Pan-University Bachelor of Science Degree Structure

Background

With the restructuring of Faculties at York University in the last few years it became evident that pan-University structures for both BA and BSc degrees were desirable. For the BSc this would provide a common framework for the degree suitable for the new multi-Faculty environment.

Consequently the Faculty of Science and Engineering (FSE) and the Faculty of Health have collaborated in arriving at the structure proposed here.

Understanding the need for change

For many years York Bachelor of Science degrees had been offered almost exclusively through FSE. The general structure for the degree included a requirement to complete a given number of "science credits" (normally 75% of the degree credits must be science credits). Historically science credits have been identified by the FSE Faculty designation "SC". In other words, all courses offered by FSE counted as science credits. The creation of the Faculty of Health in 2006 resulted in some Bachelor of Science degree programs moving from FSE to the new faculty. Consequently, science courses are being offered by two Faculties and the designation SC no longer identifies all science courses.

Thus it is no longer feasible to continue identifying courses as being "science" both because a definition of such a type of course is problematic as are the processes required to approve a course as such. Thus in developing a pan-University BSc degree structure it was necessary to abandon the need to count "science" credits.

General Approach

In developing a pan-University degree structure a working group consisting of representatives from FSE and Health, as well as the Geography BSc program, was established. The group took a fresh look at what constitutes a contemporary education in science, and developed a set of defining elements that all BSc degrees should have in common. These elements are presented in Part A. They include knowledge and ways of thinking that ideally every student graduating with a BSc should possess. As well they reflect the fact that modern science is inherently inter- or multi-disciplinary, and relies on mathematics and computational approaches as key tools that enable many advances.

The implementation of these principles in a structure for the BSc degree underwent a number of iterations, and the result presented in Part B represents a best fit incorporating the elements outlined in Part A while meeting the curricular needs of some 20 programs spanning two faculties.

It is also recognized that disciplines will need to examine their existing degree requirements and bring forward any changes that are required in order to meet the new structure.

Phasing in the Changes

1. **New BSc programs**
   Once approved the new BSc structure requirements will apply to all subsequent new degree programs.

2. **Existing BSc programs**
   Existing programs will all need to review their degree requirements and, where necessary, bring forward changes in order to align program requirements with the new degree structure. It is expected that all BSc programs will meet the minimum degree requirements by the F/W 2012-13 academic year.

   Where changes are required the new requirements will apply to students admitted to that program subsequent to the date of approval of the program changes. Students admitted to the program prior to the change may proceed under the degree requirements in place when they were admitted.

3. **Students who Change Programs**
   Students who are enrolled in a BSc program prior to the new degree structure and who change to a different program (i.e. major) may proceed under the old BSc structure and the old program requirements of their new major.

Part A: Desired Elements of a Bachelor of Science Degree

Students graduating from York University with a Bachelor of Science degree should possess:

1. an understanding of and experience with the scientific method, the methodology and/or laboratory practices appropriate to the discipline and the theoretical framework of the science discipline studied;

2. knowledge of and facility with mathematics, the language of science;
   Rationale: The use of mathematics is a necessary and integral feature of science. Whether calculus, linear algebra, statistics, discrete math, or another field, mathematics is ubiquitous throughout science, as a descriptive and analytical tool, for modeling and simulation, and in some disciplines as the very foundation of the science.

3. knowledge of and facility with computational methods and tools;
   Rationale: Modern science increasingly relies on computation as an enabling tool, whether for data collection and analysis (including extremely large data sets), visualization of systems, or investigation of theoretical predictions through modeling and simulation.

4. breadth and depth in science:
   a. a degree of breadth across the foundational science disciplines of Biology, Chemistry and Physics;
      Rationale: Biology, Chemistry and Physics form the foundation of the science in so far as it seeks to describe and understand the natural world. This foundation exposes students to the broad ranges of scale and of levels of complexity, organization and abstraction spanned by science.

   b. a degree of depth and expertise in one or more disciplines within the Physical and Life Sciences, Computer Science and Mathematics.

   c. A degree of breadth in practical/laboratory experiences;

   d. a degree of depth (beyond the first-year courses) in a scientific discipline (which includes all current BSc major subject areas) outside the major in order to foster the interdisciplinarity that is increasingly a hallmark of modern science.
      Rationale: Many, if not most, new scientific fields are inherently inter- or multi-disciplinary. Given this fact it is in our students' best interests to have significant exposure to more than one discipline. Providing our students with this additional depth will help prepare them to respond to an evolving knowledge base and participate in emerging fields.

5. breadth in areas of human inquiry beyond the Bachelor of Science disciplines, including exposure to issues, methodologies and thought processes of the liberal arts;
   Rationale: University is more than just a training ground for a particular discipline. Graduates should be educated to appreciate and value as many facets of human knowledge and scholarship as possible, to more completely prepare them to contribute thoughtfully, knowledgably and compassionately to society.

6. demonstrated critical thinking and analytical skills inside and outside the discipline of the major;
   Rationale: A primary role of the University is to foster critical thinking and analytical skills in its students. Developing these skills in more than one area of study will promote adaptability and portability of skills, and enable students to approach problems with fresh perspectives and in new ways.

7. an ability to communicate orally and in writing to a variety of audiences.
   Rationale: This ability is critical to success in any career. In the case of science, creating and disseminating new knowledge and using it to better human societies and life on earth more generally will ultimately depend on communication among scientists, policy makers, industry and broader society.

Honours Bachelor of Science Degree
In addition to the above, a student graduating from York University with an Honours Bachelor of Science degree will possess greater depth in the major discipline, and a more concrete awareness of the strengths and limitations of scientific enquiry and of their own knowledge. Students will also have the opportunity to complete courses necessary to prepare for graduate study, including experience in research and/or autonomous scholarship.

General Education
We acknowledge the pan-University commitment to the notion of general education, adopting the loose definition that such a degree component should provide broad foundational knowledge and skills. As such, for an education in science we regard the following elements mentioned above as providing that foundational general education: mathematics (item 2), computation (item 3), lab experiences (reflected in items 1, 4a and 4c), and methods of enquiry outside of Science (item 5). This is reflected further below.

Part B: Proposed BSc Structure

In light of the principles presented in Part A it is proposed that the pan-University BSc degree structure include the following four broad components (each further elaborated below):

A. General Education
This component includes a minimum of 27 credits composed of foundational studies in mathematics, computation, laboratory science and human enquiry outside of science as detailed below. The component implements principles expressed in A.1, A.2, A.3, A.4a, A.4c, A.5, A.6 and A.7.

B. The Science major
This component specifies minimum credit limits constituting a disciplinary or multi-disciplinary focus for Bachelors, Specialized Honours, Honours Major, and Honours Minor programs. These minima include a requirement at the upper-level to be specified within the discipline. Further details are given below. The component implements principles expressed in A.1, A.4b, A.6 and A.7.

C. Science Electives
This component includes 24 science credits outside the major (including the science credits in the General Education component and science credits required by the major that are not in the discipline of the major), detailed below, implementing principles primarily expressed in A.1, A.4c, A.4d and A.6.

D. Upper Level Requirements
This component specifies minima for upper-level credits in the Bachelors and Honours degree types. Part or all of this requirement may be met within the major. The component implements principles primarily expressed in A.1, A.4b, A.6 and A.7.

The following gives details of the components outlined above. Being minimum requirements each Faculty or program may require additional credits, or may specify particular courses that serve specific objectives within any of the areas.

1. 27 credits General Education

a. Human enquiry outside of Science [maps to A.5, A.6, A.7]
At least 12 credits in courses that are not Science disciplines.* Generally these courses are expected to require as a major component the development of critical skills as defined in the liberal arts, including substantial writing practice. These credits may be specified by the major discipline but may not count as part of the major credits for that discipline.

b. 1000-level Mathematics [maps to A.2]
At least 6 credits in MATH 1000-level courses (excluding remedial courses) normally including calculus and other areas of mathematics relevant to the major. This provides the basic foundation of university-level mathematics. The credits may be specified by the major discipline but may not count as part of the major credits for that discipline, except if the major discipline is a Mathematics or Statistics program.

It is expected that BSc programs will, in addition, expose students to basic statistical analysis and will incorporate applied mathematics into the program, as both a descriptive and analytical tool.

c. 1000-level computation [maps to A.3]
At least 3 credits in CSE 1000-level courses. This provides the foundation in computational methods and tools. The credits may be specified by the major discipline but may not count as part of the major credits for that discipline, except if the major discipline is computer science or computer security.

It is expected that programs will build on this foundation and apply computational approaches as appropriate to the discipline.

d. 1000-level Foundational Science [maps to A.1, A.4a]
At least 6 credits from courses with laboratories in any of the following three areas: BIOL, CHEM, PHYS thereby providing breadth across foundational science disciplines. The major discipline itself, if it is one of these three, does not satisfy this requirement. Thus it is expected that a degree program will include, in addition to the 1000-level requirement of the major discipline, 6 credits more from these foundational areas.

2. **The Major requirement** [maps to A.1, A.4b, A.6, A.7]

The major requirement may be composed of courses within a single discipline plus additional cognate courses, or a selection of courses from multiple disciplines that constitute a well-defined multi- or inter-disciplinary program.

a. Bachelor: at least 30 credits, including at least 12 credits at the upper level (normally 3000-level)
b. Specialized Honours: at least 54 credits, including at least 18 credits at the upper level (3000- or 4000-level), at least 12 of which must be at the 4000-level
c. Honours Major: at least 42 credits, including at least 18 credits at the upper level (3000- or 4000-level), at least 12 of which must be at the 4000-level. The Honours Major may be stand-alone or combined with a second Honours Major.
d. Honours Minor: at least 30 credits, normally including at least 6 credits at the 4000-level. The Honours Minor may not be a stand-alone program; it must be combined with an Honours Major.

3. **Upper Level Requirement** [maps to A.1, A.4, A.6, A.7]
a. Honours programs: a total of at least 42 credits at the upper level (3000- or 4000-level). This includes any upper level credits required by the major (at least 18), each major in an Honours Double Major program (at least 36), or each major in an Honours Major/Minor program (at least 24).
b. Bachelor: a total of at least 18 credits at the upper level (normally 3000-level). This includes the 12 credits at the upper level required by the major.

4. **Science Elective** – not required for Double Major, Major/Minor combinations [maps to A4c, A4d, A6]

At least 24 credits in *Science disciplines outside the major, of which at least 3 credits must be at the 2000-level or higher, 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>

Programs that require a selection of courses from multiple disciplines may count as Science electives any required credits in the various constituent disciplines that are not already counted in reaching the Major requirement totals in 3 above.

***Current Science disciplines are: Biology (BIOL), Biochemistry (BCHM), Biophysics (BPHS), Chemistry (CHEM), Computer Science (CSE), Earth and Atmospheric Science (EATS), Geography (GEOG), Kinesiology and Health Science (KINE), Mathematics and Statistics (MATH), Physics and Astronomy (PHYS), Psychology (PSYC), Science and Technology Studies (STS).*

BSc Degree Program types

	Bachelors		Specialized Honours		Honours Major		Honours Minor	
	Current FSE	Proposed	Current FSE	Proposed	Current FSE	Proposed	Current FSE	Proposed
General Education								
Non-Science	12	12	12	12	12	12	12	12
MATH	6	6	6	6	6	6	6	6
Computing	2	3	2	3	2	3	2	3
Foundational Lab (outside major)	6 (some programs require 12)	6	6 (some programs require 12)	6	6 (some programs require 12)	6	6 (some programs require 12)	6
Total	-	27	-	27	-	27	-	27
Major								
1000-level	-	6	-	6	-	6	-	6
2000-level	-	-	-	-	-	-	-	-
3000-level	-	12	-	6	-	6	-	-
4000-level	-	-	-	12	-	12	-	6
More as required by major	24	12	54	30	36	18	30	18
Total	24	30	54	54	36	42	30	30
Upper Level Total	18	18	42	42	42	42	42	42
SC Outside Major	-	9 (3cr at 2000-level or higher)+	-	9 (3cr at 2000-level or higher)+	-	9 (3cr at 2000-level or higher)+	-	9 (3cr at 2000-level or higher)+
Overall Total	90	90	120	120	120	120	120	120
For comparison only – these subtotal, are not part of the proposed new structure:								
1000-level Sc	24	21	24	21	24	21	24	21
1000-level Lab	12	6 plus 6 in major	12	6 plus 6 in major	12	6 plus 6 in major	12	6 plus 6 in major
SC credit	66	(54*)	90	(78*)	90	(66*)	90	(87*)

+ For a total of 24 non-major science credits when combined with the General Education science credits and science credits required by the major that are not in the major discipline.
Honours Double Major and Honours Major/Minor programs are exempt from the *Science Outside the Major* requirement.

* Minimum Science path assumes remaining upper-level and free choice credit is non-Science

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 not in the major; and -science credits required by the major that are not in the major discipline.
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 not in the major; and -science credits required by the major that are not in the major discipline.
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.