

Double Major (Honours) in “Applied and Industrial Mathematics” and “Physics”

Presently, the Faculty of Science offers separate Honours BSc degrees in “Applied and Industrial Mathematics” and “Physics”. The mathematics and physics backgrounds that are acquired by completing the respective program are complementary. A solid background in both of these disciplines would be an invaluable asset for students, in particular, for those moving on to graduate research. Thus, the strongest students, with interest in both disciplines, may wish to complete the requirements of both programs. To this end, we propose to offer these students the possibility of a single honours degree with the two designations of “Applied and Industrial Mathematics” and “Physics”. The guidelines for offering this degree are below. We have also included short discussions about double major offerings at other universities and the issue of double-counting, and a possible program map.

Note that this not a new program. It is means to provide recognition to students who have satisfied all of the requirements of two different programs. It is also distinct from a second degree in that only one degree is granted. Also, note that there is a student who will be completing these requirements at the end of this year.

Proposed Double Major Guidelines

- A single honours degree with the two designations (i.e. two majors) “Applied and Industrial Mathematics” and “Physics” can be granted when all requirements of both programs are satisfied. The student will be awarded a BSc (Hons) listing both program designations.
- For this “double major” only a single degree is granted, and thus it is distinctly different from a second degree in that it does not require the program requirements of the two degrees to be *exclusively* satisfied, i.e. all courses taken to satisfy the degree requirements from one of the major programs can count toward the elective courses of the other program, and visa-versa, and any non-science electives can count toward both degree requirements.
- Regarding the thesis project, a student may petition to have a single project accepted for both majors prior to the date of commencing the project. In this case, there will be a primary supervisor from the discipline of one of the majors, and a secondary supervisor from the second major discipline. The secondary supervisor will participate in the approval of the thesis topic, in monitoring the progress of the thesis, and in the evaluation of the thesis. It is expected that the thesis project will have a cross-disciplinary component. It is not expected that a student working toward a double major would take the directed studies option. However, if they do, they can also petition to have the course accepted for both programs.
- A student pursuing a double major will designate one as the primary major and one as the secondary major; generally, the student will pursue the thesis in the primary area.

(Note: these have been adapted from the double major guidelines of Michigan Tech)

Discussion

Given the above guidelines, it would be possible to get an honours degree with majors in “Applied and Industrial Mathematics” and “Physics” in 5 years by taking 15 credits per semester (see possible program map below). To finish in 4 years it would require 18-credit semesters. It is not possible to satisfy the requirements with just 120 credits; almost 150 credits are necessary. **Note:** there is a student who will be completing these requirements at the end of this year.

Guelph offers a double major (honours) in science. This requires 12 upper level courses (3000 and 4000 level) in each of two majors. Western offers an honours degree if the student satisfies two ‘major modules’ in two different subjects; each module requires 12 to 14 total courses (in general, this is less intensive than our programs). U of T, York, and Ottawa also offer similar (not-so-intensive) double major options. Other than that, there are honours programs that combine disciplines into a single program (e.g. a single program called ‘Mathematics and Physics’). One exception was a program offered at McGill which they called a ‘joint’ honours in Physics and Math. However, I believe this is more similar to a single program, and that the requirements of two honours degrees are not required to be satisfied (i.e. it is different that a ‘double honours’).

Some (but not all) double majors degrees at other universities have limits on double counting of courses toward program requirements. When there are such restrictions, typically, a maximum of 4 or 5 courses (other than core science courses) can be double counted. Generally, these restrictions do not apply to total credit requirements (i.e. general science and liberal arts electives), and only apply to specific program requirements (i.e. if 14 courses in a particular subject are required for a major in that subject, then the double counting restriction is that only 4 of these specific courses can count toward the 14 courses required for the second major). With the guidelines given above, the honours double major degree in “Applied and Industrial Mathematics” and “Physics” at UOIT would satisfy the strictest of other university’s double counting policy, since only two courses (in the second year) plus the thesis would be double counted.

Possible Course Map for Double Major in Applied Math and Physics

YEAR 1

Semester 1 (15 credit hours)

BIOL 1010U Biology I
CHEM 1010U Chemistry I
CSCI 1000U Scientific Computing Tools
MATH 1000U Introductory Calculus or
MATH 1010U Calculus I
PHY 1010U Physics I or
PHY 1030U Introductory Physics

Semester 2 (15 credit hours)

BIOL 1020U Biology II
CHEM 1020U Chemistry II
MATH 1020U Calculus II
PHY 1020U Physics II
CSCI 1030U Introduction to Computer Science

YEAR 2

Semester 1 (15 credit hours)

MATH 2010U Advanced Calculus I
MATH 2050U Linear Algebra
MATH 2080U Discrete Mathematics
STAT 2010U Statistics and Probability for Physical Science
PHY 2030U Mechanics I

Semester 2 (15 credit hours)

MATH 2020U Advanced Calculus II
MATH 2060U Differential Equations
MATH 2072U Computational Science I
PHY 2040U Mechanics II
PHY 2050U Thermodynamics and Heat Transfer

YEAR 3

Semester 1 (15 credit hours)

MATH 3020U Real Analysis
MATH 3040U Optimization
PHY 3050U Waves and Optics
PHY 2060U Nuclear Physics and Relativity
PHY 2010U Electricity and Magnetism I

Semester 2 (15 credit hours)

MATH 3050U Mathematical Modelling
MATH 3060U Complex Analysis
PHY 2020U Electricity and Magnetism II
PHY 3040U Mathematical Physics
Non-science elective**

YEAR 4

Semester 1 (15 credit hours)

PHY 3010U Statistical Mechanics I
PHY 3020U Quantum Mechanics I
MATH 4010U Dynamical Systems and Chaos
MATH 4020U Computational Science II
Non-science elective**

Semester 2 (15 credit hours)

PHY 3030U Electronics
PHY 3060U Fluid Mechanics
MATH 4030U Applied Functional Analysis
MATH 3070U Algebraic Structures
Non-science elective**

YEAR 5

Semester 1 (15 credit hours)

MATH 4060U Industrial Mathematics
PHY 4020U Quantum Mechanics II
senior physics elective
Thesis I
Non-science elective**

Semester 2 (15 credit hours)

MATH 4042U Topics in Applied Mathematics II
MATH 4050U Partial Differential Equations
PHY 4010U Statistical Mechanics II
PHY 4030U Modern Physics
Thesis II