety of ecology sub-disciplines (e.g. Population, Community, Behavioural, Ecosystem). The existing BIOL 3170 3.00 *Population and Community Ecology* is our only active ecology sub-discipline course.

Second, it is unusual to cover both *Population Ecology* and *Community Ecology* in a single one-semester course. The subjects are really too large to be covered in this way at the 3000-level.

So, by replacing BIOL 3170 3.00 *Population and Community Ecology* with BIOL 3172 3.00 *Community Ecology* (this proposal) and BIOL 3171 3.00 *Population Ecology* (a companion proposal), we are according a more appropriate number of credits for the two subjects (6, rather than 3) and simultaneously, we are offering more options for students in the following areas: (a) Biology, who are pursuing an ecology-evolution curriculum, (b) Environmental Biology, and (b) Environmental Science in the existing life sciences stream or in the proposed conservation science stream.

The expected enrolment cap in this course is 72 students, which will allow for three 24-person tutorial sections.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

FS Resource Implications Form **Unit: Biology** **Date: November 26, 2019**

		Course(s) Created X or Modified to ☐ (check one)		Course(s) Retired ☐ or Modified from ☐
Complete Course Designation		Community Ecology BIOL 3172 3.00		
Enrolment (Estimate)		72		
Number of:	Lecture Sections:	One		
	Lab Sections:	None		
	Tutorial Sections:	Two or three		
Number of:	Course Coordinators (Tutor 1):	Tutorial leaders (approximately 135 hours total)		
	Lab Demonstrators (Tutor 2):	None		
	Mark/Graders (Tutor 3):	One, if enrollments exceed 50 students		
Prerequisites (P) Corequisites (C) Credit Exclusions (E)		BIOL 2050 4.00 Ecology (P) BIOL 2060 3.00 Statistics for Biologists (P) BIOL 3170 3.00 Population & Community Ecology 3.00 (E)		
For which degree program is this required (if applicable)?		Not required, but will be 3000-level science credits in Biology, Environmental Biology, and likely Environmental Science (Conservation stream)		
Other resource implications (please specify)		This course is one of two courses intended to replace the current course BIOL 3170 3.00, which has two hours of lecture and three hours of labs (2 or 3 sections). BIOL 3171 will have that same structure. BIOL 3172 will be three lecture hours and one tutorial hour per week.		
Reason(s) for creation/ modification/ retirement		Currently, we teach population and community ecology in one 3-credit course with 2 lecture hours and 3 lab hours. If the two new courses are approved, we will teach the material in two 3-credit courses with 5 lecture hours (total), 3 lab hours (BIOL 3171) and one tutorial hour (BIOL 3172). This will improve content outcomes and will double the number of choices for students interested in this area. Most universities treat these two subjects in two separate courses (e.g. Toronto, Western, Guelph).		

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science
Department: Indicate department and course prefix (e.g. Languages, GER)	Chemistry (CHEM)
Date of Submission:	November 11, 2019
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	3061
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Environmental chemistry
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Environmental chemistry

With every new course proposal it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters *(approximately 300 words including spaces and punctuation).*

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

This course introduces students to mechanisms underlying chemical sources and fate in the environment. The reactions and partitioning of organic and inorganic compounds will be discussed on a molecular level allowing students to understand and predict chemical fate and distribution. Critical environmental processes that determine the fate of organic pollutants, including abiotic oxidation and reduction reactions, as well as biological processing, will be examined. The biogeochemical cycles and reactions that determine the environmental fate of metals will be described. The chemistry driving important environmental issues, including ocean acidification, pollutant transport, and bioaccumulation will also be addressed. Students will gain an appreciation for and become familiar with the current state of understanding of the chemical mechanisms in the environment.

Prerequisite: CHEM 2021

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

This course examines the sources and fate of chemicals in the environment, including reactions and partitioning of organic and inorganic compounds. Topics include abiotic and biotic reactions of organic pollutants, biogeochemical cycles of metals, ocean acidification, pollutant transport, and bioaccumulation.

Prerequisite: CHEM 2021

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

This course will be comprised of four major topics.
1. **Introduction**. This topic will include: (i) chemical composition of the major environmental spheres in which reactions can occur (atmosphere, hydrosphere, and lithosphere); and (ii) an overview of the sources of major inorganic and organic environmental pollutants.
2. **Aqueous chemistry of inorganic pollutants**. This topic will include: (i) chemical speciation of inorganic chemicals in fresh and ocean water; (ii) biogeochemistry of metals in aqueous systems; (iii) sediment chemistry; and (iv) ocean acidification.
3. **Reactions of organic pollutants**. This topic will include: (i) direct photolysis; (ii) sources of aqueous oxidants; (iii) indirect photolysis; (iv) hydrolysis; (v) reduction; (vi) microbial degradation; and (vii) fate in plants and animals.
4. **Distribution of organic pollutants**. This topic will include: (i) solubility; (ii) bioconcentration and bioaccumulation; (iii) volatility; (iv) sorption; (v) transport; and (vi) simple fate and transport models.

Learning objectives
Upon successful completion of the course, students will be able to:

- Predict the distribution and fate of organic and inorganic chemicals in the environment.
- Explain the molecular-level chemistry underlying important processes of environmental concern.
- Critically read and analyze peer-reviewed literature in environmental chemistry.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course will be delivered in the traditional lecture format. Assignments will be based on the current peer-reviewed literature and will encourage the development of critical reading skills, while enhancing an understanding of the course material. A midterm and final exam will test the students' learning of the course content.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

1. This course would be offered every year or every other year, depending on student interest.

2. This course could be taught by 4 current departmental members: Cora Young, Trevor VandenBoer, Rob McLaren, and Derek Jackson.

3. The course is likely to be taught in the first instance by Cora Young.

4. The students will attend 3 h of lecture per week. It is expected they will devote another 3 h per week to private study.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Assignments: 40 %
Midterm exam: 20 %
Exam: 40 %

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

Suggested text:
Schwarzenbach, R.P., Gschwend, P.M., Imboden, D.M. Environmental Organic Chemistry, 3rd Ed. 2016 Wiley ISBN: 978-1-118-76723-8.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

A lecture room with standard audio-visual equipment is required to deliver this course.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

This course complements an existing departmental offering of atmospheric chemistry (CHEM 3060) by giving students background in the chemistry occurring in other environmental reservoirs besides the atmosphere (hydrosphere, biosphere and soils), with an emphasis on reaction chemistry. This will provide a fundamental background for students pursuing a career in government or environmental industries and a broader perspective for those who pursue a career in other aspects of chemistry.
This course does not overlap with an existing course in biology, Environmental Contaminants: Impacts on Organisms and Ecosystems (BIOL 4720). Although some topics may appear similar at a superficial level, this course will focus on molecular-level reactions and processes that require second-year chemistry prerequisites. No chemistry beyond first year is required for BIOL 4720.
This course also does not overlap with courses under development for NATS. These courses are designed for non-science majors and not comparable to this proposed course.

Expected enrollment in the course: 40-50. Currently there are 50-60 enrolled in 3060 on an annual basis; we might expect similar interest as CHEM 3060, but an overall drop in enrolment if both these courses are offered in a year. We would request that CHEM 3061 be offered in the other term compared to CHEM 3060, such that students wishing to specialize in Environmental Chemistry can take both courses.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	_____	_____	_____
	Signature (Authorizing cross-listing)	Department	Date
Dept:	_____	_____	_____
	Signature (Authorizing cross-listing)	Department	Date
Dept:	_____	_____	_____
	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

STEACIE SCIENCE & ENGINEERING LIBRARY
YORK UNIVERSITY

MEMORANDUM

To:	Dr. Pierre G. Potvin, Undergraduate Program Director, Chemistry
From:	Minglu Wang, Research Data Management Librarian
Re:	CHEM 3061 – Environmental Chemistry
Date:	November 13, 2019

I have reviewed the course proposal and bibliography for **CHEM 3061 – Environmental Chemistry** and can state that the York University Libraries have the required resources to support this graduate level course.

Please be aware that the library offers the following services to help students with their research:

- A librarian is also available for individual consultations, both face-to-face and online, with students to help them find the materials they need for their projects.
- A librarian can create a custom workshop tailored to the course. Content can include both introductory and in-depth instruction on searching for chemical information in SciFinder, Reaxys, Web of Science, Scopus, and elsewhere. Reference management using software such as Mendeley and Zotero can also be introduced.
- A custom online research guide tailored to the course can be created upon request.

An electronic copy of the following suggested reading in the course bibliography has been ordered and will be available in the library:

Schwarzenbach, R.P., Gschwend, P.M., Imboden, D.M. Environmental Organic Chemistry, 3rd Ed. 2016 Wiley ISBN: 978-1-118-76723-8.

If you would like copies of this book to be placed on reserve at the library for students' use, please place a reserve request by visiting reserves.library.yorku.ca. For more information about course reserves, please visit: http://www.library.yorku.ca/web/ask-services/facultyinstructor-support/places-items-on-reserve/.

The following electronic resources licensed by the library may be of help to the students in this course:

- **SciFinder**
- **Reaxys**
- **Web of Science**
- **Scopus**

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YORK UNIVERSITY

MEMORANDUM

A more complete listing of resources is available at the following Research Guide:

- Chemistry: http://researchguides.library.yorku.ca/chemistry

Please note that the Steacie Library has extensive collections of books and reference materials that are relevant to this course.

In summary, I state that we are well positioned to support this course. If you have any questions, please do not hesitate to contact me.

Sincerely,

Minglu Wang, Research Data Management Librarian
Steacie Science & Engineering Library
416-736-2100 x40075 mingluwa@yorku.ca

FS Resource Implications Form **Unit: _Chemistry____** **Date: __Nov_14_2019__**

		Course(s) Created X or Modified to ☐ (check one)		Course(s) Retired ☐ or Modified from ☐
Complete Course Designation		SC/CHEM 3061 3.00		
Enrolment (Estimate or Last Offering)		50		
Number of:	**Lecture Sections:**	1		
	Lab Sections:	0		
	Tutorial Sections:	0		
Number of:	**Course Coordinators (Tutor 1):**	1		
	Lab Demonstrators (Tutor 2):	0		
	Mark/Graders (Tutor 3):	1		
Prerequisites (P) Corequisites (C) Credit Exclusions (E)		SC/CHEM 2021		
For which degree program is this required (if applicable)?		none		
Other resource implications (please specify)		none		
Reason(s) for creation/ modification/ retirement		Broadening and modernizing upper-year offerings, addressing student interest.		

COMMITTEE ON ACADEMIC STANDARDS, CURRICULUM AND PEDAGOGY TEMPLATE

NEW COURSE PROPOSAL FORM

Faculty: Indicate all relevant Faculty(ies)	Science
Department: Indicate department and course prefix (e.g. Languages, GER)	Chemistry
Date of Submission:	
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	4052/5052
Var:	
Academic Credit Weight: Indicate both the fee, and MTCU weight if different from academic weight (e.g. AC=6, FEE=8, MET=6	3
Course Title: The official name of the course as it will appear in the Undergraduate Calendar and on the Repository	Chemical Biology
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Chemical Biology

With every new course proposal it is the Department's responsibility to ensure that new courses do not overlap with existing courses in other units. If similarities exist, consultation with the respective departments is necessary to determine degree credit exclusions and/or cross-listed courses.

Brief Course Description:

Maximum 2000 characters
(approximately 300 words including spaces and punctuation).

The course description should be carefully written to convey what the course is about. It should be followed by a statement of prerequisites and co-requisites, if applicable. This description appears in the calendar.

For editorial consistency, and in consideration of the various uses of the Calendars, verbs should be in the present tense (i.e., "This course analyzes the nature and extent of...," rather than "This course will analyze...")

This course introduces students to the fundamentals of chemical biology, which focuses on the use of chemistry to study, probe, re-engineer, and exploit biological systems. The course explains how chemistry can be used in biological applications, including the profiling of the transcriptome and proteome; the interference of genes, transcripts and protein function; the tracking of transcripts and proteins in vivo using bioconjugation technologies; the measurement of protein activity in vivo; the synthesis of large libraries of chemicals and their screening for function using state-of-the-art technologies such as combinatorial chemistry and DNA-encoded synthesis; the use of chemical probes to determine biomolecular interaction in cells; the use and re-engineering of biosynthetic machinery to synthesize new drugs; the re-engineering of biological systems to generate proteins bearing unnatural amino acids; and the use of CRISPR-cas9 machinery to edit the genome, transcriptome, and epitranscriptome. The course will introduce students to critical evaluation of literature in chemical biology, and familiarize students with recent advances in the field.

Prerequisites: SC/CHEM 3021 3.0, and SC/CHEM 2050 4.0 or SC/BCHM 2020 3.0 or SC/BIOL 2020 3.0

Generic Course Description:

This is the description of the "Parent / Generic course" for Special Topics courses under which variances of the "Generic" course can be offered in different years (Max. 40 words). Generic course descriptions are published in the calendar.

List all degree credit exclusions, prerequisites, integrated courses, and notes below the course description.

The course introduces students to the concept of using chemistry to study, probe, re-engineer, and exploit biological systems. The use of chemical biology tools to effect change at the genomic, transcriptomic, proteomic and metabolomic level is discussed.

Expanded Course Description:

Please provide a detailed course description, including topics / theories and learning objectives, as it will appear in supplemental calendars.

The course will cover the following topics:

- An overview of replication, transcription, and translation from an organic chemistry viewpoint, including the physical organic chemistry of how DNA is packaged; the molecular basis of DNA replication and differences between eukaryotes and bacteria; the molecular basis and roles of telomers and the dynamics in health and disease; the molecular basis of transcription and the roles and distinction between different RNA polymerases; the post-transcriptional modification in bacteria and eukaryotes, including transcript slicing; and the molecular basis of translation.
- A discussion of sub-cellular organization, including each organelle and its implication in human disease; the peptide tagging system for localizations of proteins to specific organelles; chaperone proteins and the unfolded protein response and its implication in treating human disease; targeting of checkpoints during cell division for cancer therapy; cell penetrating peptides, and their use in chemical biology.
- Basics of recombinant protein expression, including the T7 expression system among other more recent developments. The use of Gibson assembly to generate fusion genes toward the expression of fusion proteins is also discussed. Culturing of cells, different cell lines and strains, and their uses in specific expression applications is described.
- An overview of methods to quantify nucleic acids and protein levels, including fundamentals of PCR and RT-PCR, and how they are applied to quantitative PCR analysis; DNA microarray technologies and their applications to transcriptional profiling of diseases in humans; a general overview of the organic chemistry of chemical DNA synthesis; and the use of transcriptional profiling to diagnose and predict the prognosis of cancer
- Introduction to model organisms and their limitations/advantages are described. The concept of "Forward" and "Reverse" genetics is introduced. The molecular rationale and preparation of knockout mice are described in detail and highlighted through literature examples of knockout studies in Forward genetics. RNA interference, including the history of the discovery, the molecular basis of the phenomenon, and its application to treat human disease are also discussed. Chemical genetics, and its Forward and Reverse variants are introduced including drug screens from the literature and industry.
- A brief overview of fluorescence is followed by discussion of fluorophores used in chemical biology including the organic chemistry used to selectively and non-selectively attach fluorophores to DNA, RNA, and proteins; immunofluorescence and its applications to study biomolecules, including the concept of epitope tagging; targeting specific biomolecules or organelles using specifically localized organic dyes; green fluorescent protein (GFP), the molecular basis of its fluorescence, the ability to genetically engineer GFP to enable other colours, and its uses

in chemical biology; "spinach" RNA and its derivatives, the molecular basis of its fluorescence, and its application to study RNA in vivo; and the physics of Förster Resonance Energy Transfer (FRET) and its application to study biological systems.

- A discussion of how to characterize biomolecular interactions, including methods such as fluorescence perturbation, fluorescence polarization; surface plasmon resonance, isothermal titration calorimetry, mass spectrometry, nuclear magnetic resonance, microscale thermophoresis, and biolayer interferometry. Photoaffinity labelling, including the mechanism of photoreactive species is discussed, including literature examples of its use in drug discovery. The concept of bioconjugation in introduced, with specific examples of "click" chemistry, such as Staudinger ligation, azide-alkyne 3+2 cycloadditions, and Native Chemical Ligation.
- Concepts in combinatorial chemistry as applied to drug discovery is introduced. Topics include solid-phase chemical synthesis, split-and-pool synthesis, and parallel solution-phase synthesis aided through solid-supported reagents. Principles of library construction are discussed with literature examples, such as focused libraries and diversity-oriented synthesis.
- Advances in high-throughput screening of combinatorial libraries is described including the principles and molecular basis behind developing and using high-throughput screening assays for biological function. The generation of small-molecule microarrays and their application to the detection of biomolecular interactions is described and highlighted through literature examples.
- The identification of unknown biological targets of small-molecule drugs is discussed in the context of several drug examples, including Lyrica, Tacrolimus, Trapoxin, (-)-FR182877, Bistramide A, Withaferin A, and Diazonamide A. The methods used in affinity pulldown from serum and protein identification are described.
- An overview of natural products in comparison with total chemical synthesis, with discussion of semi-synthesis of natural products from sustainable sources. The mechanism and molecular basis of polyketide synthesis is described in detail including how to read the polyketides synthetic code and re-engineer the synthetic code to generate unnatural/designer polyketides. Non-ribosomal peptide synthesis is introduced.
- Introduction to ribozymes, riboswitches, and aptamers, including the known ribozymes with discussion of their mechanism of action and structure. The "RNA World" hypothesis is introduced in the context of ribozyme, riboswitches, aptamers, and the ribosome. The concept of Systematic Evolution of Exponential Enrichment to evolve ribozymes and aptamers is further discussed in detail.
- The concept of DNA-encoded libraries, including their synthesis by combinatorial chemistry and their screening to discover drugs is discussed in detail including examples from the literature and

pharmaceutical companies. Limitations and advantages of the technology are critically evaluated.

- Unnatural amino acid incorporation into proteins is discussed, first in the context of chemical tools that site-specifically label amino acids, and then in the context of evolving and re-engineering the natural translation system to incorporate un-natural amino acids. The molecular basis of the evolution of the biomachinery, and the design of artificial codon sets is discussed. The evolutionary implication of an expanded genetic code is evaluated.
- Biomolecule display technologies are introduced, including phage display, ribosomal display, mRNA display, and DNA display. Limitations and advantages of each technology are discussed in the context of ligand/drug discovery and ability to survey chemical space.
- The concept of affinity-based protein profiling (ABPP) is introduced and critically compared with transcriptional profiling. The design and synthesis of ABPP probes are demonstrated through targeting different protein classes. The implementation of ABPP probes to survey the activity of the whole proteome is highlighted through literature examples and the use of the technology to diagnose and predict the prognosis of human disease are highlighted.
- Epigenetics and epitranscriptomics are discussed, including different epigenetic markers on DNA and RNA, how they are dynamically maintained through methylation and demethylation enzymes, methods to quantify the markers, and methods to site-specifically detect the markers by new sequencing technologies. The implication of these markers in human disease and the possibility to use drugs to target epitranscriptomic and epigenetic markers is discussed.
- An Introduction to CRISPR-cas9 system, including its discovery in prokaryotes and its redesign to use in genome engineering. Burgeoning new adaptations/re-engineering of the CRISPR-cas9 system that enable point-mutation editing is highlighted, including the use of the system to enable mRNA knockdown and site-specific demethylation of the epitranscriptome. The use of this new technology in humans, and its ethical implications is highlighted.

Learning Objectives:
Upon successful completion of the course, students will be able to:

- Describe and discuss chemical biology tools to study, perturb, and exploit living systems
- Discuss methods to target organelles and biomolecules in vitro or in vivo
- Discuss methods to determine biomolecular interaction in vitro and in vivo

- Critically analyze readouts from chemical biology technologies, such as transcriptional profiling or activity-based protein profiling.
- Discuss approaches to design and screen large libraries of small molecules or biomolecules for a desired function, such as binding or catalysis.
- Discuss approaches at the genomic, transcriptomic, and proteomic levels to treat human disease, and their strengths and weaknesses.
- Critically discuss the chemical biology scientific literature.
- Devise a methodologically sound and original research project based in chemical biology.

Course Design:

Indicate how the course design supports students in achieving the learning objectives. For example, in the absence of scheduled contact hours what role does student-to-student and/or student-to-instructor communication play, and how is it encouraged?

Detail any aspects of the content, delivery, or learning goals that involve "face-to-face" communication, non-campus attendance or experiential education components.

Alternatively, explain how the course design encourages student engagement and supports student learning in the absence of substantial on-campus attendance.

The course will be formatted as both a lecture and a group discussion. An assigned recent research article that builds upon the concepts taught during the previous class will be discussed at the beginning of the class, followed by the lecture. The class will have a midterm and a final exam. Each student will be tasked with writing an original research proposal using the technologies discussed in the class. The proposal will be guided by one-on-one consultations with the instructor, to help develop the idea/proposal. The proposal is subjected to a double-blind peer review to encourage fair, yet critical, peer evaluation. Students are evaluated on their peer review and proposal. The final class (more if necessary) is devoted to presentations of the proposal to help develop science communication skills. In the event of large class sizes, proposals and presentations will be assigned in groups.

Instruction:

1. Planned frequency of offering and number of sections anticipated (every year, alternate years, etc.).
2. Number of department members currently competent to teach the course.
3. Instructor(s) likely to teach the course in the coming year.
4. An indication of the number of contact hours (defined in terms of hours, weeks, etc.) involved, in order to indicate whether an effective length of term is being maintained **OR** in the absence of scheduled contact hours a detailed breakdown of the estimated time students are likely to spend engaged in learning activities required by the course.

This course will be offered every year beginning Fall of 2020.

One member of the Department is currently competent to teach all aspects of this course.

Prof. Ryan Hili will teach this course.

The students will have 3 h of lecture per week, and it is expected that they will devote at least 3 h per week to private study.

Evaluation:

A detailed percentage breakdown of the basis of evaluation in the proposed course must be provided.

If the course is to be integrated, the additional requirements for graduate students are to be listed.

If the course is amenable to technologically mediated forms of delivery please identify how the integrity of learning evaluation will be maintained. (e.g. will "on-site" examinations be required, etc.)

Midterm: 20%
Research Proposal: 20%
Research Presentation: 20%
Peer review: 10%
Final Exam: 30%

Bibliography:

A READING LIST MUST BE INCLUDED FOR ALL NEW COURSES

The Library has requested that the reading list contain complete bibliographical information, such as full name of author, title, year of publication, etc., and that you distinguish between required and suggested readings. A statement is required from the bibliographer responsible for the discipline to indicate whether resources are adequate to support the course.

Also please list any online resources.

If the course is to be integrated (graduate/ undergraduate), a list of the additional readings to be required of graduate students must be included. If no additional readings are to be required, a rationale should be supplied.

LIBRARY SUPPORT STATEMENT MUST BE INCLUDED.

No textbook is required for the course.

Suggested readings (available at Steacie Library):

Stuart L. Schreiber, Tarun M. Kapoor and Günther Wess (Eds). Chemical biology : from small molecules to systems biology and drug design. 1st Edition. Wiley-VCH. 2007 (QP 514.2 C4556 2007)

Herbert Waldmann, Petra Janning (Eds.) Chemical biology: a practical course. 1st Edition. Wiley-VCH. 2004 (QD 415.3 W35 2004)

Jeffrey M. Craig and Nicholas C. Wong (Eds) Epigenetics : a reference manual. 1st Edition, Caister Academic Press. 2011 (QH 450 E654 2011)

Jennifer A. Doudna, Erik J. Sontheimer (Eds) The Use of CRISPR/Cas9, ZFNs, and TALENs in Generating Site-Specific Genome Alterations. Elsevier Ltd., 2014 (eBook ISBN 0128013346)

Andrea Trabocchi, Sesto Fiorentino (Eds). Diversity-oriented synthesis : basics and applications in organic synthesis, drug discovery, and chemical biology. Wiley. 2013 (QD 262 D58 2013)

No additional readings for graduate students. Graduate student will be expected to survey the literature for reviews and primary sources on topics in the course – a critical skill for graduate students to hone.

Other Resources:

A statement regarding the adequacy of physical resources (equipment, space, etc.) must be appended. If other resources will be required to mount this course, please explain

COURSES WILL NOT BE APPROVED UNLESS IT IS CLEAR THAT ADEQUATE RESOURCES ARE AVAILABLE TO SUPPORT IT.

A standard Audio-Visual System will be used for projection of MS-Power Point slides. A chalkboard or whiteboard is also necessary.

Course Rationale:

The following points should be addressed in the rationale:

How the course contributes to the learning objectives of the program / degree.

The relationship of the proposed course to other existing offerings, particularly in terms of overlap in objectives and/or content. If inter-Faculty overlap exists, some indication of consultation with the Faculty affected should be given.

The expected enrolment in the course.

This course is very important for undergraduate and graduate chemistry students, as its interdisciplinary nature at the interface of chemistry and biology demonstrates how their education can be applied beyond their field and allow them to pursue career paths as chemists in the biologically focused industries, such as the pharmaceutical and biomedical industries.

The course builds from SC/CHEM 3051 3.0 and complements SC/CHEM 4051 3.0. There is partial overlap at the beginning of the course with both courses, in order to calibrate students as chemical biologists – focusing on the physical organic chemistry of biomacromolecules and other cellular components. There is no overlap beyond this.

The expected enrolment in the course is 20 students.

Faculty and Department Approval for Cross-listings:

If the course is to be cross-listed with another department, this section needs to be signed by all parties. In some cases there may be more than two signatures required (i.e. Mathematics, Women's Studies). In the majority of the cases either the Undergraduate Director or Chair of a unit approves the agreement to cross-list. All relevant signatures must be obtained prior to submission to the Faculty curriculum committee.

Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date
Dept:	Signature (Authorizing cross-listing)	Department	Date

Accessible format can be provided upon request.

STEACIE SCIENCE & ENGINEERING LIBRARY
YORK UNIVERSITY

MEMORANDUM

To: Dr. Pierre G. Potvin, Graduate Program Director, Chemistry

From: Minglu Wang, Research Data Management Librarian

Re: CHEM 4052/5052 – Chemical Biology

Date: October 22, 2019

I have reviewed the course proposal and bibliography for **CHEM 4052/5052 – Chemical Biology** and can state that the York University Libraries have the required resources to support this graduate level course.

Please be aware that the library offers the following services to help students with their research:

- A librarian is also available for individual consultations, both face-to-face and online, with students to help them find the materials they need for their projects.
- A librarian can create a custom workshop tailored to the course. Content can include both introductory and in-depth instruction on searching for chemical information in SciFinder, Reaxys, Web of Science, Scopus, and elsewhere. Reference management using software such as Mendeley and Zotero can also be introduced.
- A custom online research guide tailored to the course can be created upon request.

The following suggested readings in the course bibliography are currently available in the library:

Stuart L. Schreiber, Tarun M. Kapoor and Günther Wess (Eds). *Chemical biology: from small molecules to systems biology and drug design*. 1st Edition. Wiley-VCH. 2007 (QP 514.2 C4556 2007)

Herbert Waldmann, Petra Janning (Eds.) *Chemical biology: a practical course.* 1st Edition. Wiley-VCH. 2004 (QD 415.3 W35 2004)

Jeffrey M. Craig and Nicholas C. Wong (Eds) *Epigenetics: a reference manual.* 1st Edition, Caister Academic Press. 2011 (QH 450 E654 2011)

Jennifer A. Doudna, Erik J. Sontheimer (Eds) *The Use of CRISPR/Cas9, ZFNs, and TALENs in Generating Site-Specific Genome Alterations.* Elsevier Ltd., 2014 (eBook ISBN 0128013346)

STEACIE SCIENCE & ENGINEERING LIBRARY
YORK UNIVERSITY

MEMORANDUM

Andrea Trabocchi, Sesto Fiorentino (Eds). *Diversity-oriented synthesis: basics and applications in organic synthesis, drug discovery, and chemical biology.* Wiley. 2013 (QD 262 D58 2013)

If you would like copies of these books to be placed on reserve at the library for students' use, please place a reserve request by visiting reserves.library.yorku.ca. For more information about course reserves, please visit: http://www.library.yorku.ca/web/ask-services/facultyinstructor-support/places-items-on-reserve/.

The following electronic resources licensed by the library may be of help to the students in this course:

- **SciFinder**
- **Reaxys**
- **Web of Science**
- **Scopus**

A more complete listing of resources is available at the following Research Guide:

- Chemistry: http://researchguides.library.yorku.ca/chemistry

Please note that the Steacie Library has extensive collections of books and reference materials that are relevant to this course.

In summary, I state that we are well positioned to support this course. If you have any questions, please do not hesitate to contact me.

Sincerely,

Minglu Wang, Research Data Management Librarian
Steacie Science & Engineering Library
416-736-2100 x40075 mingluwa@yorku.ca

FS Resource Implications Form **Unit: __Chemistry_____** **Date: __10/22/2019__**

		Course(s) Created X or Modified to □ (check one)		Course(s) Retired □ or Modified from □
Complete Course Designation		SC/CHEM 4052 3.0		
Enrolment (Estimate or Last Offering)		20		
Number of:	**Lecture Sections:**	1		
	Lab Sections:	0		
	Tutorial Sections:	0		
Number of:	**Course Coordinators (Tutor 1):**	1		
	Lab Demonstrators (Tutor 2):	0		
	Mark/Graders (Tutor 3):	0		
Prerequisites (P) Corequisites (C) Credit Exclusions (E)		CHEM 3021 3.0 and CHEM 2050 4.0 or BIOL 2020 3.0 or BCHM 2020 3.0		
For which degree program is this required (if applicable)?		None; one of a restricted list of options in the Spec. Hon. BSc Chemistry – Pharmaceutical & Biological Chemistry Stream		
Other resource implications (please specify)		none		
Reason(s) for creation/ modification/ retirement		To match what is now taught as a different course. To modernize the 4th-year offerings.		

FS Resource Implications Form **Unit: __Chemistry_____** **Date: __10/22/2019__**

		Course(s) Created X or Modified to ☐ (check one)		Course(s) Retired ☐ or Modified from ☐
Complete Course Designation		SC/CHEM 4052 3.0		
Enrolment (Estimate or Last Offering)		20		
Number of:	**Lecture Sections:**	1		
	Lab Sections:	0		
	Tutorial Sections:	0		
Number of:	**Course Coordinators (Tutor 1):**	1		
	Lab Demonstrators (Tutor 2):	0		
	Mark/Graders (Tutor 3):	0		
Prerequisites (P) Corequisites (C) Credit Exclusions (E)		CHEM 3021 3.0 and CHEM 2050 4.0 or BIOL 2020 3.0 or BCHM 2020 3.0		
For which degree program is this required (if applicable)?		None; one of a restricted list of options in the Spec. Hon. BSc Chemistry – Pharmaceutical & Biological Chemistry Stream		
Other resource implications (please specify)		none		
Reason(s) for creation/ modification/ retirement		To match what is now taught as a different course. To modernize the 4th-year offerings.		

FSc Faculty Council – December 10, 2019

Proposed Motion 1 - Changes to rules of Council

To alter the rules of FSc Council as proposed in order to add the Graduate Education Committee as a Standing Committee of the FSc Council and rename the Curriculum committee to Undergraduate Curriculum committee

Proposed Motion 2 – approval of Graduate Education committee

To approve the Graduate Education Committee

University Academic Plan Community Consultations

Fall/Winter 2019-20

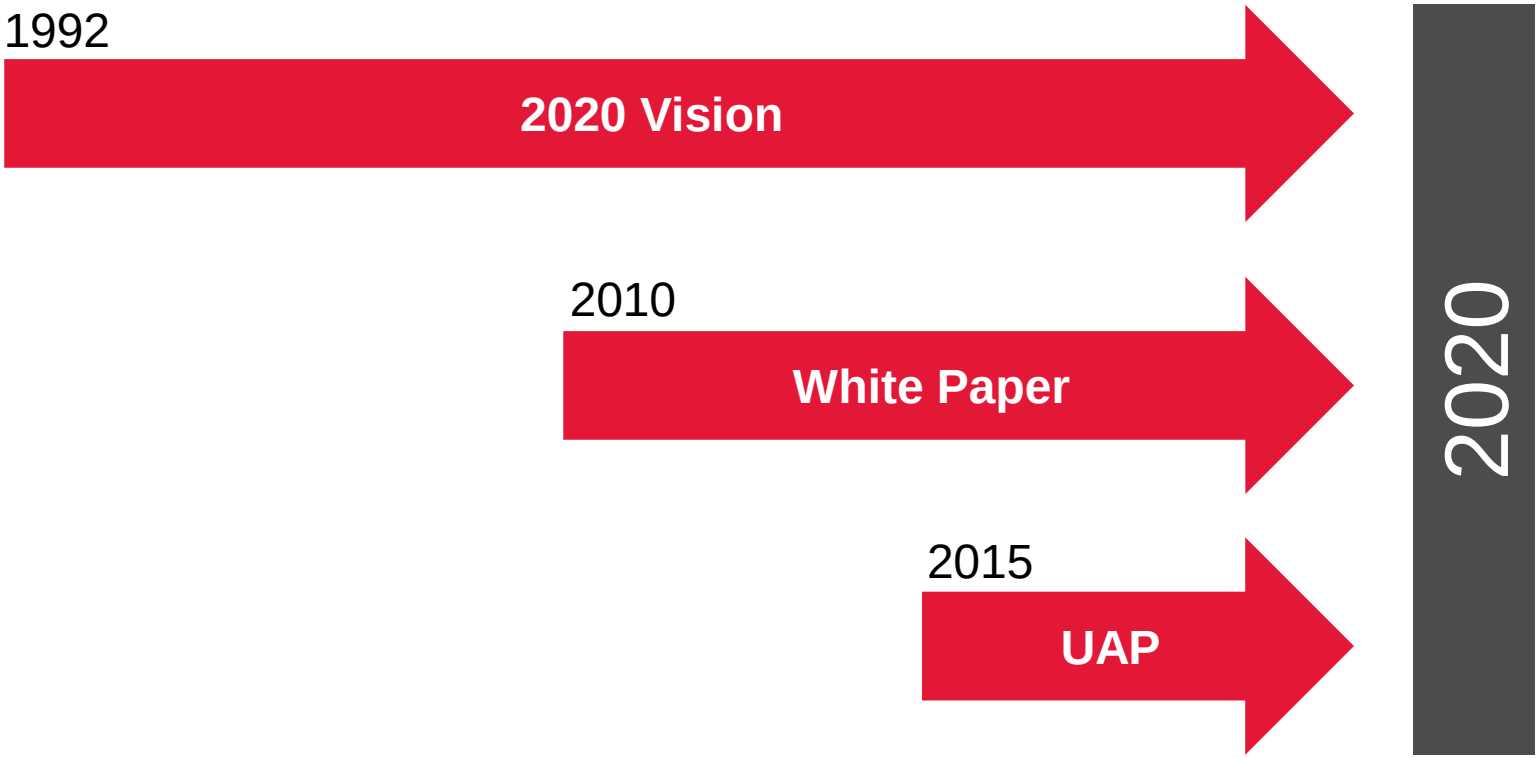
Consultation goal

To share ideas on the future of York University and the University Academic Plan 2020-2025

What is the UAP and why talk about it now?

- The University Academic Plan (UAP) is a foundational document, approved by the University Senate, to articulate our vision and academic priorities as an institution.
- The current UAP runs from 2015-20.
- The Academic Policy, Planning & Research Committee (APPRC) of Senate has initiated the process to create our next UAP.

3 Strategic Documents Spanning 27 Years



York's Current UAP: 7 Priorities

1. Innovative, Quality Programs for Academic Excellence
2. Advancing Exploration, Innovation and Achievement in Scholarship, Research and Related Creative Activities
3. Enhanced Quality in Teaching and Student Learning
4. A Student-Centred Approach
5. Enhanced Campus Experience
6. Enhanced Community Engagement
7. Enabling the Plan

What are Other Universities Doing? Brief Environmental Scan

We reviewed:

- 21 International Universities and 19 Canadian Universities across 11 Countries and 5 continents
- Top QS schools, Canadian Universities across provinces, comprehensive universities

Three formats are common across institutions:

- ***Traditional***: organized around excellence in programming, research, student success, and community engagement
- ***Thematic***: organized around one or more central themes (e.g., impact of technology on society)
- ***Grand Challenges***: organized around local/global challenges/opportunities

Thematic Approaches

E.g. Northeastern University

- Focus on evolving a new kind of university for a digital and artificial intelligence age: blueprint for the “networked university”

E.g. Sorbonne University strategic themes

- Acting in a global world
- Contributing to the open science, digital and data revolutions
- Learning, understanding and undertaking in a changing world

What is a “Grand Challenge?”

- complex and urgent societal issues of our time
- with global and local dimensions
- too big to be understood from any one perspective
- calls for thinking across disciplines, collaborating across institutions, sectors and borders
- focus on social innovation, solutions and impact

Grand Challenges Approach:
E.g. University of Minnesota

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Q1

What do you see as York's greatest values?

Q2

Describe using one word the greatest opportunities for York that should inform the next University Academic Plan.

Q3

Which of these approaches seems most appealing to you?

- Standard approach (organized by different activities of research, teaching ,etc.)
- Thematic approach
- Grand challenges/big questions approach

Q4

Are there local or global challenges that York is especially well placed to help solve?

Q5

Should APPRC frame the University Academic Plan around Grand Challenges?

Traditional UAP Themes

- Advancing:
  - the teaching mission
  - research, scholarship and creative activity
  - student success
  - community engagement

Q6

How might we best advance the teaching mission of the University over the next 5 years?

Q7

How might we best advance research, scholarship and creative activity over the next 5 years?

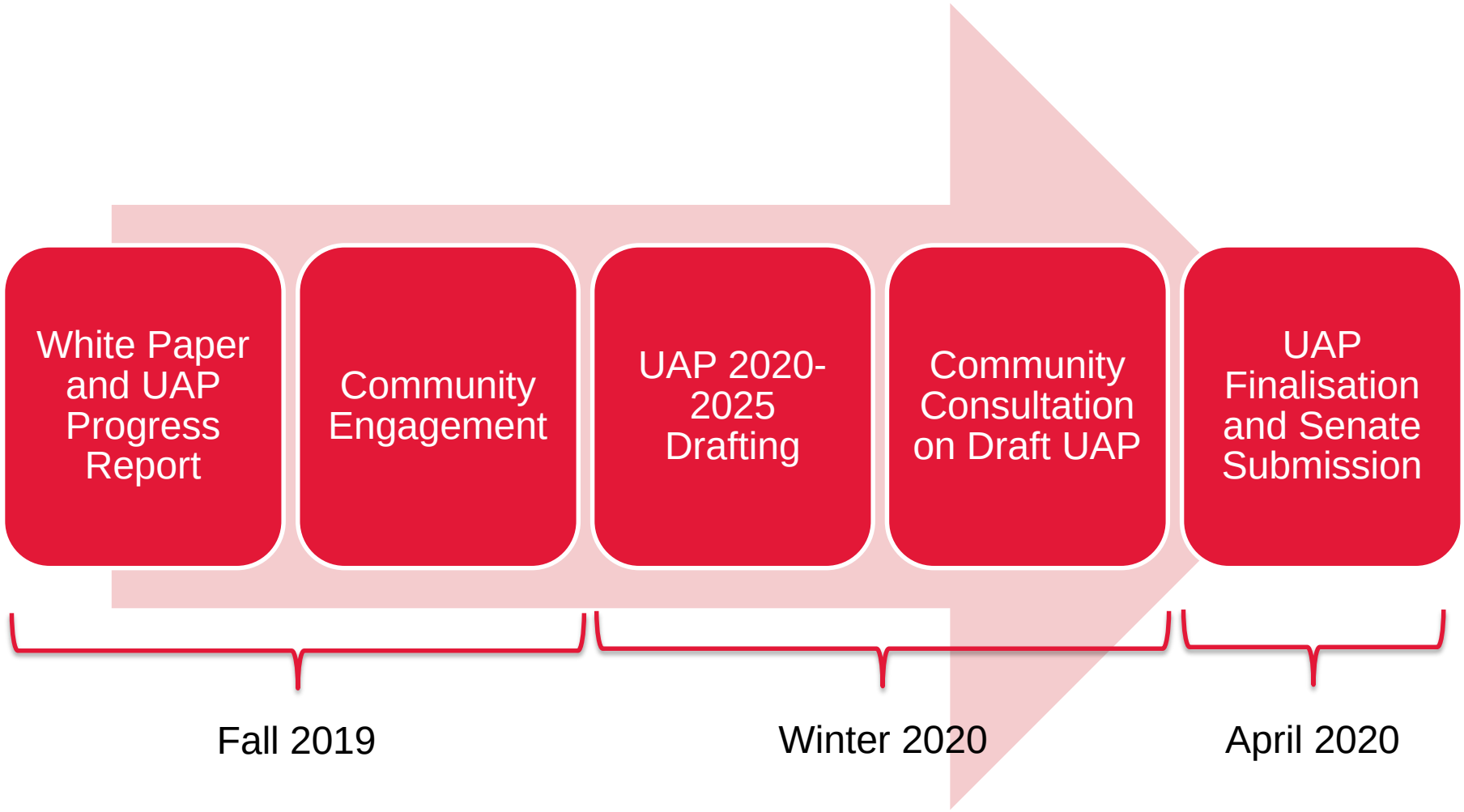
Q8

How might we best advance student success over the next 5 years?

Q9

How might we best advance community engagement over the next 5 years?

UAP Process



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Engagement Options

There are many ways to provide input to the Senate Committee:

- Faculty Council discussions
- By posting your thoughts on public bulletin boards located at Scott Library and Vari Hall
- Through the feedback form on the UAP Renewal website
- By email to info.univsec@yorku.ca

Thank you for your participation!

Links to Notable UAP Examples

- ***Delft University of Technology***: Interactive plan online
- ***University of Saskatchewan***: The University the World Needs
- ***Northeastern University***: No boundaries
- ***Sorbonne University***: Focus on technology
- ***OCADU***: Strategic Directions and Summary
- ***University of Sydney***: Best title

York University Senate

Academic Policy, Planning and Research Committee

Memorandum

To: Senate Committees
Faculty Councils

From: Carl S. Ehrlich, Chair, Academic Policy, Planning and Research Committee of Senate

Date: November 6, 2019

Subject: **University Academic Plan 2020-2025 Consultations**

The process leading to approval of the next version of the University Academic Plan is now underway. As the most important bodies in collegial governance, Senate committees and Faculty Councils are key contributors in the discussions on UAP 2020-2025, and the Academic Policy, Planning and Research Committee of Senate (APPRC) seeks your responses to the questions on the pages that follow.

The year 2020 marks not only the conclusion of UAP 2015-2020 but also two other visioning and planning documents: the Provostial White Paper (2010-2020) and 2020 Vision (1992-2020). The overarching themes of these three documents are:

- comprehensiveness and quality
- access and engagement
- growth, reach and infrastructure

We take it as axiomatic that these themes will continue to remain central to academic planning, and that the goal of ensuring York is recognized for its excellence and global leadership in the nexus of research, teaching and learning will continue to infuse our plans and drive our efforts. The questions have been designed to solicit views on contexts, priorities and objectives, and the structure and thrust of the next UAP. APPRC also welcomes advice on any other aspect of the document.

We ask, therefore, that Senate Committees and Faculty Councils include time on their November or December meeting agendas to discuss the questions and that Faculty Council Secretaries advise APPRC Secretary Kathryn White (kwhite1@yorku.ca) of the timing of

these discussions to allow for the participation of APPRC members. APPRC is cognizant of the constraints on your time and agendas, and understands that it may not be possible for all eight questions to be discussed at length. In view of this, each Senate committee or Faculty Council may wish to highlight a few of the questions in their discussions and responses, and encourage members to submit supplementary feedback via email at info.univsec@yorku.ca or the online questionnaire.

A UAP Renewal Website has been created to provide you with background material as you prepare a response. The documents listed below, available on the UAP Renewal website, are particularly helpful as a collective expression of the vision for York as a comprehensive, research-intensive university committed to excellence, student success, outreach and partnership.

25+ Years of Achievement: A Retrospective (Draft)
UAP 2015-2020
UAP 2010-2015
Building a More Engaged University: Strategic Directions for York University (Provostial White Paper 2010-2020)
2020 Vision: The Future Development of York University (1992-2020)
Strategic Research Plan 2018-2023

Please submit your completed responses to the University Secretariat at info.univsec@yorku.ca by no later than January 22, 2020.

Thank you in advance for your vital assistance.

cc: Lisa Philipps, Provost and Vice-President Academic
Cheryl Underhill, Interim University Secretary
Kathryn White, Secretary, APPRC

Questions

1. What do you see as York's greatest values?

2. Describe the greatest opportunities for York that should inform the next University Academic Plan.

3. APPRC is considering a new format for the University Academic Plan that seeks to inspire the University. In this approach, the Plan would be centred around a series of Grand Challenges, a departure from York's 2015-2020 Plan which is focused on categories that reflect our academic mission and activities.

   Grand Challenges are more than ordinary questions or themes that inform our core activities. They are the most complex societal issues of our time that are globally significant, and have local dimensions and impacts. These challenges are too big to

be understood from only one perspective. Finding solutions requires thinking across disciplines and often collaboration across institutions, sectors and borders. Additional details about the Grand Challenges approach will be outlined in the November 7 Open Forum slide presentation, to be made available on the UAP Renewal website following the Forum.

Do you think the next University Academic Plan should be framed around Grand Challenges? Please feel free to expand upon your response.

4. Are there local or global challenges that York is especially well placed to help solve?
5. How might we best advance the teaching mission of the University over the next 5 years?
6. How might we best advance research, scholarship and creative activity over the next 5 years?
7. How might we best advance student success over the next 5 years?
8. How might we best advance community engagement over the next 5 years?

25+ YEARS OF ACHIEVEMENT:

A RETROSPECTIVE

YORK UNIVERSITÉ UNIVERSITY

DRAFT
October 31, 2019

DRAFT

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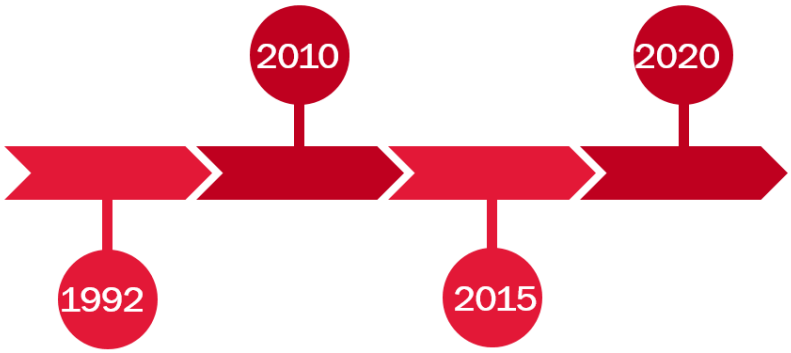

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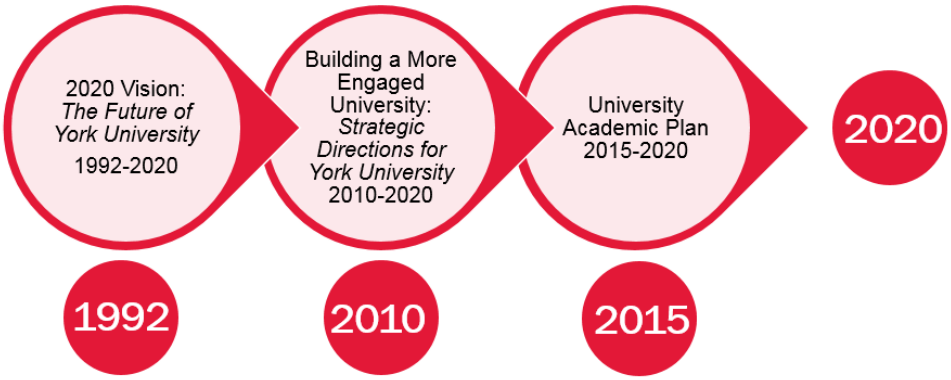
Introduction

The year 2020 is a momentous one for academic planning at York University, marking the conclusion of three major visioning documents.



With all three of these visioning documents culminating in 2020, a retrospective is warranted. Themes of excellence, connectedness, and access resonate though all three guiding documents. York's aspirations have evolved from the 1992 focus on increased comprehensiveness to the 2010 goal of full local, national and global engagement, to the 2015 vision for an engaged, comprehensive university able to demonstrate meaningful and lasting impacts in the lives of students, the community and the world.

Comprehensiveness and Quality

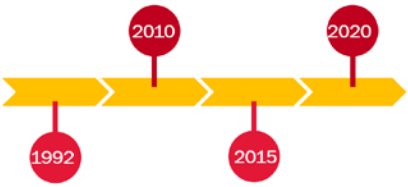
2020 Vision (1992) laid out a description of the higher education environment expected over three next decades. It anticipated enrollment growth, rapid societal and labour market change and dwindling financial resources. The most pressing goal at the time was to become a fully "comprehensive university". Top priorities were:

- academic diversification
- increasing the proportion of graduate to undergraduate students,
- building on strengths to develop new initiatives in health, design and communications and information science.

The 2010 *White Paper* restated these goals with specific aims to increase the full-time faculty complement, to increase students' opportunities for experiential education, to improve overall research profile and the quality of graduate programs, and to build new programs in:

- health and medicine
- engineering
- applied science
- business-related and professional programs.

As we approach 2020, York can be proud of achieving major progress on many of its stated objectives. Compared to 1992 and even 2010 the University is undeniably delivering a far more diverse and comprehensive sweep of educational offerings and research outputs. York is a leader in community engaged learning, research and innovation, and is recognized as a University that generates positive impact for students and communities.



Some key accomplishments include:

- Establishment of the Faculty of Health in 2006
- Establishment of the Lassonde School of Engineering in 2013
- Expanding and diversifying York's program mix (ie. Cognitive Science, Children's Studies, Global Health, Disaster & Emergency Management, Digital Media, etc.)
- Tenure stream faculty complement has increased from approximately 1240 in 1992-93 to 1504 in 2019-2020
- Number of graduate programs has grown from 44 in 2004 (earliest available data) to 69 in 2019-20
- Undergraduate and graduate student headcounts have remained relatively steady and just below 50,000 and 6,000 respectively.
- Research amplification has been a very notable trend over the last 25+ years in terms of income, diversity of outputs, disciplinary breadth, and infrastructure, for both individual and collaborative research.
- Creation of the YUExperience Hub and building support for experiential education across the University, with a record 8,234 students participating in 2017-18.
- Creation of Innovation York in 2012 - Commercialization, Entrepreneurship, Industry Engagement, and Knowledge Mobilization.

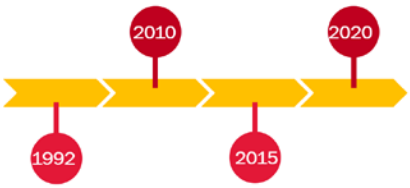
Access and Engagement

2020 Vision stated York's long-standing commitment to the principle of accessibility – an opportunity for all qualified students to pursue university studies, with special emphasis on those from nontraditional constituencies, mature, and part-time students. The authors recognized that for many local students, studying close to home is the only viable pathway to higher education.

In 2010 the White Paper reinforced this commitment to access, defining strategies for serving broader groups of students seeking a quality education at a research-intensive university within the GTA through community engagement, expanded capacity in online delivery, and increased internationalization.

York University signature achievements around access to education include:

- 124% growth in online course offerings have grown 124% since 2010-11.
- Blended offerings have increased from 18 courses in 2010-11 to 291 courses in 2018-19.
- Establishing the York University TD Community Engagement Centre.
- Transition Year Program launched in 2008.
- Ready, Set, U launched in 2018 to support the success of new students with specialized interventions.
- The **Master of Leadership and Community Engagement (MLCE)** professional master's degree prepares graduates to advance in leadership roles in public sector organizations and communities, with a focus on community engagement and innovation.
- Established the School of Continuing Studies



Campus Growth: Reach and Infrastructure

The 1992 authors foresaw the need for increased recreational and athletic spaces, new buildings to permit growth, and suggested that a new transit hub would help alleviate a parking stress on campus. They encouraged the Glendon campus to amplify its mandate for bilingual education through strategic growth and laid out the possibility of a third York campus in York Region.

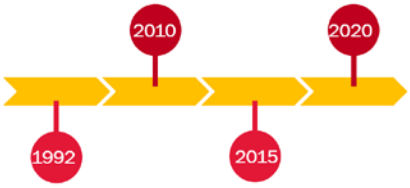
Those same authors would be pleased to see Keele campus today, with its two TTC subway stations, its covered walkways surrounding central greenspace, and the new Lions Stadium, legacy of the 2015 Pan Am Games.

York University now has satellite locations in Costa Rica (FES), in India (Schulich), in downtown Toronto (Osgoode), and in Markham (YSpace). The Glendon and Keele campuses have seen renovation and growth, and a third campus in planned for York Region.

York University campus growth milestones include:

- Accolade East and West
- The Bergeron Centre for Engineering Excellence
- Centre of Excellence, Glendon College
- Dahdaleh Building
- Life Sciences Building
- Rob and Cheryl McEwen Graduate Study & Research Building, Schulich School of Business
- Second Student Centre
- Sherman Health Sciences Research Centre
- Vari Hall
- York Lions Stadium

In 2019-20 York is entering a period of significant investment to improve facilities across the University including classroom infrastructure and technology renewal, washroom renovations, new offices, labs and refreshed common spaces, and deferred maintenance projects.



2010 White Paper Quick Facts

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Strengths

White Paper Benchmark #1: The paramount goal for York over the next decade is an increase in the full-time faculty complement

- 2010-20: net growth of 10.26% (1,364-1,504)
- 2019-20: approximately 140 hires to date (9%+ increase YOY)
- Tracking to ~13% increase over 10 years
- Should impact student:full-time faculty ratios
- 22% of last year's hires formerly taught as CUPE contract faculty

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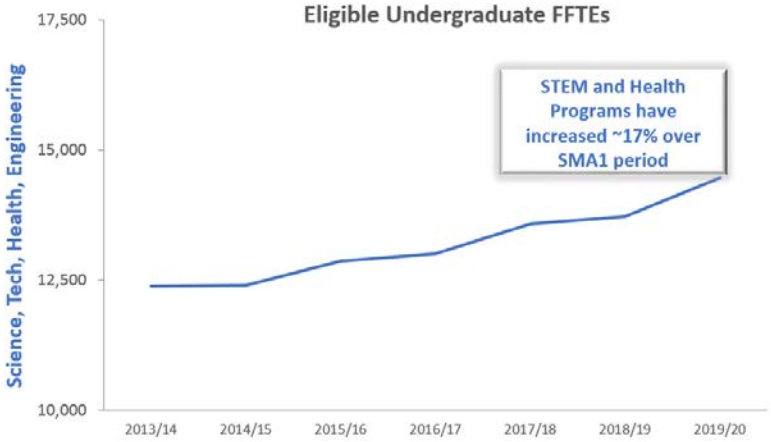
White Paper Benchmark #2: Over the next decade, there will be an annual systematic increase in our international peer reviewed performance in research and creative work, including efforts to secure externally funded research

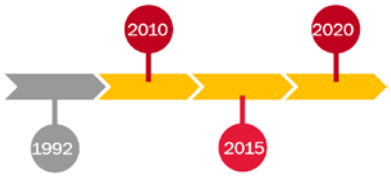
- Increased research income – over $100M
- Total publications increased 5.2% in last 5 years; publications per faculty member increased 10%

White Paper Benchmark #3: Over the next decade there will be a deepening and broadening of our institutional engagement with research partners locally and globally and leading innovative networks and clusters

- Consistent success in large-scale, partnered grant competitions from diverse funding sources
- Examples include projects such as VISTA, Making the Shift NCE, BHER and many SSHRC Partnership Grants
- Host of the CIHR Institute of Population and Public Health

White Paper Benchmark #4: Over the next decade, York will continue our efforts to become a more comprehensive University, by continuing to expand …in the areas of health and medicine, engineering, applied science, business-related and professional programs





Strengths

White Paper Benchmark #5: A minimum GPA admission requirement for applicants from secondary school of 74% will be set as the initial benchmark for September 2010; this minimum will rise to 75% by September 2011, to 76% by September 2014 and to 77% by 2017

- Admit average across all Faculties for 2019-20 is 82.82% and has been generally consistent since 2016-17.
- Entering GPA cutoff is holding at 72% in some programs; higher in others

---

White Paper Benchmark #6: By September 2012, the University will have developed and implemented an enhanced first year program for undergraduate students

- YUStart
- LA&PS Gateways
- Teaching Commons' "First Year Experience In The Classroom Toolkit" for Instructors

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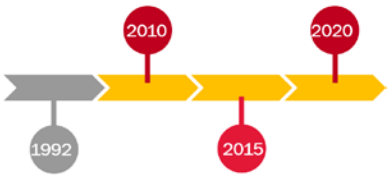
White Paper Benchmark #7: Over the next decade, there will be a significant increase in opportunities for students to participate in an experiential education activity, both domestically and internationally, as a component of their degree program

- In 2017-2018, 8,234 students participated in an experiential learning opportunity
- EE Coordinators hired
- York International's "Go Global" program has increased quantum of study abroad

---

White Paper Benchmark #8: We commit to identifying benchmarks and developing policies and mechanisms to increase the number of students who successfully complete their PhDs by the end of Year VI

- New graduate funding model focused on research and scholarship
- Curricular revisioning around comprehensive exams
- Wellness services implemented
- Postdoctoral Fellowship Program launched as incentive



White Paper Benchmark #9: We will …increase both the number of successful applications from York students and postdoctoral fellows for externally-funded domestic and international scholarships and fellowships, as well as increasing the numbers of students and postdoctoral fellows coming to York with external awards to 25% by 2015

White Paper Benchmark #10: York University will improve accessibility for students by significantly expanding online delivery of courses and programs as part of its efforts to enhance learning through the use of technology

White Paper Benchmark #11: York will continue its efforts to enhance internationalization, including the recruitment of international students. By 2013, at least 7.5% of York students will be international students; by 2017, at least 10% of all York students will be international students

White Paper Benchmark #12: The Vice-President Academic & Provost will lead and coordinate the development of a pan-university strategy for community engagement

Strengths

- Number of doctoral students with external awards increased
- Consistent success with a range of student awards (federal, provincial, other)
- Overall number of postdocs increasing (primarily grant funded)

- Online course offerings have grown 124% since 2010-11, with 399 courses being offered in 2018-19
- Blended offerings have increased from 18 courses in 2010-11 to 291 courses in 2018-19
- The School of Continuing Studies and Osgoode Professional Development have introduced online/blended certificate programs

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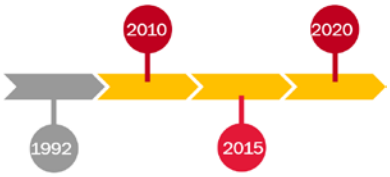
- Comparing 2009-10 to 2018-19:
  - UG visa grew from 5.8% to 15.6%
  - Grad visa grew from 8.3% to 18%

- YorkU-TD Community Engagement Centre
- Scholars Hub (York Region Public Libraries)
- Anchor YorkU
- Observatory
- AGYU
- KMb unit
- GRACE – Office of Government Relations and Community Engagement (est.2018)
- The Indigenous Framework for York University
- And more: http://community.info.yorku.ca



Priority 1: Innovative, Quality Programs for Academic Excellence

100% of York University's programs have documented learning outcomes

Certificate in Black Canadian Studies created

All Faculty Integrated Resource Plans include actions to enhance quality academic programming

Expansion of Engineering programming

Faculty-Spanning Curriculum

Honours BSc program in Neuroscience

Graduate Program in Digital Media

Master of Management in AI

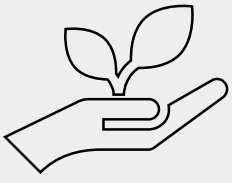
Developed Framework for Cross-Faculty Degree Programs

Enhanced the suite of supports for curricular development: Teaching Commons programming, educational developers, market research capacity & facilitation

Quality Assurance framework improved to provide clarity and consistency

Faculty of Urban & Environmental Change

- **Collaborative curricular revisioning in the Faculty of Environmental Studies and the Department of Geography**
- **Revisioning of the Environmental Science Program**



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The University Academic Plan 2015-2020 – How Are We Doing?

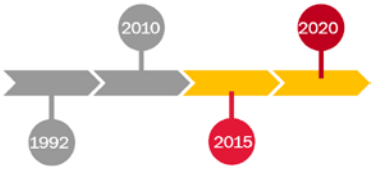
PRIORITY 1 Innovative, Quality Programs for Academic Excellence

A paramount priority for the UAP 2015 - 2020 in advancing York's vision as a comprehensive, research-intensive and internationally recognized University is to enhance the quality of our academic programs.

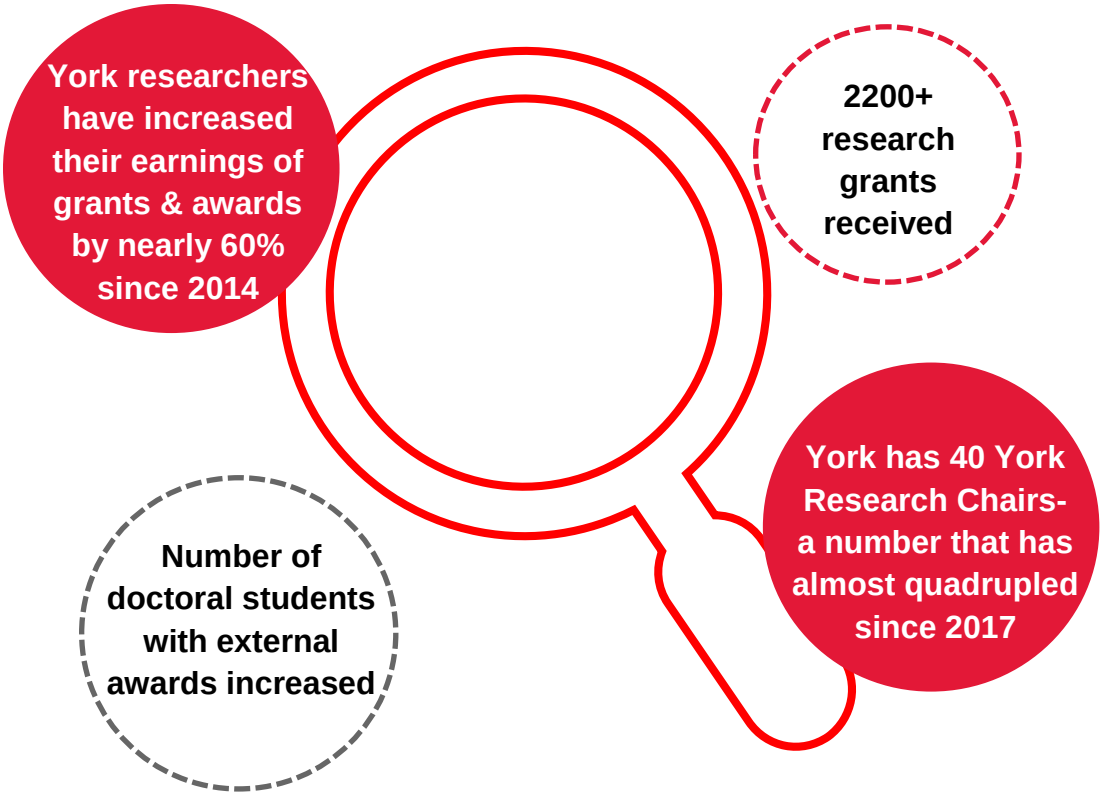
Objectives	Examples and Signature Outcomes

1. Develop and implement Faculty plans to enhance the quality of our academic programs	• 100% of York University's programs have documented learning outcomes.
	• Collaborative curricular revisioning in the Faculty of Environmental Studies and the Department of Geography.
	• Framework for Cross-Faculty Degree Programs
	• Quality Assurance framework improved to provide clarity and consistency
	• Enhanced suite of supports for curricular development: Teaching Commons programming, educational developers, market research capacity, facilitation
	• All Faculty Integrated Resource Plans include actions to enhance quality academic programming
	• *Engineering:*
	  ▪ MASc and PhD programs in Civil Engineering
	  ▪ MASc and PhD programs in Mechanical Engineering
	  ▪ Broadening of PhD program in Electrical Engineering to add computer, electrical software engineering fields
	• Certificate in Black Canadian Studies created
	• Master of Management in Artificial Intelligence
	• Honours BSc program in Neuroscience
	• Graduate Program in Digital Media
	• Introduction of a 4+1 program for high achieving students to be admitted simultaneously to Glendon, AMPD or Science and the Masters of Management
	• Revisioning of the Environmental Science program
	• Schulich School of Business has introduced several one-year Masters programs, in addition to a Master of Management in Artificial Intelligence
	• 18 degree, certificate and diploma program closures

2. Strengthen comprehensiveness and interdisciplinarity by: • Developing innovative degree programs in business, education studies, engineering, health, professional studies and science that excel in curricular design and delivery, and align with societal needs as appropriate for our campuses • Championing liberal and creative arts by seeking out opportunities to promote their value, enhancing program quality including innovative new degree combinations • Achieving the optimal size and breadth in engineering leading to increased impact and reputation of engineering education • Enhancing the flexibility and empowerment of students to pursue degree and other program combinations that allow them to pursue interests beyond their majors, collaborate, and/or enhance professional skills including an undergraduate "finishing year", as well as professional and course-based Masters programs	
3. Ensure that the quality assurance framework is refined and respected including the submission of learning outcomes for every program and the alignment of assessment with learning outcomes	
4. Create more Faculty-spanning curriculum (i.e., drawing on more than one academic unit) with incentives for cooperation	



Priority 2: Advancing Exploration, Innovation and Achievement in Scholarship, Research and related Creative Activities



Profiling Research

Graphic animated whiteboards that tell the story of research acceleration at York

Brainstorm: Monthly special research issue of Y-File – 100 articles to date

"2 Minutes, 3 Questions" video series

Expanding Access to York Scholarship

- **York University Open Access Policy passed by Senate in 2019**
- **York Libraries host specialized infrastructure platforms (YorkSpace; York Digital Journals) that extend the global visibility of York Scholarship**

Since 2014, York has ranked No.2 in total research-related media mentions among Ontario universities

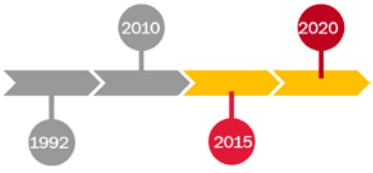
Home of Making the Shift: the only social sciences-based Network of Centres of Excellence (NCE) in Canada

York's research impact is No.1 in Ontario in business, kinesiology, management & accounting, & mathematics

PRIORITY 2 Advancing Exploration, Innovation and Achievement in Scholarship, Research and related Creative Activities

Scholarship is the lifeblood of any university. York has always favoured a broad definition of scholarship, and will continue to value the endeavours of faculty members throughout the University.

Objectives	Examples and Signature Outcomes
1. Significantly increase the number and proportion of reportable research outcomes by our scholars and enhance the means through which we can measure and articulate the full range of our scholarly outcomes from our work and their impact	• Electronic CV Management Software project • Artificial Intelligence task force report and AI @ York U website launched • York University Open Access Policy passed by Senate in 2019 • York Libraries host specialized infrastructure platforms that extend the global visibility of York Scholarship: ▪ YorkSpace research repository - 33,400 items and averages 2.4 million downloads per year ▪ York Digital Journals publishing service • Open Access Fund for York scholarship • Osgoode Digital Commons and open access to legal scholarship • Brainstorm: Monthly special research issue of Y-File – 100 articles to date • "2 Minutes, 3 Questions" video series - researchers and academics across all 11 Faculties discuss the impact of their work and York's leadership on a global stage • Graphic aminated whiteboards that tell the story of research acceleration at York • Annual infographics featuring proof points and research rankings • # of doctoral students with external awards increased • Consistent success with a range of student awards • Overall # of postdocs increasing (primarily grant funded) • 2200+ research grants received
2. Enhance the quality and quantity of research and knowledge mobilization aimed at shaping the public debate, law and policy reform, social and economic enterprise, and improving the outcomes of York research for society	
3. Increase the number of our research partnerships, and increase the networks and other points of contact between partners through the deployment of software, provision of training and other means	
4. Expand open access to York research in order to enhance visibility, open disciplinary boundaries and facilitate sharing knowledge more freely with the world	
5. Expand collaboration within the University and between faculty members at York and other individuals to make York more than the sum of its parts, and profile our faculty and their research	
6. Enhance and project the profiles of our Organized Research Units	
7. Significantly increase the number and proportion of researchers pursuing external research funding to support research projects, graduate students and postdoctoral fellows, and significantly increase research income in real and proportionate terms	
8. Establish York as an innovation hub by increasing and promoting the translational and entrepreneurial activities offered by Innovation York, and the Knowledge Mobilization group, including the Markham Convergence Centre, LaunchYU and newly emerging innovation activities in the Faculties including enlisting media to extend our reach	
9. Establish and implement an Institutional Research Equipment and Facilities Plan in collaboration with the Faculties for maintaining and enhancing the necessary infrastructure including space for student learning and tracking investments to ensure that they are commensurate with objective	
10. Emphasize enhancing and increasing our population of graduate students and postdoctoral fellows (quality and quantity) and mentoring and supporting them in their research activities	



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Priority 3: Enhanced Quality in Teaching and Student Learning

Pan-university committee established to support on-line learning initiatives

Establishment of the YU Experience Hub

Innovatus Y-File launched

Launched C4:The Cross-Campus Capstone Classroom

Funding for Enhanced Quality in Teaching & Learning initiatives available through AIF

Student Success

YU Start: Online program to transition students from point of accepting to the first months of university

Ready, Set, YU: Supports access and specialized interventions for new students

Revisioning of Advising: Pop-up Advising Fair

Training & Support for Faculty Members

- **Teaching Commons programming includes modules on EE, TEL and other pedagogical innovation**
- **Development of documents and tools to guide faculty to identify the EE opportunities they are already using in the classroom**

University-wide international exchange: 1,793 students

Summer-short term international programs Abroad: 1,084 students

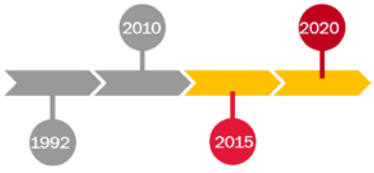
Integrated Global Health Practicum is a program bridging theory and practice in a variety of health settings

GL/SP 3000 Spanish summer course: From 2013 to 2016, ~40 students participated in an experiential course through Glendon in cooperation with the National Autonomous University of Mexico.

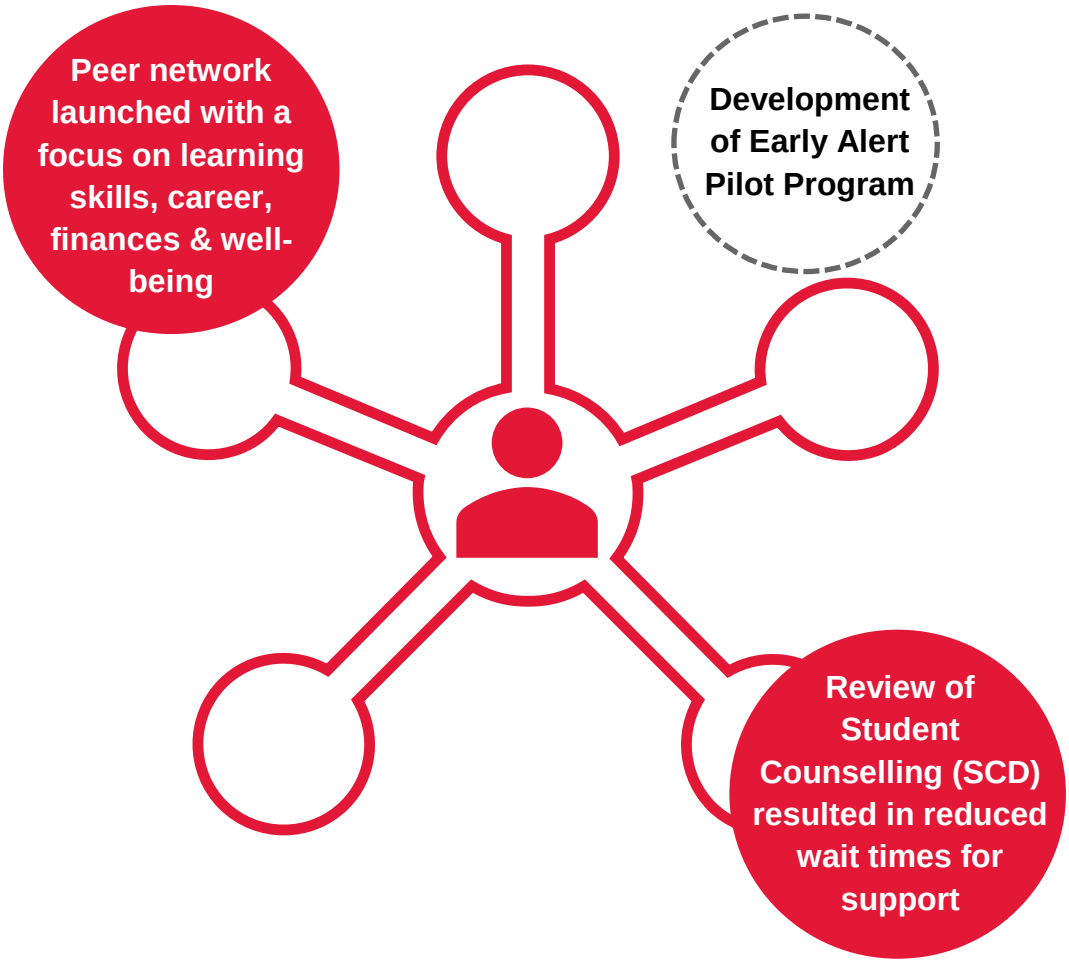
PRIORITY 3 Enhanced Quality in Teaching and Student Learning

York has an outstanding and well-deserved reputation for high quality teaching and learning as supported by student surveys and cyclical program reviews, and has an opportunity to establish itself as a leader in pedagogical innovation.

Objectives	Examples and Signature Outcomes
1. Incorporate to the extent possible an experiential component in every program including activities such as classroom-based labs and studios, clinical and intensive labs, community based or community service learning, local or international internships or cooperative placements, field studies, research opportunities including capstone independent research projects, etc. • Increase the number of EE opportunities both internally and on campus including for example student participation in Organized Research Units • Develop the means by which to organize and track experiential education opportunities, problem-based inquiry and related strategies as is the case with online and blended courses	• Striving towards integration of EE within greater proportion of York's programming. • Over the last 5 years we have established a pan university unit - the YU Experience Hub - to advance EE activities within the curriculum. The Hub supports students, faculty and community partners in EE activities. • We have established a common language document, developing tools to guide faculty to identify the EE opportunities they are already using in the classroom, working with the division of students to develop a comprehensive tracking system for EE. • Pan-university committee established to support on-line learning initiatives. • Funding for Enhanced Quality in Teaching and Student Learning initiatives is available through the Academic Initiatives Fund. • Teaching Commons programming includes modules on EE, TEL and other pedagogical innovation. • YU Experience Hub supports communities of practice. • University-wide international exchange: 1,793 students • Summer-short term international programs Abroad: 1,084 students • Learning from Los Angeles Film Course is a study-abroad course that will explore the fantastic histories, myths, and contradictions of the first modern media city, and the image it fashioned for itself. • GL/SP 3000 Spanish summer course**:** From 2013 to 2016, ~40 students participated in an immersive/experiential course through Glendon Hispanic Studies in cooperation with the National Autonomous University of Mexico. • Integrated Global Health Practicum is a program bridging theory and practice in a variety of health settings. • Expanded Becoming YU to full campus – program grounded in experiential learning theory and allows students to recognize the value of their experiences and articulate their skills. • YU Start - online flagship program to transition students from point of accepting to the first months of university • Ready, Set, YU – implemented in 2018 to support the success of new students with specialized interventions and support who otherwise would not have had access to attend post-secondary education. • Revisioning of Advising at York and Advising: Pop-up Advising Fair • Innovatus launched - a special issue of YFile, explores how York University community members are expanding experiential learning, enhancing the student experience, inspiring innovation in technology-enhanced learning and embracing educational development. • Launched C4: The Cross-Campus Capstone Classroom
2. Expand technology enhanced learning including the number of courses, modules and programs available online or through blended learning	
3. Expand internationalization in the curriculum as well as international experiences such as summer programs, international internships, and exchanges • Enhancing student mobility including a commitment to flexible course scheduling and improved credit transfer • Promoting opportunities for York students interested in studying abroad and broadening the diversity of their experiences • Facilitate faculty member exchanges	
4. Provide training and support for faculty members interested in incorporating experiential education, technology enhanced learning and other pedagogical innovation • Continue to strengthen supports offered by the Teaching Commons	
5. Provide students with timely, relevant information about courses they may choose or in which they have enrolled before classes have started	



Priority 4: A Student-Centred Approach



Optimized Technology

- Student Virtual Assistant
- Advising Referral Tool
- Q-Less Line Management System

Enhanced Communication

- Providing timely, targeted, and accurate information for students, including information regarding finances, important dates, development opportunities & workshops

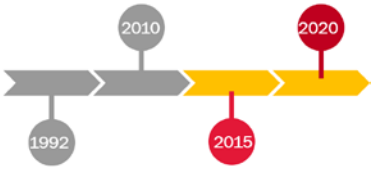
Significant investment in full-time faculty complement

Faculty Complement Strategy developed including goals for student:faculty ratio improvements

PRIORITY 4 A Student-Centred Approach

Input for this Plan has highlighted the importance of a student-centred approach in facilitating the success of our students and ensuring that our graduates have the knowledge, skills and abilities for success as global citizens in the 21st century.

Objectives	Examples and Signature Outcomes
1. Develop a new integrated advising model clarifying the roles and responsibilities of the Division of Students, the Faculties and Colleges and providing comprehensive advising processes and online resources to ensure that our students have the confidence to navigate degree requirements; have access to academic, career, library and financial support; and receive timely and accurate responses to requests	• Significant investment in full-time faculty complement. • Faculty Complement Strategy developed including goals for student:faculty ratio improvements • Upstream and pro-active supports launched in 2018 through peer network with a focus on Learning Skills, Career, Financial Services and Well-being. • Technology optimized to support student success (Kuali, Student Virtual Assistant, Advising Referral Tool (Civitas), Q-Less Line management System, etc.) • Enhanced Communication efforts to provide timely, targeted, and accurate information for students, including information regarding finances, important dates, development opportunities, workshops, etc. • Review of Student Counselling (SCD) resulted in reduced wait times for support - from 7-10 business days to 20-30 minutes for an initial appointment. • Early Alert Pilot – providing better support for students who are facing difficulties that put their academic success at risk.
2. Actively monitor student learning needs and develop appropriate academic supports	
3. Cross-train and allocate staff members to student support tasks when most needed	
4. Increase contact time between faculty members and students	
5. Make scholarships and bursaries, including graduate scholarships and Postdoctoral Fellowships, a centerpiece of the fundraising campaign to be launched in 2016	
6. Further advance our SEM approach including enhancing student supports tailored to different student segments improving retention and time to-completion of degrees by undergraduate and graduate students	
7. See an increase in student satisfaction	



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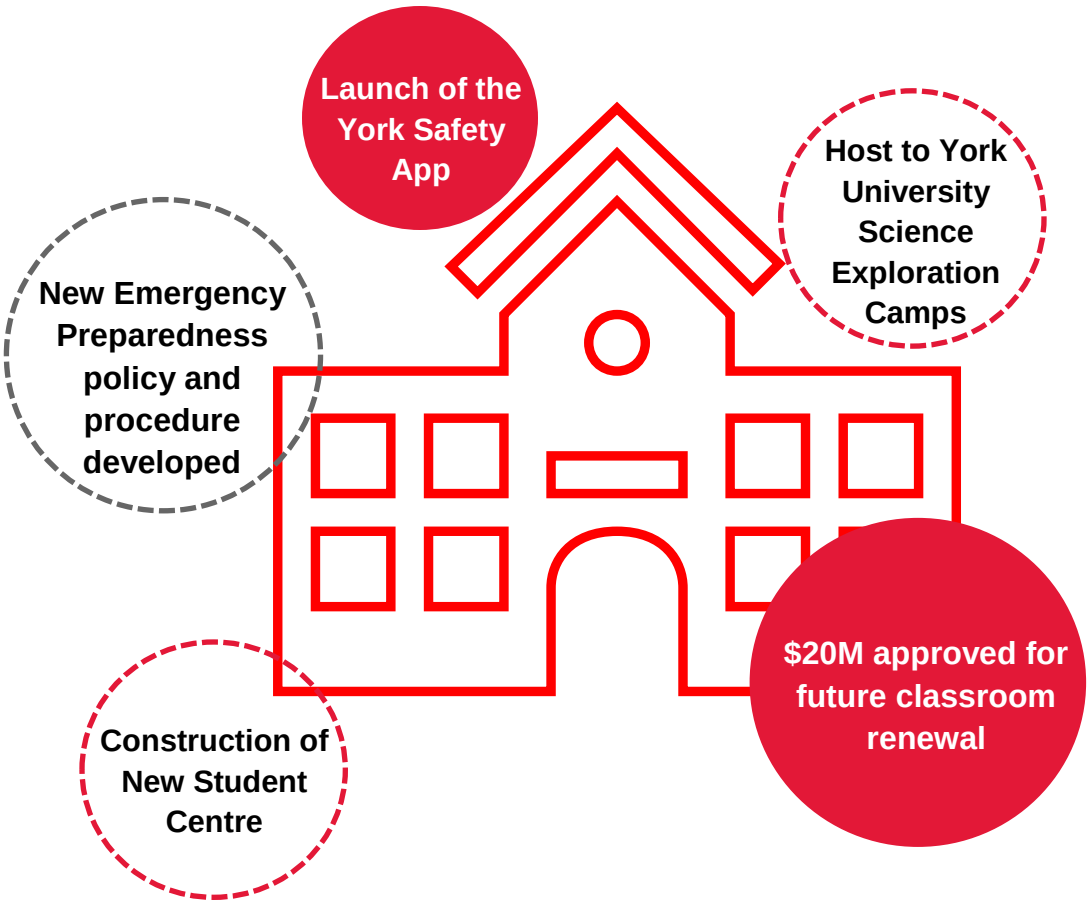
Priority 5: Enhanced Campus Experience



Community Safety

Safer Together strategic plan launched

President's Community Safety Leadership Awards program established

New Security intervention model in place

Rejuvenating Classrooms

- **Established Sustainable Framework established to refresh classrooms every 5 years**
- **85 classroom technology upgrades complete**

Rob and Cheryl McEwen Graduate Study & Research Building, Schulich School of Business

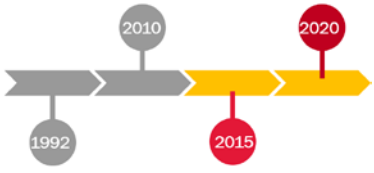
Ross Podium renewal: Expansion of extracurricular spaces for students

Toronto Transit Commission Subway – York University and Pioneer Village stations; Expansion and diversification of other transit options for students

PRIORITY 5 Enhanced Campus Experience

With the population growth in York and Peel Regions, the subway extension and related transportation developments, the Keele campus is increasingly at the crossroads of a major metropolitan area that connects to Glendon mid-town and then south to our Schulich and Osgoode downtown campuses. Together York's campuses create a cultural hub connecting York Region, the francophone population in Central and southwestern Ontario, and the Greater Toronto Area downtown.

Objectives	Examples and Signature Outcomes
1. Continue to advance a comprehensive, holistic and community-based approach to ensure the safety of our campuses	• Community Safety Department's Strategic Plan – Safer Together launched following pan-university consultations • President's Community Safety Leadership Awards program established • New Security intervention model in place • Launched the YorkU Safety App • New Emergency Preparedness policy and procedure
2. Enhance the physical infrastructure and campus spaces with capital investments aligned to academic priorities including classroom upgrades	• Rob and Cheryl McEwen Graduate Study & Research Building, Schulich School of Business • Science Teaching and research facility refresh: Farquharson, Petrie, BSB, new labs at Glendon • Second Student Centre • Established Sustainable Framework to refresh classroom technology every 5 years • 85 classroom technology upgrades complete • $20M approved for future classroom renewal • Ross Podium renewal – expansion of extra curricular spaces for students
3. Enhance spaces available for social academic interactions including opportunities to enhance faculty-student interactions and extra-curricular learning activities	
4. Leverage new facilities and amenities – subway stations and bus terminals, a second student centre, Lions' stadium, and other amenities and infrastructure – in the cause of creating inspiring and welcoming spaces	
5. Enhance ecological sustainability, and the symmetry between built and natural environments	
6. See the development of the campus as a destination, a rise in the number of individuals taking advantage of amenities, all day and on weekends, and in the space devoted to down-time along with extra- and co-curricular activities	• Toronto Transit Commission Subway – York University and Pioneer Village stations; Expansion and diversification of other transit options for students
7. Create a Cultural Innovation Fund and solicit ideas from the community on projects that will extend the concept of York as a cultural hub, provide appealing buffers to starker features such as parking lots, and create spaces for community partnerships and interactions	• As of April 2019, York 9FC games will take place at York University. • C.W. Jefferys Collegiate Institute Walk with Excellence • York University Science Exploration Camps • FES Change Your World event – to inspire youth in Ontario to be the next generation of environmentally active citizens.
8. Seek out opportunities for increasing the use of facilities by local communities	



Priority 6: Enhanced Community Engagement

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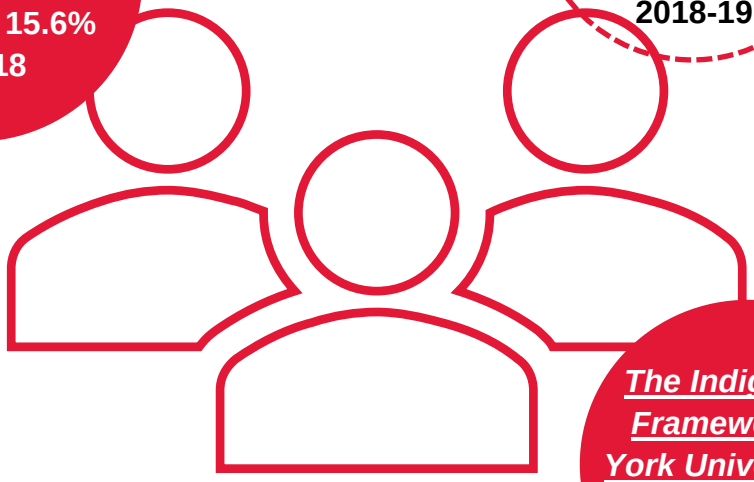
International student body grew from 10.5% in 2014 to 15.6% in 2018

School of Continuing Studies enrolment reached 4575 in 2018-19



The Indigenous Framework for York University: A Guide to Action **launched in 2017**

Mental Health & Well-Being

York University Psychology Clinic celebrates 10th Anniversary

GradConnect Wellness Services launched

Wellness Hub established

Consulting the Community

- **Instituted annual budget consultations with stakeholder groups across the University**

Issue paper released to initiate a pan-University consultation process that aims to develop an integrated institutional strategic plan on internationalization

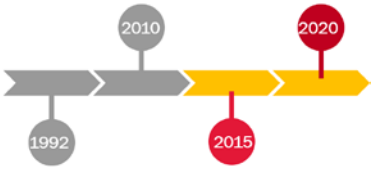
York University joined Hemispheric University Consortium (HUC) in April 2019, to become the only Canadian university member of the Consortium

York University hosted 212 delegations from the geographical continents of Africa, Asia, Australia, Europe, North America and South America

PRIORITY 6 Enhanced Community Engagement

We envision a University that supports and builds communities, both within and without, in a spirit of inclusion and empowerment.

Objectives	Examples and Signature Outcomes
1. Enhance community engagement on our campuses by facilitating the collegial participation of all community members – full-time and contract faculty, staff and students – in our local level and institutional planning processes	• *The Indigenous Framework for York University: A Guide to Action* launched in 2017. • President's Council on Internationalization & Global Engagement released an issue paper to initiate a pan-University consultation process that aims to develop an integrated institutional strategic plan on internationalization. • International student body grew from 10.5% in 2014 to 15.6% in 2018. • York University Psychology Clinic celebrates 10th Anniversary. • GradConnect Wellness Services launched to support and enhance the mental health and well-being of York University graduate students. • Wellness Hub: York's Mental Health and Wellness Strategy outlines the need for an increase in accessibility to health promotion services and making resources more readily available. • 249 agreements with institutions located in the continents of Africa, Asia, Australia, Europe, North America and South America. • York University joined Hemispheric University Consortium (HUC) in April 2019, to become the only Canadian university member of the Consortium. • York University hosted 212 delegations from the geographical continents of Africa, Asia, Australia, Europe, North America and South America. • Instituted annual budget consultations with the York community • School of Continuing Studies enrolment reached 4575 in 2018-19.
2. Inaugurate and implement a pre-eminent mental health and well-being strategy for faculty, staff and students that includes: • embedding mental health in the classroom along with new and improved services • an approach that focuses on building up the skills of our community to know when help is needed with better resources to direct our community when that help is needed • a larger system that supports mental health before help is needed	
3. Expand community outreach and engagement with our larger communities by: • Solidifying existing strategic partnerships aligned with our priorities of research achievement, enhanced student learning, and increased student success while reaching further out to increase the number and diversity of external academic partnerships	
4. Finalize a new Internationalization Plan outlining objectives and initiatives including: • strategic academic partnerships both locally and globally • increasing the proportion of international students to 15 - 20% by the end of the Plan • a one-stop portal for prospective and current international students	
5. Celebrate York's rich and diverse community and the vibrant communities that surround York including the accomplishments of members of the community, daily and at regular events	
6. Expand the programs offered through our continuing studies and professional development units	



Priority 7: Enabling the Plan

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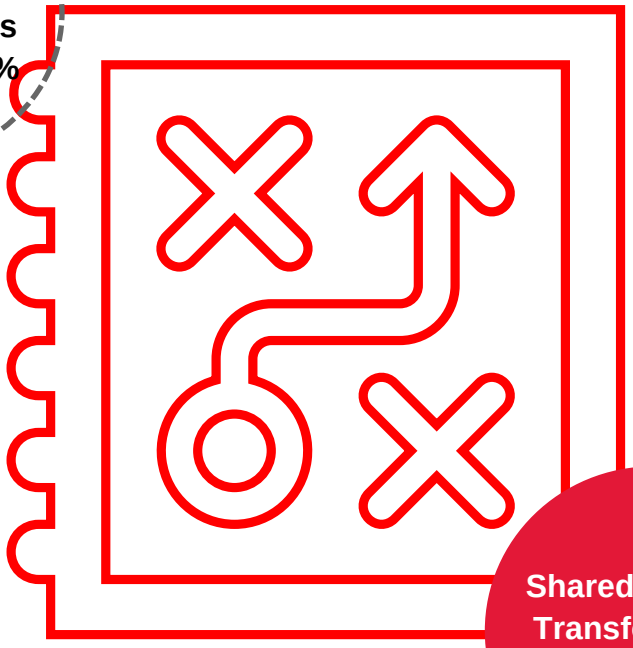
Audiences across social media platforms have grown 40%



Shared Services Transformation project launched

Enhancing Transparency & Accountability

OIPA Data Hub making institutional data accessible and searchable, launched December 2017

Improvements to Financial Plans/Models

- **Equity restructuring plan for the York Pension Plan completed**
- **SHARP budget model implemented; review and revisions in progress**

Renewal of Student Information System project launched

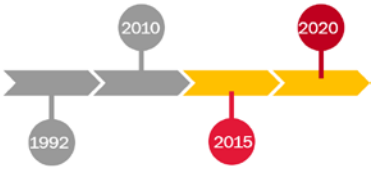
Doubling of funds allocated to deferred maintenance projects

YORK UNIVERSITÉ UNIVERSITY

PRIORITY 7 Enabling the Plan

Executing this plan will require sophisticated planning efforts everywhere in the University, at the local level and the institutional level, looking both internally and externally for best practices, evidence-based approaches to decision-making and implementation, and on-going evaluation of our progress based on agreed-upon measures that we are able to monitor.

Objectives	Examples and Signature Outcomes
1. Develop high quality and effective administrative service models to support academic priorities, expanding the shared services approach, and empowering staff and local planners with appropriate career / skills development	• Integrated Resource Planning launched and completed across the institution demonstrating how resources are aligned with UAP priorities. • Shared Services Transformation project launched • Equity restructuring plan for the York Pension Plan completed • SHARP budget model implemented; review and revisions in progress • Quick Facts Data hub making institutional data accessible and searchable, launched December 2017 • Faculty Complement Renewal Strategy 2019 • Renewal of Student Information System project launched • Doubling of funds allocated to deferred maintenance projects • Audiences across social media platforms have grown 40%
2. Strengthen our communications and advocacy for York to enhance York's reputation, transparency and accountability including: • improved websites • more effective and creative communication strategies to engage our students	
3. Review our academic unit structures to support the achievement of objectives including enhanced support for graduate education	
4. Enhance data analytics to increase access to information and evidence-based decision making	
5. Collegially develop and confirm measures to be used for monitoring and reporting on our progress for all priorities taking advantage of repositories of best practices	
6. Establish seamless, consistent and complementary planning modalities including longer-term enrolment and complement plans as well as capital and facilities plans	
7. Achieve financial sustainability, together with reliable and forward-looking budget information for planners, maximizing resources and investments aligned with academic priorities	



Standing Committees

26. The following shall be the Standing Committees of Council, whose duties are defined in the Rules of Council and may be revised by a vote of Council. Ex officio members shall be non-voting. Chairs or their designates serve as departmental representatives on some Council committees, such as the Science Curriculum Committee. In such cases, Chairs or their designates are not considered ex officio, and have full voting rights. Standing committees will report on at least a yearly basis to Council.
    a) Executive Committee
    b) Academic Policy and Planning Committee
    c) Curriculum Committee
    d) Committee on Examinations and Academic Standards
    e) Petitions Committee
    f) Appeals Committee
    g) Committee on Tenure and Promotions
    h) Committee on Research and Awards
    i) Committee on Teaching and Learning

Please amend 26 as follows:

26. The following shall be the Standing Committees of Council, whose duties are defined in the Rules of Council and may be revised by a vote of Council. *Ex officio* members shall be non-voting. Chairs or their designates serve as departmental representatives on some Council committees, such as the ~~Science~~ Undergraduate Curriculum Committee. In such cases, Chairs or their designates are not considered *ex officio*, and have full voting rights. Standing Committees will report on at least a yearly basis to Council.

a) Executive Committee
b) Academic Policy and Planning Committee
c) Undergraduate Curriculum Committee
d) Graduate Education Committee
e) Committee on Examinations and Academic Standards
f) Petitions Committee
g) Appeals Committee
h) Committee on Tenure and Promotions
i) Committee on Research and Awards
j) Committee on Teaching and Learning

32. No proposal to amend any of the rules and procedures shall be considered except at a regular meeting, and unless notice of the proposed change has been given.

So, Council must be notified this will be up for the December meeting.

34. Faculty members of Standing Committees shall serve for terms of three years and in each year one-third of the membership of each Standing Committee shall retire and be replaced by election from slates of names presented by the Executive Committee, possibly augmented by names from the floor. Student members of the Standing Committees shall serve for terms of one year but may be re-elected in subsequent years.

Please amend 34 as follows:

34. Faculty members of Standing Committees shall serve for terms of three years unless the membership is defined by a particular appointment, such as the graduate program director. In each year where possible, one-third of the membership of each Standing Committee shall retire and be replaced by election from slates of names presented by the Executive Committee, possibly augmented by names from the floor of Faculty Council. Student members of Standing Committees shall serve for terms of one year but may be re-elected in subsequent years.

c) **The Curriculum Committee**

The Curriculum Committee shall include the Dean (ex officio) and an Associate Dean (ex officio), the Chair or nominee from each teaching Division or Department, the Chair or nominee of the Department of Geography, three faculty members elected by Council and two student members of Council.

In discharging its functions, the Committee shall:

1. Review annually a summary of the notice of intentions filed by units in the Faculty of Science;
2. Receive curricular submissions from departments and divisions for review, and recommendation to Council for approval or other appropriate action, concerning new course proposals, changes to existing courses, changes to program requirements and new programs;
3. Forward proposals to Senate as appropriate;
4. Encourage the development of innovative inter-disciplinary programs;
5. Collaborate with the Committee on Examinations and Academic Standards and the Committee on Teaching and Learning on issues of joint concern.

Please amend 36 (c) as follows:

36 c) **The Undergraduate Curriculum Committee**

The Undergraduate Curriculum Committee shall include the Dean (*ex officio*) and an Associate Dean (*ex officio*) etc. …

Please add a new 36 (d) as follows:

36 d) **The Graduate Education Committee**

The Graduate Education Committee shall include the Graduate Program Director of each department in the Faculty of Science, as well as two Graduate students.

In Discharging its functions, the Committee shall:

1. Receive submissions from graduate programs for review and recommendations to council for approval or other appropriate action concerning new course proposals, course change proposals, changes to programs or diploma requirements, new graduate fields, new graduate diplomas or new graduate programs.
2. Forward proposals to Senate as appropriate.

Graduate Education Committee

Mandate

To provide broad review and commendation to Council via the Academic Policy and Planning Committee of all proposals received from Graduate Programs with respect to:

- New Course Proposals
- Course Change Proposals
- Minor Changes to Program/Graduate Diploma Academic Requirements
- Major Modifications to Program/Graduate Diploma Academic Requirements
- New Graduate Fields
- New Graduate Diplomas
- New Graduate Degree Programs

Membership

The Graduate Education Committee shall consist of the Associate Dean – Research & Graduate Education (ex officio), Graduate Program Director (or designate who must be a member of the graduate program) of each Graduate Program in the Faculty of Science and two graduate student members from any Graduate Program within the Faculty of Science.

The Chair of the Committee is selected by the voting members of the Committee for a one-year term.