FACULTY OF SCIENCE

COUNCIL OF THE FACULTY OF SCIENCE

Notice of Meeting

Tuesday, November 11,, 2014
at 3:00pm – 4:30pm
306 Lumbers

Agenda

1. Call to Order and Approval of Agenda
2. Chair's Remarks
3. Minutes of October 14, 2014 meeting
4. Business Arising
5. Dean's Report to Council
6. Associate Deans' and Bethune Master's Remarks
7. Reports from Science Representatives on Senate Committees
8. Reports from Standing Committees of Council
   - **Executive Committee**
     - Executive Committee's Vacancies Report on Senate and FSc Committees (item for action)
     - Curriculum Committee
       - Mathematical Biology Program (item for action)
       - Other curriculum matters (consent agenda items)
9. Inquiries and Communications

   9.1 Five-minute **Presentation on Helix Call for Proposals,** by Justin Chan, Associate Director, K-12 Enrichment Program

   9.3 Senate Synopsis: 607th Meeting of Senate: October 23, 2014

FACULTY OF SCIENCE

COUNCIL OF THE FACULTY OF SCIENCE

Tuesday, October 14, 2014
at 3:00pm – 4:30pm
306 Lumbers

Minutes

Attendance: E. Hamm, Y. Gao, S. Benchimol, D. Hossain, S. O. Kochman, P. L. Lakin-Thomas, P. Cribb, D. Hastie, D. Perez, W. Booth, P. Dehghani, J. Dumitrescu, K. R. Maltman, W. P. Tholen, G. Lovoie, A. Mills, V. Tsoukanova, E. Janse vanRensburg, B. Woodley, L. T. Ber, R. Jayawardhana, A. Rafieian-Karpaei, S. Juris, R. G. Tsushima, S. Siyakatshana (Assistant Secretary)

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

   The Chair of Council, Alex Mills called the meeting to order and the Agenda was adopted as presented.

2. **Chair's Remarks**

   The Chair welcomed Council members to the meeting.

3. **Minutes of September 9, 2014 meeting**

The Draft Minutes of September 9, 2014 were approved subject to two minor amendments that were moved and approved.

4. **Business Arising**

There was no Business Arising.

5. **Dean's Report to Council**

Dean Ray Jayawardhana informed Council that the University had submitted two proposals to the Ministry of Training, Colleges and Universities for major capacity expansion - one for a York Region campus and the other for a 2nd new engineering building on the Keele campus. Both proposals included plans for the Faculty of Science to expand in the area of life sciences.

He updated Council that the Chancellor of York University, Dr. Gregory Sorbara had visited our Faculty a couple of weeks ago. The purpose of the visit was for the Chancellor to become familiar with our faculty, our needs and challenges.

The Dean congratulated Dr. Tamara Kelly for winning the OCUFA teaching award for the 2013-2014 academic year. The announcement would be coming out on Y-File in the near future.

The Dean noted that Dr. Allan Carswell, an Emeritus Professor in the Department of Physics and Astronomy will be receiving an honorary doctor of Science from York University at the Fall Convocation. The Dean described Dr. Carswell as a pioneer and international leader in the field of laser-imaging technology (lidar) and the development of related space instrumentation. He added that Dr. Carswell is the founder of Optech, a world leader in lidar and related technologies. Furthermore, his company had funded the Faculty of Science laboratories and in his personal capacity he has established a number of scholarships at York University.

He also announced that Suzana Pinto, our Communications Manager, was organizing a media workshop for scientists, faculty, graduate students and postdoctoral researchers. This workshop will be held on October 29, 2014, at 9:30am – 12:00pm. He encouraged faculty and students to register and attend the event. Renowned science reporters will be speaking at this workshop.

Lastly, the Dean noted that the Pan Am Stadium was nearing completion. He consulted with Council on any science outreach ideas to show case Science to the diverse crowd attending the games. He noted that they he had already received suggestions and ideas with respect to Physics and Astronomy. He encouraged Council members to forward their ideas to him and Suzana Pinto. Ultimately, these suggestions will be presented to the Provost for consideration.

6. **Associate Deans' and Bethune Master's Remarks**

Associate Dean Robert Tsushima updated Council on the recent RTI. Three applicants had requested an internal review and all three applicants were selected and their applications will go forward. He stated that there were sixteen applicants for the NSERC Discovery Grants and these

will undergo an internal review. Lastly, he announced that the deadline for receiving applications for the Faculty Research Awards is Friday, October 24, 2014 and the awardees will be announced in November.

Associate Dean Janse vanRensburg reminded faculty that the call for the Anomaly Exercise had gone out with a deadline of November 14, 2014. He highlighted outstanding vacancies on the Standing Committees of Council and encouraged members to self-nominate.

Professor Juris Steprans informed Council that Professor Man Wah Wong had agreed to serve on the Tenure and Promotions Committee.

Associate Dean Peter Cribb reminded Council about the Ontario Online Initiative funding opportunity to create courses or modules of online courses. A number of criteria are relevant - including large courses being one of the priorities. Proposals should be collaborative between universities or faculties within the same university. He encouraged faculty to participate in this exercise.

Master of Bethune's report was paraphrased by Dr. Alex Mills in his absence as follows,

- Bethune College Breakfast held on Sept 11th, 2014 was a success.
- The next Bethune College Breakfast will be held on Wed Oct 22nd, 2014 at 9:30 am in BC 320. This is specifically for 1st-year students. Faculty members are encouraged to register at bethune.yorku.ca/events/ and attend.
- Student-support programs are going well.
- They are getting upward of 70-80 students attending some PASS sessions on a regular basis, which is requiring Bethune to hire and train more PASS Leaders.
- They have staff from the different York units present workshops at Bethune College: SCLD (SafeTALK), CDS and personal counselling services, career centre, etc.
- Graduate Students are also presenting workshops on topics related to research, choosing the right lab, and graduate studies, etc.
- Dean Ray will be presenting on Nov 4th "Space Rock Hunting in Antarctica, Testing Gravity on a Falling Plane, Looking for Life Deep Underground and Other Adventures on the Frontiers of Science". Professors and staff are encouraged to make a 20 minute presentation on any fun topic (not necessarily related to research). Those interested are to contact the Master of Bethune College.

7. **Reports from Science Representatives on Senate Committees**

   There were no reports.

8. **Reports from Standing Committees of Council**

   Executive Committee's Vacancies Report on Senate and FSc Committees

   The Chair referred to the Standing Committees' vacancies report. He highlighted some outstanding vacancies. A motion was moved, seconded and carried to approve Professor Man Wah Wong's nomination to serve on the Tenure and Promotions Committee.

Revisions to the Rules of FSc Faculty Council

Council moved, seconded and carried a motion to approve the minor amendments to the Rules of Council.

Council members noted the following annual reports for information from the Standing Committees of Council;

- Committee on Research and Awards
- Committee on Examinations and Academic Standards
- Appeals Committee
- Petitions Committee

9. **Inquiries and Communications**

9.1 *Presentation on the Task Force on Sustainability, by Jennifer Foster, Associate Professor & Urban Ecologies Certificate Coordinator and Chair of the Task Force*

Dr. Jennifer Foster gave a brief presentation on sustainability research which focuses mainly on research and building of York strengths in the area of research. She presented a summary of the Task Force's mission, organization and objectives.

9.2 *Presentation on Update on the Teaching Commons, by Celia Popovic, Director & Yelin Su, Educational Developer, Teaching Commons*

Celia Popovic highlighted programs by the Teaching Commons for the 2014-2015 academic year. She introduced Yelin Su, the Educational Developer. She added that Yelin was the representative for FSc faculty and members should feel free to contact her for assistance.

9.3 Council noted the Senate Synopsis of the 606th Meeting of Senate held on September 25, 2014.

10. **Other Business**

There was no other business.

Chair of Council, A. Mills

Assistant Secretary of Council, S. Siyakatshana

2014 - 2015 Executive Committee Report of Vacancies on Senate and FSc Committees

Vacancies still outstanding as of November 7, 2014

Science Curriculum Committee

1 vacancy for an elected member

Committee on Examinations and Academic Standards

- 1 alternate vacancy for Chemistry
- 1 alternate vacancy for Student Representative

Appeals Committee

1 vacancy for Natural Science

D. Lungu moved from the Appeals Committee to sit on the Petitions Committee

Committee on Teaching and Learning

- 1 vacancy for Natural Science
- 1 vacancy for Physics & Astronomy
- 1 vacancy for a graduate student

York University

COUNCIL OF THE FACULTY OF SCIENCE
Report of the Science Curriculum Committee
November 2014

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 September 30th and October 28th, 2014 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 jpearson@yorku.ca

7.2.1	Proposed BSc Program in Mathematical Biology	
	Program Changes	
7.2.2	Biology -	change in degree requirements
7.2.3	Environmental Science -	change in degree requirements
	New Courses	
7.2.4	SC/NATS 1505 3.00 -	Understanding Cyberspace
7.2.5	SC/MATH 3141 3.00 -	Introduction to Number Theory
	Course Changes	
7.2.6	SC/BIOL 4250 3.00 -	Birds and the Environment
7.2.7	SC/BIOL 4155 3.00 -	Advance Virology
7.2.8	SC/BIOL 3001 3.00,	Field Course
	SC/ENVB 3001 3.00,	Field Course
	SC/BIOL 3002 3.00,	Field Course
	SC/BIOL 3003 3.00,	Field Course
	SC/ENVB 3003 3.00,	Field Course
	SC/BIOL 3001 2.00,	Field Course
	SC/ENVB 3001 2.00,	Field Course
	SC/BIOL 3002 2.00,	Field Course
	SC/ENVB 3002 2.00,	Field Course
	SC/BIOL 3003 2.00,	Field Course
	SC/ENVB 3003 2.00,	Field Course
7.2.9	SC/BIOL 4070 3.00	Behavioural Ecology
7.2.10	SC/BIOL 3170 3.00	Population Ecology

7.2.11	SC/BIOL 4090 4.00,	Plant Ecology
	SC/ENVB 4090 4.00	Plant Ecology
7.2.12	SC/BIOL 4300 3.00	Origins and Development of Biological Theories
7.2.13	SC/BIOL 4230 4.00	General Entomology
	SC/ENVB 4230 4.00	General Entomology
7.2.14	SC/BIOL 4080 4.00	Freshwater Biology
	SC/ENVB 4080 4.00	Freshwater Biology
7.2.15	SC/BIOL 4245 3.00	Conservation Biology
	SC/ENVB 4245 3.00	Conservation Biology
7.2.16	SC/NATS 1650 6.00	Human Anatomy for the Fine Arts
7.2.17	SC/NATS 1585 3.00	Astronomy: Exploring the Universe
7.2.18	SC/NATS 1570 3.00	Exploring the Solar System
7.2.19	SC/NATS 1560 3.00	Understanding Food
7.2.20	SC/NATS 1530 3.00	Science of Space Flight and Exploration
7.2.21	SC/NATS 1920 6.00	The Nature and Growth of Ideas in Mathematics
7.2.22	SC/NATS 1880 6.00	Life Beyond Earth
7.2.23	SC/NATS 1870 6.00	Understanding Colour
7.2.24	SC/NATS 1860 6.00	Science: Past, Present and Future
7.2.25	SC/NATS 1850 6.00	Science and Pseudoscience
7.2.26	SC/NATS 1810 6.00	Energy
7.2.27	SC/NATS 1775 6.00	Technology and Civilization
7.2.28	SC/NATS 1760 6.00	Science, Technology and Society
7.2.29	SC/NATS 1745 3.00	History of Astronomy
7.2.30	SC/NATS 1740 3.00	Astronomy
7.2.31	SC/NATS 1730 6.00	Scientific Change
7.2.32	SC/NATS 1700 6.00	Computers, Information and Society
7.2.33	SC/NATS 1675 6.00	Human Development
7.2.34	SC/NATS 1670 6.00	Concepts in Human Health and Disease
7.2.35	SC/NATS 1780 6.00	Weather and Climate
7.2.36	SC/NATS 1750 6.00	The Earth and its Atmosphere
7.2.37	SC/NATS 1540 3.00	Theories and Dinosaur Extinction
7.2.38	SC/NATS 1610 6.00	The Living Body
7.2.39	SC/NATS 1660 6.00	The Biology of Sex
7.2.40	SC/NATS 1690 6.00	Evolution
7.2.41	SC/NATS 1840 6.00	Science, Technology and the Environment
7.2.42	SC/MATH 2565 3.00	Introduction to Applied Statistics
7.2.43	SC/MATH 2560 3.00	Elementary Statistics I

7.2.1

YORK UNIVERSITÉ UNIVERSITY

New Proposed Undergraduate Program in Mathematical Biology

York University Libraries

April 10, 2012

Submitted by Rajiv Nariani, Science Librarian

INTRODUCTION

This statement of library support for the proposed *B.Sc. in Mathematical Biology* has been prepared in accordance with the guidelines outlined in the Quality Assurance Framework as set out by the Ontario Universities Council on Quality Assurance. It describes the level of support currently provided by York University Libraries for the undergraduate courses in Mathematical Biology proposed to be offered in the Department of Mathematics & Statistics on the Keele campus. The Libraries offer support for Science & Engineering programs through collections, instructional services, research assistance, access to knowledge resources, supporting research dissemination and providing adaptive services.

The proposed program has been developed by faculty in the Mathematics & Statistics department, with input from the departments of Chemistry and Biology and the Faculty of Kinesiology and Health Sciences. The B.Sc. in Mathematical Biology will offers courses that have application in mathematics, statistics, biology, epidemiology, immunology, virology, medicine, chemistry, biochemistry, ecology and environmental science. Mathematical tools used to conduct studies in mathematical biology include dynamical systems, bioinformatics, geometry, imaging theory, stochastic modeling, numerical methods, statistics and probability will also be covered. Library resources in all these subject areas are very adequate and will be further strengthened in the coming terms.

COLLECTIONS SUPPORT

The multidisciplinary nature of Mathematical Biology draws strength from the collective knowledge of subject liaison librarians:

Department of Mathematics & Statistics,	Rajiv Nariani
School of Kinesiology & Health Sciences (KAHS),	Rajiv Nariani
Department of Chemistry	Rajiv Nariani
Department of Biology	Ilo-Katryn Maimets
Department of Computer Science & Engineering	John Dupuis

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Department of Physics & Astronomy	John Dupuis
Department of Geography	Rosa Orlandini

Subject liaison librarians and the Libraries' collections support the teaching and learning needs of the faculty as well as the students enrolled in undergraduate and graduate programs in these areas.

Formats

The Libraries' collection comprises print, electronic, audio-visual, and microform resources in the form of monographs, journals, reference materials, films, videos, DVDs, government documents and statistics. Digital / electronic resources can be accessed from all libraries, York University labs and offices and off-campus through the York Libraries' web site.

Location of Resources

The print materials for core courses are located primarily at the Steacie Science & Engineering Library. This includes resources on mathematics & statistics, kinesiology & health sciences, bioinformatics, biology, epidemiology, immunology, virology, medicine, chemistry, biochemistry, ecology and environmental science. Some other resources on stochastic modeling and mathematics, statistics and probability are also at the Bronfman Business Library & Scott Library. The Libraries also purchases French language resources, and these are primarily located at the Frost Library located on the Glendon campus.

Reference materials

Print and digital specialized encyclopaedias, dictionaries, glossaries, handbooks, directories and bibliographies are available in the Libraries collections and as online resources.

Print & electronic books (e-books)

Monographs are purchased through our vendors, *YBP* and *Coutts*, although other sources of new titles are also used. Searches are also conducted in *WorldCat* to locate titles of relevance and interest. Librarians with subject specialties in Mathematics & Statistics, Kinesiology, Geospatial Data, Biology, Chemistry, Physics & Astronomy and Business provide collective input. Comprehensive approval plans are extensively supplemented by individual orders gleaned from reviewing journals, faculty publishing trends, vendor notification programs, publisher catalogues and faculty and graduate student requests. We have acquired a number of e-book packages from different publishers under consortial agreements as well as a significant number of e-book packages that are unique to York University. These can be accessed by the York

academic community via the Libraries' catalogue and also by browsing this link: http://www.library.yorku.ca/ccm/rg/rn/ebooks.en#MAT. Included are the e-books from *SpringerLink, Safari Books Online, Synthesis Engineering & Biomedical Books, Books24x7* and *Oxford Scholarship Online.*

Journals (including e-journals)

Given the applied science and highly interdisciplinary nature of the program, the journal collections are especially important and currency is emphasised. Online subscriptions are maintained for all significant periodicals, and back runs are acquired if available. The demand for periodicals, particularly online journals is increasingly fulfilled through our involvement and memberships in consortia. The Libraries take full advantage of these consortial purchases which provide online access to large sets of academic e-journals. York University's membership in two key consortia – the *Ontario Council of University Libraries (OCUL)* and the *Canada Research Knowledge Network (CRKN)* has afforded the York community to a wealth of electronic resources. Many journals are also made available directly from publishers' websites.

Relevant Databases & Indexes

The primary databases and indexes of relevance include *Medline (Pubmed), Web of Knowledge, Scopus, MathSciNet, CINAHL, Compendex, Current Index to Statistics* and *Biological Abstracts* but there are many others that address the multidisciplinary aspects of this program. In addition the library computers provide access to software and applications including SPSS, SAS, ORTEP, WinGX, R, R Studio and ChemSketch.

List of databases that would be useful for the B.Sc. Mathematical Biology program
Mathematics: http://researchguides.library.yorku.ca/mathematics
Statistics: http://researchguides.library.yorku.ca/statistics
Chemistry: http://researchguides.library.yorku.ca/chemistry
Kinesiology & Health Sciences http://researchguides.library.yorku.ca/kinesiology
Neuroscience: http://researchguides.library.yorku.ca/neuroscience
Physics: http://researchguides.library.yorku.ca/physics
Astronomy: http://researchguides.library.yorku.ca/astronomy
Biology: http://researchguides.library.yorku.ca/biology
Geospatial Data: http://researchguides.library.yorku.ca/geospatial?hs=a
List of databases:
http://www.library.yorku.ca/cms/steacie/scifinder/science_databases/

All of these subject guides are easily accessed from the Libraries' homepage and can be viewed from the indicated links. Most databases possess the capability to link to full-text journal articles, should the Libraries subscribe to the parent journals. These databases are also compatible with *link resolver technology / SFX* so that users can request document delivery (ILL) in case we do not subscribe to the journal.

Theses & Dissertations

Access to theses and dissertations is made possible through *ProQuest Theses & Dissertations* database which provides full-text access to North American and European dissertations. International theses can be located through the *Networked Digital Library of Theses and Dissertations* (NDLTD) and other portals. Theses that are not available full-text can be requested through Interlibrary loan (ILL).

Government Documents

York University Libraries are a repository for the Government of Canada documents, and therefore the Libraries automatically receive materials produced and disseminated by federal government organizations through the Depository Services Program. Provincial documents from the Province of Quebec and the Province of Ontario are also collected in both campus libraries. A subject guide to locating government publications can be found here:
http://researchguides.library.yorku.ca/content.php?pid=256710&sid=2118718

SUPPORTING TEACHING, LEARNING & RESEARCH SERVICES

Research Dissemination through Open Access Initiatives

York University Libraries have been generous in supporting Open Access and encourage submissions by faculty and graduate students to OA journals. York University Libraries have directed a part of their collections funds to support publishing endeavours by paying the Article Processing Charges for select OA publishers. Some of the supported publishers include *BioMed Central*, *Hindawi*, and *Public Library of Science (PLoS)*. Faculty are invited to deposit their papers for publication in YorkSpace (http://pi.library.yorku.ca/dspace/), York's institutional digital repository. The non-exclusive archiving of research in York's digital repository lends an institutional presence and increases York University's scholarly profile while protecting their work for future use.

LIBRARY SERVICES & SPACES

Specialized Liaison Librarians

Library support for this undergraduate program will be provided primarily at the Steacie Science & Engineering Library, Bronfman Business Library, and Scott Library. Liaison librarians assist students and faculty with literature research, writing skills by providing in-class workshops and developing research and course guides. Librarians also help to manage and organize the research literature using citation management programs. Science students and faculty can get reference help during reference hours in person, via e-mail, by telephone, and through the Science Meebo/Chat Reference Service. In

addition, the libraries provide research help by email, phone and by chat using our *Ask Chat with a librarian* that has extensive hours during the week and on weekends.

Managing Research Results

All faculty and students have access to *RefWorks*, a web-based citation management program, to store and format citations to books, journal articles and other scholarly resources. The software is provided free-of-charge under a site license agreement paid for by the Library. EndNote Web is another citation management program which is available through Web of Knowledge. Many liaison librarians also provide support in the use of two free web-based citation management systems. Zotero and Mendeley.

Intercampus Borrowing

Because some of the library collections extend over two campuses, the Library provides an intercampus borrowing system at no charge. Students can submit a request online to have library materials delivered from one campus to the other by the following business day. Students can also use a free shuttle service to travel between campuses.

Interlibrary Loans/Resource Sharing and Off- Campus Resources

Undergraduate and graduate students and faculty have access to the collections of other university libraries through the interlibrary loan system called *RACER* (Rapid Access to Collections by Electronic Requesting). York University Libraries subsidize interlibrary loans for students and faculty who may borrow monographs through *RACER* at no cost. Additionally, undergraduate students can receive free up to 25 journal articles in any single year and faculty may receive 50 journal articles every year through RACER. There is no limit to RACER requests (journal articles) for graduate students.

All libraries in Ontario, except the University of Toronto, support a direct borrowing program that allows students and faculty to borrow materials when visiting other Ontario university libraries. Many Canadian Universities support reciprocal borrowing by graduate students and faculty.

Scholarly Publishing Services

York University Libraries provide an electronic journal hosting service for York-affiliated journals. This service is called *York Digital Journals* (YDJ). York University uses *Open Journal Systems* (OJS), an open source software platform developed by the. The YDJ team is happy to work with York community members to create new journals or migrate existing journals to an online environment. The libraries will provide training and troubleshooting help with the OJS software, as well as advice to ensure maximum exposure.

YorkSpace is York University's digital library of research outputs. It is a platform that enables York community members to post, organize and preserve their research online in an institutional context. It showcases the scholarship of the York University community through the use of a special standards-based software platform that collects usage statistics and promotes visibility on the web. The Department of Mathematics & Statistics has a growing number of research papers stored in *YorkSpace* which can be discovered using Google.

LIBRARY INSTRUCTIONAL SUPPORT FOR ACADEMIC LITERACIES

Information Literacy is an essential component of students' education. Without the skills to find, retrieve, evaluate and use information, students cannot participate fully in a university environment or in their disciplinary culture. Critical engagement with information is an integral component of scholarly discourse and fundamental when involving students in teaching and learning. Subject librarians align information literacy (IL) instruction with the Association of College and Research Libraries (ACRL) Information Literacy Competency Standards for Higher Education at:
http://www.ala.org/ala/mgrps/divs/acrl/standards/informationliteracycompetency.cfm

York University Libraries has a very active IL program supporting both undergraduate and graduate students. Traditionally, individual faculty members have made arrangements with librarians to lead course-specific workshops in a library lab or in the classroom; and this option continues. However, increasingly, programs at York University are developing curriculum-integrated approaches to IL.
This is a process whereby IL instruction and principles are embedded throughout an entire degree program by a progressive incremental building of IL skills. More students are reached as IL instruction is embedded strategically at critical junctures throughout the program.

If this were implemented for the B. Sc in Mathematical Biology program, the Mathematics & Statistics librarian will be available to work with faculty members and curriculum committees to:

- articulate learning objectives related to for this program,
- decipher how they might be mapped strategically into the courses
- provide help with resources in interdisciplinary databases and writing resources which would hone discipline-specific learning and comprehension skills.

Assignments can be collaboratively designed by faculty and librarians to assess the learning outcomes that address both the disciplinary content and the research process. Checks can also be built in at each level to ensure that previously acquired skills and knowledge are retained, utilized and developed to a more sophisticated level. Please note that in addition to face-to-face instruction, instruction is increasingly tailored to assignments and program needs by means of online learning tools.

Reference and Supplemental Support

Supplemental point-of-need assistance is available to students with assignments and research in the library through reference service, library promoted chat tools, e-mail, telephone and face-to-face consultations. Online tutorials and short video-streamed seminars are available on the library homepage. In addition, undergraduate students are encouraged to attend one or more themed workshops offered by librarians, learning skills counsellors and writing specialists in the Learning Commons at Scott library and in Bethune College. They are timed to match the evolving needs of students as the year progresses.

Among the many new library-driven initiatives is the Ontario Council of University Libraries collaborative web based digital library infrastructure which provides easy access to data sets (statistical, geospatial and health informatics). Faculty and students, who make extensive use of data in their research and studies, will have ready access to geospatial, as well as qualitative and quantitative data and health data stored in the OCUL digital library. One of the strengths of geospatial data is how it can represent complex information in highly visual presentations that support understanding and comprehension in a way that cannot be achieved easily with textual representations.

Scott Library Learning Commons

The new Scott Library Learning Commons brings together librarians, writing specialists, learning specialists and career advisors into single, student-friendly space where students are welcome to drop-in for personal assistance with all aspects of the researching and writing processes. Librarians can assist with choosing or refining appropriate research topics, identifying and evaluating the best scholarly materials on the topic, improving reading and note-taking skills, developing a thesis statement, preparing an outline and learning to edit the essay and formatting a bibliography.

A variety of services for differently abled students is available by arrangement with Library Accessibility Services (LAS) located in Scott Library. LAS staff provide transcription services for required readings in alternate formats and retrieving of items from the library stacks. The libraries also provide help with using adaptive technology located in the library.

CONCLUSION

Library support for the proposed B.Sc. program in Mathematical Biology at York University is solid. This support stems from collaborations between the Libraries and faculty members and the student community. York University Libraries look forward to maintaining this important working relationship so that the Libraries have the resources in place to support the Department of Mathematics & Statistics and its plans for growth and diversification, as new courses are introduced and new faculty are appointed.

APPENDIX 1: LIBRARY STATISTICS (from 2009-10 YUL Annual Report)

Turnstile Count	2007/2008	2008/2009	2009/2010
Scott	2,260,265	2,073,861	2,780,339
Bronfman	290,952	268,973	338,514
Frost	112,240	108,055	120,628
Steacie	458,431	356,506	506,121
Total	3,121,888	2,807,395	3,745,602

CIRCULATION	2007/2008	2008/2009	2009/2010
Scott			
Circulation Services	321,807	222,057	219,356
Scott Reserves	59,488	45,056	60,461
Self Check	1,748	35,866	140,822 *
Sound and Moving Image (incl. resv)	100,043	71,405	75,219
Archives & Special Collections	2,100	1,711	2,943
Map Library (incl. resv)	1,713	930	4,622
GIS	21,997	27,371	10,267
Subtotal	508,896	404,396	513,690
Bronfman (incl. reserves)	14,169	14,181	19,093
Frost (incl. reserves)	31,216	23,233	28,108
Steacie (incl. reserves)	59,248	51,582	57,828
Subtotal	613,529	493,392	618,719
Renewals	519,871	524,473	504,798
Total	1,143,372	1,017,865	1,123,517

* 4 self check machines added in 2009-2010

LAPTOP LENDING	2007/2008	2008/2009	2009/2010
Scott	6,498	9,828	18,923
Bronfman	817	576	575
Frost	9	35	28
Steacie	3,618	3,013	3,966
Total	10,942	13,452	23,492

ITEMS SHELVED	2007/2008	2008/2009	2009/2010
Scott			
Circulation	940,507	693,495	899,062
Government Documents	15,195	1,155	9,939
Microtext	55,965	50,310	19,744
Reference	9,099	4,800	5,055
Reserves	48,162	35,514	41,710
Map Library	6,979	7,630	6,630
Archives & Special Collections	2,751	U/A	4,614
Sound and Moving Image	1,870	480	U/A
Bronfman	24,093	16,406	26,932
Frost	62,466	50,381	59,200
Steacie	92,476	86,497	92,917
Total	1,259,563	946,668	1,165,803

APPENDIX 1: LIBRARY STATISTICS

COLLECTION GROWTH	As of April 1, 2008	As of April 1, 2009	As of April 1, 2010
Print Volumes	2,249,301	2,272,355	2,418,404
Microform Units	4,049,042	4,086,565	4,152,092
Journal Titles/Other Subscriptions	6,530	6,275	5,503
CD ROMS	8	18	11
Digital Journal Titles	39,282	43,246	48,549
Digital Mongraph Titles	242,497	293,545	310,958
Media			
Maps	111,980	112,192	112,520
Aerial Photographs	5,052	5,046	5,046
GIS Data titles	319	387	543
Sound Recordings	36,227	38,427	39,642
Videocassettes	9,927	9,872	9,424
Films	3,014	2,867	2,658
DVDs	8,112	10,818	13,457
Manuscripts and Archives			
Manuscripts (Linear metres)	3,763	3,863	4,056
University Records (Linear metres)	837	844	894
Photographs (Linear metres)	371	376	382
Moving Image Archives (Linear metres)	143	88,255	88,271
Online Catalogue			
Bibliographic Records	1,963,726	2,071,969	2,163,141
Authority records	515,953	533,782	549,281
Titles Catalogued	138,748	105,488	68,278

DIGITAL COLLECTIONS @ York	2007/2008	2008/2009	2009/2010
Digital Items Created	10,632	11,562	8,087 *
Total Ditial Items	13,420	24,982	30,614

*2,455 items stored in the Internet Archive

LIBRARY ACCESSIBILITY SERVICES	2007/2008	2008/2009	2009/2010
Transcription Requests	1,435	1,647	U/A
Number of pages scanned	385,309	491,648	U/A

RESOURCE SHARING		2007/2008	2008/2009	2009/2010
ILL, Interfilm	Total Lending	13,886	14,258	14,193
ILL, Interfilm	Total Borrowing	4,625	5,054	5,294

APPENDIX 1: LIBRARY STATISTICS

REFERENCE SERVICES	2007/2008	2008/2009	2009/2010
Scott			
First Stop/Information Desk *	43,073	34,500	63,512
Scott Reference	14,217	12,770	14,777
Sound and Moving Image	3,005	1,937	U/A
Map Library	6,535	6,021	8,847
Archives & Special Collections	1,326	864	513
Subtotal	69,152	57,148	87,649
Bronfman	6,174	12,194	16,893
Steacie	14,890	13,466	15,342
Frost	5,729	6,228	6,365
Virtual Reference	3,596	3,724	2,710
Total	99,541	92,760	128,959

* includes directional enquiries

LIBRARY INSTRUCTION	2007/2008		2008/2009		2009/2010	
	Classes	Participants	Classes	Participants	Classes	Participants
Bronfman	100	2,946	104	3,010	102	4,443
Frost	72	1,860	63	1,990	79	2,568
Maps	34	1,045	24	790	38	1,502
Scott	393	14,222	333	10,647	314	10,238
SMIL	34	1,045		U/A		
Steacie	125	3,863	127	7,559	113	7,034
Total	758	24,981	651	23,996	533	25,785

OPERATING BUDGET	2007/2008	2008/2009	2009/2010
Salaries	$ 9,667,331	$ 10,161,155	$ 10,313,175
Part Time Assistance	$ 1,032,018	$ 1,013,778	$ 912,129
Benefits	$ 2,368,019	$ 2,465,850	$ 2,419,240
Subtotal	$ 13,067,369	$ 13,640,783	$ 13,644,544
Collections	$ 9,826,510	$ 10,003,256	$ 10,321,624
Binding	$ 152,816	$ 119,981	$ 99,724
Subtotal	$ 9,979,326	$ 10,123,237	$ 10,421,348
General operating	$ 3,646,319	$ 3,473,461	$ 4,508,857
Total Expenses	$ 26,693,013	$ 27,237,481	$ 28,574,749
Recovery	-$ 1,067,617	$ 867,850	$ 995,767
Total Expenses less recovery	$ 25,625,396	$ 28,105,331	$ 29,570,516
Gifts in Kind	$ 1,339,928	$ 4,927,171	$ 966,375

MATH 32xx: Mathematical Biology

Library Support Statement

I have reviewed the course proposal and the supporting bibliography and find that York University Libraries have the required resources to support this undergraduate level course based on the availability of following resources:

- Journals, books, handbooks and encyclopedias
- Pertinent databases
- Access to other libraries' holdings through Interlibrary loans and resource sharing
- Ongoing purchases of new library materials based on course requirements

We have all the books mentioned in the reading list. Books on the reading list can be made available as reserve copies from the Steacie Science & Engineering Library reserve desk (http://www.library.yorku.ca/ccm/Home/Faculty/placing-items-on-reserve). Steacie library staff can create permanent links to articles that are available in digital format.

Adequate resources on mathematical biology & epidemiology, population biology and disease modelling are available from the Steacie Science & Engineering Library. The libraries have sufficient print and electronic books on biology, virology, immunology, chemistry, applied mathematics and statistics, Maple & MATLAB. Many books on mathematical biology are available from Springer e-books (http://www.library.yorku.ca/e/resolver/id/1861316) and through other e-book providers. We subscribe to almost all the highly ranked journals in this field. Students can request 25 journal articles free of cost using RACER (InterLibrary Loan). Faculty can request 50 journal articles per year (for journals we do not have) using RACER (http://www.library.yorku.ca/e/resolver/id/335601). Students have access to Maple & MATLAB from the library computers.

Some databases that will be useful to students are:

- Scopus
- Web of Science
- SpringerLink
- SIAM Journals Online
- MathSciNet
- Complete list of Mathematics databases
- Complete list of Statistics databases

There may be certain specific areas that require additional resources and collection development in the library is an ongoing process. It is 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 will be purchased for the library. Please forward any requests for purchase to the Mathematics & Statistics Librarian, Rajiv Nariani at rajivn@yorku.ca

Please note that librarians also provide library research skills and information literacy workshops to students on topics, including:

- Formulating search strategies in specific databases
- Help with locating data sources
- Evaluating information sources
- Managing references and creating bibliographies using appropriate citation management programs

In summary, I would state that the Steacie Science & Engineering library is well-positioned to support this undergraduate course.

Sincerely,

Rajiv Nariani
Mathematics & Statistics Librarian
102L, Steacie Science and Engineering Library
York University
(416) 736 2100 x20396
rajivn@yorku.ca
April 04, 2012

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Memo

To: Professor Jane Heffernan, Department of Mathematics and Statistics, Faculty of Science and Engineering

From: Cynthia Archer, University Librarian

Date: April 10, 2012

Subject: Library Support for Proposed Undergraduate Program, Mathematical Biology

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York University Libraries has excellent support for the proposed undergraduate program in mathematical biology.

Collections: As well as having a strong collection of monographs and journals in print and electronic formats we are building a robust infrastructure to support emerging areas such as mathematical biology. Among the many new library-driven initiatives is the Ontario Council of University Libraries collaborative web based digital library infrastructure which provides easy access to data sets (statistical, geospatial and health informatics). Faculty and students, who make extensive use of data in their research and studies, will have ready access to geospatial, as well as qualitative and quantitative data and health data stored in the OCUL digital library. One of the strengths of geospatial data is how it can represent complex information in highly visual presentations that support understanding and comprehension in a way that cannot be achieved easily with textual representations. The Geospatial Portal provides a powerful research, teaching and learning tool by integrating health informatics data with geospatial data through visual analysis.

Academic and research support: Librarians are actively acquiring new areas of expertise to support faculty and student research in health, including expertise in bioinformatics and evidence-based practice. Faculty, in turn, are increasingly collaborating with librarians to incorporate information literacy components into their curricula so students may fully benefit from the new technologies, resources and expert skills available at the libraries. Reference assistance continues to be offered both in the libraries and online, and students may use the librarian consultation service which is available by appointment.

cc: Rajiv Nariani, Science Librarian
John Dupuis, Head, Steacie Science & Engineering Library
Catherine Davidson, Associate University Librarian, Collections and Research

New Undergraduate and Graduate Degree Program
New Program Brief Template

The development of new undergraduate and graduate degree programs follows the protocol for new degree approvals as outlined in the York University Quality Assurance Process and also complies with the Quality Council's Quality Assurance Framework.

The Program Brief for new degree programs that require full approval includes two components for undergraduate programs and three components for graduate programs, as follows:

- program proposal, including letters of consultation/support and other relevant appendices
- curricula vitae of the faculty, including program-specific appointment criteria (for new graduate programs only)
- external reviewer nominations

To ensure that all of the evaluation criteria are addressed in the proposal under development, program proponents are required to submit the New Program Brief in the following format.

York University

New Program Brief
of the
Bachelor of Science
in
Mathematical Biology

Submitted: August 2013
Revised: February 2014

1. Introduction

1.1 Provide a brief statement of the degree program(s) being proposed, including commentary on the appropriateness and consistency of the degree designation(s) and program name with current usage in the discipline or area of study.

We propose Specialized Honours, Honours Major and Honours Minor programs in Mathematical Biology. Mathematical Biology is a field of Applied Mathematics with a range of applications in biology. Studies in Mathematical Biology aim to represent biological processes using a variety of mathematical techniques and tools. It has applications in biology, epidemiology, immunology, virology, medicine, public health, chemistry, biochemistry, ecology and environmental science. Mathematical tools used to conduct studies in Mathematical Biology include dynamical systems, bioinformatics, geometry, imaging theory, stochastic modeling, numerical methods, statistics and probability.

Mathematical Biology has a long history, but recently this field has experienced an explosion of interest. Reasons for this include: the availability of large and rich datasets (genomics, increased sensitivity in laboratory and clinical tools), the development of robust mathematical tools that can be used to understand complex nonlinear systems, an increase in computing power (calculations, simulation and visualization can be easily accessed), and increasing interest in the computer simulation of biological mechanisms so that complications incurred in human and animal research (i.e. ethical considerations, cost, risk, unreliability, etc) are reduced.

The "Biology" component of this proposed program should be understood in a very general and broad sense to include, for example, chemistry, biophysics, cell biology, ecology, kinesiology, health sciences and bioinformatics. As such, this proposed program is expected to enhance the coordination and collaboration between the Department of Mathematics & Statistics and other units within the Faculty of Science and the Faculty of Health.

1.2 For graduate programs that wish to have a Quality Council endorsed field(s), please indicate the field(s) for each of the master's and PhD programs.
NA

1.3 Provide a brief description of the method used of the development and preparation of the New Program Brief, including faculty and student input and involvement.

The proposed program has been developed within the Applied Mathematics section in the Department of Mathematics & Statistics, and incorporates suggestions from the Statistics and Pure Mathematics sections. Input from the departments of Chemistry and Biology, and the Faculty of Health was solicited. Feedback was integrated into the proposal. Letters of support from these entities are attached.

The proposal development team determined the need and attractiveness of a program in Mathematical Biology. The team also determined a format which would best appeal to

students. This was determined through discussion with some students majoring in both mathematics and biology at York University.

1.4 Indicate the Faculty/unit in which the program will be housed (for undergraduate programs) or anchored (for graduate programs).

The proposed program will be housed in the Department of Mathematics & Statistics within the Faculty of Science. This structure has been agreed upon by Biology, Chemistry departments and the Faculty of Health, since students will be taking some courses in these disciplines, but the majority of the degree program consists of mathematics courses. A program coordinator will lead administration of the program consistent with Appendix P of the YUFA Collective Agreement and the Mathematics & Statistics workload document. Initially, the Applied Mathematics coordinator will be responsible for coordination of the Mathematical Biology program. Feedback from Biology, Chemistry and the Faculty of Health on the program will be solicited in the early stages of the degree offering. Opportunities for feedback from Biology, Chemistry and the Faculty of Health in later years will also occur. Such feedback will provide for an enhanced multidisciplinary program for the students.

2. General Objectives of the Program

2.1 Provide a brief description of the general objectives of the program.

Mathematical Biology is concerned with the mathematical representation, treatment and modelling of biological processes, using a variety of mathematical techniques and tools. The main objective of the proposed program is to provide the foundational knowledge in mathematics and in the application of mathematics to biological processes. Individuals graduating from the program will have knowledge in biology, will be able to reduce a complex biological issue to a key question, determine an appropriate mathematical model to describe/reflect this biological process, analyze the model with mathematical theory and numerical methods, produce mathematical results, interpret the results in terms of the original biological question, and identify areas where the mathematical model can be refined and expanded.

2.2 Describe how the general objectives of the program align with University and Faculty missions and academic plans.

As outlined in the 2013 Strategic Research Plan and the 2010 University Academic Plan, York University is committed to supporting research and teaching and learning in interdisciplinary studies, in areas of study that support global health and sustainability. The 2010 White Paper, Canada's Engaged University: Strategic Directions for York University 2010-2020 includes a major focus on the expansion of teaching and research activities in the areas of medicine, health and applied sciences. This goal is also included in the President's December 2007 vision statement, and previous documents, including the 1999 *Provostial White Paper* and the 1992 *Vision 2020* Green Paper. A degree program in Mathematical Biology fits the foci of these documents, and contributes an avenue towards the establishment of a medical school, a goal

of the York University community, as this program will aid in an increase in applied science and it will increase the status of York University in medical and health research.

Recently, MITACS (Mathematics for Information Technology and Complex Systems), a NCE centre, officially established the MITACS Centre for Disease Modelling (CDM) at York University. Although relatively new, the CDM has established itself as a leader in the use of biomathematics as a core tool for setting disease control policies and advancing public health capacity to detect and manage emerging crises in Canada and globally. This is clearly evident from contributions and involvement of the CDM at the national level, where modelling research outcomes provided clear and understandable information to help inform stakeholders and policy makers, and guide Canada's response to the 2009 H1N1 pandemic in times of uncertainty. The CDM has already attracted many researchers and students to York University, as well as external funding support and interdisciplinary collaboration opportunities with industry and government agencies. The CDM has been in full support of the development of an undergraduate program in Mathematical Biology. The CDM has communicated that CDM training and outreach programs will provide summer schools, internships and projects for senior students of this proposed undergraduate program in Mathematical Biology. Such undertakings have been common practice of the CDM. Recent summer schools held at York by the CDM have included a York University course credit component at the graduate level. A letter of support outlining this contribution from the CDM is attached.

The Department of Mathematics & Statistics has many faculty members with active research in Mathematical Biology and related areas (see Table 1, Section 7). Mathematical Biology has been identified as an area for growth in the department (departmental 5 year plan). A program in Mathematical Biology, thus, is in line with departmental strengths and objectives.

3. Need and Demand

More universities are opening programs in Mathematical Biology as enrolments/demands for these programs are increasing. Minisymposia focusing on undergraduate mathematical biology programs now exist at major international meetings in mathematical biology and applied mathematics in general. There is a great opportunity for York to initiate a program in the field of Mathematical Biology due to this general environment, the demand and our growing faculty strength in multiple disciplines.

This proposed degree program will elevate York's reputation in interdisciplinary research and training. It will attract and retain students, who would otherwise not consider York as an undergraduate university, and it will provide important connections to industry and government through our research courses and our future graduates. This program will attract a wide range of students considering careers in mathematical, medical, biological or environmental research, academia, teaching, public health, public health policy, ecology (animal and plant), and practical medicine.

3.1 Identify similar programs offered at York and/or by other Ontario universities, with special attention paid to any innovative and distinguishing aspects of the proposed program.

There are no programs at York University similar to the proposed program in Mathematical Biology that integrates a range of mathematics and statistics with Biology, Chemistry and Kinesiology and Health Sciences. Mathematical Biology degree programs exist at other universities, however, there are very few in Canada (Appendix A). Undergraduate programs in Applied Mathematics with Biology or Life Sciences as an option for combination are offered at some Ontario universities: Waterloo, Western, McMaster, Wilfred Laurier. These programs, however, are not named degrees in Mathematical Biology. The undergraduate degree programs in Ontario are outlined below.

University of Waterloo
Applied Mathematics/Biology Option
This program has the same course requirements as an Honours program in Applied Mathematics, and requires additional credits in Cell Biology and Genetics. The required component in Biology is low, with only 4 full courses needed. The specialization is only in Cell Biology. A final year thesis is not required.
http://ugradcalendar.uwaterloo.ca/page/MATH-Applied-Mathematics-or-Biology-Option

Western University
Applied Mathematics and Biology
Students interested in this area are advised to take a major in Applied Mathematics and a minor which incorporates Evolutionary Biology, Ecology and/or Genetics. One course, housed in the Applied Mathematics Department, "An Introduction to Mathematical Biology" is recommended.
http://www.apmaths.uwo.ca/ugradprogram.shtml

McMaster
Honours Biology and Mathematics
Enrolment in this program is on completion of Year 1 with a cumulative average of at least a C+. Enrolment is limited and is not guaranteed if the requirements are satisfied. The program requires 36 units of Biology, 6 units of Chemistry, 3 units of Life Sciences, 42 units Mathematics and Statistics, and 120 units total. The program does not require a final year project thesis.
http://registrar.mcmaster.ca/calendar/2012-13/pg1532.html

Wilfred Laurier
Honours BSc in Biology and Mathematics
The Honours BSc Biology and Mathematics program consists of a minimum of 20.0 credits, including at least 6.5 senior credits in each of Biology and Mathematics. Not more than 6.0 credits may be at the 100 level. This program does not require a fourth year thesis.
http://www.wlu.ca/calendars/program.php?cal=1&d=1038&p=2098&s=501&y=53

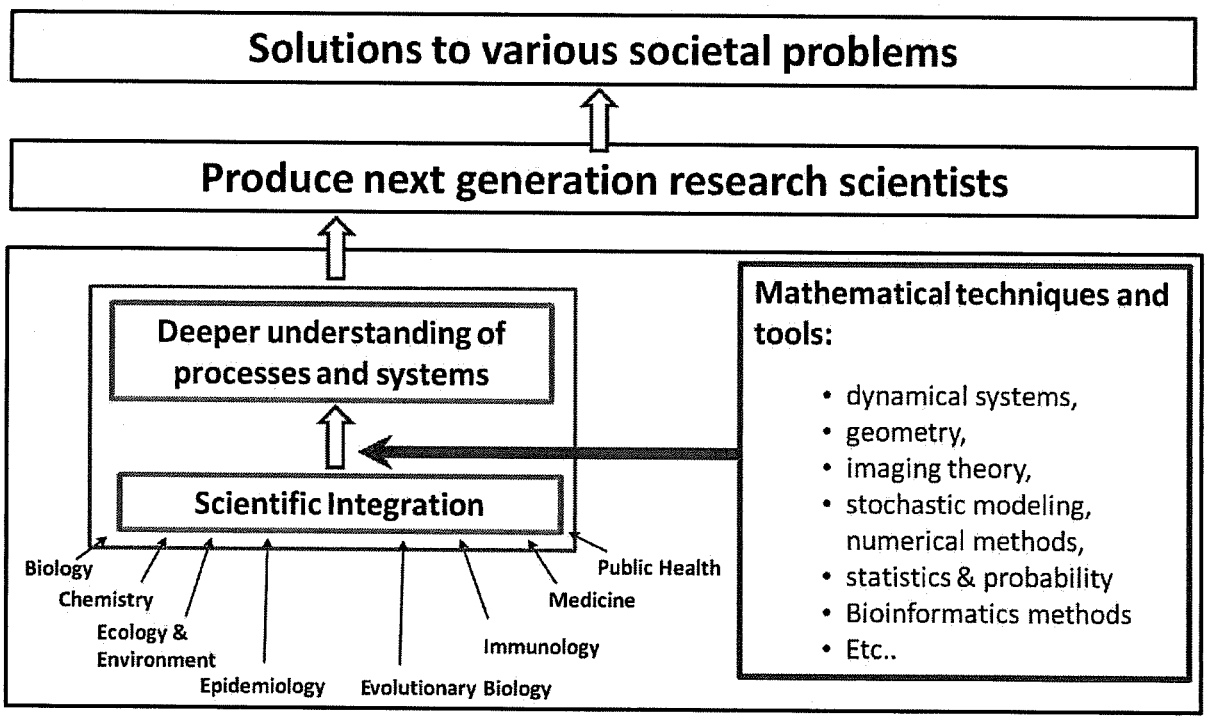
York University would have the fifth formalized degree program in Mathematics and Biology in Canada, but this degree would be the first to be granted as a degree in Mathematical Biology. There are advantages to a program with this name. For example, it carries the name of the field to which it applies, thus applicants interested in this field have an immediate program to apply to. Also, it has currency to a field that is exploding, and becoming a major field of

international research, which will aid in program advertisement. Finally, if applicants have queries related to the application of Mathematics to Biology, the degree name can be easily searched by these individuals online, and thus, can provide a pool of applicants that might otherwise have been interested in applying to different programs, and other universities.

3.2 Provide brief description of the need and demand for the proposed program, focusing as appropriate on student interest, social need, potential employment opportunities for graduates, and/or needs expressed by professional associations, government agencies or policy bodies.

Solutions for 21st-century challenges involve complex systems that no single discipline can fully address. As many of the key problems are found in the biological sciences, future scientists must be ready to work in diverse settings in interdisciplinary collaborations. Mathematical Biology involves using mathematical techniques and computational tools to answer problems that arise in Biology. New and exciting challenges in the life sciences are now being met using mathematical modelling, which is having a direct impact on health, social and ecological aspects of modern life.

Figure 1: Role of Mathematical Biology from Research (in Academia, Government or Industry) to Society



Since 2003, various reports and peer-reviewed articles have been published on transforming undergraduate-level education for future research scientists. Notably the National Research Council of National Academics (Washington USA) recommended a new program that relies on integrating knowledge from many disciplines to derive deeper understanding of mathematical and biological systems [1-4]. As a result, programs in Mathematical Biology at the

undergraduate and graduate levels have been emerging (Appendix A). However, there is still a need to develop more of these programs, especially at the undergraduate level, since the mathematical biology community is still quite small compared with the demands of the biosciences [5], especially with the recent emergence of the fields of Systems Biology and Mathematical Immunology. A program in Mathematical Biology at York University will aid in this respect.

An increasing demand for knowledge in mathematics within the medical sciences has also been recognized. Several US medical organizations already have mathematics as a medical degree requirement [6], and Canada will follow.

Government agencies have also recognized the usefulness of quantitative scientists within their ranks. In the field of public health and disease control and prevention, for example, the Public Health Agency of Canada (PHAC) recognizes the importance of modelling and has hired mathematical modellers for years. The recently established Public Health Ontario also houses mathematical modellers, and so does the BC Center for Disease Control (BCCDC) and various NRC Institutes. The US Center for Disease Control (CDC) and the World Health Organization (WHO) also employ modellers. Other places where mathematical biologists have been employed and are in great demand include: major research hospitals, medical research centres, pharmaceutical companies, universities and colleges, intelligence agencies, the armed forces, natural resource management, the Ministry of the Environment and many other government agencies and ministries. A survey of Mathematical Biology programs in the United States of America shows close links and collaborations between these programs and many potential employers, including zoos and aquariums; National Parks services; Departments of transportation, land management and water treatment; research institutes; oil and gas companies; scientific consulting companies; cyber-security and security companies; electronics companies; and space and aeronautics research companies. Specific examples include: Mitre, NASA, Boeing, Metron and Philips. [7,8].

Interest in combining mathematics and biology has been seen by the proposal writing committee members over the past few years. Potential applicants to undergraduate programs have solicited advice, as well as undergraduate students majoring in mathematics and biology (with combinations of Major/Major, Major/Minor).

After Graduation

A recent study of careers that combine Mathematics with Biology [9] reports that Biomathematicians mainly work in careers in research and development services in human genetics, health care, pharmaceuticals and conservation. A recent report from the Bureau of Labor Statistics in the USA forecasts employment growth of 16% for all mathematicians, including biomathematicians, between 2012-2020 [10].

Mathematics and Applied Mathematics graduates have been successful in obtaining careers after graduation. It is expected that companies that hire Mathematics and Applied Mathematics majors are also likely to hire majors in Mathematical Biology. An advantage that a Mathematical Biology degree holder from York University will have over individuals with other Mathematics degrees, however, is that this individual will have had: training in

interpreting the real world to mathematics and vice versa; hands on experiences with data; experience writing reports and giving presentations to individuals with mathematics, biology and other backgrounds; experience conducting their own mathematical modelling study on a current issue in the real world from start to finish. These are experiences/skills that will be seen as assets on a resumes and during interviews.

Following a BSc in Mathematical Biology, there will be many avenues for graduate study. The students shall have completed an Honours Degree in Mathematics, and shall have covered all the material included in general graduate examinations such as the Graduate Record Exam in Mathematics. As such they will be admissible to a number of graduate programs in Mathematics and Applied Mathematics in North America, as well as professional programs, such as an MBA, in which other Mathematics Majors currently enroll. Graduates from the Mathematical Biology program will also be admissible to graduate programs in Mathematical Biology globally. For other more specialized graduate programs, students may have to tailor their elective course selections to be fully prepared. They will also be well prepared for admission to interdisciplinary graduate programs.

The Mathematical Biology program will be attractive to students preparing for careers in medicine or public health. The program satisfies the requirements needed to prepare students for the MCAT and medical school. Also, higher education in mathematics is listed in the recommendations of most medical schools for admission, and is required by some [6,11], and mathematical modeling is listed as a recommendation to medical schools by the AAMC-HHMI Scientific Foundations for Future Physicians [12]. The program also prepares students well to contribute to public health studies and policy making.

Students preparing to work in ecology will also be attracted to York's program in Mathematical Biology. Such students will choose to focus the biology portion of this program in ecology courses including field work studies.

It has been identified within Ontario and other geographical regions that there is a need for educators for Mathematics and Sciences courses [13]. The Ontario curriculum identifies Modelling, Reflecting, Problem Solving, Representing and Communicating as important areas for high school education within Mathematics and the Sciences, which are areas of training in the Mathematical Biology degree. The Mathematical Biology program will be attractive to students preparing to complete a B.Ed. (concurrent or consecutive) to teach at the Intermediate/Senior (high school) level. Such a B.Ed. requires two subjects (disciplines) as 'teachable' subjects. We have ensured that the degree requirements will give students a mathematics teachable as well as ensure adequate room for courses in a second subject (18-24 credits), which could be Biology, Chemistry or Kinesiology and Health Science within the biology part of the Mathematical Biology degree. The minor below will also provide a second teachable in Mathematics for students majoring in another discipline.

We conducted a small survey of Ontario Universities to determine an interest level in Mathematical Biology related programs. Two universities were able to share enrolment data. Data from these two respondents show that at least 25 students are currently pursuing double degrees that combine mathematics with biology, chemistry or kinesiology. There are currently ten individuals that are pursuing major/major or major/minor degrees with mathematics and biol-

ogy, chemistry or kinesiology at York University. Thus, there are at least 35 students at three Ontario universities pursuing degrees that lie within the field of Mathematical Biology. This limited sample speaks to a broad interest in Mathematical Biology in Ontario. It is expected that the program will have an intake of 20-35 students per year (see Section 8). This is comparable to other programs in Mathematics & Statistics.

4. Program Content and Curriculum

4.1 Describe the program requirements, including the ways in which the curriculum addresses the current state of the discipline or area of study. Identify any unique curriculum or program innovations or creative components.

The Mathematical Biology program requires students to complete a range of Mathematics and Statistics courses and courses in Biology, Chemistry, and/or Kinesiology and Health Sciences. Students will graduate as specialized Applied Mathematicians, with mathematical knowledge, and knowledge in the utility of applications of Mathematics to Biology, Chemistry, Kinesiology and Health Sciences.

The program is designed for both domestic and international students. Arrangements with selected international universities (eg. China and India, etc) will be explored as a mechanism for attracting top international students after the first years of program delivery.

As stated in Section 3, solutions for 21st-century challenges involve complex systems that no single discipline can fully address. Many of the issues society faces today stem from problems within Biology and the Life Sciences. Graduates from the program in Mathematical Biology will have the tools and knowledge that can be applied to answer questions in Biology and have a direct impact on health, social, and ecological aspects of modern life.

This new degree is in keeping with recommendations for transforming undergraduate programs to ones that integrate knowledge from many disciplines [1-4]. It is also in keeping with the observed and growing need for Mathematical Biologists [5].

The program structure has been chosen to provide flexibility to students. Students can choose an area of biology of interest (see suggested streams below), or can opt to generalize, taking courses in different areas. This is an attractive structure as it can accommodate students pursuing careers in Health, Biology, Ecology, Environmental Science, Biochemistry, Public Health and Medicine. Thus, it is expected that this program will attract a wide range of students considering careers in Mathematical, Medical, Biological or Environmental research, academia, teaching, public health, public health policy, ecology (animal and plant), and practical medicine.

The Specialized Honours and Honours Major programs require 60 and 48 credits in Mathematics courses respectively. Additionally they require 1000-level credits in biology, chemistry and computer science. The Specialized Honours program requires a further 15 credits in Biology courses, while the Honours Major may be completed either by taking a further 15 credits in Biology or by combining with a Minor in Biology or Kinesiology, in which

case it is an Honours Major/Minor program. The Honours Major, when completed by taking the additional 15 credits in Biology, may be combined with any other Honours Major in an Honours Double Major program. The Honours Minor must be combined with an Honours Major either in Biology or Kinesiology and requires the 1000-level credits in biology, chemistry and computer science, and 30 credits in Mathematics.

All students must meet the general requirements for a BSc program in the Faculty of Science (see Appendix B). Specifically, this includes the General Education and breadth requirements shared by the BSc programs in the Faculty of Science. To declare, proceed and graduate from the Honours program requires successful completion of all Faculty requirements and departmental required courses, a minimum cumulative credit-weighted grade-point average of 6.0 over all required program Mathematics & Statistics (MATH), Biology (BIOL), Chemistry (CHEM) and Computer Science (CSE) courses, and a minimum cumulative credit-weighted grade-point average of 5.0 over all courses completed. If these requirements are not satisfied, students will be transferred to the Applied Mathematics BSc degree program. Mathematical Biology may only be a Minor in an Honours Major/Minor program if it is combined with an Honours Major BSc in Biology or Kinesiology and Health Science. Note that the minimum B (6.0) average is not required where Mathematical Biology is the minor in an Honours Major/Minor program. In this case, the minimum GPA is determined by Biology or Kinesiology and Health Science.

The GPA of 6.0 (B) over all required MATH, BIOL, CHEM and CSE courses is required to continue in the Honours program as it is imperative that a student have a sound background in Mathematics and the area of application in order for the student to be successful in developing mathematical models describing biological processes in upper year courses.

Most courses that would be required for the degree program already exist. A new course in the third year MATH 32xx 3.0 Mathematical Biology will be required. A final year thesis course MATH 42xx 6.0 will be developed in the future when enrollments reach a critical mass where individual projects take more faculty time than the courses would. The new courses will boost the program's status significantly when they are fully implemented. In the meantime however, when the program is small, and with transfers from other programs courses such as Mathematical Modelling SC/MATH 4090 3.0 and the Individual Project Course SC/MATH 4000 6.0 (as long as the project includes an application in biology) may suffice.

A unique feature of this program, compared to other programs in Mathematical Biology, is that a 4th year project course is required. It is through this course that students will truly 'experience' a Mathematical Biology project. Critical thinking and problem-solving skills are best learned in an environment of an independent research project. Students will be partnered with supervisors in the Department of Mathematics & Statistics and will have one or more collaborators in their field of application, within the university or industry. As part of this course, there will be some classroom training on scientific writing, a skill required for all jobs in academia, government and industry in Mathematical Biology.

Apart from the 4th year thesis course, innovative teaching methods will be introduced in MATH 32xx Mathematical Biology, a required course for this degree program. Such innovative

teaching methods include an emphasis on case studies and problem solving skills. Reflection papers, relating mathematical and computational techniques to problems in the Biological Sciences are also required. This will fulfill requirements to learn communication skills, describing mathematics and how it is applied. Communication skills will also be acquired through oral presentations, and written project proposals and final papers. Students in this course will also be given experience learning special software packages that are widely used in Mathematical Biology, using symbolic computation and numerical solutions (Maple, Matlab, Mathematica, Octave).

Course Requirements for Degrees Offered

Mathematics and Statistics Core:

SC/MATH 1021 3.0 Linear Algebra I
SC/MATH 1131 3.0 Introduction to Statistics I
SC/MATH 1200 3.0 Problems, Conjectures and Proofs
SC/MATH 1300 3.0 Differential Calculus with Applications
SC/MATH 1310 3.0 Integral Calculus with Applications
SC/MATH 2022 3.0 Linear Algebra II
SC/MATH 2030 3.0 Elementary Probability
SC/MATH 2310 3.0 Calculus of Several Variables with Applications

Summary: 24 credits of MATH + 3 credits of CSE (see below for CSE course)

Required courses from the Faculty of Science, Lassonde School of Engineering, or Faculty of Health:

SC/CSE 1560 3.0 Computing in Mathematics & Statistics
SC/BIOL 1000 3.0, SC/BIOL 1001 3.0 Biology I and Biology II (or SC/BIOL 1010 6.0 Biological Science)
SC/CHEM 1000 3.0, SC/CHEM1001 3.0 Chemical Structure and Chemical Dynamics

And:

(1) Specialized Honours
A minimum of 15 additional credits at the 2000 level or higher from Biology with at least 9 credits from the 3000 level or higher.

(2) Honours Major
A minimum of 15 additional credits at the 2000 level or higher from Biology with at least 9 credits from the 3000 level or higher.

(3) Double Major, or Major in a Major/Minor Program
A minimum of 15 additional credits at the 2000 level or higher from Biology with at least 9 credits from the 3000 level or higher if Biology or Kinesiology is not the second major or minor
Or a minor in Biology
Or a minor in Kinesiology and Health Sciences

Summary: At least 27 credits

Additional Recommendation: One or more of
SC/PHYS 1010 6.0 Physics
Or SC/PHYS 1410 6.0 Physical Science
Or SC/PHYS 1420 6.0 Physics with Applications to Life Sciences
Or HH/KINE 2011 3.0 & 2031 3.0 Human Physiology 1 and Human Anatomy
Or ES/ENVS 1000 6.0 Earth in Our Hands: Introduction to Environmental Studies

All students registered in a Bachelor of Science (BSc.) program must complete a minimum of 12 non-science credits from at least two different departments. No more than 9 credits in one subject area will be counted towards the non-science requirement.

Note that students who complete additional credits from Biology, Kinesiology and Health Science or Chemistry may satisfy the requirements for a minor in that field in an Honours Major/Minor Program. An Honours Major/Minor with Mathematical Biology as the Major and another subject area other than Biology, Kinesiology, Environmental Science or Chemistry declared as the Minor is also permitted. Students may also complete a double major in Mathematical Biology and another field. Examples include: Biology, Chemistry, Physics, Kinesiology, etc.

SPECIALIZED HONOURS

SC/MATH 2001 3.0 Real Analysis
SC/MATH 2041 3.0 Symbolic Computational Lab I
SC/MATH 2270 3.0 Differential Equations
SC/MATH 3010 3.0 Vector Integral Calculus
SC/MATH 3241 3.0 Numerical Methods I
SC/MATH 32xx 3.0 Mathematical Biology
SC/MATH 3410 3.0 Complex Variables
SC/MATH 3050 6.0 Introduction to Geometries
or 3090 3.0 Computational Mathematics
or 3170 6.0 Operations Research
or 3242 3.0 Numerical Methods II
or 3260 3.0 Introduction to Graph Theory
or 3271 3.0 Partial Differential Equations
SC/MATH 42xx 6.0 Practicum in Mathematical Biology (SC/MATH 4000 6.0 may substitute*)
6 additional credits selected from:
SC/MATH 4090 3.0 Mathematical Modelling
SC/MATH 4170 6.0 Operations Research II
SC/MATH 4271 3.0 Dynamical Systems
SC/MATH 4430 3.0 Stochastic Processes
SC/MATH 4431 3.0 Probability Models
Summary: 24+36 credits of MATH + 3 CSE + 6 BIOL + 6 CHEM + at least 15 credits from BIOL at the 2000 level or higher

*SC/MATH 4000 6.0 may substitute for SC/MATH 42xx 6.0 ONLY if the project completed in SC/MATH 4000 included an application to biology

HONOURS MAJOR, DOUBLE MAJOR, or MAJOR in a MAJOR /MINOR PROGRAM.

SC/MATH 2041 3.0 Symbolic Computational Lab I
SC/MATH 2270 3.0 Differential Equations
SC/MATH 32xx 3.0 Mathematical Biology
SC/MATH 3090 3.0 Computational Mathematics
or 3170 6.0 Operations Research
or 3241 3.0 Numerical Methods I
or 3260 3.0 Introduction to Graph Theory
or 3271 3.0 Partial Differential Equations
SC/MATH 42xx 6.0 Practicum in Mathematical Biology (SC/MATH 4000 6.0 may substitute*)
6 additional credits selected from
SC/MATH 4090 3.0 Mathematical Modelling
SC/MATH 4170 6.0 Operations Research II
SC/MATH 4271 3.0 Dynamical Systems
SC/MATH 4430 3.0 Stochastic Processes
SC/MATH 4431 3.0 Probability Models

Summary: 24+24 credits of MATH + 3 CSE + 6 BIOL + 6 CHEM + at least 15 credits from BIOL at the 2000 level or higher OR a minor in Biology OR a minor in Kinesiology and Health Sciences

*SC/MATH 4000 6.0 may substitute for SC/MATH 42xx 6.0 ONLY if the project completed in SC/MATH 4000 included an application to biology

Apart from the degree programs above, a minor in Mathematical Biology can be achieved. The minor in Mathematical Biology can only be combined with an Honours Major in Biology or an Honours Major in Kinesiology and Health Science.

HONOURS MINOR

SC/MATH 1021 3.0 Linear Algebra I
SC/MATH 1300 3.0 Differential Calculus with Applications
SC/MATH 1310 3.0 Integral Calculus with Applications
SC/MATH 2310 3.0 Calculus of Several Variables with Applications
SC/MATH 32xx 3.0 Mathematical Biology
6 additional credits from:
SC/MATH 2022 3.0 Linear Algebra II
SC/MATH 2030 3.0 Elementary Probability
SC/MATH 2041 3.0 Symbolic Computational Lab I
SC/MATH 2222 3.0 Linear Algebra with Applications II
SC/MATH 2270 3.0 Differential Equations
3 additional credits from:
SC/MATH 3090 3.0 Computational Mathematics
SC/MATH 3170 6.0 Operations Research

SC/MATH 3241 3.0 Numerical Methods I
6 additional credits from:
SC/MATH 4090 3.0 Mathematical Modelling
SC/MATH 4170 3.0 Operations Research II
SC/MATH 4430 3.0 Stochastic Processes
SC/MATH 4431 3.0 Probability Models
SC/MATH 42xx 6.0 Practicum in Mathematical Biology (SC/MATH 4000 6.0 may substitute*)
CSE 1560 3.0 Computing in Mathematics & Statistics (or equivalent)
Summary: 30 credits of MATH + 3 CSE

*SC/MATH 4000 6.0 may substitute for SC/MATH 42xx 6.0 ONLY if the project completed in SC/MATH 4000 included an application to biology

Students may choose an area of application in biology, but are not required to do so. Examples include: Biochemistry and Molecular Biology, Cell Biology, Human Biology/Anatomy, Genetics/Molecular Genetics, Plant Science, Ecology, Epidemiology, Immunology, Virology, Biomechanics, etc. Students are advised to choose their 2000-level biology courses wisely, based on the prerequisites for the courses they wish to take at the 3000 level or higher. The program director and professors of the Mathematical Biology program will be provided with examples of course choices within Biology, Chemistry and Kinesiology and Health Sciences that are among the streams listed. This is for counselling purposes.

In each year of the Mathematical Biology program there are courses that address each one of the UUDLES listed below. Key courses include MATH 1200, MATH 2030, MATH 2041, MATH 32xx, MATH 4090, MATH 42xx.

The modes of delivery of the required and suggested courses include: lecture formats, hands--on computer labs, interactive tutorials, and laboratory/discovery modules. The variety in course delivery is important for this program. Students graduating from this program will need to interact with individuals in other fields, perhaps perform some field work, employ computer techniques and programs, read the literature, learn from colleagues and give presentations or lectures (see UUDLES). An effective mathematical biologist will be able to perform these effectively (these are included in the assessment tools of the program courses), and will benefit from the experience of these delivery methods in their education.

With the exception of the Honours Minor, Mathematical Biology students are required to complete a project course MATH 42xx 6.0 in their final year of the program. This course includes researching the current literature, identifying a problem of study, determining key components of this problem, determining a model describing the problem at hand, analyzing the model, performing computer simulation, refining the model, writing progress and final reports and presenting results. The Mathematical Biology program will be the only program in the Mathematics & Statistics department where a fourth year project course is required. It is essential that students in an interdisciplinary program learn how to effectively apply their knowledge to their field of application (see UUDLES). MATH 42xx ensures that students have the opportunity to apply mathematical tools to an area of biology.

4.2 Provide a list of courses that will be offered in support of the program. The list of courses must indicate the unit responsible for offering the course (including cross-lists and integrations, as appropriate), the course number, the credit value, the short course description, and whether or not it is an existing or new course. For existing courses, the frequency of offering should be noted. For new courses, full course proposals are required and should be included in the proposal as an appendix. (The list of courses may be organized to reflect the manner in which the courses count towards the program requirements, as appropriate; e.g. required versus optional; required from a list of specified courses; specific to certain concentrations, streams or fields within the program, etc.)

See Appendix C for courses and descriptions

4.3 For undergraduate programs, comment on the anticipated class sizes. For graduate programs, comment on how the course offerings will ensure that each graduate student in the program will take a minimum of two-thirds of the course requirements from among graduate level courses.

Class sizes will vary from year 1 to year 4. It is expected that MATH 32xx and MATH 42xx will include the entire class cohort in that year of study (see Section 8). In situations where the course is also offered for other degree programs, the class size may be larger, ranging from 30-150 students, with the larger class sizes experienced in the first and second year of study, and smaller sizes in third and fourth year.

4.4 As an appendix, provide a copy of the program requirements as they will appear in the Undergraduate Calendar or Graduate Calendar, as appropriate.

See Appendix D for Calendar Copy

5. Program Structure, Learning Outcomes and Assessment

The intent of this section is to provide reviewers with an understanding of the knowledge, methodologies, and skills students will have acquired by the time they complete the program (i.e. the program learning outcomes), including the appropriateness of the program learning outcomes and how they will be supported and demonstrated. With that in mind, and with explicit reference to the relevant degree level expectations, it would be useful to focus on what students in the program will know and/or be able to do by the end of a defined period of time and how that knowledge, methodology and/or skill will be supported and demonstrated.

5.1 Provide a detailed description of the program learning outcomes and indicate how the program learning outcomes are appropriate and align with the relevant degree level expectations.

In keeping with the university level framework for B.Sc degree, this program incorporates all elements to insure it is in alignment with the degree requirements and degree level expectations.

Graduates in Mathematical Biology will possess:

- an understanding of the scientific method, experience in laboratory practices in Mathematics and the Biological Sciences
- A knowledge of and facility with mathematics, and computational methods and tools
- Breadth and depth in Mathematics and its uses
- Breadth and depth in Science, from Biology, Chemistry, Computer Science and Physics
- Demonstrated critical thinking, reasoning, problem solving and reflection
- An ability to communicate orally, in writing, and through graphical methods
- An awareness of the needs and changing needs in the broad field of Mathematical Biology, and limitations of one's knowledge within it
- An awareness of current intellectual and ethical issues and challenges within the field of Mathematical Biology

A number of the standards and educational goals are shared with existing Mathematics and Statistics Programs. These standards and goals are:

- independent and critical reading, problem solving, and selecting appropriate problem solving techniques; (1200, 2030, 32xx, 42xx)
- conjecturing, reasoning and proving mathematical statements; (1200, 2030, 2270, 32xx, 42xx)
- reflecting on and monitoring their processes; (1200, 32xx, 42xx)
- selecting tools and computational strategies to solve problems and aid conceptual understanding; (1131, 2030, 32xx, 42xx)
- making connections among mathematical concepts; (1200, 2030, 2270, 32xx, 42xx)
- representing and modelling mathematical ideas in multiple forms: concrete, graphical, numerical, algebraic, and with technology; (1200, 2030, 2270, 32xx, 42xx)
- communicating conjectures, reasoning, connections, and problem solutions in clear and effective ways, orally, in writing, with visuals, and with models and technology. (1200, 32xx, 42xx)

With respect to learning objectives, upon completion of Mathematical Biology Degree, students should be able to:

Program learning outcomes

Degree Level Expectation	**Program Learning Outcome** **The graduate of this program will:**	**Course Requirement that Fulfills Outcome**
Breadth and depth of knowledge	Integrate relevant knowledge and pose questions across a wide range of basic mathematics, applied mathematics and statistics; A sense of interdisciplinary perspective, an understanding of how these disciplines interact;	1st and 2nd year core, 32xx, 42xx, and additional course at 3000 and 4000 levels 1st and 2nd year core, 2270, 3090, 3271, 32xx, 4090, 42xx

	Breadth and depth in the application of mathematics to Biology Developed critical thinking and analytical skills	32xx, 42xx All required courses
Knowledge of Methodologies	Make connections among mathematical concepts Make connections among mathematical concepts in areas of biological applications Identify and construct appropriate models when solutions are needed 'as soon as possible' versus 'a future deadline' (simple vs complex and refined models) Identify appropriate methods for analyzing various types of data sets Learn new mathematical concepts, methods and tools from the literature, and texts and be able to apply them appropriately in biological contexts;	1st and 2nd year core, 32xx, 42xx and additional courses at 3000 and 4000 levels 32xx, 42xx 1300, 1310, 2030, 2270, 2310, 3090, 3170, 3241, 32xx, 4090, 4170, 4271, 42xx, 4431 1131, 2030, 32xx, 42xx 32xx, 42xx
Applications of Knowledge, Skills, and Tools	Apply a range of techniques effectively to solve problems in mathematics and statistics and in the applications of mathematics and statistics, including theory, deduction, approximation, and simulation, and present multiple pathways for a given problem; Construct, analyze, and interpret mathematical models for a variety of real-life problems, drawing on a wide range of areas of mathematics and a wide range of tools Use computer programs and algorithms: both numerical and graphical, to obtain useful approximate solutions to mathematical problems and to present and visualize numerical results and reasoning appropriately Collect, organize, analyze, and interpret results, involving mathematical patterns and structures	1200, 2030, 32xx, 42xx 1300, 2310, 3090, 3170, 32xx, 4090, 4170, 42xx 1131, 2041, 3090, 3170, 3241, 32xx, 4090, 4170, 42xx 1200, 2030, 3090, 3170, 32xx, 4090, 42xx, 4170, 4271, 4431

	Analyze data using appropriate concepts and techniques from statistics and mathematics	1131, 2030, 32xx, 42xx
	Employ technology effectively, including computer software, to investigate open-ended problems and to illustrate mathematical and statistical concepts and solutions to these problems;	1131, 2041, 3090, 3170, 3241, 32xx, 4090, 4170, 42xx and CSE 1560
	Critically analyze a proposed argument in mathematics, provide counter examples, and develop a supporting argument for a statement at the appropriate level designed for an appropriate audience	1200, 2030, 32xx, 42xx, 4431
Communication Skills	Present conjectures and results	1200, 2030, 32xx, 42xx
	Communicate mathematical and statistical concepts, models, reasoning, explanation, interpretation and solutions clearly and effectively in multiple ways and to audiences inside and outside of mathematics: oral presentations, written reports, visually and with physical models, and present explanations for selecting these methods	1200, 2030, 3010, 3090, 3170, 32xx, 4090, 4170, 42xx
Limits of Knowledge	Awareness of limitations of mathematical models, and the inherent error in models dependent on the underlying assumptions made	All required courses incorporate discussions here
	Awareness of the limitations and computational complexity of various numerical algorithms and applications, and uncertainty in computational methods	1131, 2041, 3090, 3170, 3241, 32xx, 4090, 4170, 42xx and CSE 1560
	Awareness of the limitations imposed by computer hardware restrictions and computational costs	2041, 3090, 3241, 32xx, 42xx and CSE 1560
	When discussing mathematics and its applications, the speaker should be aware of the inherent limitations and differences in knowledge between the speaker and the audience	3090, 3170, 32xx, 4090, 4170, 42xx
	Aware that there are many important problems in Mathematical Biology that are unsolved, and may be unsolvable, but could be approximated	32xx, 42xx
Autonomy and	Identify and describe some of the current intellec-	All courses

Professional Capacity	tual and ethical issues and challenges within the fields of mathematics and statistics, the applications of mathematics and statistics and the learning of mathematics	
	Identify and describe some of the current intellectual and ethical issues and challenges within the field of Mathematical Biology	32xx, 42xx
	Demonstrate professionalism, and be able to work independently and in groups	All courses
	Ability to manage personal challenges in learning and identify areas for growth	All courses
	Behaviour consistent with academic integrity and social responsibility	All courses

Proposed BSc Mathematical Biology degree structure and degree level of expectations

Year 1

Credit value	**BSc specified requirements** (applies to Honours and Specialized Honours)		**Course relevance to program requirements**
3.0	SC/MATH 1021	Linear Algebra I	Math & Stats core
3.0	SC/MATH 1131	Introduction to Statistics I	Math & Stats core
3.0	SC/MATH 1200	Problems, Conjectures and Proofs	Math & Stats core
3.0	SC/MATH 1300	Differential Calculus with Applications	Math & Stats core
3.0	SC/MATH 1310	Integral Calculus with Applications	Math & Stats core
3.0	SC/CHEM 1000	Chemical Structure and Chemical Dynamics	Required Laboratory requirement General Education
3.0	SC/CHEM 1001	Chemical Dynamics	Required Laboratory requirement General Education
3.0	SC/BIOL 1000	Biology I - Cells, Molecular Biology and Genetics	Required Laboratory requirement General Education
3.0	SC/BIOL 1001	Biology II - Evolution, Ecology, Biodiversity and Conservation Biology	Required Laboratory requirement General Education
3.0	SC/CSE 1560	Computer science	Required General Education

BSc degree level expectations at the end of year one:

Breadth and depth of knowledge: Students will acquire the basic foundation of which mathematical modelling builds on: statistics, calculus, algebra, and mathematical reasoning. They will learn through their work that knowledge in one area of mathematics will aid in others. Students will have begun to pose questions within their specific areas of course coverage, and expand to questions which are related to more than one. Through studies in mathematics and other disciplines, students will have begun to get a sense of how different science disciplines interact.

Knowledge of Methodologies: Students will be exposed to a range of mathematical and statistical tools and techniques which build the foundational tools for Mathematical Biology. Students will have experience determining appropriate methods for solving mathematical problems and 'word problems'.

Applications of Knowledge, Skills, and Tools: Students will apply mathematical tools and techniques to solve mathematical problems and 'word problems'. This includes written work, and work aided by computer programs.

Communication Skills: Students will have experience developing written and oral presentations of their solutions.

Limits of Knowledge: Students will discuss 'error' in mathematics and statistics. They will be exposed to methods of approximation, and discuss approximate versus exact solutions.

Autonomy and Professional Capacity: Students will be capable of carrying out individual work, and working in groups. Students will perform their studies in line with York's policy on academic integrity and social responsibility.

Year 2

Credit value	**BSc specified requirements** (applies to Honours and Specialized Honours)		Course relevance to program requirements
3.0	SC/MATH 2030	Elementary Probability	Math & Stats core
3.0	SC/MATH 2022	Linear Algebra II	Math & Stats core
3.0	SC/MATH 2270	Differential Equations	Math & Stats core
3.0	SC/MATH 2310	Calculus of Several Variables with Applications	Math & Stats core
3.0	SC/MATH 2041	Symbolic Computational Lab I	Required
6.0	SC/BIOL at 2000 level or higher		Required
6.0	Electives at 1000 level or higher	SC/CHEM 2020 6.0 or HH/KINE 2011 3.0 + HH/KINE 2031 3.0 or SC/PHYS 1010 6.0 or SC/PHYS 1410 6.0 or	Electives

		ENVS 1000 6.0 *Note that CHEM 2020 6.0 is required for some 3000 and 4000 level courses in BIOL.	
PLUS			
3.0	Electives at 1000 level or higher		Elective for Honours Major
3.0	SC/MATH 2001	Real Analysis I	Required for Specialized Honours Major

BSc degree level expectations at the end of year 2:

Breadth and depth of knowledge: Students continue to build breadth and depth in knowledge in mathematics and statistics. Students continue to get a sense of the interdisciplinary nature of mathematics and how it can be applied to other fields in science. Students are further developing analytical skills and critical thinking through experiences in course work.

Knowledge of Methodologies: Students have a better understanding of mathematical methods and tools that can be used to model certain phenomenon in nature. Students have an understanding the methods of approximation, and why approximations are useful. Students have begun to learn how to pose questions in mathematics and how to assess the appropriateness of different mathematical tools to answer such questions.

Applications of Knowledge, Skills, and Tools: Students have had experience applying a range of mathematical tools, techniques and approximations to solve mathematical problems, and apply their skills to some real-world problems. Students have become familiar with some computational tools and have used them to investigate problems in mathematics and statistics, inspired by real-world problems.

Communication Skills: Students will have experience developing written and oral presentations of their solutions.

Limits of Knowledge: Students have experience with error calculations and have learned about approximations and when they are useful. Students have discussed limitations in mathematics linked to computational restrictions.

Autonomy and Professional Capacity: Students will be capable of carrying out individual work, and working in groups. Students will being to have the ability to manage their own learning in changing circumstances. Students will perform their studies in line with York's policy on academic integrity and social responsibility.

Year 3

Credit	BSc specified requirements	Course relevance to

value	(applies to Honours and Specialized Honours)		program requirements
9.0	SC/BIOL at 3000 level or higher		Required
6.0	Electives at 2000 level or higher	SC/CHEM 2020 6.0 , or HH/KINE 2011 3.0 + HH/KINE 2031 3.0 recommended	Electives
3.0	SC/MATH 32xx	Mathematical Biology	Required
PLUS			
3.0	SC/MATH 3090 or SC/MATH 3171 or SC/MATH 3241 or SC/MATH 3260 or SC/MATH 3271	Computational Mathematics Operations Research Numerical Methods I Introduction to Graph Theory Partial Differential Equations	Required for Honours Major
9.0	Electives at 2000 level or higher		Electives for Honours Major
3.0	SC/MATH 3010	Vector Integral Calculus	Required for Specialized Honours Major
3.0	SC/MATH 3241	Numerical Methods I	Required for Specialized Honours Major
3.0	SC/MATH 3410	Complex Variables	Required for Specialized Honours Major
3.0	SC/MATH 3050 or SC/MATH 3090 or SC/MATH 3170 or SC/MATH 3242 or SC/MATH 3260 or SC/MATH 3271	Introduction to Geometries Computational Mathematics Operations Research Numerical Methods II Introduction to Graph Theory Partial Differential Equaitons	Required for Specialized Honours Major

BSc degree level expectations at the end of year 3:

Breadth and depth of knowledge: Students have acquired more knowledge in mathematics and their field of application. Student will have focus on Mathematical Biology in this year. Critical thinking and analytical skills are further tuned.

Knowledge of Methodologies: Students have learned methods within the mathematical and computational sciences that are commonly used in mathematical modelling. They will be able to associate certain methods with real-world problems.

Applications of Knowledge, Skills, and Tools: Students have developed the ability to collect, organize, analyze and interpret results. They have learned how to dissect a real-world problem, identify appropriate mathematical and computational methods, apply these methods correctly, and interpret the results.

Communication Skills: Students will have experience developing written and oral presentations of their solutions. They will have also have experience interpreting mathematical results to a scientific language that can be understood by scientists in other fields. Students will also have the opportunity to write reflections on issues within Mathematical Biology, and discuss their thoughts with their peers.

Limits of Knowledge: Students have discussed the limitations of mathematical models with respect to complexity in an underlying biological system, interpretation of biological problems to simple versus complex mathematical models, and error in results.

Autonomy and Professional Capacity: Students have the ability to manage their own learning in changing circumstances. Students are capable of carrying out individual work, and work in groups. Students have shown some initiative and ownership of their learning. Students will perform their studies in line with York's policy on academic integrity and social responsibility.

Year 4

Credit value	**BSc specified requirements** (applies to Honours and Specialized Honours)		**Course relevance to program requirements**
6.0	SC/MATH 42xx	Practicum in Mathematical Biology (SC/MATH 4000 may substitute)	Required
6.0	SC/MATH 4090 SC/MATH 4170 SC/MATH 4271 SC/MATH 4430 SC/MATH 4431	Mathematical Modelling Operations Research II Dynamical Systems Stochastic Processes Probability models	Required
18.0	Electives at 2000 level or higher such that total number of credits at 3000 level or higher is at least 42		Electives

BSc degree level expectations at the end of year 4:

Breadth and depth of knowledge: Students have developed detailed knowledge in mathematics and their field of application. Students will have developed critical thinking and analytical skills inside and outside their focus in Mathematical Biology. Students have the ability to learn in areas outside their discipline.

Knowledge of Methodologies: Students have learned methods within the mathematical and computational sciences that are commonly used in mathematical modelling. They are able to determine appropriate mathematical and computational methods for different biological

problems. Students are able to comment on the particular aspects of current research and discuss areas for development.

Applications of Knowledge, Skills, and Tools: Students can properly identify appropriate mathematical and computational tools to apply to a problem of interest. Students can apply these methods correctly, interpret results in their fields of application, identify areas for further investigation, and critically evaluate their own solution, as well as, studies in the Mathematical Biology literature.

Communication Skills: Students have the ability to communicate their work and results to individuals inside and outside their field of study, using a variety of communication tools/media.

Limits of Knowledge: Students have gained an understanding of the limits to their knowledge. Students have an understanding of error and approximations, and are able to appreciate uncertainty and limits that these issues pose in Mathematical Biology. Students are able to identify limitations in their work, and in the Mathematical Biology literature.

Autonomy and Professional Capacity: Students have the necessary knowledge and skills to move on their field of study. Students have the ability to manage their own learning within and outside their field of study. Students are capable of carrying out individual work, and work in groups. Students have shown some initiative and ownership of their learning. Students have demonstrated academic integrity and honesty.

5.2 Address how the program curriculum and structure supports achievement of the program learning outcomes. For research-focused graduate programs, comment on the nature and suitability of the major research requirement(s) for degree completion. For undergraduate programs, comment on the nature and suitability of students' final-year academic achievement in the program.

See above

5.3 Address how the methods and criteria for assessing student achievement are appropriate and effective relative to the program learning outcomes and Degree Level Expectations.

Program courses are structured with varying modes of assessment i.e. assignments, tests, presentations, participation, computer demonstrations, reflection papers, projects. Students will work as individuals and in teams. Upon program completion, Mathematical Biology students will have demonstrated that they are successful in individual and team work, when solutions are needed 'as soon as possible' versus 'a future deadline' (simple vs complex and refined models) .

5.4 For graduate programs, indicate the normal full-time program length (i.e. the length of time in terms in which full-time students are expected to complete the program) including a description of how students' time-to-completion will be supported and managed to ensure that the program requirements can be reasonably completed within the proposed time period.

Indicate if the program will be available on a part-time basis, and, if applicable, explain how students' time-to-completion will be supported and managed to ensure that program requirements can be reasonably completed on a part-time basis.

NA

5.5 Describe the proposed mode(s) of delivery, including how it/they are appropriate to and effective in supporting the program learning outcomes.

The mode of delivery of the required and suggested courses include lecture formats, hands on computer labs, interactive tutorials, and laboratory/discovery modules. The variety in course delivery is important for this program. Students graduating from this program will need to interact with individuals in other fields, perhaps perform some field work, employ computer techniques and programs, read the literature, learn from colleagues, give presentations, and complete a final year research project (see UUDLES). An effective Mathematical Biologist will be able to perform these effectively (these are included in the assessment tools of the program courses), and will benefit from the experience of these delivery methods in their education. Breadth and depth of program requirements will be met by the variety in course delivery.

6. Admission Requirements

6.1 Describe the program admission requirements, including how these requirements are appropriately aligned with the program learning outcomes.

Applicants from Ontario Secondary Schools

- Ontario Secondary School Diploma
- MHF4U Advanced Functions, MCV4U Calculus and Vectors, SCH4U Chemistry and SBI4U Biology, with SPH4U Physics recommended

The admission requirements reflect the interdisciplinary nature of the Mathematical Biology program.

6.2 Explain any alternative requirements, if any, for admission into an undergraduate, graduate or second-entry program, such as minimum grade point average, additional languages or portfolios, along with how the program recognizes prior work or learning experience.

Students from alternate backgrounds and pathways are also encouraged to apply:

Applicants from Secondary School (not Ontario)

- Subject to meeting equilvalents to Ontario Secondary School admission requirements

Transfer with Other Mathematics Programs

The proposal includes the new core of all mathematics major programs, matching the revised B.Sc. Programs at York University. Students already pursuing a degree in

mathematics as well as with a biological science may choose to switch their major to Mathematical Biology. Depending on their choices in the fourth semester they can still transfer in and out of other major programs in mathematics. During their third year, students can switch in, or out, of this program from/to Applied Mathematics with a minimum of additional courses.

7. Resources

7.1 Comment on the areas of strength and expertise of the faculty who will actively participate in delivering the program, focusing on its current status, as well as any plans in place to provide the resources necessary to implement and/or sustain the program.

The Department of Mathematics & Statistics has many faculty members with active research in Mathematical Biology and related areas. Table 1 (below) outlines the research and teaching areas of these individuals. Faculty members in Biology, Chemistry and Kinesiology and Health Science have been consulted and, apart from teaching courses in these subject areas, can participate in supervisory and collaborative roles on final year projects. Faculty within the Mathematics & Statistics Department already have collaborative projects with many faculty in these units, and thus, final year projects in the Mathematical Biology program can facilitate these projects.

7.2 Comment on the anticipated role of retired faculty and contract instructors in the delivery of the program, as appropriate.

Retired faculty and contract faculty teach courses within the Mathematical Biology curriculum. This is common practice of Mathematics & Statistics, Biology, Chemistry and Kinesiology and Health Sciences. The majority of courses will be taught by fulltime faculty, however. MATH 32xx will be taught by fulltime faculty with primary research area in Mathematical Biology.

7.3 As appropriate, identify major laboratory facilities/equipment that will be available for use by undergraduate and/or graduate students and to support faculty research, recent acquisitions, and commitments/plans (if any) for the next five years.

The majority of the courses in the program do not require laboratory space. Students have access to labs in Biology, Chemistry and Kinesiology and Health Sciences as part of their courses. No extra lab space is required. Within the Mathematics & Statistics offerings computer labs are utilized and available. The new course MATH 32xx will use computing facilities within the Mathematics & Statistics Department.

7.4 As appropriate, provide information on the office, laboratory and general research space available that will be available for faculty, undergraduate and/or graduate students; the availability of common rooms for faculty and graduate students; administrative space; as well as any commitments/plans (if any) for the next five years.

The program has no new requirements for space. Students will have access to laboratories and research space as part of their courses. Computing needs are well supported within the

Mathematics & Statistics Department in the Gauss Lab located in Ross S110. This lab is maintained by IT technicians within the department. Students also have access to computer labs on campus, and can login to computing facilities remotely (http://computing.yorku.ca)

Administration of the program falls within the current structure of the Applied Mathematics section within the Mathematics & Statistics Department. Coordination of the program will require administrative release time once enrolments are confirmed into the fourth year level, and a program coordinator will be appointed. A new curriculum committee will be required immediately to continue development of the program. Individual faculty members in Mathematical Biology will need to offer additional advising for this pool of students.

The project course MATH 42xx 6.0 will require a course coordinator. Coordinating MATH 42xx 6.0 will count towards the teaching load. 15 to 25 students are projected for the final year of the Mathematical Biology program (see Section 8). This is similar to final year thesis courses in other science subjects (i.e. Biology, Chemistry, Biochemistry) that have a course coordinator. Note that MATH 4000 does not have a course coordinator. MATH 4000 is not a required course for any Mathematics & Statistics program. Therefore, it has a very small enrolment.

7.5 As appropriate, comment on academic supports and services, including information technology, that directly contribute to the academic quality of the program proposed.

Academic supports and services are available in the Mathematics & Statistics Department and the Faculty of Science. Students will be advised by the program coordinator and instructors and advisors at the Faculty level. To facilitate the program, a program website will be developed and maintained. Course instructors may employ Moodle or other technological aids to facilitate course instruction and student engagement.

7.6 For graduate programs, indicate financial support that will be provided to master's and/or PhD students, including how this support will be sufficient to ensure adequate quality and numbers of students. Comment on how supervisory loads will be distributed, as appropriate. Special attention should be paid to supervisory capacity for new PhD programs.
N/A

7.7 For undergraduate programs, indicate anticipated class sizes and capacity for supervision of experiential learning opportunities, as appropriate.

Class sizes will vary from year 1 to year 4. It is expected that MATH 32xx and MATH 42xx will include the entire class cohort in that year of study (see Section 8). In situations where the course is also offered for other degree programs, the class size may be larger, ranging from 30-150 students, with the larger class sizes experienced in the first and second year of study, and smaller sizes in third and fourth year.

Students will be partnered with supervisors in the Department of Mathematics & Statistics in their final year project course MATH 42xx. Students will have one or more collaborators in their field of application, within the university or industry. A list of the faculty from Mathematics & Statistics whom will aid in delivery of the program is found in Table 1 (below).

Collaborators in other departments, schools and industry are not listed as this list is continuously evolving.

Table 1 – Listing of Faculty

Mathematics & Statistics

Name	Rank	Home Unit	Area(s) of Specialization
Michael Chen	Associate Professor	Applied Mathematics	Operations Research Teaching: MATH 1021, MATH 3170, MATH 4170, MATH 42xx
Jorg Grigull	Associate Professor	Applied Mathematics	Bioinformatics, Computational Biology Teaching: MATH 2030, MATH 3090, MATH 4090, MATH 42xx, MATH 4431
Michael Haslam	Associate Professor	Applied Mathematics	Numerical Analysis, Scientific Computing, Computational Electromagnetics, Computational Fluid Dynamics, Special Functions Teaching: MATH 3090, MATH 42xx
Jane Heffernan	Associate Professor	Applied Mathematics	Mathematical Biology, Disease Modelling, Stochastic Simulation Teaching: MATH 32xx, MATH 4090, MATH 42xx
Huaxiong Huang	Professor	Applied Mathematics	Operations Research, Financial Mathematics, Mathematical Biology, Disease Modelling, Computational Biology Teaching: MATH 3090, MATH 3170, MATH 4090, MATH 4170, MATH 42xx
Dong Liang	Professor	Applied Mathematics	Computational Mathematics, Computational Biology Teaching: MATH 3241, MATH 3242, MATH 42xx
Neal Madras	Professor	Applied Mathematics	Probability, Mathematical Biology, Disease Modelling Teaching: MATH 2030, MATH 32xx, MATH 4090, MATH 4170, MATH 42xx
Seyed Moghadas	Assistant Professor	Applied Mathematics	Mathematical Biology, Disease Modelling, Agent Based Simulations Teaching: MATH 3090, MATH 32xx, MATH 4090, MATH 42xx
Tom Salisbury	Professor	Applied Mathematics	Probability, Brownian motion, Markov processes, Super Brownian motion, Actuarial finance` Teaching: MATH 1300, MATH 2310, MATH 42xx
EJ Janse Van Rensburg	Professor	Applied Mathematics	Bioinformatics, Monte Carlo simulations, Discrete Mathematics, Combina-

			torics, Statistical Mechanics Teaching: MATH 2022, MATH 2041, MATH 3242, MATH 42xx
Walter Whitely	Professor	Applied Mathematics	Geometry, Mathematical Modelling of Biological structures Teaching: MATH 3050, MATH 42xx
Man Wah Wong	Professor	Applied Mathematics	Analysis, Medical Imaging, Partial Differential Equations Teaching: MATH 3271, MATH 42xx
Jianhong Wu	Professor	Applied Mathematics	Dynamical System, Delay Differential Equations, Mathematical Biology, Disease Modelling, Mathematical Ecology Teaching: MATH 32xx, MATH 42xx
Hongmei Zhu	Associate Professor	Applied Mathematics	Analysis, Medical Imaging Teaching: MATH 3410, MATH 42xx
Huaiping Zhu	Associate Professor	Applied Mathematics	Dynamical Systems, Mathematical Biology, Disease Modelling, Modelling Environment and Ecology Teaching: MATH 2270, MATH 32xx, MATH 4090, MATH 42xx
Cindy Fu	Associate Professor	Statistics	Mixture Models, Statistical Genetics, Empirical Likelihood Teaching: MATH 1131, MATH 42xx
Xin Gao	Associate Professor	Statistics	Biostatistics, statistical genetics, bioinformatics, biostatistics, nonparametrics, large sample theory, statistical computing Teaching: MATH 1131, MATH 42xx
Hanna Jankowski	Associate Professor	Statistics	Medical Imaging, Bird migration Teaching: MATH 1131, MATH 42xx, MATH 4430
Wei Lui	Associate Professor	Statistics	Biostatistics Teaching: MATH 1131, MATH 42xx
Helene Massam	Professor	Statistics	Biostatistics Teaching: MATH 1131, MATH 42xx
Peggy Ng	Associate Professor	Statistics	Biostatistics Teaching: MATH 1131, MATH 42xx
Steven Wang	Associate Professor	Statistics	Cluster analysis, Bioinformatics Teaching: MATH 1131, MATH 42xx

8. Enrolment Projections

8.1 Indicate the anticipated implementation date (i.e. year and term of initial in-take), and provide details regarding the anticipated yearly in-take and projected steady-state enrolment target, including when steady-state will be achieved.

5 year enrolment projection

The anticipated implementation date of this program is FW 2014-2015. We anticipate some immediate transfers into the program, as soon as it is available, as it meets the needs of some students currently in other mathematics, biology, chemistry, and kinesiology programs. We also anticipate an increase in applications to York University when this program is initiated. This program will attract students who may not have considered York as a potential place for their university studies.

	Level I	Level II	Level III	Level IV	Total
Year 1	15	10*			25
Year 2	25	10	5		40
Year 3	29	15	7	2	52
Year 4	35	18	10	3	67
Year 5	38	22	13	5	77

*Based on the York University Fact Book and a query for number of Applied Mathematics majors and Applied Mathematics or Mathematics majors combined with a major or minor in Biology, Chemistry or Kinesiology and Health Science.

All other numbers are projections and are based on applied mathematics enrolments in Level I at York University, major/minor and double major combinations of applied mathematics or mathematics with Biology, Chemistry or Kinesiology and Health Science, retention rates in the Applied Mathematics program, and a small augmentation to these numbers based on the recruitment campaign planned for this program once it is approved.

Recruitment Campaign – Literature on the new program will be distributed at University recruitment fairs and Science fairs (i.e., Science Rendezvous), and faculty members involved in the program will be available to talk to potential students. Visits to secondary schools to give talks on Mathematical Biology, with topics chosen that relate to current and popular real world issues for these age groups will be conducted through the York University Science Speakers Bureau. Mathematical Biology will also be given a focus in the new Faculty of Science enrichment program for secondary school students, including one or more weeks of introductory courses on Mathematical Biology. A new website will also be professionally developed that will provide information to current and future students of the Mathematical Biology program, including possible streams of focus, career opportunities and research interests.

Student Life- When a critical mass of 3rd and final year students are in the program a York Mathematical Biology Club (MBC@York) may be developed. This club will be student run similar to other undergraduate clubs and it may have close ties to the CDM. Suggestions for club events include: every year, MBC@York and CDM will organize at least two events: MB Orientation (Introduction of Program requirements and Introduction to Graduate Study: this will

have a senior student talking about their experience, MB Program coordinator talking about program requirement, Graduate Program talking about Graduate Admission, and a Guest speaker from neighbouring university); MB Excitation (Senior Undergraduate Students talking about their projects and internships, Faculty or their Postdoctoral fellows talking about current and future research opportunities; MB Program coordinator introducing national and international MB events for the coming summer; CDM distinguished lecture, followed by a general reception).

9. Support Statements

Attachments

- Statement of support from the dean
- Comment on resource implications from VP academic
- Statement from University Librarian
- Statement from the University Registrar
- Confirmations from interested programs that their comments have been solicited
  - We have approached Biology, Chemistry, The Faculty of Kinesiology and Health Science, and the Centre for Disease Modelling
- Estimate of demand for the program from the office of Admissions
- Supporting documentation from the consultative process

Letter of Support from the Faculty of Kinesiology and Health Science

To: Jane Heffernan, Mathematics and Statistics
Re: B.Sc. in Mathematical Biology Proposal
From: Carol Wilson, Undergraduate Program Director
School of Kinesiology and Health Science
Date: December 5, 2011

The School of Kinesiology and Health Science (School) supports the revised B. Sc. in Mathematical Biology, Department of Mathematics and Statistics, Faculty of Science and Engineering. The revised proposal, received November 4, 2011, addresses the concerns of the School.

Cc: Angelo Belcastro, Kinesiology and Health Science, Chair
Committee of Undergraduate Studies in Kinesiology and Health Science

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Letter of Support from the Biology Department

Hi Jane,

The Teaching Committee only just met this afternoon. We will support your proposal's Biology needs.

My apologies for the delay.

Regards,

Tamara (Tamara Kelly)

Letter of Support from the Chemistry Department

Jane,

Chemistry support the idea of developing a BSc in Mathematical Biology. Involvement of Chemistry is minor, in principle limited to a limited number of students in the new BSc program who will take CHEM 1000 and 1001. I see no problem to accommodate the projected number of students in CHEM 1000 and 1001.
I see potential for further involvement in connection with the Biochemistry program. However, since Biochem is run jointly with Biology, this will require further discussion with Biology.

Jochen

P.S. Do not hesitate to contact me if you need anything else.

Jochen Rudolph, rudolphj@yorku.ca
Chair, Department of Chemistry,
Also Centre for Atmospheric Chemistry
York University, 4700 Keele St., Toronto, Ontario M3J 1P3.
Phone (416) 650 8117 or 736 5246 FAX (416) 736 5411 or 736 5936

YORK UNIVERSITY

FACULTY OF SCIENCE

Office of the Dean

MEMORANDUM

TO: Rhonda Lenton, Vice-Provost Academic

FROM: Donald Hastie, Dean

DATE: September 11, 2013

SUBJECT: Mathematical Biology – Letter of Support

It is my pleasure to support the proposal for a B.Sc. in Mathematical Biology offered by the Department of Mathematics and Statistics, Faculty of Science and Engineering.

While the curricular additions to the Departments offerings are small (two courses: one 3 credit the other 6 credits) it is the focus of the program that gives it value. The application of advanced mathematical methods in the physical sciences is well established. However, this has not been as true for the life sciences. Recently, with the more quantitative nature of life sciences and the increasing availability of computing power, the need to apply rigorous mathematical methods in this area have increased markedly; bioinformatics, and applying modelling and statistics to health science data are obvious examples. It is this growing area that this proposal seeks to address. The program has collected existing relevant courses into a program with additional courses to produce a coherent program of mathematics applied to biological and health sciences, although I would be surprised if it did not also meet the needs of physical science students.

This program meets the Department's plans to expand in the University priority areas of applied science and health science. The Department is well positioned to run this program immediately as the bulk of the courses already exist and there is a plan to bring the additional courses online. There is faculty strength in this area, particularly from those members of the Centre for Disease Modelling.

The students who graduate from this program will be well positioned for careers in a number of applied areas described in the proposal (general need), or move into mathematics or interdisciplinary graduate programs.

The development of the program will have small resource requirements with the two courses coming online as student numbers demand, and the administration could be covered by existing undergraduate support.

I am excited to see this program come forward from the Department and look forward to supporting its implementation.

DH/ss

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OFFICE OF THE VICE-PRESIDENT ACADEMIC & PROVOST

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Memorandum

To: Paul Axelrod, Chair, Senate APPRC

From: Rhonda Lenton, Provost

Date: October 8, 2013

Subject: Proposal for a BSc Program in Mathematical Biology

I have reviewed the proposal from the Faculty of Science to introduce a BSc program (Specialized Honours, Honours Major, Honours Minor) in Mathematical Biology, to be housed in the Department of Mathematics & Statistics. This proposal provides an excellent example of how existing resources can be drawn together in innovative ways in order to create programs that address both institutional priorities and demand. The program will expand York's programming and increase our profile in the applied sciences and health, thereby enhancing our comprehensiveness. York is already well known for contributions to research and policy development in this area, primarily through the Centre for Disease Modelling. The program is expected to attract new constituencies of students and respond to demand for mathematical modelling approaches to health sciences in hospitals, universities, industry and government agencies, for example.

Building on the program's mathematics core, students will have flexibility to choose additional courses from the sciences (e.g. biology, chemistry) and health (e.g., kinesiology) to meet their interests. The programs whose courses will be available have indicated that students can be accommodated in those courses. Initial new enrolments of 15 (plus about 10 transfers from other programs) are anticipated, growing to close to 80 after five years. Only two new courses will be required – a 3000-level course specifically on mathematical biology and a 4000-level project course, to be added to the curriculum as enrolments warrant.

Dean Hastie has confirmed that faculty and administrative resources are in place to support this program, as are plans to introduce the new courses in future years.

I am pleased to record my support for this proposal.

Cc: Dean D. Hastie
C. Underhill for ASCP

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REGISTRAR'S OFFICE

Bennett Centre for Student Services
4700 Keele Street
Toronto Ontario
Canada M3J 1P3
Tel 416.650.8002
Fax 416.650.8124

Memorandum

To: J. Heffernan, Mathematics and Statistics
C. Underhill, Secretary, Senate ASCP
Date: October 30, 2013

From: J. Parna, Acting University Registrar and Director of Admissions

Subject: Bachelor of Science in Mathematical Biology

I am writing with regards to the proposal for a Bachelor of Science in Mathematical Biology, an important addition to the offerings in the Faculty of Science.

We have reviewed the proposal from an implementation perspective in the Registrar's Office. There no issues with the implementation date of FW14-15 provided all the required approvals are in place by March 2014.

Appendix A

Mathematical Biology programs
(see references [14-16])

University	Location	Level
University of Leeds	UK	UG
University of Dundee	UK	UG, MSc http://www.dundee.ac.uk/undergraduate/courses/mathematical_biology.htm
University of Essex	UK	UG
University of Southampton	UK	UG
University of Nottingham	UK	G
University of Hertfordshire	UK	UG
Harvey Mudd	USA	UG
University of Michigan	USA	UG
Rutgers University	USA	UG
University of Delaware	USA	UG
Beloit College	USA	UG
Carnegie Mellon	USA	UG, G
SUNY Buffalo	USA	UG
SUNY Brockport	USA	UG
Case Western Reserve University	USA	UG
New Jersey Institute of Technology	USA	UG
Florida State University	USA	UG
University of Scranton	USA	UG
UC Davis	USA	UG
Loyola College in Maryland	USA	UG
University of Alberta	Canada	G
McGill	Canada	UG, G biology.mcgill.ca/undergrad/jointmajor_biolmath.html
UBC	Canada	G
University of Waterloo	Canada	UG, BMath App Math degree/Biol Option
McMaster	Canada	UG, Interdisciplinary program Hon BSc Biology and Mathematics
Western University	Canada	UG, Math and Biology Major
Wilfrid Laurier	Canada	UG, Hon BSc Biology and Mathematics

Appendix B

Structure of BSc degree

Quantitative Structure of the BSc Degree

Degree Option/Requirement	Minimum Credit Requirement
Minimum Number of Major or Minor Credits *(including, where applicable, iBSc options):*	
BSc Major	30 credits; including 12 credits at the 3000 or 4000 level
Specialized Honours Major Bsc	54 credits; including 18 credits at the 3000 or 4000 level, with at least 12 credits at the 4000 level
Honours BSc Major	42 credits; including 18 credits at the 3000 or 4000 level, with at least 12 credits at the 4000 level
Honours Double Major BSc	42 credits; including 18 credits at the 3000 or 4000 level, with at least 12 credits at the 4000 level
Honours Major/Minor Bsc	42 credits, including 12 credits at the 4000 level in the major and 30 credits, normally including 6 credits at the 4000 level, in the minor
Laboratory Requirement	
	6 credits from courses with laboratories at the 1000-level in any of the following areas: biology, chemistry and physics (Biology, Chemistry and Physics programs require 6 additional credits outside the major)
Upper Level Requirements	
90 credit BSc	18 credits at the 3000 or 4000 level including 12 credits in the major.
120 credit Specialized Honours BSc and Honours BSc degrees	42 credits at the 3000 or 4000-level. This includes the 18 credits at 3000 and 4000 level in the major and minor listed above.
General Education Requirements	
	27 credits in total as follows: • 12 credits in human enquiry outside of science disciplines. • 6 credits in math at the 1000 level (excluding remedial courses); • 3 credits in computer science at the 1000 level; and • 6 credits from courses with laboratories at the 1000-level in any of the following areas: biology, chemistry and physics.
Science Requirement Outside the Major Program	
90 Credit BSc	24 credits in science disciplines outside the major, of which 3 credits must be at the 2000 level or above, which may include: -science credits in the General Education requirements that are <u>not in the major</u>; and -science credits required by the major that are <u>not in the major discipline</u>.
120 credit Specialized Honours BSc and Honours BSc degrees *Not applicable to double major and major/minor programs.*	24 credits in science disciplines outside the major, of which 3 credits must be at the 2000 level or above, which may include: -the science credits in the General Education requirements that are <u>not in the major</u>; and -science credits required by the major that are <u>not in the major discipline</u>.
Residency Requirement	
	A minimum of 30 course credits and at least half (50 per-cent) of the course credits required in each undergraduate degree program major/minor must be taken at York University.

Appendix C

Course Descriptions

MATH 1021 3.00 FW
Linear Algebra I
Linear equations, matrices, Gaussian elimination, determinants and vector spaces. This course covers material similar to that in SC/MATH 2221 3.00 but at a more advanced level. Required in Specialized Honours statistics and in all applied mathematics, mathematics and mathematics for commerce programs except the BA Program in Mathematics for Commerce. Prerequisite: One 12U or OAC mathematics course or equivalent. Course credit exclusions: SC/MATH 1025 3.00, SC/MATH 2021 3.00, SC/MATH 2221 3.00, GL/MATH/MODR 2650 3.00.

MATH 1131 3.00 FW
Introduction to Statistics I
Displaying and describing distributions; relations in categorical data; Simpson's paradox and the need for design; experimental design and sampling design; randomization; probability laws and models; central limit theorem; statistical inference including confidence intervals and tests of significance; matched pairs; simulation. Prerequisite: At least one 12U mathematics course or OAC in mathematics is recommended. Course credit exclusion: SC/MATH 2560 3.00, GL/MATH/MODR 1610 3.00.

MATH 1200 3.00 Y
Problems, Conjectures and Proofs
Extended exploration of elementary problems leading to conjectures, partial solutions, revisions, and convincing reasoning, and hence to proofs. Emphasis on problem solving, reasoning, and proving. Regular participation is required. Prerequisite: 12U Advanced Functions (MHF4U) or Advanced Functions and Introductory Calculus (MCB4U).
NCR note: Not open to any student who is taking or has passed a MATH course at the 3000 level or higher.

MATH 1300 3.00 FW
Differential Calculus with Applications
Limits, derivatives with applications, antiderivatives, fundamental theorem of calculus, beginnings of integral calculus. Prerequisite: SC/MATH 1515 3.00 SC/MATH 1520 3.00 or SC/MATH 1710 6.00 or a high school calculus course. Course credit exclusions: SC/MATH 1000 3.00, SC/MATH 1013 3.00, SC/MATH 1505 6.00, SC/MATH 1513 6.00, SC/MATH 1530 3.00, SC/MATH 1550 6.00, GL/MATH/MODR 1930 3.00, AP/ECON 1530 3.00.

MATH 1310 3.00 FW
Integral Calculus with Applications
Transcendental functions, differential equations, techniques of integration, improper integrals, infinite series. Prerequisite(s): One of SC/MATH 1000 3.00, SC/MATH 1013 3.00, SC/MATH 1300 3.00, or SC/MATH 1513 6.00; or, for non-science students only, six credits from SC/MATH 1530 3.00 and SC/MATH 1540 3.00, SC/MATH 1550 6.00, AP/ECON 1530 3.00 and AP/ECON 1540 3.00. Course credit exclusions: SC/MATH 1010 3.00, SC/MATH 1014 3.00, SC/MATH 1505 6.00,

GL/MATH/MODR 1940 3.00.

MATH 2022 3.00 W
Linear Algebra II
Inner product spaces, linear transformations, eigenvalues, diagonalization, least squares, quadratic forms and Markov chains. Similar to MATH 2222 3.00 but at a more advanced level. Required in Specialized Honours applied mathematics, Specialized Honours statistics and in all mathematics and mathematics for commerce programs except the BA program in mathematics for commerce. Prerequisite: one of SC/MATH 1021 3.00, SC/MATH 2021 3.00, GL/MATH/MODR 2650 3.00 or permission of the course coordinator. Course credit exclusions: SC/MATH 2222 3.00, GL/MATH/MODR 2660 3.00.

MATH 2030 3.00 FW
Elementary Probability
Introduction to the theory of probability as preparation for further study in either mathematical or applied probability and statistics. Topics include probability spaces, conditional probability, independence, random variables, distribution functions, expectation, Chebyshev's inequality, common distributions, moment-generating functions and limit theorems. Prerequisite: One of SC/MATH 1010 3.00, SC/MATH 1014 3.00, SC/MATH 1310 3.00.

MATH 2310 3.00 F
Calculus of Several Variables with Applications
Vector functions, partial derivatives, gradient, multiple integrals, line integrals, optimization, applications. Prerequisite: SC/MATH 1010 3.00 or SC/MATH 1014 3.00 or SC/MATH 1310 3.00. Students should have a knowledge of vector algebra in two and three dimensions. Course credit exclusions: SC/MATH 2010 3.00, SC/MATH 2015 3.00, GL/MATH/MODR 2670 3.00, GL/MATH 3200 3.00.

MATH 2001 3.00 F
Real Analysis I
Axioms for, and properties of, the real numbers; sequences; functions of a real variable, continuity, and differentiation. Rigorous definitions of convergence and limit underpin a proof-based treatment of the subject material. Intended for Honours students in Mathematics. Prerequisites: SC/MATH 1200 3.00, SC/MATH 1300 3.00. Course credit exclusion: SC/MATH 3110 3.00. NCR note: MATH 2001 3.00 is not open to any student who has passed MATH 1010 3.00

MATH 2041 3.00 F
Symbolic Computation Laboratory I
An introduction to symbolic computing in the Maple environment. Topics from single-variable differential and integral calculus, including simple ordinary differential equations, are covered. Both mathematical understanding and applications are emphasized. Three lecture hours, open laboratory hours. One term. Three credits. Prerequisites: SC/CSE 1540 3.00 (formerly COSC) or equivalent computing experience; SC/MATH 1010 3.00 or SC/MATH 1014 3.00 or SC/MATH 1310 3.00.

MATH 2270 3.00 W
Differential Equations
Introduction to differential equations, including a discussion of the formation of mathematical models for real phenomena; solution by special techniques; applications; linear equations; solutions in series; other topics if time permits. Prerequisites: One of SC/MATH 2010 3.00, SC/MATH 2015 3.00 or

SC/MATH 2310 3.00; one of SC/MATH 1021 3.00, SC/MATH 1025 3.00, or SC/MATH 2221 3.00. Course credit exclusion: SC/MATH 2271 3.00, GL/MATH 3400 3.00

MATH 3010 3.00 F
Vector Integral Calculus
Integrability of continuous functions over suitable domains, iterated integrals and Fubini's theorem, counterexamples, change of variables, Jacobian determinants, polar and spherical coordinates, volumes, vector fields, divergence, curl, line and surface integrals, Green's and Stokes's theorems, differential forms, general Stokes's theorem. Prerequisite: SC/MATH 2010 3.00, or SC/MATH 2310 3.00; or SC/MATH 2015 3.00 and written permission of the mathematics undergraduate director (normally granted only to students proceeding in Honours programs in mathematics or in the Specialized Honours program in statistics). Prerequisite or corequisite: SC/MATH 2022 3.00 or SC/MATH 2222 3.00.

MATH 3050 6.00 Y
Introduction to Geometries
Analytic geometry over a field with vector and barycentric coordinate methods, affine and projective transformations, inversive geometry, foundations of Euclidean and non-Euclidean geometry, applications throughout to Euclidean geometry. Prerequisite: SC/MATH 2022 3.00 or SC/MATH 2222 3.00 or permission of the course coordinator.

MATH 3090 3.00 F
Computational Mathematics
Modelling (discrete and continuous, deterministic and stochastic) and practical solutions to general categories of applied problems. Case studies of solutions through modelling and representation of data. Implementation, numerical considerations, efficiency, and application of numerical algorithms. Three lecture hours per week. Prerequisites: SC/MATH 2022 3.00; SC/MATH 2030 3.00; SC/CSE 1560 3.00, or SC/CSE 2031 3.00 and SC/MATH 2041 3.00, or SC/CSE 1540 3.00 and SC/MATH 2041 3.00.

MATH 3170 6.00 Y
Operations Research I
A study of linear programming; transportation problems, including network flows, assignment problems and critical path analysis; integer programming; dynamic programming and an introduction to stochastic models. Application to a set of problems representative of the field of operations research. Prerequisites: SC/MATH 1021 3.00 or SC/MATH 1025 3.00 or SC/MATH 2221 3.00; one of SC/CSE 1520 3.00, SC/CSE 1540 3.00 or SC/CSE 1020 3.00 or equivalent. Course credit exclusions: SC/MATH 2751 3.00, AP/ECON 3120 3.00, AP/ADMS 3331 3.00, AP/ADMS 3351 3.00, GL/MATH 3660 6.00.

MATH 3241 3.00 F
Numerical Methods I
(same as CSE 3121 3.00)
An introductory course in computational linear algebra. Topics include simple error analysis, linear systems of equations, non-linear equations, linear least squares and interpolation. Prerequisites: One of SC/MATH 1010 3.00, SC/MATH 1014 3.00, SC/MATH 1310 3.00; one of SC/MATH 1021 3.00, SC/MATH 1025 3.00, SC/MATH 2221 3.00; one of SC/CSE 1540 3.00, SC/CSE 2031 3.00, or SC/CSE 2501 1.00. Course credit exclusion: SC/COSC 3121 3.00.

MATH 3242 3.00 W

Numerical Methods II
(same as CSE 3122 3.00)
Algorithms and computer methods for solving problems of differentiation, integration, systems of non-linear equations and matrix eigenvalues. Prerequisite: SC/MATH 3241 3.00 or SC/CSE 3121 3.00. Course credit exclusion: SC/COSC 3122 3.00.

MATH 3260 3.00 W
Introduction to Graph Theory
Introductory graph theory with applications. Graphs, digraphs. Eulerian and Hamiltonian graphs. The travelling salesman. Path algorithms; connectivity; trees; planarity; colourings; scheduling; minimal cost networks. Tree searches and sortings, minimal connectors and applications from physical and biological sciences. Prerequisite: At least six credits from 2000-level mathematics courses without second digit 5.

MATH 3271 3.00 F
Partial Differential Equations
Partial differential equations of mathematical physics and their solutions in various coordinates, separation of variables in Cartesian coordinates, application of boundary conditions; Fourier series and eigenfunction expansions; generalized curvilinear coordinates; separation of variables in spherical and polar coordinates. Prerequisites: SC/MATH 2270 3.00; SC/MATH 2010 3.00 or SC/MATH 2015 3.00 or SC/MATH 2310 3.00; SC/MATH 3010 3.00 is also desirable, though not essential, as prerequisite for students presenting SC/MATH 2010 3.00 or SC/MATH 2310 3.00.

MATH 3410 3.00 W
Complex Variables
Analytic functions, the Cauchy-Riemann equations, complex integrals, the Cauchy integral theorem, maximum modulus theorem. Calculations of residues and applications to definite integrals, two-dimensional potential problems and conformal mappings. Prerequisite: SC/MATH 2010 3.00 or SC/MATH 2015 3.00 or SC/MATH 2310 3.00. (SC/MATH 3010 3.00 is also recommended as a prerequisite for students who have taken SC/MATH 2010 3.00.) Course credit exclusion: GL/MATH 4230 3.00.

MATH 4000 3.00 FW and 6.00 Y
Individual Project
A project of a pure or applied nature in mathematics or statistics under the supervision of a faculty member. The project allows the student to apply mathematical or statistical knowledge to problems of current interest. A report is required at the conclusion of the project. Prerequisites: Open to all students in Honours programs in the Department of Mathematics and Statistics. Permission of the program director is required. Applied mathematics students can enrol only after they have completed the core program in applied mathematics.

MATH 4090 3.00 W
Mathematical Modelling
Discrete, continuous and probabilistic modelling of problems from industry, finance and the life and physical sciences. The ability to model complex problems is stressed. Three lecture hours. One term. Three credits. Note: Registration required in an Honours Program in Mathematics and Statistics, and the completion of all specified core courses in that program.

MATH 4170 6.00 Y
Operations Research II
(same as GS/MATH 6900 3.00 plus
GS/MATH 6901 3.00)
Selected topics from game theory, decision theory, simulation, reliability theory, queuing theory, non-linear programming, classification, pattern-recognition and prediction. Each chapter contains an optimization problem and methods and algorithms for solving it. The course is rich in examples. Prerequisites: SC/MATH 2010 3.00 or SC/MATH 2015 3.00 or SC/MATH 2310 3.00; SC/MATH 2030 3.00; SC/MATH 3170 6.00; or permission of the course coordinator. Course credit exclusion: AS/MATH 4570 6.00.

MATH 4271 3.0 W
MATH 3270 3.0 - before 1998/99
Dynamical Systems
Iterations of maps and differential equations; phase portraits, flows; fixed points, periodic solutions and homoclinic orbits; stability, attraction, repulsion; Poincaré maps, transition to chaos. Applications: logistic maps, interacting populations, reaction kinetics, forced Van der Pol, damped Duffing, and Lorenz equations. Students who have not passed MATH 3210 must obtain permission of the instructor to enrol. Prerequisite:AS/SC/MATH 2021.03 or AS/SC/AK/MATH 2221.03 or AS/SC/MATH 1025.03; AS/SC/AK/MATH 2270.03. Exclusion:AS/SC/AK/MATH 3270 3.0

MATH 4430 3.0 W
Stochastic Processes
Basic stochastic processes, including Markov chains, Poisson processes, and birth-death processes. Topic from queues, renewal processes, stationary processes, Brownian motion. Prerequisite:AS/SC/AK/ MATH 2030 3.0.

MATH 4431 3.0
Probability Models
This course introduces the theory and applications of several kinds of probabilistic models, including renewal theory, branching processes and martingales. Additional topics may include stationary processes, large deviations from the sciences. Prerequisite:AS/SC/AK/ MATH 2030 3.0.

Proposed new courses

MATH 32xx 3.0
Mathematical Biology I (see attached new course proposal)
This course will introduce the student to mathematical modelling with applications in biology in related fields such as chemistry, ecology and health. There is an emphasis on case studies and problem solving skills. Topics include discrete and continuous models describing population dynamics (i.e. logistic model, predator prey), population health, chemical reactions and biological structures. This course is required for the Honours Specialist, the Honours Major, Double Major and Major in a Major/Minor program. It is also listed as a course choice in the Honours Minor requirements. Prerequisites: Registration in an Honours Program in Mathematics and Statistics and the completion of all specified core courses in that program or permission of the instructor.

MATH 42xx 6.0
Practicum in Mathematical Biology
(MATH 4000 will suffice until there is a significant enrolment in the Mathematical Biology program. The MATH 4000 project must include application to biology to substitute for MATH 42xx. No new course proposal is attached here.)
Students in the Honours Specialist, the Honours Major, Double Major and Major in a Major/Minor program in the Mathematical Biology program are required to complete a practicum project in mathematics applied to an area in a biological science. This course is listed as a course choice in the Honours Minor requirements. The student works under the supervision of a faculty member in mathematics on a topic a field of application (Biology, Chemistry or Kinesiology and Health Science). These topics may be provided by faculty members in Biology, Chemistry or Kinesiology and Health Science. These faculty members will also have the opportunity to supervise the project if they are interested. A report is required at the conclusions of the project as well as a presentation. The amount of work expected of the student is approximately 10 hours per week. The supervisors are expected to spend about one or two hours per week with the student (together or individually) average over the duration of the project. In addition to the final report, a mid term progress report is required during the course. The final grade will be based upon the final report as well as the interim progress reports. Prerequisites: Open to all students majoring in a Mathematical Biology program who have completed the 3rd year requirements. This course is required for students in the Honours Specialist, the Honours Major, Double Major and Major in a Major/Minor program in Mathematical Biology. However, SC/MATH 4000 6.0 may be used as a substitute if SC/MATH 42xx is not offered.

Named Courses which are not MATH courses

SC/CSE 1560 3.0
Introduction to Computing for Mathematics and Statistics
An introduction to scientific computing using an integrated computing and visualization environment. The course presents computer-based problem-solving techniques through a series of applications rooted in Mathematics and Statistics. Two lecture hours per week and one weekly three hour laboratory session. Prerequisite: SC/MATH 1300 3.00: Corequisites: SC/MATH 1310 3.00; SC/MATH 1131 3.00. Prior to Fall 2009: Prerequisite: AK/AS/SC/MATH 1300 3.00; Corequisites: AK/AS/SC/MATH 1310 3.00; AK/AS/SC/MATH 1131 3.00. Course credit exclusion: SC/CSE 1570 3.00. NCR Note: This course is not open to any student who has passed or is taking SC/PHYS 2030 3.00.

SC/CHEM 1000 3.0
Chemical Structure
Introduction to chemistry with emphasis on physical and electronic structure of matter, including gases, liquids and solids. Topics include behaviour of gases; thermochemistry; atomic structure and periodic table; chemical bonding and architecture; structure of liquids and solids; frontiers of chemistry. Two and one-half lecture hours per week, one tutorial hour per week, six three-hour laboratory sessions. One term. Three credits. Prerequisites: OAC chemistry, 12U chemistry or SC/CHEM 1500 4.00 or equivalent. Course credit exclusions: SC/CHEM 1000 6.00, SC/CHEM 1010 6.00.

SC/CHEM 1001 3.0
Chemical Dynamics
This course complements SC/CHEM 1000 3.00 - with emphasis on chemical change and equilibrium. Topics include chemical kinetics; chemical equilibrium; entropy and free energy as driving forces for chemical change; electrochemistry; frontiers in chemistry. Two and one-half lecture hours per week, one tutorial hour per week, six three-hour laboratory sessions. One term. Three credits. Prerequisites: OAC chemistry, 12U chemistry or SC/CHEM 1500 4.00 or equivalent. Course credit exclusions: SC/CHEM 1000 6.00, SC/CHEM 1010 6.00.

SC/BIOL 1000 3.00
Biology I - Cells, Molecular Biology and Genetics
An introduction to major unifying concepts and fundamental principles of biology, including evolution and cell theory. Topics include cells, biological energetics, metabolism, cell division and genetics. The laboratory and lecture components must be passed independently to pass the course. Three lecture hours per week; three laboratory hours in alternate weeks. One term. Three credits. Prerequisite: OAC Biology or 12U Biology or SC/BIOL 1500 3.00; OAC Chemistry or 12U Chemistry or SC/CHEM 1500 4.00. Course credit exclusions: SC/BIOL 1010 6.00; SC/BIOL 1410 6.00.

SC/BIOL 1001 3.00
Biology II - Evolution, Ecology, Biodiversity and Conservation Biology
A continuation of Biology I, exploring major unifying concepts and fundamental principles of biology, building on earlier concepts. Topics include mechanisms of evolution, ecology, a survey of biodiversity and conservation biology. The laboratory and lecture components must be passed independently to pass the course. Three lecture hours per week; three laboratory hours in alternate weeks. One term. Three credits. Prerequisite: SC/BIOL 1000 3.00. Course credit exclusions: SC/BIOL 1010 6.00; SC/BIOL 1410 6.00.

SC/PHYS 1010 6.00
Physics
Topics include linear, rotational and oscillatory motion; Newtonian mechanics; gravitation; electrostatics; magnetostatics; electric current and induction; heat; geometrical and physical optics and sound. Differential and integral calculus and vector algebra are used. This course covers fewer topics than SC/PHYS 1410 6.00, but covers them in greater depth. It should be taken by all those likely to enrol in 2000-level physics courses. Includes three hour laboratory component normally in alternating weeks. Prerequisite: OAC Physics or 12U Physics or SC/PHYS 1510 4.00. Corequisite(s): SC/MATH 1013 3.00 and SC/MATH 1014 3.00, or SC/MATH 1505 6.00, or equivalents. Course credit exclusions: SC/PHYS 1410 6.00 and SC/PHYS 1420 6.00. Prior to Fall 2009: Prerequisite: OAC Physics or 12U Physics or SC/PHYS 1510 4.00. Corequisite(s): AS/SC/MATH 1013 3.00 and AS/SC/MATH 1014 3.00, or AS/SC/MATH 1505 6.00, or equivalents. Course credit exclusions: SC/PHYS 1410 6.00 and

SC/PHYS 1420 6.00.

SC/PHYS 1410 6.00
Physical Science
A survey of physics. Topics include kinematics, dynamics, momentum and energy for linear and rotational motion; elementary kinetic theory and thermodynamics; static and current electricity; waves and physical and geometrical optics; elements of modern physics. This is a calculus-based course recommended for students unlikely to take 2000-level Physics courses. It includes a three hour laboratory component, normally in alternating weeks. Prerequisites: 12U Physics or OAC Physics or SC/PHYS 1510 4.00; MHF4U Advanced Functions and MCV4U Calculus and Vectors, or 12U Advanced Functions and Introductory Calculus, or OAC Algebra and OAC Calculus, or SC/MATH 1505 6.00, or SC/MATH 1520 3.00. Course credit exclusions: SC/PHYS 1010 6.00, SC/PHYS 1420 6.00

HH/KINE 2011 3.00
Human Physiology I
The focus of this course is the cellular basis of human physiology. Basic principles of physiology are presented from the viewpoint of the simplest structural unit-the cell-in order to provide a sound basis for understanding complex multi-cellular organisms in subsequent courses. Course credit exclusions: AS/HH/SC/KINE 3011 3.00.

HH/KINE 2031 3.00
Human Anatomy
An overview of the organization and structure of the human body. Each of the following systems is examined with respect to cell morphology, cell and tissue arrangement and inter-systems organization: skeletal, muscular, nervous, circulatory, lymphatic, respiratory, urinary, reproductive and endocrine. Three lecture hours per week, two laboratory hours in alternate weeks. One term. Course credit exclusions: AS/SC/KINE 3070 3.00 (prior to Fall/Winter 1997-1998), AS/SC/PHED 2070 3.00 (prior to Fall/Winter 1996-1997), SC/PHED 2070 4.00 (prior to Fall/Winter 1996-1997), AS/PHED 3070 3.00 (prior to Fall/Winter 1996-1997), SC/PHED 3070 4.00 (prior to Fall/Winter 1996-1997), SC/NATS 1650 6.00.

ES/ENVS 1000 6.00
Earth in Our Hands: Introduction to Environmental Studies
This course is designed to provide students with an introductory perspective or framework of understanding for environmental studies at the broadest level. The course introduces students to environmental issues, using the urgent, emerging prospect of the fate of the "Earth in our hands" as the main organizing ethical, scientific and practical theme throughout the year. Course credit exclusion: ES/ENVS 1000 6.00 (prior to 2009)

Appendix C

Calendar Copy for Mathematical Biology BSc

New Copy **Bachelor of Science Programs** The mathematics/statistics core is defined as: SC/MATH 1021 3.00; SC/MATH 1131 3.00; SC/MATH 1200 3.00; SC/MATH 1300 3.00; SC/MATH 1310 3.00; SC/MATH 2022 3.00; SC/MATH 2030 3.00; SC/MATH 2310 3.00	**New Copy** **Bachelor of Science Programs** The mathematics/statistics core is defined as: SC/MATH 1021 3.00; SC/MATH 1131 3.00; SC/MATH 1200 3.00; SC/MATH 1300 3.00; SC/MATH 1310 3.00; SC/MATH 2022 3.00; SC/MATH 2030 3.00; SC/MATH 2310 3.00
	Mathematical Biology This is a mathematics program focusing on the needs of students interested in pursuing careers in medicine, public health, ecology and environmental science. **Specialized Honours (BSc)** A. General Education: • Non-science requirement: 12 credits; • Mathematics: satisfied within the major requirements; • Computer science: SC/CSE 1560 3.00; • Foundational science: SC/CHEM 1000 3.00, SC/CHEM 1001 3.00. B. Major requirements: • SC/BIOL 1000 3.00, SC/BIOL 1001 3.00; • a minimum of 15 additional credits at the 2000 level or higher in Biology courses including at least 9 credits from the 3000 level or higher; • the mathematics/statistics core (24 credits); • SC/MATH 2001 3.00; SC/MATH 2041 3.00; SC/MATH 2270 3.00; • SC/MATH 3010 3.00; SC/MATH 3241 3.00; SC/MATH 32xx 3.00; SC/MATH 3410 3.00; • One of: MATH 3050 6.0 or MATH 3090 3.0 or MATH 3170 6.0 or MATH 3242 3.0 or MATH 3260 3.0 or MATH 3271 3.0 • MATH42xx 6.0 • 6 additional credits selected from MATH 4090 3.0, MATH 4170 6.0, MATH 4271 3.0, MATH 4430 3.0, MATH 4431 3.0, for an overall total of at least 60 credits from

	major mathematics courses; C. Science breadth: satisfied by the above requirements. D. Upper level: a minimum of 42 credits must be at the 3000 level or above. E. Additional elective credits, as required, for an overall total of 120 credits for the Honours program. F. Standing requirements: To proceed in the Specialized Honours program requires in addition to the overall cumulative GPA as established by Senate, a major GPA (defined to include all required Chemistry, Computer Science, Biology, and Mathematics courses) of at least 6.0. To graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a major GPA (as defined above) of at least 6.0 and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. **Honours Major (BSc)** A. General Education: • Non-science requirement: 12 credits; • Mathematics: satisfied within the major requirements; • Computer science: SC/CSE 1560 3.00; • Foundational science: SC/CHEM 1000 3.00, SC/CHEM 1001 3.00. B. Major requirements: • SC/BIOL 1000 3.00, SC/BIOL 1001 3.00; • a minimum of 15 additional credits at the 2000 level or higher in Biology courses including at least 9 credits from the 3000 level or higher; • the mathematics/statistics core (24 credits); • SC/MATH 2041 3.00; SC/MATH 2270 3.00; • SC/MATH 32xx 3.00; • One of: MATH 3090 3.0 or MATH 3170 6.0 or MATH 3241 3.0 or MATH 3260 3.0 or MATH 3271 3.0 • MATH42xx 6.0 • 6 additional credits selected from MATH 4090 3.0, MATH 4170 6.0, MATH 4271 3.0, MATH 4430 3.0, MATH 4431 3.0, for

	an overall total of at least 48 credits from major mathematics courses; C. Science breadth: satisfied by the above requirements. D. Upper level: a minimum of 42 credits must be at the 3000 level or above. E. Additional elective credits, as required, for an overall total of 120 credits for the Honours program. F. Standing requirements: to proceed in the Honours program requires in addition to the overall cumulative GPA as established by Senate, a major GPA (defined to include all required Chemistry, Computer Science, Biology, and Mathematics courses) of at least 6.0. To graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a major GPA (as defined above) of at least 6.0 and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. **Honours Double Major and Major/Minor (BSc)** A. General Education: • Non-science requirement: 12 credits; • Mathematics: satisfied within the major requirements; • Computer science: SC/CSE 1560 3.00; • Foundational science: SC/CHEM 1000 3.00, SC/CHEM 1001 3.00. B. Major requirements: When the second major or the minor is neither Biology nor Kinesiology: • SC/BIOL 1000 3.00, SC/BIOL 1001 3.00; • a minimum of 15 additional credits at the 2000 level or higher in Biology courses including at least 9 credits from the 3000 level or higher; • the requirements of the second major; • When the second major or the minor is either Biology or Kinesiology: • SC/BIOL 1000 3.00, SC/BIOL 1001 3.00; • the requirements of either the Biology or the Kinesiology major; • Plus • the mathematics/statistics core (24 credits);

- SC/MATH 2041 3.00; SC/MATH 2270 3.00;
- SC/MATH 32xx 3.00;
- One of: MATH 3090 3.0 or MATH 3170 6.0 or MATH 3241 3.0 or MATH 3260 3.0 or MATH 3271 3.0;
- MATH 42xx 6.0;
- 6 additional credits selected from MATH 4090 3.0, MATH 4170 6.0, MATH 4271 3.0, MATH 4430 3.0, MATH 4431 3.0, for an overall total of at least 48 credits from major mathematics courses.

C. Science breadth: satisfied by the above requirements.

D. Upper level: a minimum of 42 credits must be at the 3000 level or above.

E. Additional elective credits, as required, for an overall total of 120 credits for the Honours program.

F. Standing requirements: to proceed in the Honours program requires in addition to the overall cumulative GPA as established by Senate, a major GPA (defined to include all required Chemistry, Computer Science, Biology, and Mathematics courses) of at least 6.0. To graduate in an Honours program requires successful completion of all Faculty requirements and departmental required courses, a major GPA (as defined above) of at least 6.0 and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

Honours Minor (BSc)

The Honours Minor may only be combined with a Biology major or a Kinesiology major.

A. General Education:

- Non-science requirement: 12 credits;
- Mathematics: satisfied within the major requirements;
- Computer science: SC/CSE 1560 3.00;
- Foundational science: SC/CHEM 1000 3.00, SC/CHEM 1001 3.00.

B. Major requirements:

- MATH 1021 3.0; MATH 1300 3.0; MATH 1310 3.0;
- MATH 2310 3.0;
- MATH 32xx 3.0

	• 6 additional credits from MATH 2022 3.0, MATH 2030 3.0, MATH 2041 3.0, MATH 2222 3.0, MATH 2270 3.0; • 3 additional credits from MATH 3090 3.0, MATH 3170 6.0, MATH 3241 3.0, MATH 3242 3.0, MATH; • 6 additional credits from MATH 4090 3.0, MATH 4170 3.0, MATH 4430 3.0, MATH 4431 3.0, MATH 42xx 6.0; • the requirements of the Biology or Kinesiology major; C. Science breadth: satisfied by the above requirements. D. Upper level: a minimum of 42 credits must be at the 3000 level or above. E. Additional elective credits, as required, for an overall total of 120 credits for the Honours program. F. Standing requirements: as specified by the major.

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16. Canadian-universities.net, Canada's Higher Education & Career Guide. http://www.canadian-universities.net/Universities/Programs/Mathematical_Biology-Ontario.html

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MEMORANDUM

To: Rhonda Lenton, Vice President, Academic and Provost

From: Ray Jayawardhana, Dean

Date: September 30, 2014

Subject: Proposal for a BSc program in Mathematical Biology

I am pleased to add my strong support for the proposed BSc program in Mathematical Biology, to be offered in the Department of Mathematics and Statistics within the Faculty of Science.

This compelling proposal brings together relevant existing courses (that have additional capacity) with two new course offerings to create a coherent, exciting, interdisciplinary program. Furthermore, it aims to leverage the world-class research strength at York in this area, particularly in the Centre for Disease Modelling, to attract and benefit high-performing undergraduates. The graduates of the program would be well positioned for a wide range of careers and graduate/professional schools. The proposal also advances the Faculty's goals of raising the profile of sciences at York and of recruiting top students, through innovative curricular offerings and experiential learning opportunities.

One concern, also noted by the external reviewer, is the difficulty of assessing student demand. My sense is that it will be possible to reach the anticipated enrollment levels through vigorous promotion of the program, for example, by offering a week-long module in the Faculty-run Helix summer science institute for high school students and workshops on related topics for teachers on campus or as part of professional association meetings (e.g., Science Teachers Association of Ontario annual conference). Elucidating the varied opportunities for graduates of the program, perhaps with data/insights from the Society for Mathematical Biology, may also help.

I appreciate the initiative taken by faculty members in Mathematics and Statistics in developing this excellent program proposal, and look forward to its successful implementation.

7.2.2

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree

Department: Biology

Date of Submission: September, 2014

Course Number:

Effective Session: F/W 2015

Course Title: Bachelor of Science in Environmental Biology

Type of Change:

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

Change From:	To:
See attached document for calendar copy	

Rationale: This is a minor change to Enviromental Biology programs to reflect changes in courses resulting from a curriculum review in 2013-14. Two courses (BIOL 4080 and BIOL4090) have been changed to 3000 level courses (BIOL 3080 and BIOL 3090). We are adding a course BIOL 3270 to the list of options, and are changing the course SC/BIOL 3250 to its ENVB crosslist ENVB 3250 4.0.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Existing	Proposed
SCIENCE – ENVIRONMENTAL BIOLOGY The program core (35 or 36 credits) is defined as: • SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 (or SC/BIOL 1010 6.00); • 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: 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 2070 3.00, SC/CHEM 2020 3.00, SC/CHEM 2021 3.00; • SC/ENVB 3001 2.00 or SC/ENVB 3001 3.00; SC/BIOL 3170 3.00; • SC/BIOL 4245 3.00; SC/BIOL 4255 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, 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; • computer science: LE/EECS 1520 3.00 or LE/EECS 1530 3.00 or LE/EECS	**SCIENCE – ENVIRONMENTAL BIOLOGY** The program core (35 or 36 credits) is defined as: • SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 (or SC/BIOL 1010 6.00); • 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: 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 2070 3.00, SC/CHEM 2020 3.00, SC/CHEM 2021 3.00; • SC/ENVB 3001 2.00 or SC/ENVB 3001 3.00; SC/BIOL 3170 3.00; • SC/BIOL 4245 3.00; SC/BIOL 4255 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, 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; • 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. B. Major requirement: • the program core, as specified above (35 or 36 credits); • additional credits from the following list of courses for an overall total of at least 42 credits from environmental biology and biology courses of which at least 12 credits are at the 3000 or higher level: SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/BIOL 3150 4.00, SC/BIOL 3200 3.00, SC/BIOL 3250 3.00, SC/BIOL 3500 3.00, SC/ENVB 4080 3.00, SC/BIOL 4085 3.00, SC/ENVB 4090 4.00, SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00; • SC/GEOG 1400 6.00. C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied by the above requirements. D. Upper level: a minimum of 18 credits at the 3000 level or above. E. Additional elective 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** **Honours Major Program**	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. B. Major requirement: • the program core, as specified above (35 or 36 credits); • additional credits from the following list of courses for an overall total of at least 42 credits from environmental biology and biology courses of which at least 12 credits are at the 3000 or higher level: : SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/ENVB 3080, 3.00, SC/ENVB 3090 4.00 SC/BIOL 3150 4.00, SC/BIOL 3200 3.00, SC/ENVB 3250 4.00, SC/ENVB 3270 3.00, SC/BIOL 3500 3.00, ~~SC/ENVB 4080 4.00~~, SC/BIOL 4085 3.00, ~~SC/ENVB 4090 4.00,~~ SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00; • SC/GEOG 1400 6.00. C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied by the above requirements. D. Upper level: a minimum of 18 credits at the 3000 level or above. E. Additional elective 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**

A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00, 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. **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. B. Major requirements: • The program core as specified above (35 or 36 credits); • SC/ENVB 4700 3.00; • additional credits from the following list of courses for an overall total of at least 51 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level: SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/BIOL 3150 4.00, SC/BIOL 3200 3.00, SC/BIOL 3250 3.00, SC/BIOL 3500	**Honours Major Program** A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00, 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. **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. B. Major requirements: • The program core as specified above (35 or 36 credits); • SC/ENVB 4700 3.00; • additional credits from the following list of courses for an overall total of at least 51 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level: SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/ENVB

3.00, SC/ENVB 4080 3.00, SC/BIOL 4085 3.00, SC/ENVB 4090 4.00, SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00; • SC/GEOG 1400 6.00. C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied by the above requirements. D. Upper level: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required, for an overall minimum total of 85 credits from science disciplines (including the major) and 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, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. **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 under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section of this calendar. A. General education: • non-science requirement: 12 credits. ES/ENVS 1000, 6.00 ES/ENVS 1000 6.00 is recommended for	3080, 3.00, SC/ENVB 3090 4.00 SC/BIOL 3150 4.00, SC/BIOL 3200 3.00, SC/ENVB 3250 4.00, SC/ENVB 3270 3.00, SC/BIOL 3500 3.00, ~~SC/ENVB 4080 4.00~~, SC/BIOL 4085 3.00, ~~SC/ENVB 4090 4.00,~~ SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00; • SC/GEOG 1400 6.00. C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied by the above requirements. D. Upper level: a minimum of 42 credits at the 3000 level or above. E. Additional elective credits, as required, for an overall minimum total of 85 credits from science disciplines (including the major) and 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, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. **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 under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section of this calendar.

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. B. Major requirements: • SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00; • SC/ENVB 2050 4.00; SC/BIOL 2060 3.00; any two of 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 2070 3.00. Both SC/CHEM 2020 3.00 and SC/CHEM2021 3.00 may replace one of these two biology courses; • SC/ENVB 3001 2.00 or SC/ENVB 3001 3.00; • additional credits from the following list of courses for an overall total of at least 42 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level: SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/BIOL 3150 4.00, SC/BIOL 3200 3.00, SC/BIOL 3250 3.00, SC/BIOL 3500	A. General education: • non-science requirement: 12 credits. ES/ENVS 1000, 6.00 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. B. Major requirements: • SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00; • SC/ENVB 2050 4.00; SC/BIOL 2060 3.00; any two of 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 2070 3.00. Both SC/CHEM 2020 3.00 and SC/CHEM2021 3.00 may replace one of these two biology courses; • SC/ENVB 3001 2.00 or SC/ENVB 3001 3.00; • additional credits from the following list of courses for an overall total of at least 42 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level,

3.00, SC/ENVB 4080 3.00, SC/BIOL 4085 3.00, SC/ENVB 4090 4.00, SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00; C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the above requirements. Satisfied if the second major is another science discipline. D. Upper level: 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, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. **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 under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section of this calendar. A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00, ES/ENVS 1000 6.00 is recommended for students interested in taking additional environmental studies courses:	of which at least 12 credits must be at the 4000 level: SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/ENVB 3080, 3.00, SC/ENVB 3090 4.00 SC/BIOL 3150 4.00, SC/BIOL 3200 3.00, SC/ENVB 3250 4.00, SC/ENVB 3270 3.00, SC/BIOL 3500 3.00, ~~SC/ENVB 4080 4.00~~, SC/BIOL 4085 3.00, ~~SC/ENVB 4090 4.00,~~ SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00; • C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 15 of these 24 credits are satisfied by the above requirements. Satisfied if the second major is another science discipline. D. Upper level: 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, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed. **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 under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section of this

• 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. B. Major requirements: • the program core as specified above (35 to 36 credits); • SC/ENVB 4700 3.00; • additional credits from the following list of courses for an overall total of at least 51 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level: SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/BIOL 3150 4.00, SC/BIOL 3200 3.00, SC/BIOL 3250 3.00, SC/BIOL 3500 3.00, SC/ENVB 4080 3.00, SC/BIOL 4085 3.00, SC/ENVB 4090 4.00, SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00; • SC/GEOG 1400 6.00; • the course requirements for the minor. C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied	calendar. A. General education: • non-science requirement: 12 credits. ES/ENVS 1000 6.00, 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. B. Major requirements: • the program core as specified above (35 to 36 credits); • SC/ENVB 4700 3.00; • additional credits from the following list of courses for an overall total of at least 51 credits from environmental biology and biology courses, including at least 18 credits at the 3000 or higher level, of which at least 12 credits must be at the 4000 level: : SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/ENVB 3080, 3.00, SC/ENVB 3090 4.00 SC/BIOL 3150 4.00, SC/BIOL 3200 3.00, SC/ENVB 3250 4.00, SC/ENVB 3270 3.00, SC/BIOL 3500 3.00, ~~SC/ENVB 4080 4.00~~,

by the above requirements. Satisfied if the minor is another science discipline.

D. Upper level: 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, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

Honours Minor

An Honours minor in environmental biology may be combined with an Honours major in another subject area. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section of this calendar.

- SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00;
- SC/ENVB 2050 4.00; SC/BIOL 2060 3.00; any two of 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. (Both SC/CHEM 2020 3.00 and SC/CHEM 2021 3.00 may substitute for one of these two biology courses.);
- SC/ENVB 3001 2.00 or SC/ENVB 3001 3.00;
- additional credits from the following list of courses for an overall total of at least nine credits from environmental biology and biology courses at the 3000 or 4000 level; SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/BIOL 3150 4.00, SC/BIOL 4085 3.00, ~~SC/ENVB 4090 4.00,~~ SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00;
- SC/GEOG 1400 6.00;
- the course requirements for the minor.

C. Science breadth: 24 credits in science disciplines outside the major, of which three credits must be at the 2000 level or above. 21 of these 24 credits are satisfied by the above requirements. Satisfied if the minor is another science discipline.

D. Upper level: 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, a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all environmental biology and biology courses completed, and a minimum cumulative credit-weighted grade point average of 5.00 (C+) over all courses completed.

Honours Minor

An Honours minor in environmental biology may be combined with an Honours major in another subject area. Possible subject combinations are listed under Undergraduate Degree Programs in the Faculty of Science Undergraduate Degree and Certificate Programs section of this calendar.

- SC/BIOL 1000 3.00 and SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00;
- SC/ENVB 2050 4.00; SC/BIOL 2060 3.00; any two of 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. (Both SC/CHEM 2020 3.00 and

SC/BIOL 3200 3.00, SC/BIOL 3250 3.00, SC/BIOL 3500 3.00, SC/ENVB 4080 3.00, SC/BIOL 4085 3.00, SC/ENVB 4090 4.00, SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00; • additional credits from the above listed environmental biology and biology courses at the 2000 or higher level, as required for an overall total of at least 30 environmental biology or biology credits.	SC/CHEM 2021 3.00 may substitute for one of these two biology courses.); • SC/ENVB 3001 2.00 or SC/ENVB 3001 3.00; • additional credits from the following list of courses for an overall total of at least nine credits from environmental biology and biology courses at the 3000 or 4000 level; : SC/ENVB 3002 2.00, SC/ENVB 3002 3.00, SC/ENVB 3080, 3.00, SC/ENVB 3090 4.00 SC/BIOL 3150 4.00, SC/BIOL 3200 3.00, SC/ENVB 3250 4.00, SC/ENVB 3270 3.00, SC/BIOL 3500 3.00, ~~SC/ENVB 4080 4.00~~, SC/BIOL 4085 3.00, ~~SC/ENVB 4090 4.00,~~ SC/ENVB 4095 3.00, SC/ENVB 4230 4.00, SC/ENVB 4250 3.00, SC/ENVB 4265 3.00, SC/BIOL 4305 3.00, SC/BIOL 4390 3.00; • additional credits from the above listed environmental biology and biology courses at the 2000 or higher level, as required for an overall total of at least 30 environmental biology or biology credits.

7.2.3

Form 2

Revised form Oct. 3/2002

Faculty of Science + Engineering
Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Environmental Science

Date of Submission: October 20, 2014

Course Number: ENVS 4447

Effective Session: FW2015-2016

Course Title: Northern Ecosystems

Type of Change:

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

Change From:

To:

additional requirements

12 additional SC/GEOG credits at the 2000 level or higher

These credits can be taken from the SC/GEOG courses listed above as well as from the following SC/GEOG courses:

SC/GEOG2340 3.0	Geoinformatics: Introduction
SC/GEOG2600 3.0	Geomorphology I
SC/GEOG2610 3.0	Geomorphology II
SC/GEOG3340 3.0	Geoinformatics: GIS I
SC/GEOG3360 3.0	Morphogenesis of Soils
SC/GEOG3440 3.0	Geoinformatics: Remote Sensing I
SC/GEOG3500 3.0	Biogeography (cross-listed with SC/BIOL 3500)
SC/GEOG3510 3.0	Methods of Sediment
SC/GEOG3540 3.0	Research Design and Field Studies in Physical Geography
SC/GEOG3700 3.0	Disaster! The Earth's Extreme Natural Events
SC/GEOG3900 3.0	Physical Geography of the City
SC/GEOG4000 6.0	Honours Thesis
SC/GEOG4215 3.0	Ecological Climatology
SC/GEOG4340 3.0	Geoinformatics: GIS II
SC/GEOG4440 3.0	Geoinformatics: Remote Sensing II
SC/GEOG4500 3.0	Northern Forest Environments
SC/GEOG4541 3.0	Advanced Field Studies in Physical Geography

additional requirements

12 additional SC/GEOG credits at the 2000 level or higher

These credits can be taken from the SC/GEOG courses listed above as well as from the following SC/GEOG courses:

SC/GEOG2340 3.0	Geoinformatics: Introduction
SC/GEOG2600 3.0	Geomorphology I
SC/GEOG2610 3.0	Geomorphology II
SC/GEOG3180 3.0	Geoinformatics: GIS I
SC/GEOG3360 3.0	Morphogenesis of Soils
SC/GEOG3440 3.0	Geoinformatics: Remote Sensing I
SC/GEOG3500 3.0	Biogeography (cross-listed with SC/BIOL 3500)
SC/GEOG3510 3.0	Methods of Sediment
SC/GEOG3540 3.0	Research Design and Field Studies in Physical Geography
SC/GEOG3700 3.0	Disaster! The Earth's Extreme Natural Events
SC/GEOG3900 3.0	Physical Geography of the City
SC/GEOG4000 6.0	Honours Thesis
SC/GEOG4215 3.0	Ecological Climatology
SC/GEOG4340 3.0	Geoinformatics: GIS II
SC/GEOG4440 3.0	Geoinformatics: Remote Sensing II
ES/ENVS 4447 3.0	Northern Ecosystems
SC/GEOG4500 3.0	Northern Forest Environments
SC/GEOG4541 3.0	Advanced Field Studies in Physical Geography

Rationale:

The Life Science stream of the Environmental Science degree program; would offer an enriched suite of upper level course offerings available to senior undergraduate students by including the Environmental Studies course ENVS 4447- Northern Ecosystems. Thematically this course addresses several issues of importance to rapidly changing northern ecosystems as a result of climate change namely, how species have adapted to arctic environments and how these species are responding to recent environmental change. The course complements other course offerings within the program focusing on Arctic hydrology and high latitude climates.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.4

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)	STS Department, Division of Natural Science (NATS)
Date of Submission:	August 2014
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	NATS 1505
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	Understanding Cyberspace
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Understanding Cyberspace

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 examines the development, impact and use of current information and communications technologies (ICTs) that we use in our everyday lives. We will explore how social values have shaped these systems, and how these technologies have helped transform the way we communicate, work, play, think and process information. Topics that will be examined include wireless communications, cyber sociability, ICTs and cognitive and behavioral change, digital information multitasking, online privacy and internet management and control.

Prerequisites: None
Corequisites: None

CCE: SC/NATS 1700 6.0

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.

STEACIE SCIENCE & ENGINEERING LIBRARY
YORK UNIVERSITY

MEMORANDUM

To: Paul Delaney, Director, Division of Natural Science, Faculty of Science & Engineering

From: Sarah Shujah, Science Librarian

Re: NATS1505 – Understanding Cyberspace

Date: September 24, 2014

I have reviewed the course proposal and attached bibliography for **NATS1505 – Understanding Cyberspace** and can state that the York University Libraries have the required resources to support this undergraduate level course.

Please be aware that the library offers the following services to help students with their ICT Controversy Paper and Tutorial assignments:

- A librarian can go to the classroom or tutorial and introduce students to the various resources available at the library including electronic journals, newspaper indexes and other databases.
- The other option is to hold a tutorial session for each tutorial section in the library computer lab to provide a hands-on learning opportunity for students to research resources in the library.
- A librarian is also available for individual consultations with students to help them find the materials they need for their research.
- A librarian can be available as a user on the course Moodle page to answer student questions using the Forum discussion, provide links to resources in the course, and post handouts presented in face-to-face instruction.

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

- **Scopus** is the world's largest abstract and citation database of peer-reviewed literature. It has many articles that are relevant to natural science, and information and communication technologies (ICT's). Additionally, it contains citation information.
- **Web of Science** is an extensive database that has very good coverage of sciences including science and technology issues. Additionally, it allows for citation search.
- **IEEE Xplore**: This database provides full text of journals and conferences relevant to ICT's. This includes IEEE Technology and Society magazine, a good resource for popular news on the social values that shape science.
- **General Science Abstracts** is appropriate for beginning undergraduate science and natural science students who need to search general science topics.
- **Scholars Portal** is a single search screen that provides access to multiple databases for searching literature in a variety of disciplines. This is an excellent extensive resource suitable for first year students learning the research process.

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

- Natural Sciences LibGuide http://researchguides.library.yorku.ca/nats
- Science and Technology LibGuide http://researchguides.library.yorku.ca/sts

Please note that the Steacie and Scott Libraries have 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,

Sarah Shujah, Science Librarian
Steacie Science & Engineering Library
416-736-2100 x33945
sshujah@yorku.ca

Expanded Course Description:

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

This course examines the development, impact and use of current information and communications technologies (ICTs) that we use in our everyday lives. Topics that will be examined include wireless communications, cyber sociability, ICTs and cognitive and behavioral change, digital information multitasking, online privacy and internet management and control. By the end of this course, students will learn how social values (including cultural, legal, political and economic influences) have shaped these systems, and how these technologies have helped transform the way we communicate, work, play, think and process information.

Lecture Topics (Please note that each topic will cover 1-2 lectures):

1. Understanding Information and Communication Technologies:

Students will be introduced to information and communication technologies, and the differences between today's ICTs and traditional telecom and media platforms. They will be presented with the pros and cons of different theories describing the relationship between technology and society including technological determinism and the social shaping/social construction theories of technology. Students will also become familiar with the course themes. Themes are subjects that will be highlighted in every lecture. Course themes include: users shaping new technology, managing and controlling technology, technology and issues of gender, class, race and culture, and the relationship between old and new technologies.

By the end the lecture, students should be able to:

1. Identify the differences between ICTs and older media/telecom platforms
2. Define technological determinism and recognize major weaknesses of the theory
3. Differentiate tech determinism from social shaping/social construction theories of technological development
4. Explain why the idea of unintended consequences plays a large role in any discussion of users shaping new technologies
5. Describe why ICT usage is not universal and is dependent on a number of factors including gender, race, culture and socio-economic status
6. Compare the evolutionary versus revolutionary interpretations of tech development

2. Landline and Wireless Communications – The Relationship between Old and New Technologies

Students will learn the history of both landline and cellular phone development. They will see how both landlines and cell phones are classic examples of "users shaping new technology." This theory is based on the idea that while inventors or companies might create a technology for one purpose, users can often reshape the technology for their own needs in a way the inventor or company never imagined. Landline and cell phone usage will also be discussed in relation to issues of sociability, security, privacy and alienation to highlight the relationship between old and new technologies and the concept of "amplification". As described by Cara Wallis (2006), amplification relates to the idea that uses between older and newer technologies are not necessarily unique but "amplified" because of technological differences. Finally, students will examine what makes cell phone usage unique today, including issues related to physical and emotional dependency, personal identity and functionality.

By the end of this lecture, students should be able to:

1. Connect the early history of landline and cell phones to the idea of "users shaping new technology"
2. Compare and contrast early landline usage to early cell phone usage in terms of issues like sociability, security, privacy and social connections using Cara Wallis' "amplification" idea
3. Explain what makes cell phone usage unique to landlines and whether the benefits of the technology outweigh the drawbacks
4. Examine their own personal cell phone usage and determine what aspects of the technology are most important to them and why

3. Cyber Sociability: Does Using the Internet Strengthen or Weaken Social Bonds?

Students will first examine internet sociability from global (macro) perspective. Issues that will highlighted include whether cyberspace has truly created a "global" village, or if in fact we live a more isolated, narcissistic and ethnocentric society than ever before. Theories such as narrowcasting and homophily will also be discussed. Students will then look at cyber sociability from an individual (micro) perspective, and in particular focus on the topic of social network site (SNS) usage (i.e. Facebook) and connectivity. Research linking connectivity to motivation and personality type will be examined such as the rich getting richer and social compensation theories. Finally, students will look at offline versus online social connectedness which highlight distinctions in areas like type and degree of connectivity.

By the end of this lecture, students should be able to:

1. Analyze the arguments for and against the idea that we live in a global village
2. Determine which factors are most important to consider when examining the issue of SNS sociability (i.e. personality, online activity, age, gender or socioeconomic status)
3. Appraise the pros and cons of both the rich getting richer versus social compensation debate
4. Formulate and write an opinion piece answering the original lecture question based on lecture materials, readings and personal online experiences

4. Cyber Privacy

Students will examine online privacy issues including the latest ways in which personal information can be obtained without your knowledge. Various social and technical engineering practices will be highlighted including phishing, pharming, vishing, flash and super cookie placement and web "bugs". Students will then explore privacy violations on social network sites and the negative impact this can have on an individual's reputation, social standing, or academic or employment record. We will look at "privacy flaws" inherent in the technical settings on SNS sites and practical ways to protect privacy on SNS. Finally, students will examine the debate about whether privacy is still a valued social norm to social media users in the online world.

By the end of this lecture, students should be able to:

1. Describe and provide examples of how privacy is compromised when you visit online websites
2. Decide whether SNS sites are currently doing enough to protect your privacy
3. Debate the importance of privacy rights versus the social conveniences that come with using SNS
4. Look at your own Facebook profile page. What personal info have you included in it? How many people have access to this information? Can you truly claim to know every single person that has access to even some of this information? (If you do not have an SNS profile please examine some open profiles describe what info Is publicly visible)

5. (Mis)information in a Digital World

Students will explore the topic of information credibility both past and present. In the past there were a limited number of both credible sources of information and people who had reputations for providing credible information (i.e. parents, teachers, experts). They will then investigate the current problems that come with ICT usage where there is an abundance and diversity of information sources but where it is

increasingly difficult to verify the credibility of this information. This new info environment not only challenges traditional routes of verifying info, but it also brings new methods of assessing info credibility. In terms of determining the credibility of online web content, they will be introduced to the science of cognitive heuristics. According to Metzger et al. (2010), "cognitive heuristics...constitute info-processing strategies consisting of useful mental shortcuts, rules of thumb, or guidelines that reduce cognitive load during info processing and decision making." We will look at a variety of cognitive heuristics that people are currently using to assess, evaluate and verify online information and the pros and cons that come with each mental shortcut.

By the end of this lecture, students should be able to:

1. Compare and contrast traditional ways of verifying information versus those we use in a digital environment
2. Define the term heuristics and its importance in info processing
3. Describe the different heuristics that are used when assessing online information credibility
4. Identify problems that arise when using heuristics to evaluate online info sources
5. Survey their own use of heuristic use by answering questions an in class survey

6. Is the Internet Changing the Way We Think and Process Information?

Students will investigate the topic of internet use and cognitive change. We will start by highlighting Nicholas Carr's book *The Shallows* (2010) which really started this debate when he asked if "Google is making us stupid," and whether internet use has cost us the ability to engage in deep thinking and reading. Students will learn about learn about the science of neuroplasticity, and the latest research in this field looking at internet use and brain activity. They will be introduced to Richard Watson's (2010) discussion about the rise of the "screenager," and determine whether this is a valid term to describe a generation that has had constant internet exposure. Finally, we will examine Carr and Watson's ideas in relation to technological determinism and social shaping theories of technology.

By the end of this lecture, students should be able to:

1. Define neuroplasticity and recognize its impact on lifetime learning
2. Analyze Carr's argument that "more activity is not necessarily better brain activity" in relation to internet usage
3. Connect Carr's arguments about brain change with Watson's discussion about the rise of "screenagers"
4. Explain why Carr considers brain change and internet use to be more problematic than the sensory changes that have occurred with the

introduction of earlier communication technologies
4. Judge whether Carr's arguments are an example of technological determinism

7. The Myth of Multitasking

Prior to the class, students will be given a activity sheet asking them to complete two tasks – one where they first write a sentence and then a series of numbers, and one where they are asked to switch between writing letters and numbers to complete the same sentence and sequence. This exercise will show them that it always takes more time to switch between tasks then complete one task at a time. This will be their introduction to multitasking. Students will learn that while popular culture sees multitasking as a way to save time and increase efficiency, scientific studies over the last decade show that multitasking is actually counterproductive and often hinders high level conceptual learning. We will learn about common multitasking "myths" and highlight the negative impact of multitasking in both work and educational environments. Students will also investigate why multitasking is still such a popular idea despite its obvious limitations by examining issues like emotional gratification, social rewards and classic conditioning.

By the end of this lecture, students should be able to:

1. Connect the discussion on multitasking to our exploration of internet use and cognitive change
2. Explain what multitasking is and why people so often get the idea of multitasking wrong
3. Describe various "myths" and the adverse impact multitasking has on both work productivity and learning including brain functioning
4. Analyze why it may be difficult to keep people from multitasking

8. The Politics of Cyberspace, Part I

Students will be introduced to the general idea of internet crime and why in the past it as so difficult to control various illegal activities in cyberspace. They will then explore how the internet is controlled today though both technological surveillance methods as well as increased law enforcement presence (i.e. cybercrime units). Students will then explore the idea of cybercrime in Canada, and focus on current controversies like cyberbullying and copyright, and relate the discussion back to previously discussed issues like privacy and identity theft.

By the end of this lecture, students should be able to:

1. Recognize the challenges countries face in attempting to control illegal activities in cyberspace

2. Argue why the internet is NOT an unlawful or ungovernable domain
3. Explain how cybercrime is another example of amplification when looking at the relationship between old and new technologies
4. Identify the different laws which govern illegal online behavior in Canada
5. Debate whether Canada requires a new law related to cyberbullying

9. The Politics of Cyberspace, Part II

Students will learn about the different private and civic organizations responsible for controlling the internet such as the Internet Corporation of Assigned Names and Numbers (ICANN). For example, we will look at the controversy surrounding this organization, including ICANN's most recent decision to liberalize top level domain names including the much debated .xxx address, and how these technical issues are usually a cover for power and control. Current issues also pertaining to internet regulation will also be examined, including the idea of net neutrality in North America.

By the end of this lecture, students should be able to:

1. Explain what makes ICANN such a controversial organization
2. Recognize why the .xxx debate is a classic example of a technical issue really being one about power and control
3. Describe instances of how net neutrality has been violated by ISPs in North America
4. Debate whether or not net neutrality should continue to be the guiding principle behind the internet

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.

This course will consist of three hours of lecture/discussion every week. There will be a midterm and final exam, 4 tutorial assignments and one ICT controversy paper (see below). The readings will consist of journal articles and online book chapters that the students will have to *find themselves* as a way of enhancing their independent learning and research skills.

Each lecture will introduce the students to new course content and the readings have been selected to supplement what is discussed in class. These readings are designed to enhance students' science and technical literacy skills and include graphical representations and examples of the scientific method. Following lecture, every class will have a 30 to 45 minute discussion period where students will engage in a variety of activities. These include question and answer periods and group activities where students will brainstorm and engage in problem solving about a controversial issue discussed in class, allowing for further opportunities in civic engagement.

The individual or group tutorial assignments have been designed to allow students to see real world applications of the material discussed in class. This will include writing opinion pieces, and completing surveys and activities which let them see a) how much private information they share with the outside world, b) how much they value online sociability versus privacy, c) which heuristics they use in terms of assessing online information, and d) whether they can see the limits of their own attempts at multitasking – especially in a classroom or lecture setting.

In addition to group assignments, students will also benefit from student-to-student contact in the virtual world though Moodle forums and in the real world through study groups. The NATS class representative will be encouraged to form these study groups where students can work together to better familiarize themselves with 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. In year one, this course would be offered to approximately 200 students.

2. Several faculty members in the Department of STS (including Natural Science) are competent to teach this course.

3. Vera Pavri will teach this course in the 2015-16 academic year.

4. 36 hours of professor contact in lectures, in addition to 1 weekly office hour. The anticipated student workload outside of lectures is approximately 42 hours which is based on an average weekly expectation of 3.5 hours of reading, studying or writing for course requirements.

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 Exam (25%) and Final Exam (30%)

The midterm and final exam will consist of a variety of short and long answer questions. Questions will be based on lecture and reading material, and will be used to evaluate students' critical thinking and writing skills.

Tutorial Assignments and Participation (20%)

Attendance for the class is mandatory and is designed to enhance the student/teacher relationship in class and promote a sense of community within the class. Students will be signed in during each class by the instructor, and this will represent 5% of their mark. The other 15% will be based on completing four tutorial assignments given throughout the term. Details can be found in the course design section of this form.

ICT Controversy Paper (25%)

This assignment involves picking a controversial ICT debate (topics will be provided to students) and examining the different sides of the issue using only SCHOLARLY and ACADEMIC sources. Students will choose a minimum of six (6) academic sources (i.e. peer reviewed journal articles, university press books or book chapters, science and/or technology policy papers) to gain information about the controversy and the various arguments on either side of the debate. Once the student has outlined the pros and cons of the debate, they will be required to provide me with their own critical reflections on the topic and relate their discussion to the course theories and/or themes.

The purpose of this assignment is to actively encourage students to further their research and independent learning skills by getting them to think about what constitutes a scholarly or academic source and to further develop their critical enquiry, reading, writing and thinking 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

Since this course is about exploring the digital and information environment, I have decided to have students enhance their independent learning and research skills by finding their own readings. All of the currently selected readings for this course can be found through York's library database (LD) and through online searches (OS).

(LD) Susan J. Douglas, "The Turn Within: The Irony of Technology in a Globalized World," *American Quarterly*, Vol. 58, No. 3, Sept. 2006: 619-638

(OS) "Chapter 9: Media Technology" in D. Croteau, W. Hoynes & S. Milan, *Media/Society: Industries, Images and Audiences*, 4th Ed., Sage

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.

Publications, 2011

Optional: (OS) "Introduction" in M.R. Smith & L. Marx', *Does Technology Drive History? The Dilemma of Technological Determinism*, 4th Ed, MIT Press, 1998

(LD) L. Srivastava, "Mobile Phones and the Evolution of Social Behaviour," *Behaviour and Information Technology*, Vol. 24, No. 2, March 2005: 111-129

(LD) Ran Wei & Ven-Hwei Lo, "Staying Connected While on the Move: Cell Phone Use and Social Connectedness," *New Media and Society*, Vol. 8, No. 1, 2006: 53-72

(LD) Marco Yzer & Brian Southwell, "New Communication Technologies, Old Questions," *American Behavioral Scientist*, Vol. 52, No. 1, Sept. 2008: 8-20

(LD) A. Nadkarni & S. G. Hofmann, "Why do people use Facebook?" *Personality and Individual Differences*, Vol. 52, No. 3, 2012: 243-49.

(LD) B. Debatin et. al., "Facebook and Online Privacy: Attitudes, Behaviors and Unintended Consequences," *J. of Computer Mediated Communication*, Vol. 15, 2009: 83-108.

(OS) Nicholas Carr, "Is Google making us stupid?" *The Atlantic Monthly*, July/Aug 2008

(LD) Z. Wang & J. Tehernev, "The 'Myth' of Multitasking: Reciprocal Dynamics of Media Multitasking, Personal Needs and Gratifications," *Journal of Communication*, Vol. 62, No. 3, 2012: 493-513

(LD) Miriam Metzger & Andrew Flanagin, "Credibility and the use of information in online environments: the use of cognitive heuristics," *Journal of Pragmatics*, Vol. 59, Part B, 2013: 210-20

(LD) Michael Pope et. al, "The Domain Name System – Past, Present and Future," *Communications of the Association for Information Systems*, Vol. 30, No. 1, 2012, Article 21

(LD) S. Anderson, "Net Neutrality: The View from Canada," *Media Development*, Vol.1, 2009: 8-12

(LD) Christine Stover, "Net Neutrality: A Thematic Analysis of Policy Perspectives Across the Globe," *Globe Media Journal (Canadian Ed.)*, Vol. 3, No. 1, 2010: 75-86

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 requires a lecture room for approximately 200 students. The room must have PC, document camera and internet access.

Teaching assistants will be required for marking students' exams, tutorial assignments and papers.

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 primary objectives of this Natural Science course are to explore ICT issues using literature which promote science and technical literacy and communication. Lecture material and course readings will allow students to understand research data through graphical representations. Students will also be exposed to materials which present evidence using the scientific method, and build and improve independent learning skills through literature searches and course research. Finally, a variety of course topics aim to contextualize science and technology issues in both past and present environments.

In terms of General Education requirements, this course has been designed to further develop and help students practice their critical enquiry, writing, research, reading, listening and thinking skills.

Expected initial enrolment: 200

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

7.2.5

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)	Mathematics and Statistics, MATH
Date of Submission:	October 2014
Course Number: Special Topics courses Include variance (e.g. HUMA 3000C 6.0, Variance is "C")	3141
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	Introduction to Number Theory
Short Title: Appears on any documents where space is limited - e.g. transcripts and lecture schedules - **maximum 40 characters**	Introduction to Number Theory

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...")

Basic topics in number theory. Divisibility, primes and factorization, congruences, quadratic residues and the law of quadratic reciprocity, arithmetic functions and the Mobius inversion formula, Diophantine equations, primitive roots, continued fractions, partitions, the distribution of prime numbers, and applications to primality testing and cryptography.

Prerequisites: MATH 1200 (or MATH 2200), and one of MATH 1021 or MATH 1025.

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.

Basic topics in number theory. Divisibility, primes and factorization, congruences, quadratic residues and the law of quadratic reciprocity, arithmetic functions and the Mobius inversion formula, Diophantine equations, primitive roots, continued fractions, partitions, the distribution of prime numbers, and applications to primality testing and cryptography.

Expanded Course Description:

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

This course is an introduction to number theory, the branch of mathematics that deals with the properties of numbers in general and integers in particular. It is also one of the oldest branches of mathematics, and one of the largest. This course is a rigorous mathematical course, so there will be a certain amount of definitions, theorems, and proofs. However, there will also be a good deal of concrete, hands-on computations, and many interesting and fun applications. Core topics include:

1. Divisibility: the greatest common divisor, the Euclidean algorithm, the least common multiple.
2. Primes and factorization: the Fundamental Theorem of Arithmetic, Euclid's Lemma, Goldbach and Twin Primes conjectures, Fermat primes, Mersenne Primes.
3. Congruences: residue classes, complete and reduced residue systems, systems of linear congruences, the Chinese Remainder Theorem, Wilson's Theorem, Fermat's Little Theorem, pseudoprimes and Carmichael numbers, Euler's Theorem.
4. Quadratic residues: quadratic congruences, the Legendre symbol, the law of quadratic reciprocity, the Jacobi symbol, binary quadratic forms.
5. Arithmetic functions: Multiplicative functions, Euler's totient function, the Mobius function, the Mobius inversion formula, the number of divisors and sum of divisors functions.

Additional topics covered at the discretion of the instructor include: Diophantine equations (the Pythagorean equation, Pell's equation, Fermat's infinite descent, Fermat's Last Theorem); the distribution of prime numbers (proofs that there are infinitely many primes, Chebyshev's estimates for the prime counting function, Mertens' Theorems); Partitions (formal power series, generating functions, the partition function); primitive roots and orders; continued fractions and rational approximations; applications to primality testing and cryptography.

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 primary mode of delivery for the course will be face-to-face lecture based teaching in a live classroom setting.

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. Being an optional third year course, there will probably be one section. The course will likely be offered every year.
2. There are several faculty members in the department of mathematics and statistics who are competent to teach the course, including Youness Lamzouri, Nantel Bergeron, Ada Chan, Yun Gao, Peter Gibson, Stan Kochman, Asia Weiss, and Mike Zabrocki.
3. Youness Lamzouri is likely to teach the course in its first offering.
4. Scheduled contact hours will be 3 hours per week for instructor's lectures.

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.)

The weight distribution of the course components is as follows:

20%- Assignments (biweekly).

20%- First Midterm (in class).

20%- Second Midterm (in class).

40%- Final Exam (scheduled by the Registrar office).

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.

Reference texts:

1. James Strayer, Elementary Number Theory.
2. Kenneth Rosen, Elementary Number Theory and its Applications.
3. George E. Andrews, Number Theory.
4. Joseph H. Silverman, A Friendly Introduction to Number Theory.

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 lab space or equipment is needed. Only a room booked by the RO for the weekly lecture will be needed.

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.

Number theory is a fundamental part of pure mathematics. Not only does it have roots deep in antiquity, but lately it has seen numerous new developments. Fundamental connections have emerged between number theory and such diverse areas as mathematical physics and information theory. It is therefore essential that number theory be a part of the undergraduate mathematics program at York, in order for the program to remain current and to properly reflect the subject as a whole.

The previously existing number theory course, MATH 3140 6.0, has not been serving its intended purpose for several reasons, and therefore needs to be replaced. Firstly, being 6.0 credits, there was very low student demand. Secondly the course content of 3140 was missing several topics which would be considered standard in any modern undergraduate treatment of the subject. In particular, quadratic residues and the law of quadratic reciprocity, and the theory of arithmetic and multiplicative functions.

MATH 3141 is designed to correct the aforementioned imbalance in course content, providing a more streamlined 3.0 credit course that can be offered on a regular rotation.

The expected enrolment in the course will be around 20 to 30 students.

YORK
UNIVERSITÉ
UNIVERSITY

MEMORANDUM

Office of the Vice President
Academic & Provost

Kaneff Tower
4700 Keele St.
Toronto Ontario
Canada M3J 1P3

Tel 416 736 5280
Fax 416 736 5876

To: Deans, Principal & University Librarian

From: Rhonda Lenton, Vice President Academic & Provost

Date: October 20, 2014

Subject: 2nd Quarter Budget and Enrolment Meetings

Second quarter budget and enrolment meetings have been scheduled with Faculties in the months of November and December.

In this meeting I would like to discuss:

- Your Faculty's current enrolment position and the impact that this may have on your in-year budget and possible targets for the 2015/16 enrolment contract;
- Your action plans for Winter 2015 in order to meet your 2014/15 enrolment contract or to minimize the shortage of enrolment target in your 2014/15 enrolment contract;
- Your actuals to-date, year-end forecast and a summary of major variances or changes that you may anticipate relative to your initial budget;
- Budget adjustments that your Faculty are making to address the anticipated revenue shortage; and
- For Faculties in deficit situation, your plans to address cumulative deficits in anticipation of response for AAPR and SHARP implementation.

At this time, an update of the three year rolling budget is not necessary. Updated three year rolling budgets will be reviewed at our year-end budget meetings in the spring.

If you have any questions about these upcoming meetings, please contact Richard Ooi in my office.

I thank you in advance for your cooperation.

c.c: Faculty Executive Officers
Janet Morrison, Vice Provost Students, VPS
Sarah Cantrell, Executive Director, OIPA
Mario Verrilli, Director, Academic Resource Planning
Richard Ooi, SEO, VPA&P
Darus Suharto, Senior Finance & Academic Planning Officer

Financial Forecast 2014/15

Faculty: XXXXX

Budget Fiscal Year: 2014/15

Fund: 200

	Current Year - 2014/15				
	Budget	**Actuals (as at Oct 31, 2014)**	**Forecast**	**Variance Budget to Forecast ($)**	**Variance Budget to Forecast (%)**
Revenues					
1 Total Base Revenue					
2 Total OTO and XTO Revenue					
3 Total Cost Recoveries					
Total Revenues					
Expenses					
4 Salary Related Expenses					
4.1 Faculty Administration					
4.2 Faculty Overload & Retiree					
4.3 FT Faculty					
4.4 CUPE 3903-2 & Exempt					
4.5 CUPE 3903-1					
4.6 CUPE 3903-3 Grad Stud&Research					
4.7 Sabbaticals					
4.10 Other Salaries					
Total Salary Related Expenses					
5 Other Expenses					
Total Expenses					
Total Revenue Less Expenses					
Carryforward from Previous Year					
Carryforward to Next Year					

Note: This form should be accompanied with explanation notes on variance over 10% or $100K

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

Library Support Statement

MATH 3141 3.0 -- Introduction to Number Theory

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

- Books (including e-books), encyclopedias, and handbooks
- E-journals, databases and other electronic resources
- Access to all York Libraries' holdings and through interlibrary loans and resource sharing
- Ongoing purchases of new library materials based on course requirements

A catalogue search on YUL website shows that we have adequate resources on Number Theory, Algebraic Number Theory, Divisions Algebra, Factorization, Arithmetic functions, Congruences & Residues, Reciprocity Theorems, Approximation, Diophantine, Numbers-Prime, Data Encryption and Cryptography. The Peter F. Bronfman business library also has additional resources on some of the topics. E-books are searchable using the library catalogue: http://www.library.yorku.ca/web/

Some of the databases of relevance are:

- MathSciNet
- Scopus
- Web of Science
- ProQuest databases

Resources for Mathematics, Statistics & Finance can be accessed from these guides:
Mathematics: http://researchguides.library.yorku.ca/mathematics
Statistics: http://researchguides.library.yorku.ca/statistics
List of other databases: http://www.library.yorku.ca/web/steacie/science-databases/

All the books mentioned in the reading list are available in the library. Course readings can be made available from the Steacie Science & Engineering Library reserve desk. Journal articles that are not available at York can be requested through RACER (Rapid Access to Collections by Electronic Requesting). RACER can be accessed from this link: http://www.library.yorku.ca/e/resolver/id/1534609. Undergraduate students can use the Interlibrary loan and request journal articles (for journals not available at York).

There may be certain specific areas that require additional resources and collection development in the library is an ongoing process. It is 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 will be purchased for the library. Please forward any requests for purchase to the Mathematics & Statistics subject librarian, Rajiv Nariani at rajivn@yorku.ca

Please note that librarians also provide library research skills and information literacy workshops to students on topics, including:

- Formulating search strategies in different databases
- Evaluating information sources
- Managing references and using citation management programs including Mendeley, Zotero and integration with BibTeX and LaTeX

In summary, I would state that the Steacie Science & Engineering library is well positioned to support this undergraduate course.

Sincerely,

Rajiv Nariani
Science Librarian
102L, Steacie Science and Engineering Library
York University
Phone: 416 736 2100 x20396
E-mail: rajivn@yorku.ca
23rd October 2014

Form 2 112

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.6

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Biology

Date of Submission: September, 2014

Course Number: SC/BIOL 4250 3.00
SC/ENVB 4250 3.00

Effective Session: F/W 2015

Course Title: Birds and the Environment

Type of Change:

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

Change From:	To:
Course Description: A review of the adaptations of birds to different environments, behaviour and ecology, biodiversity and evolution, and currents threats to the world's birds. Laboratories include field trips, a study of bird anatomy and examination of museum specimens. Two lecture hours, three laboratory hours. One term. Three credits. Prerequisite: One of SC/BIOL 2030 4.00, SC/BIOL 2031 3.00.	**Course Description:** A review of the adaptations of birds to different environments, behaviour and ecology, biodiversity and evolution, and currents threats to the world's birds. Laboratories include field trips, a study of bird anatomy and examination of museum specimens. Two lecture hours, three laboratory hours. One term. Three credits. Prerequisite: SC/BIOL 2050 4.00, SC/BIOL 2060 3.00.

Rationale:

BIOL 2050 Ecology provides more comprehensive background in ecological theory for this course on bird evolution, ecology and conservation than the more narrow BIOL 2030 (Animals). This course involves collecting, analyzing, and interpreting scientific data and requires a solid background in statistics and so BIOL 2060 Stastics is also needed as a prerequisite. This course change is part of the 2013-14 Biology Curriculum review recommendation to make prerequisites more consistent across courses and to require that students in most 3rd and 4th year ecology and evolution courses have BIOL 2060 Statistics as a prerequisite.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 113

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.7

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Biology

Date of Submission: June, 3, 2014

Course Number: 4155

Effective Session: Fall 2015

Course Title: Advanced Virology

Type of Change:

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

Change From:	To:
Course Description: This course investigates advanced concepts and experimental systems in virology, including recent basic and applied research that has led to major scientific innovations in medicine, agriculture and nanotechnology. Three lecture hours per week. One term. Prerequisites: SC/BIOL 2020 3.00, SC/BIOL 2021 3.00, SC/BIOL 3155 3.00.	**Course Description:** This course investigates advanced concepts and experimental systems in virology, including recent basic and applied research that has led to major scientific innovations in medicine, agriculture and nanotechnology. Three lecture hours per week. One term. Prerequisites: ~~SC/BIOL 2020 3.00, SC/BIOL 2021 3.00,~~ SC/BIOL 3110 3.00, SC/BIOL 3130 3.00, SC/BIOL 3155 3.00.

Rationale:

BIOL3110 (Molecular Biologyl: Nucleic Acid Metabolism) and BIOL3130 (Molecular Biology II: Regulation of gene expression) cover processes and techniques in cellular and molecular biology that will greatly facilitate the ability of students taking Advanced Viology to understand the content of primary research articles that will be covered in the course. As BIOL 2020/2021 are prerequisite to 3110/3130/3155 they are redundant.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 115

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.8

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Biology

Date of Submission: September, 2014

Course Number: SC/BIOL 3001 3.00, SC/ENVB 3001 3.00, SC/BIOL 3002 3.00, SC/ENVB 3002 3.00, SC/BIOL 3003 3.00, SC/ENVB 3003 3.00, SC/BIOL 3001 2.00, SC/ENVB 3001 2.00, SC/BIOL 3002 2.00, SC/ENVB 3002 2.00, SC/BIOL 3003 2.00, SC/ENVB 3003 2.00

Effective Session: F/W 2015

Course Title: Field Course

Type of Change:

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

Change From:	To:
Course Description: A course given at one of several biological stations, the objective of which is to give the student the opportunity to study plants and animals in their natural surroundings. The departmental brochure should be consulted for further details. Two-week field course. Three credits. Prerequisites: SC/BIOL 2010 4.00; one of SC/BIOL 2030 4.00 or SC/BIOL 2031 3.00; plus special prerequisites where specified for some modules. Note: Students must be manually enrolled in this course through the Biology Department early in the January prior to the session in which the course is offered. Enrolment is not possible at any other time of year. In addition to the tuition fee levied by the University, each student must pay for transportation, room and board.	**Course Description:** A course given at one of several biological stations, the objective of which is to give the student the opportunity to study plants and animals in their natural surroundings. The departmental brochure should be consulted for further details. Two-week field course. Three credits. Prerequisites: SC/BIOL 2050 4.00 and BIOL 2060 3.0; plus other prerequisites if specified for a given module. Note: Students must be manually enrolled in this course through the Biology Department early in ~~the~~ January or prior to the session in which the course is offered. Enrolment is not possible at any other time of year. In addition to the tuition fee levied by the University, each student must pay for transportation, room and board.

Rationale:

BIOL 2050 Ecology provides more suitable background in ecological theory for field courses than BIOL 2010 (Plants) and BIOL 2030 (Animals). All field courses involve collecting, analyzing, and interpreting scientific data and require a solid background in statistics and so BIOL 2060 Statistics is needed as a prerequisite. This course change is part of the 2013-14 Biology Curriculum review recommendation to make prerequisites more consistent across courses and to require that students in most 3rd and 4th year ecology and evolution courses have BIOL 2060 Statistics as a prerequisite.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 117

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.9

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department:	Biology	**Date of Submission:**	September 2014
Course Number:	4070.03	**Effective Session:**	September 2015
Course Title:	Behavioural Ecology		

Type of Change:

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

Change From:	To:
SC/BIOL 4070 3.00 Behavioural Ecology Interactions between the behaviour and ecology of animals are discussed from several points of view, including feeding, use of space, mate selection, mother-young interactions, social behaviour, learning and communication. Laboratories include techniques for studying behaviour and seminars reviewing recent research. Two lecture hours, three laboratory hours. One term. Three credits. **Prerequisite**: One of SC/BIOL 2030 5.00 or SC/BIOL 2031 3.00.	**SC/BIOL 3270 3.00 SC/ENVB 3270 3.00 Sociobiology** A review of the evolution of territoriality, mate selection, parent-offspring interactions, kin selection, reciprocal altruism, learning and communication in animals. Laboratories focus on experimental techniques for studying behaviour,data analysis and interpretation, and presentation of results in scientific format. Two lecture hours, three laboratory hours. One term. Three credits. **Prerequisite:** SC/BIOL 2060 3.00 **Course Credit Exclusion:** SC/BIOL 4070 3.00

Rationale:

Behavioural Ecology was designed as a 4th year speciality course for students in the ecology/evolution stream. This revised course, with a new more appealing name and lacking the restrictive prerequisite of BIOL 2050, will be taught at the 3rd year level. These changes will make the course more accessible to a broader base of students interested in the evolution of animal and human behaviour. The concepts and topics that will be covered will remain the same: ie. the evolution of mating selection behaviour, parental behaviour, space use (territoriality and coloniality) in animals, together with social behaviour topics such as kin selection (group living) and reciprocity (cooperation); these topics are of broad interest and apply to human behaviour. The latter topics have always been covered in Behavioural Ecology; thus the revised description is more complete.

This course change is part of the 2013-14 Biology Curriculum review recommendation to offer more courses at the 3rd year level and to provide more training and skill development at this level in conducting experiments and presenting results in scientific format.

We add the cross list to ENVB as it is relevant to this program

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7·2·10

Revised form Oct. 3/2002

Form 2

119

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department:	Biology	**Date of Submission:**	September, 2014
Course Number:	SC/BIOL 3170	**Effective Session:**	F/W 2015
Course Title:	Population Ecology		

Type of Change:

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

Change From:	**To:**
SC/BIOL 3170 3.0 Population Ecology Reviews recent studies in population ecology with special emphasis on processes that lead to population decline and recovery. Lecture topics include population growth models, competition, dispersal, predator/prey interactions, disease and parasites. The laboratories stress field studies and data analysis. Two lecture hours, three laboratory hours. One term. Three credits. **Prerequisites**: One of SC/BIOL 2030 4.00 or SC/BIOL 2031 3.00; SC/BIOL 2050 4.00; LE/CSE 1520 3.00, or LE/CSE 1530 3.00, or LE/CSE 1540 3.00 or LE/EECS 1520 3.00, or LE/EECS 1530 3.00, or LE/EECS 1540 3.00. Prior to Summer 2013: Prerequisites: One of SC/BIOL 2030 4.00 or SC/BIOL 2031 3.00; SC/BIOL 2050 4.00; SC/CSE 1520 3.00 or SC/CSE 1530 3.00 or SC/CSE 1540 3.00.	**SC/BIOL 3170 3.0 Population and Community Ecology** A comprehensive survey of populations (spatial and temporal patterns of distribution, population growth and regulation, territoriality, life history biology) and communities (community structure, community stability and change, community development, species interactions). Reviews theory, recent research, and applications. Laboratories stress field studies and data analysis. Two lecture hours, three laboratory hours. One term. Three credits. **Prerequisites**: BIOL 2060 3.0 and BIOL 2050 4.0

Rationale:

The course already covers many aspects of community ecology such as predator-prey interactions and competition. Many other universities offer exclusive courses in community ecology, and changing the course title will signal to students that this course offers substantial content in community ecology.

The prerequisite for this course BIOL 2030 Animals is no longer needed given that the course now includes plants and animals (historically the course was called Concepts in Animal Ecology). BIOL 2050 Ecology provides sufficient background in ecology and community ecology. However, skill development in collecting, analyzing, and interpreting scientific data in labs requires a solid background in statistics and BIOL 2060 Statistics is needed as a prerequisite. The prerequisites in LE/CSE are no longer required for this course. This course change is part of the 2013-14 Biology Curriculum review recommendation to make prerequisites more consistent across courses and to require that students in most 3rd and 4th year ecology and evolution courses have BIOL 2060 Statistics as a prerequisite.

Note: For course proposals involving cross-listings, Integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2

121

Faculty of Science

Curriculum Committee
352 Lumbers Building

7·2·11

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Biology

Date of Submission: September, 2014

Course Number: SC/BIOL 4090 4.00
SC/ENVB 4090 4.00

Effective Session: F/W 2015

Course Title: Plant Ecology

Type of Change:

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

Change From:	To:
SC/BIOL 4090 4.00 SC/ENVB 4090 4.00 **Course Description** This course reflects the diversity of topics that make up the field of plant ecology: ecosystems, plant population ecology, physiological and evolutionary ecology, plant-herbivore interactions and applied ecology. Laboratories cover field and laboratory techniques, including sampling methods. Three lecture hours, three laboratory hours. One term. Four credits. Prerequisites: SC/BIOL 2010 4.00; SC/BIOL 2050 4.00.	SC/BIOL 3290 4.00 SC/ENVB 3290 4.00 **Course Description** This course reflects the diversity of topics that make up the field of plant ecology: ecosystems, plant population ecology, physiological and evolutionary ecology, plant-herbivore interactions and applied ecology. Laboratories cover field and laboratory techniques, including sampling methods. Three lecture hours, three laboratory hours. One term. Four credits. Prerequisites: SC/BIOL 2010 4.00; SC/BIOL 2050 4.00; SC/BIOL 2060 3.00 Course Credit Exclusion: SC/BIOL 4090 4.00 SC/ENVB 4090 4.00

Rationale: This course change is part of the 2013-14 Biology Curriculum review recommendation to offer more courses at the 3rd year level and to provide more training and skill development at this level in conducting experiments and presenting results in scientific format. Since the expansion in 4th year level courses has been mostly in the area of Applied Ecology, it makes sense to teach the more theoretical plant ecology course in 3rd year, so that students taking diverse applied ecology courses are provided with a more detailed overview of the plant ecology perspective. This would align with the other more theoretical 3rd year ecology courses. In addition, SC/BIOL 2060 Statistics is being added as a prerequisite to ensure students have sufficient background for data collection, analysis and interpretation.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 122

Faculty of Science

Curriculum Committee
352 Lumbers Building

7·2·12

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Biology

Date of Submission: September, 2014

Course Number: SC/BIOL 4300 3.00

Effective Session: F/W 2015

Course Title: Origins and Development of Biological Theories

Type of Change:

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

Change From:	To:
SC/BIOL 4300 3.00 An analysis of some central ideas in the philosophy of science. The origins and expansion of biological theories, with emphasis on Darwinism, the gene concept, the new synthesis, and the reinterpretation of these theories in molecular biological terms. Three lecture hours. One term. Three credits. Note: Open only to students in the final year of an Honours program in biology, or with permission of the instructor.	SC/BIOL 3300 3.00 An analysis of the origins and development of biological theories, which may include those in evolutionary biology, ecology, biodiversity, and molecular phylogenetics. Three lecture hours. One term. Three credits. Note: Open only to students in the third or final year of a biology program, or with permission of the instructor. Course Credit Exclusion: SC/BIOL 4300 3.00

Rationale: This course change is part of the 2013-14 Biology Curriculum review recommendation to offer more courses at the 3rd year level and to provide more training and skill development at this level in conducting experiments and presenting results in scientific format, and critical writing about science. The course description has also been updated to better reflect the current content.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 123

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.13

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Biology

Date of Submission: September, 2014

Course Number: SC/BIOL 4230 4.0
SC/ENVB 4230 4.0

Effective Session: Summer, 2015

Course Title: General Entomology

Type of Change:

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

Change From:	To:
General Entomology	Entomology
Course Description: The distinguishing characteristics, biology and economic importance of the major orders and families of insects. Three lecture hours, three laboratory hours. One term. Four credits. Prerequisite: SC/BIOL 2030 4.00.	**Course Description:** The distinguishing characteristics, biology and economic importance of the major orders and families of insects. Three lecture hours, three laboratory hours. One term. Four credits. Prerequisite: SC/BIOL 2030 4.00.

Rationale: There is no other Entomology course in Biology, thus there is no need for the descriptor "General".

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 125

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.14

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Biology

Date of Submission: September, 2014

Course Number: SC/BIOL 4080 4.0
SC/ENVB 4080 4.0

Effective Session: F/W 2015

Course Title: Freshwater Biology

Type of Change:

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

Change From:	To:
SC/BIOL 4080 4.0, SC/ENVB 4080 4.0 The study of physical, chemical and biological aspects of freshwater aquatic ecosystems, with a focus on lake systems. Laboratory deals with taxonomy of freshwater organisms, use of limnological equipment, and analysis/interpretation of aquatic data. Two lecture hours, three laboratory hours. One term. Three credits. Prerequisites: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00, SC/BIOL 2050 4.00 or permission of the instructor. Note: SC/PHYS 1510 4.00 or similar (OAC Physics, 12U Physics) is strongly recommended.	**SC/BIOL 3280 4.0, SC/ENVB 3280 4.0** The study of physical, chemical and biological aspects of freshwater aquatic ecosystems, with a focus on lake systems. Laboratory deals with taxonomy of freshwater organisms, use of limnological equipment, and analysis/interpretation of aquatic data. Two lecture hours, three laboratory hours. One term. Three credits. Prerequisites: SC/CHEM 1000 3.00 and SC/CHEM 1001 3.00, SC/BIOL 2050 4.00 and SC/BIOL 2060 3.0. Note: SC/PHYS 1510 4.00 or equivalent (OAC Physics, 12U Physics) is strongly recommended. Course Credit Exclusion: SC/BIOL 4080 3.00/4.00, SC/ENVB 4080 3.00/4.00

Rationale: This course change is part of the 2013-14 Biology Curriculum review recommendation to offer more courses at the 3rd year level and to provide more training and skill development at this level in conducting experiments and presenting results in scientific format. In addition, SC/BIOL 2060 Statistics is being added as a prerequisite to ensure students have sufficient background for data collection, analysis and interpretation.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 126

Faculty of Science

Curriculum Committee
352 Lumbers Building

7-2-15

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Biology

Date of Submission: September, 2014

Course Number: SC/BIOL 4245 3.00
SC/ENVB 4245 3.00

Effective Session: F/W 2015

Course Title: Conservation Biology

Type of Change:

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

Change From:	To:
Course Description: This course explores the role of biological science in efforts to conserve natural resources, systems and the organisms therein. Two lecture hours, three laboratory hours. One term. Three credits. Prerequisites: SC/BIOL 2010 4.00; SC/BIOL 2030 4.00, SC/BIOL 2040 3.00, SC/BIOL 2050 4.00; or permission of the instructor.	**Course Description:** This course explores the role of biological science in efforts to conserve natural resources, systems and the organisms therein. Two lecture hours, three laboratory hours. One term. Three credits. Prerequisites: ~~SC/BIOL 2010 4.00; SC/BIOL 2030 4.00, SC/BIOL 2040 3.00,~~ SC/BIOL 2050 4.00, SC/BIOL 2060 3.00. ~~or permission of the instructor.~~

Rationale: This course change is part of the 2013-14 Biology Curriculum review recommendation to simplify prerequisites within the Ecology/Evolution course offerings. SC/BIOL 2060 Statistics is being added as a prerequisite to ensure students have sufficient background for data collection, analysis and interpretation.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7·2·16

Revised form Oct. 3/2002

Form 2

127

Faculty of Science
Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1650 6.00

Effective Session: Summer 2015

Course Title: Human Anatomy for the Fine Arts

Type of Change:

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

Change From:	**To:**
An introductory course on the structure and function of the human body specifically oriented towards the needs of students in Fine Arts. Body systems are studied from anatomical, physiological and biomechanical perspectives. Included as well are on-going references to nutrition, athletic injuries, and health and wellness. Two lecture hours, two laboratory hours. Two terms. Six credits. Course credit exclusions: AS/SC/KINE 2031 3.00, HH/KINE 2031 3.00, SC/NATS 1610 6.00, SC/NATS 1660 6.00, SC/NATS 1690 6.00, AK/NATS 1820 6.00. NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.	An introductory course on the structure and function of the human body specifically oriented towards the needs of students in Fine Arts. Body systems are studied from anatomical, physiological and biomechanical perspectives. Included as well are on-going references to nutrition, athletic injuries, and health and wellness. ~~Two lecture hours, two laboratory hours. Two terms. Six credits.~~ Course credit exclusions: AS/SC/KINE 2031 3.00, HH/KINE 2031 3.00, SC/NATS 1610 6.00, SC/NATS 1660 6.00, SC/NATS 1690 6.00, ~~AK/NATS 1820 6.00. NCR~~ Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.

Rationale:

A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2

129

Faculty of Science

Curriculum Committee
352 Lumbers Building

7·2·17

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1585 3.00

Effective Session: Summer 2015

Course Title: Astronomy: Exploring the Universe

Type of Change:

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

Change From:

To:

This course explores the universe beyond our solar system. We begin by studying how gravity triggers fusion reactions in starts that create heat, light, and every element in our bodies except hydrogen: overall, stars shine by converting mass into energy (Einstein's E=mc^2). We discuss how we can use the corpses of stars (white dwarfs, neutron stars, and black holes) to probe how space and time are related via Einstein's theories of relativity. We examine how stars are bound together into galaxies by gravity and how to use various wavelengths of light to determine why there are different types of galaxies: elegant spirals, massive ellipticals, and faint dwarf galaxies. We learn how the Doppler effect reveals that dark matter must produce some of the gravity that binds stars into galaxies, galaxies into clusters of galaxies, and clusters of galaxies into superclusters. We explore how we can use distant galaxies to study the development of the universe over its entire history, including the increasing importance of dark energy. We confront both the earliest instants and the far future of our universe's history: what we know, what we still hope to learn, and what we think we can ever learn. Finally, we join some modern scientists in the speculation about whether or not other universes might exist beyond the one we can perceive. Three lecture/activity hours per week, 1-hour e-learning exercise every 2 weeks, and 2-hour tutorial every 2-3 weeks. One Term, Three credits. Course credit exclusions: NATS 1740. NCR Note: No credit will be retained if this course is taken after SC/PHYS 1070 3.00. Not open to any student enrolled in the Astronomy stream. Minimal simple arithmetical calculation at about the Grade 10 level.	This course explores the universe beyond our solar system. We begin by studying how gravity triggers fusion reactions in starts that create heat, light, and every element in our bodies except hydrogen: overall, stars shine by converting mass into energy (Einstein's E=mc^2). We discuss how we can use the corpses of stars (white dwarfs, neutron stars, and black holes) to probe how space and time are related via Einstein's theories of relativity. We examine how stars are bound together into galaxies by gravity and how to use various wavelengths of light to determine why there are different types of galaxies: elegant spirals, massive ellipticals, and faint dwarf galaxies. We learn how the Doppler effect reveals that dark matter must produce some of the gravity that binds stars into galaxies, galaxies into clusters of galaxies, and clusters of galaxies into superclusters. We explore how we can use distant galaxies to study the development of the universe over its entire history, including the increasing importance of dark energy. We confront both the earliest instants and the far future of our universe's history: what we know, what we still hope to learn, and what we think we can ever learn. Finally, we join some modern scientists in the speculation about whether or not other universes might exist beyond the one we can perceive. ~~Three lecture/activity hours per week, 1-hour e-learning exercise every 2 weeks, and 2-hour tutorial every 2-3 weeks. One Term, Three credits.~~ Course credit exclusions: NATS 1740. NCR Note: No credit will be retained if this course is taken after SC/PHYS 1070 3.00. Not open to any student enrolled in the Astronomy stream. Minimal simple arithmetical calculation at about the Grade 10 level.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 131

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.18

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1570 3.00

Effective Session: Summer 2015

Course Title: Exploring the Solar System

Type of Change:

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

Change From:	To:
This course considers the science of the Solar System, including the structure of the planets and other objects within it, as well as its dynamic processes. Course credit exclusions: SC/NATS 1740 6.00, SC/NATS 1880 6.00, SC/NATS 1750 6.00. NCR Note: No credit will be retained if this course is taken after the successful completion of SC/PHYS 1070 3.00. One term per year. Three credits. Three lecture hours per week. Two hour laboratory/tutorial biweekly. Not open to any students enrolled in the Astronomy Stream.	This course considers the science of the Solar System, including the structure of the planets and other objects within it, as well as its dynamic processes. Course credit exclusions: SC/NATS 1740 6.00, SC/NATS 1880 6.00, SC/NATS 1750 6.00. NCR Note: No credit will be retained if this course is taken after the successful completion of SC/PHYS 1070 3.00. ~~One term per year. Three credits. Three lecture hours per week. Two hour laboratory/tutorial biweekly.~~ Not open to any students enrolled in the Astronomy Stream.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 132

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.19

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1560 3.00

Effective Session: Summer 2015

Course Title: Understanding Food

Type of Change:

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

Change From:	To:
A study of what food is, where it comes from and the roles various foods play in human nutrition and health. Topics include scientific and technological aspects of modern food production such as genetics, farming, fishing, and beverage industries. Three lecture hours per week. Three credits. Prerequisites/corequisites: None. NCR Note: No Credit Retained (NCR) if SC/NATS 1910 6.00 has been completed.	A study of what food is, where it comes from and the roles various foods play in human nutrition and health. Topics include scientific and technological aspects of modern food production such as genetics, farming, fishing, and beverage industries. ~~Three lecture hours per week. Three credits.~~ Prerequisites/corequisites: None. NCR Note: No Credit Retained (NCR) if SC/NATS 1910 6.00 has been completed.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.20

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1530 3.00

Effective Session: Summer 2015

Course Title: Science of Space Flight and Exploration

Type of Change:

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

Change From:	To:
This course will look from a historical timeline at the science and technology of space flight and the discoveries and expansion of our knowledge through space exploration. Three lecture hours per week. One tutorial hour in alternate weeks. One Term. Three credits.	This course will look from a historical timeline at the science and technology of space flight and the discoveries and expansion of our knowledge through space exploration. ~~Three lecture hours per week. One tutorial hour in alternate weeks. One Term. Three credits.~~

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 134

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.21

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1920 6.00

Effective Session: Summer 2015

Course Title: The Nature and Growth of Ideas in Mathematics

Type of Change:

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

Change From:	To:
Students are shown the central position of mathematics in our culture: great discoveries in mathematics and their effect on general culture and society; history of mathematics; mathematics of art and architecture, sound, games and gambling and computing.^^Course credit exclusion: AK/MATH 1700 6.00^^	Students are shown the central position of mathematics in our culture: great discoveries in mathematics and their effect on general culture and society; history of mathematics; mathematics of art and architecture, sound, games and gambling and computing.~~^^Course credit exclusion: AK/MATH 1700 6.00^^~~

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2 #35

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.22 Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1880 6.00

Effective Session: Summer 2015

Course Title: Life Beyond Earth

Type of Change:

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

Change From:	To:
This course considers the various factors required for life to exist beyond Earth, both life that may have evolved elsewhere and what would be necessary for humans moving out into space. Three lecture hours per week plus alternate week tutorial/laboratory sessions of two hours. Two terms. Six credits. Course credit exclusions: SC/NATS 1570 3.00, SC/NATS 1740 6.00. NCR Note: Not open to any student in the Astronomy stream nor to any student who has passed or is taking SC/PHYS 1070 3.00, SC/BIOL 1010 6.00, SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or AP/ANTH 3270 3.00.	This course considers the various factors required for life to exist beyond Earth, both life that may have evolved elsewhere and what would be necessary for humans moving out into space. ~~Three lecture hours per week plus alternate week tutorial/laboratory sessions of two hours. Two terms. Six credits.~~ Course credit exclusions: SC/NATS 1570 3.00, SC/NATS 1740 6.00. NCR Note: Not open to any student in the Astronomy stream nor to any student who has passed or is taking SC/PHYS 1070 3.00, SC/BIOL 1010 6.00, SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or AP/ANTH 3270 3.00.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.23

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1870 6.00

Effective Session: Summer 2015

Course Title: Understanding Colour

Type of Change:

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

Change From:	To:
A cross-disciplinary approach in examining colour, with the aim of understanding colour from the multiple viewpoints of art, physics, chemistry, physiology and history. Topics include: perception, wave nature of light, spectroscopy, colour harmony and contrast, natural phenomena, dyes and pigments. Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1870 6.00, SC/NATS 1720 6.00	A cross-disciplinary approach in examining colour, with the aim of understanding colour from the multiple viewpoints of art, physics, chemistry, physiology and history. Topics include: perception, wave nature of light, spectroscopy, colour harmony and contrast, natural phenomena, dyes and pigments. ~~Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1870 6.00,~~ SC/NATS 1720 6.00

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.24

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1860 6.00

Effective Session: Summer 2015

Course Title: Sceince: Past, Present and Future

Type of Change:

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

Change From:	To:
Modern science has drastically changed our lives and how we perceive the world and will do so in future. This course explores, through case studies of revolutions in biological and physical sciences, how scientists work, experiment, theorize, communicate and debate. Three lectures and one hour online tutorial per week. Two terms. Six credits.	Modern science has drastically changed our lives and how we perceive the world and will do so in future. This course explores, through case studies of revolutions in biological and physical sciences, how scientists work, experiment, theorize, communicate and debate. ~~Three lectures and one hour online tutorial per week. Two terms. Six credits.~~

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.25

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1850 6.00

Effective Session: Summer 2015

Course Title: Science and Pseudoscience

Type of Change:

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

Change From:	To:
Such topics as astrology, extrasensory perception, the ideas of Velikovsky, as examples of beliefs which meet with little approval in the scientific community. Methodological and social criteria by which science functions in contrast with the attitudes prevalent among those operating along its fringes. Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1850 6.00.^^	Such topics as astrology, extrasensory perception, the ideas of Velikovsky, as examples of beliefs which meet with little approval in the scientific community. Methodological and social criteria by which science functions in contrast with the attitudes prevalent among those operating along its fringes. ~~Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1850 6.00.^^~~

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

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

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.26

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1810 6.00

Effective Session: Summer 2015

Course Title: Energy

Type of Change:

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

Change From:	To:
Conversion technology of current and possible future energy sources is described. The extent of the resource base of each and the environmental consequences of utilization are discussed, with emphasis on nuclear power and energy policies of Ontario and Canada. Three lecture hours, one tutorial hour. Two terms. Six credits. Course credit exclusion: AK/NATS 1780 6.00.	Conversion technology of current and possible future energy sources is described. The extent of the resource base of each and the environmental consequences of utilization are discussed, with emphasis on nuclear power and energy policies of Ontario and Canada. ~~Three lecture hours, one tutorial hour. Two terms. Six credits. Course credit exclusion: AK/NATS 1780 6.00.~~

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.27

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1775 6.00

Effective Session: Summer 2015

Course Title: Technology and Civilization

Type of Change:

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

Change From:	To:
A study of the most important technological advances in the context of various civilizations throughout history. Selected important innovations (e.g. mechanized agriculture, wind, water, steam and nuclear power generation, aviation and railways and communications). Three lecture hours. Two terms. Six credits. Course credit exclusions: AK/NATS 1780 6.00, SC/NATS 1810 6.00.	A study of the most important technological advances in the context of various civilizations throughout history. Selected important innovations (e.g. mechanized agriculture, wind, water, steam and nuclear power generation, aviation and railways and communications). ~~Three lecture hours. Two terms. Six credits.~~ Course credit exclusions: ~~AK/NATS 1780 6.00~~, SC/NATS 1810 6.00.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.28

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1760 6.00

Effective Session: Summer 2015

Course Title: Science, Technology and Society

Type of Change:

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

Change From:	To:
A study of the intellectual and social nature of science and technology, their similarities and differences. The course may deal with the impact of scientific and technological advancements on societies both past and present. Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1760 6.00.	A study of the intellectual and social nature of science and technology, their similarities and differences. The course may deal with the impact of scientific and technological advancements on societies both past and present. ~~Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1760 6.00.~~

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.29

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1745

Effective Session: Summer 2015

Course Title: History of Astronomy

Type of Change:

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

Change From:	To:
Astronomy from a historical perspective. A selective survey of astronomical knowledge, techniques, applications and uses from the earliest civilizations to the present. Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1750 6.00.^^	Astronomy from a historical perspective. A selective survey of astronomical knowledge, techniques, applications and uses from the earliest civilizations to the present. ~~Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1750 6.00.^^~~

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.30

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1740

Effective Session: Summer 2015

Course Title: Astronomy

Type of Change:

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

Change From:	To:
A discussion of our present understanding of the universe and its constituents. Topics include the structure and evolution of the planets, stars, galaxies and the universe as a whole. Three lecture hours per week, two-hour laboratory sessions every second week. Two terms. Six credits. Course credit exclusions: SC/NATS 1880 6.00, SC/NATS 1570 3.00. NCR Note: No credit will be retained if this course is taken after the successful completion of SC/PHYS 1070 3.00. Not open to any students enrolled in the Astronomy stream.	A discussion of our present understanding of the universe and its constituents. Topics include the structure and evolution of the planets, stars, galaxies and the universe as a whole. ~~Three lecture hours per week, two-hour laboratory sessions every second week. Two terms. Six credits.~~ Course credit exclusions: SC/NATS 1880 6.00, SC/NATS 1570 3.00. NCR Note: No credit will be retained if this course is taken after the successful completion of SC/PHYS 1070 3.00. Not open to any students enrolled in the Astronomy stream.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

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

7.2.31

Revised form Oct. 3/2002

Form 2

Faculty of Science
Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1730 6.00

Effective Session: Summer 2015

Course Title: Scientific Change

Type of Change:

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

Change From:	To:
The nature of scientific change based on case histories, which may include Ptolemaic and Copernican astronomy, Newtonian mechanism, Darwinian evolution, the rise of bacteriology, Einstein's relativity and the discovery of the structure of DNA. Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1710 6.00, SC/NATS 1710 6.00.	The nature of scientific change based on case histories, which may include Ptolemaic and Copernican astronomy, Newtonian mechanism, Darwinian evolution, the rise of bacteriology, Einstein's relativity and the discovery of the structure of DNA. ~~Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1710 6.00~~, SC/NATS 1710 6.00.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.32

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1700 6.00

Effective Session: Summer 2015

Course Title: Computers, Information and Society

Type of Change:

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

Change From:	To:
Selected survey and critical examination of the history and present-day development of information and communication technologies and of their interplay with society and culture. Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1700 6.00.	Selected survey and critical examination of the history and present-day development of information and communication technologies and of their interplay with society and culture. ~~Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1700 6.00.~~

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.33

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1675 6.00

Effective Session: Summer 2015

Course Title: Human Development

Type of Change:

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

Change From:	To:
Biological development of the human being including the formation of germ cells, fertilization, embryological development, transmission of genetic and chromosomal characteristics and the structure of growing tissues. Emphasis may be placed on child development, learning, human evolution or aging. Three lecture hours for two terms. Six credits. Course credit exclusions: AK/NATS 1820 6.00, SC/NATS 1610 6.00, SC/NATS 1650 6.00, SC/NATS 1660 6.00, SC/NATS 1690 6.00. NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.	Biological development of the human being including the formation of germ cells, fertilization, embryological development, transmission of genetic and chromosomal characteristics and the structure of growing tissues. Emphasis may be placed on child development, learning, human evolution or aging. ~~Three lecture hours for two terms. Six credits.~~ Course credit exclusions: ~~AK/NATS 1820 6.00~~, SC/NATS 1610 6.00, SC/NATS 1650 6.00, SC/NATS 1660 6.00, SC/NATS 1690 6.00. NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.34

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1670 6.00

Effective Session: Summer 2015

Course Title: Concepts in Human Health and Disease

Type of Change:

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

Change From:	To:
This course examines health threats from a biological perspective, with focus on issues that are relevant to the 20-30 age group. For example: immunological, bacterial, viral and genetic diseases from a multi-disciplinary perspective. Three lecture hours. Two terms. Six credits. Course credit exclusion: AK/NATS 1840 6.00. NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.	This course examines health threats from a biological perspective, with focus on issues that are relevant to the 20-30 age group. For example: immunological, bacterial, viral and genetic diseases from a multi-disciplinary perspective~~. Three lecture hours. Two terms. Six credits.~~ Course credit exclusion: ~~AK/NATS 1840 6.00.~~ NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.35

Revised form Oct. 3/2002

Form 2

Faculty of Science
Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1780 6.00

Effective Session: Summer 2015

Course Title: Weather and Climate

Type of Change:

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

Change From:	To:
The weather and health of our atmosphere affect us all. This course provides an overview of the Earth's atmosphere; its chemistry, physics and dynamics; an introduction to meteorology and weather forecasting; and a discussion of climate. Canada's weather and climate are emphasized. Three lecture hours, one tutorial hour. Two terms. Six credits. Course credit exclusions: LE/SC/EATS 1011 3.00, SC/NATS 1750 6.00. Not open to any students enrolled in the Earth and Atmospheric Science program. Prior to Summer 2013: Course credit exclusions: SC/NATS 1750 6.00, SC/EATS 1011 3.00. Not open to any students enrolled in the Earth and Atmospheric Science program.	The weather and health of our atmosphere affect us all. This course provides an overview of the Earth's atmosphere; its chemistry, physics and dynamics; an introduction to meteorology and weather forecasting; and a discussion of climate. Canada's weather and climate are emphasized. ~~Three lecture hours, one tutorial hour. Two terms. Six credits.~~ Course credit exclusions: LE/SC/EATS 1011 3.00, SC/NATS 1750 6.00. Not open to any student enrolled in the Earth and Atmospheric Science program. ~~Prior to Summer 2013: Course credit exclusions: SC/NATS 1750 6.00, SC/EATS 1011 3.00. Not open to any student enrolled in the Earth and Atmospheric Science program~~.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

7.2.36

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1750 6.00

Effective Session: Summer 2015

Course Title: The Earth and its Atmosphere

Type of Change:

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

Change From:	To:
Topics addressed concerning the Earth include geochronology, seismology, geomagnetism and plate tectonics. Topics addressed concerning the atmosphere include the general circulation, climate change, ozone depletion, weather and violent storms. Three lecture hours, one tutorial hour. Two terms. Six credits. Course credit exclusions: SC/NATS 1570 3.00, SC/NATS 1780 6.00, LE/SC/EATS 1010 3.00, LE/SC/EATS 1011 3.00. Not open to any student who has passed or is taking a course in earth and atmospheric science. Prior to Summer 2013: Course credit exclusions: SC/NATS 1780 6.00, SC/EATS 1010 3.00, SC/EATS 1011 3.00. Not open to any student who has passed or is taking a course in earth and atmospheric science.	Topics addressed concerning the Earth include geochronology, seismology, geomagnetism and plate tectonics. Topics addressed concerning the atmosphere include the general circulation, climate change, ozone depletion, weather and violent storms~~. Three lecture hours, one tutorial hour. Two terms. Six credits.~~ Course credit exclusions: SC/NATS 1570 3.00, SC/NATS 1780 6.00, LE/SC/EATS 1010 3.00, LE/SC/EATS 1011 3.00. Not open to any student who has passed or is taking a course in earth and atmospheric science. Prior to Summer 2013: Course credit exclusions: SC/NATS 1780 6.00, SC/EATS 1010 3.00, SC/EATS 1011 3.00. Not open to any student who has passed or is taking a course in earth and atmospheric science.

Revised form Oct. 3/2002

Rationale:

A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

7.2.37

Revised form Oct. 3/2002

Changes to Existing Courses & Degree Programs

Department:	Natural Science	**Date of Submission:**	September 2014
Course Number:	1540 3.00	**Effective Session:**	Summer 2015
Course Title:	Theories of Dinosaur Extinction		

Type of Change:

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

Change From:	**To:**
About 65 million years ago, dinosaurs, one of the most prominent species on Earth, vanished suddenly. This acquaints students with the more prominent of the theories used to explain this disappearance, including the evidence and objections relating to each. Offered in each semester during fall academic year. One, three lecture hours, or two, one and a half lecture hours per week. Three credits.	About 65 million years ago, dinosaurs, one of the most prominent species on Earth, vanished suddenly. This course acquaints students with the more prominent of the theories used to explain this disappearance, including the evidence and objections relating to each. ~~Offered in each semester during fall academic year. One, three lecture hours, or two, one and a half lecture hours per week. Three credits.~~

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7. 2. 38

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1610 6.00

Effective Session: Summer 2015

Course Title: The Living Body

Type of Change:

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

Change From:	To:
Some aspects of human biology, including structure and function, reproduction, physiology, genetics and a study of some human diseases. Laboratories are self-paced, scheduled audio-tutorials involving demonstrations, experiments and observations. Three lecture hours, one laboratory hour. Two terms. Six credits. Course credit exclusions: SC/NATS 1650 6.00, SC/NATS 1660 6.00, SC/NATS 1675 6.00, SC/NATS 1690 6.00, AK/NATS 1820 6.00. NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.	Some aspects of human biology, including structure and function, reproduction, physiology, genetics and a study of some human diseases. ~~Laboratories are self-paced, scheduled audio-tutorials involving demonstrations, experiments and observations. Three lecture hours, one laboratory hour. Two terms. Six credits.~~ A number of laboratory exercises are included in this course. Course credit exclusions: SC/NATS 1650 6.00, SC/NATS 1660 6.00, SC/NATS 1675 6.00, SC/NATS 1690 6.00, ~~AK/NATS 1820 6.00.~~ NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

7.2.39

Revised form Oct. 3/2002

Form 2

Faculty of Science
Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1660 6.00

Effective Session: Summer 2015

Course Title: The Biology of Sex

Type of Change:

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

Change From:	To:
This course investigates the role of sexual reproduction in the living world. The cellular, physiological and genetic bases of sex are discussed. Other topics include sexual behaviour and the influence of sexual reproduction on evolution. Three lecture hours a week. Two laboratory hours every other week. Six credits. Course credit exclusions: SC/NATS 1610 6.00, SC/NATS 1650 6.00, SC/NATS 1675 6.00, SC/NATS 1690 6.00, AK/NATS 1820 6.00. NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.	This course investigates the role of sexual reproduction in the living world. The cellular, physiological and genetic bases of sex are discussed. Other topics include sexual behaviour and the influence of sexual reproduction on evolution. ~~Three lecture hours a week. Two laboratory hours every other week. Six credits.~~ A number of laboratory exercises are included in this course. Course credit exclusions: SC/NATS 1610 6.00, SC/NATS 1650 6.00, SC/NATS 1675 6.00, SC/NATS 1690 6.00, ~~AK/NATS 1820 6.00. NCR~~ Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.

Revised form Oct. 3/2002

Rationale:

A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.40

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: October 2014

Course Number: 1690 6.00

Effective Session: Summer 2015

Course Title: Evolution

Type of Change:

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

Change From:	To:
Origin and diversification of life forms on Earth. Introduction to the historical development of evolutionary theory. Classification of living things and to scientific explanations of how biological diversity has arisen. Three lecture hours a week. Two laboratory hours every other week. Six credits. Course credit exclusions: AK/NATS 1770 6.00, AK/NATS 1820 6.00, AK/NATS 1860 6.00, SC/NATS 1610 6.00, SC/NATS 1640 6.00, SC/NATS 1650 6.00, SC/NATS 1660 6.00, SC/NATS 1675 6.00. NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.	Origin and diversification of life forms on Earth. Introduction to the historical development of evolutionary theory. Classification of living things and scientific explanations of how biological diversity has arisen. ~~Three lecture hours a week. Two laboratory hours every other week. Six credits.~~ A number of laboratory exercises are included in this course Course credit exclusions: ~~AK/NATS 1770 6.00, AK/NATS 1820 6.00, AK/NATS 1860 6.00,~~ SC/NATS 1610 6.00, SC/NATS 1640 6.00, SC/NATS 1650 6.00, SC/NATS 1660 6.00, SC/NATS 1675 6.00. NCR Note: This course is not open to any student who has passed or is taking SC/BIOL 1000 3.00, SC/BIOL 1001 3.00 or SC/BIOL 1010 6.00.

Rationale:

A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website).

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.41

Revised form Oct. 3/2002

Form 2

Faculty of Science
Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Natural Science

Date of Submission: September 2014

Course Number: 1840 6.00

Effective Session: Summer 2015

Course Title: Sceince, Technology and the Environment

Type of Change:

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

Change From:	To:
Environmental issues, how they arise, and an exploration of possible solutions to present and future problems. Topics include pollution, water quality, biodiversity, resource usage, population, global warming, and medical consequences of environmental changes. Three lecture hours. Two terms. Six credits. Course credit exclusions: AK/NATS 1790 6.00, ES/ENVS 1500 6.00, SC/NATS 1510 3.00, SC/NATS 1640 6.00, SC/NATS 1770 6.00. Note: Not open to any students enrolled in the Faculty of Environmental Studies.	Environmental issues, how they arise, and an exploration of possible solutions to present and future problems. Topics include pollution, water quality, biodiversity, resource usage, population, global warming, and medical consequences of environmental changes. ~~Three lecture hours. Two terms. Six credits. Course credit exclusions: AK/NATS 1790 6.00,~~ ES/ENVS 1500 6.00, SC/NATS 1510 3.00~~, SC/NATS 1640 6.00, SC/NATS 1770 6.00.~~ Note: Not open to any students enrolled in the Faculty of Environmental Studies.

Rationale: A number of "house keeping" chores have been applied to the brief course descriptions. Removing references to AK courses, editing the former SC/ESSE courses to now reflect the new Faculty designation LE/ESSE and finally, removal of confusing "time and tutorial" references. Many of the Natural Science courses now run as fully online courses and for many years the courses have been running in double or quadruple speed formats. When the brief course outline indicates "Three lecture hours per week" (for example) it invariably causes confusion to the students and results in unnecessary phone and office traffic. Course lengths are easily seen by the student when they access the course during enrollment. Lastly, not all versions of a course run with tutorials (or laboratory sessions) but again this information is evident during the enrollment process (or checking with the actual course outline on the Natural Science website). Additionally, NATS 1640 and 1770 expired from the course repository in 2006.

7.2.42

Revised form Oct. 3/2002

Form 2

Faculty of Science

Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Mathematics & Statistics

Date of Submission: September 1, 2014

Course Number: Math 2565 3.00

Effective Session: FW2015-16

Course Title: Introduction to Applied Statistics

Type of Change:

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

Change From:	To:
Course credit exclusions: SC/BIOL 2060 3.00, AP/ECON 2500 3.00, AP/SC/GEOG 2420 3.00, HH//KINE 2050 3.00, SC/MATH 2560 3.00, SC/MATH 2570 3.00, HH/PSYC 2020 6.00, SB/OMIS 1000 3.00.	Course credit exclusions: SC/MATH 2930 3.00, SC/BIOL 2060 3.00, AP/ECON 2500 3.00, AP/SC/GEOG 2420 3.00, HH//KINE 2050 3.00, SC/MATH 2560 3.00, SC/MATH 2570 3.00, HH/PSYC 2020 6.00, SB/OMIS 1000 3.00.

Rationale: There is significant overlap between SC/MATH 2565 3.00 and SC/MATH 2930 3.00.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

7.2.43

Revised form Oct. 3/2002

Form 2

Faculty of Science
Curriculum Committee
352 Lumbers Building

Changes to Existing Courses & Degree Programs

Department: Mathematics & Statistics

Date of Submission: September 1, 2014

Course Number: Math 2560 3.00

Effective Session: FW2015-16

Course Title: Elementary Statistics I

Type of Change:

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

Change From:	To:
Course credit exclusions: SC/MATH 1131 3.00, SC/BIOL 2060 3.00, AP/ECON 2500 3.00, AP/SC/GEOG 2420 3.00, HH/KINE 2050 3.00, GL/MATH/MODR 1610 3.00, SB/OMIS 1000 3.00, AS/POLS 3300 6.00, GL/POLS 2610 3.00, HH/PSYC 2020 6.00, HH/PSYC 2021 3.00, GL/SOCI 2610 3.00, SB/OMIS 1000 3.00.	Course credit exclusions: SC/MATH 1131 3.00, SC/MATH 2930 3.00, SC/BIOL 2060 3.00, AP/ECON 2500 3.00, AP/SC/GEOG 2420 3.00, HH/KINE 2050 3.00, GL/MATH/MODR 1610 3.00, SB/OMIS 1000 3.00, AS/POLS 3300 6.00, GL/POLS 2610 3.00, HH/PSYC 2020 6.00, HH/PSYC 2021 3.00, GL/SOCI 2610 3.00, SB/OMIS 1000 3.00.

Rationale: There is significant overlap between SC/MATH 2560 3.00 and SC/MATH 2930 3.00.

Note: For course proposals involving cross-listings, integrations and degree credit exclusions, approval from all of the relevant Faculties/department/divisions 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 (Form 1) 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 ATSG indicating whether resources are adequate to support the course.

Helix Summer Science Institute Call for Proposal

The Science Engagement Office

The Science Engagement Office offers enriched, innovative, and hands-on programming to pre-university youth ages 8-18. Established in 2006 as Science Explorations offering only summer programing to youth ages 8-14, the office expanded in 2014 offering a broader scope of STEM content now with weekend workshops, March Break programming, 24 unique in-school workshops offered exclusively to classroom teachers, an expanded summer camp offerings (SciX: Science Explorations), and a new high school program the Helix Summer Science Institute.

More information about the Science Engagement Office can be found at: http://scix.science.yorku.ca

The Helix Summer Science Institute

Helix is a high school enrichment program designed exclusively for high performing students who have a strong interest in science and mathematics. Helix consists of a series of week-long, noncredit courses, for students in Grades 9-12 that run for the month of July.

Helix is designed to be intense and academically rigorous. Students will study advanced topics in science and applied mathematics that draw upon the research strengths of the Faculty of Science at York University. Students will be guided through cutting-edge interdisciplinary topics through a series of lectures, hands-on workshops, experiments, demonstrations, and field trips. Courses are developed and delivered by professors, post-doctoral fellows, visiting scholars, and graduate students.

An optional residence program provides the opportunity for students from across Canada and around the world to participate. Interested students will stay in one of York University's dormitory style residences, will be supervised by residence program staff, and share a room with another Helix student (in same-gender rooms).

More information regarding the Helix Summer Science Institute can be found at: http//helix.science.yorku.ca

Contact Details

Justin Chan
Associate Director, K-12 Science Engagement Programs
York University, Faculty of Science
416-736-2100 x 44552
jchan@yorku.ca

Application and Delivery Details

Taking place in July, Helix is a high school enrichment program for students with an interest in science and mathematics. The program will target gifted and/or high performing students, with the aim of attracting top students into the Faculty's undergraduate programs.

This summer program will consist of a series of week-long non-credit courses for students in grades 9 to 12. The courses will highlight specific research strengths within the Faculty of Science, and will be developed and delivered by a combination of graduate students, post-docs, alumni, and faculty. Instructors are to provide students with unique and relevant university content and research to introduce them to a real university learning experience. Past instructors have included graduate students and faculty from the Faculty of Science, however, students and faculty from other Faculty's at York University are also encouraged to apply. Students in undergraduate programs with significant research experience may also apply to teach Helix.

Past alumni, and individuals working in industry that have graduated from from York University's Faculty of Science or Faculty of Engineering are also encouraged to apply.

Students and faculty who wish to participate and teach with the Helix Summer Science Institute will receive a stipend at the end of program. This stipend does affect graduate and research funding graduate students already receive. Stipend receive is also subject to taxes and other applicable deductions unique to each individual.

Proposal Submission Details

SECTION 1: Application form

SECTION 2: Course proposal

SECTION 3: Instructor Bio

SECTION 4: Resume, Outline of relevant teaching experiences.

SECTION 1: Application Form

Personal Information

Please select: Dr. Mr. Ms.

First Name: _____

Last Name: _____

Email Address _____

Home Address: _____

Country: _____

City: _____

Province/State: _____

Postal/Zip Code: _____

Phone (Day): _____

Phone (Evening): _____

Educational Background

Institution and Faculty	Program and Department	Degree / Certification	Year Completed / Expected Completion

Are you:

- o An alumnus/alumna
- o Pursuing a PhD degree
- o Pursuing a Masters degree
- o Pursuing an undergraduate degree
- o Other _____

Eligibility for Employment

You are a:
- o Canadian Citizen
- o Landed Immigrant
- o Visa Student

Employee ID:_____

Student Number: _____

If you are a visa student, do you have a permit to work in Canada?
Yes No

Availability for Employment

Please check all that apply:
- o July 6 - 10, 2015
- o July 13 - 17, 2015
- o July 20 - 24, 2015
- o July 27 - 31, 2015

Additional Information
Please note that offers of employment are conditional upon instructors attending a mandatory training session workshop. Instructors may also be required to submit a police records check clearance letter, WHMIS certification, and show evidence of BioSafety training.

SECTION 2: Course Proposal

The Helix Summer Science Institutes aims to develop and offer courses from the various departments in the Faculty of Science at York University. In the past, courses have been challenging and exciting offering high school students a unique university level experience. Previous years have included projects that include PCR and Gel Electrophoresis, computer mathematical modelling of the transmission of disease, game programming, and practical computations in astrophysics.

Title: _____

Proposed Grade Level:

- o Junior (Grade 9 & 10)
- o Senior (Grades 11 & 12)

Proposed Stream: _____(If other, please specify)

Possible Stream Options:

1. Biomedical Sciences
2. Mini-Med School
3. Neuroscience
4. Physics & Astronomy
5. Applied Mathematics
6. Environmental Biology & Chemistry
7. Engineering & Applied Sciences

Course Description

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	Monday	Tuesday	Wednesday	Thursday	Friday
Title/Theme *State the overall theme of the day (eg/ Introduction, Current trends, Future direction)*					
Lecture Topics *Clearly identify topics you wish to cover each day.*					
Proposed Activities/Experiments *State what students will be doing (eg/ Gel Electrophoresis, computer modelling, feeding cells, problem sets). You may wish to state what undergraduate experiment or course your activity is found. Consider alternatives to experiments using human cells or tissue.*					
Learning Goal *Identify what you would like students to learn from the activity*					
Activity Details *Briefly describe the **protocols** and procedure of the experiment /activity.* *(If your course is selected, you will need to describe the protocol in greater detail separately.)*					
Facilities Required *Describe what would be the*					

ideal facility (Computer Lab, Wet Lab, Standard Classroom). Be specific (eg/ Farq 217)					
Materials *Identify the materials you require for each activity with approximately 25 students. Estimate the cost associated for the course. Each course has an approximate budget of $500. In past years, instructors teaching Helix have purchased materials at a pro-rated cost from their supervisors.* *(If your course is selected, you will need to provide detailed materials list separately.)*					

SECTION 3: Instructor Bio

Prof. Michael Chen graduated from Northwestern University with a PhD degree in Industrial Engineering and Management Science. Michael's research focuses on mathematical modeling of sophisticated business/industry/government management problems and fast computer algorithms for solution seeking. Michael's research is supported by the National Science and Engineering Council of Canada. Since joining York University in 2009, Michael has taught multiple courses in mathematical modelling and has been a popular teacher in this area. Michael's students are working for business intelligence or analysis department at IBM, Walmart, banks, insurance companies, etc.

Instructor Bio:

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Sample Course Proposal and Outline

Cloning Disease / Tools in Molecular Biology

Understanding how biological systems function is fundamental to developing novel strategies against disease. These diseases include cancer, neurodegenerative diseases, AIDS, and cardiovascular diseases. This course introduces one of the most important tools in molecular biology today, which is cloning. Cloning is a genetic technique to look at a specific gene, it's function, and it's overall importance to biological systems. There have been many innovations in the twentieth century that have led to the development of modern day molecular biology, particularly the discovery of restriction endonucleases, polymerase chain reaction, gel electrophoresis, and sequencing. In order to understand a disease, we must understand the gene defect or mutation *in vitro* by cloning. This is a lab course where students will be cloning the human La (hLa) gene into expression vectors. The learning objective of course is for students to develop practical research skills.

	Monday	Tuesday	Wednesday	Thursday	Friday
Theme	Course Introduction, history and discoveries in molecular biology and Polymerase chain reaction (PCR)	Developing scientific writings. Journal reviews and methods to analyze papers.	Introduction to DNA and RNA expression, replication, and structure.	How we use biological systems to conduct research; The use of prokaryotes in order to develop tools	The humble beginnings of Watson and Cricks double helix to the human genome project; current methods in biology
Lecture Topics	History of Recombinant DNA technology	How to review and interpret scientific writing	From central dogma to genetic manipulation	Introduction to Bacterial genetics	Applications of cloning: Protein purification, co-Ip, gel shift, clinical applications
Proposed Activities	Pipette training and start with the cloning procedure.	Continue on the cloning procedure and learning how to find relevant papers	Continuation of cloning and quantitative methods	Continuation of cloning and presentations	Analyzing cloning results
Learning Goal	Students will get introduced to pipette use and how to do wet lab experiments	The students will learn to evaluate and analyze peer review scientific journals.	Students will learn how to quantify DNA on agarose gels and demonstrate their	Students will be introduced to basic bacterial genetics and it's fundamental uses in molecular biology	Students will verify if their cloning experiment worked through restriction digest of plasmids
Experiments	PCR, PCR clean up and run an agarose gel	Run an agarose gel, digest inserts and vectors	- Run an agarose gel and extract the insert DNA - run another gel with the cleaned insert for quantification	Ligation of insert and vector, transformation of plasmid into XL1 *E. coli* cells and grow overnight cultures	Isolate plasmid DNA by miniprep and digest plasmids with Restriction Endonucleases to analyze the final cloning step
Materials	Pipettes (P1000, P200, P20), tips, microtubes, balance, Agarose, gel red, Tris Borate EDTA (TBE) Buffer phenol:chloroform, , PCR machine, pimers, DNA, Q5 enzymes and buffer, dNTPs, gel apparatus, PCR tubes, microtube centrifuge, Styrofoam boxes, microtube racks, ice, Ethanol (Anhydrous), Sodium Acetate	microtube centrifuge, styrafoam boxes, microtube racks, ice, 2 Restriction Endonucleases, 70% Ethanol, Enzymes and buffer, BSA, calf intestinal phosphotase (CIP),37°C heat block, gel apparatus and computers	Pipettes, tips, microtubes, balance, Agarose, gel apparatus gel red, TBE Buffer, UV transiluminator, razor blade, gel extraction kit, microtube centrifuge, ice, Styrofoam boxes, microtube racks, ice, heat block, gel dock	Pipettes, tips, microtubes, balance, Agarose, Gel red, TBE Buffer, overnight tubes, Kanamycin Antibiotic, 37 degree Celsius incubator, microtube centrifuge, Luria Broth (LB) + Kanamycin media, plates, microtube centrifuge, ice, Styrofoam boxes, microtube racks, ice, T4 DNA ligase, ligase Buffer,	Pipettes, tips, microtubes, balance, Agarose, Gel red, TBE Buffer, overnight tubes, Miniprep I kit, 2 Restriction Endonucleases, 2 Restriction Endonuclease buffers, 37 degree Celsius incubator, gel dock
Use of Materials	To practice how to use the	To digest their insert and	- Running an agarose gel	Ligating insert into vector	

	pipettes and make a PCR insert	vector to prepare them for the next step and learn how to scientific writings	and extracting insert and vector - Running an agarose gel in order to calculate gene to vector ratio for ligation	and transforming plasmid into *E.coli* cells to grow overnight cultures	
Afternoon Activity (If Applicable)	Learn how to design primers (Assignment + group discussion)	N/A	Quantification tutorial	Presentations 5-6 minute	Tour of York University research labs
Facilities Required	Biosafety level 1 lab (all day)	Biosafety level 1 lab (all day)	Biosafety level 1 lab (all day)	Biosafety level 1 lab (all day)	Biosafety level 1 lab (all day)

The Senate of York University

Synopsis

of the 607th Meeting of Senate held on Thursday, October 23, 2014

Remarks

The Chair, Professor Roxanne Mykitiuk, reflected on an inspiring and joyful round of Autumn Convocation ceremonies, and thanked those who attended and supported events. She expressed condolences on the passing of Malcolm Ransom, Secretary of the University from 1973-1998, and former Senator and Bethune College Master Griff Cunningham. Senators were reminded that the November 27 meeting will be held in Room A100, Glendon Centre of Excellence.

In his remarks, President Shoukri shared his profound sadness about the tragic events that had occurred on Parliament Hill on October 22, and emphasized the University community's unshakeable resolve to uphold the values of respect, inclusivity and democracy. Dr Shoukri also commented on the following matters:

- uplifting messages delivered at Convocation by recipients of honorary degrees at Convocation
- a highly successful visit to India coinciding with the official opening of the Schulich School of Business campus in Hyderabad, an event that was attended by local, state and national dignitaries and attracted wide, positive media coverage for the University
- York's impressive and steady rise in the *Times* Higher Education World University Rankings whereby the University was pegged at 234 of 400 overall and placed in the top 100 for the Social Sciences and Humanities
- ongoing efforts to secure government funding for international graduate students together with continuing concerns about the growing share of education costs borne by all students through their tuition fees

Major Reports*

The Interim University Librarian, Catherine Davidson, provided an overview of York University Library initiatives of interest to faculty members and students.

Senate received a synopses of the Board of Governors meeting of October 6, 2014 conveyed by Senators on the Board, Professors Angelo Belcastro and David Leyton-Brown.

Provost Lenton presented her autumn report on enrolments and complement.

Senate deferred consideration of the autumn report of the Vice-President Finance and Administration on the budget context for academic planning to the November meeting.

* All of these reports were made available in advance with the Senate agenda package.

Approvals

On a recommendation of the Academic Policy, Planning and Research Committee Senate approved the transfer of the Division of Continuing Education from the Faculty of Liberal Arts and Professional Studies to the Division of the Vice-President Academic and Provost where it will be housed with the York University English Language Institute in a renamed School of Continuing Studies.

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

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- a minor change to the Diploma in Asian Studies (Type II) such that the requirement for a graduate diploma committee be eliminated
- changes to the requirements of the MSc program in Physics & Astronomy effective Fall-Winter 2015-2016
- changes to the requirements of the PhD program in Physics & Astronomy effective Fall-Winter 2015-2016

Senate Committee Annual Reports

The Tenure and Promotions Committee and Tenure and Promotion Appeals Committee filed their annual reports for 2013-2014. In remarks at the meeting, the Chair of Tenure and Promotions drew attention to practices that would enhance and expedite processes, namely by ensuring that referees were at arm's length and obtaining commentaries from collaborators. It was also imperative that adjudicative committees link recommendations to evidence.

Senate Committee Information Items

Senate Executive informed Senate of its approval of individuals nominated by student Senators to serve on Senate committees. It also reported on Senate committee priorities for 2014-2015, remaining vacancies on Senate Committees and the membership of the Sub-Committee on Equity.

Academic Standards, Curriculum and Pedagogy transmitted sessional dates for summer 2015 terms and for Fall-Winter 2015-2016. Adjustments to the summer 2015 class schedule were necessitated by a concentration of Pan American games events over a four-day period that argued in favour of a full pause of course meetings during that span. It was confirmed that a group is undertaking a comprehensive planning exercise and that the University is closely involved in preparations that include security measures. Senate and the community will receive fuller details about planning in the months ahead.

Academic Policy, Planning and Research reported on

- its priorities for 2014-2015
- the date, time, location and focus of an open forum following on the release of Academic and Administrative Program Review Task Force reports
- its receipt of a September posting to the Senate listserv on the matter of AAPR
- the planning cycle for 2014-2015 and beyond
- an updated list of sub-committee members

For information on these items please refer to the full Senate agenda posted online.

University Secretariat: http://www.yorku.ca/secretariat or extension -55310.

Important Scheduling Note

Senate's 608th meeting will be held at 3:00 p.m. on Thursday, November 27, 2014
Room A100, Centre of Excellence, Glendon.