# Environmental Geosciences Specialist (Science Program)

## Start Session:

| Summer 2017 |

## Current Calendar Description:

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## New Calendar Description:

The Environmental Geosciences specialist program explains the interconnectedness within the Earth system (biosphere, hydrosphere, atmosphere, and geosphere), measures and models processes related to groundwater and biochemical activities, and assesses the effects of human activities on our geological surroundings.

## Current Completion Requirements:

Jointly sponsored by the School for the Environment and the Department of Earth Sciences. Topics include earth materials, sedimentary geology, aqueous geochemistry, hydrogeology and biogeochemistry. For more information, please contact the Department of Earth Sciences, undergradchair@es.utoronto.ca. Students should note that under the Professional Geoscientists Act of 2000, individuals practicing Environmental Geoscience in Ontario require education that fulfills APGO knowledge requirements or a P.Eng.

(14 full courses or their equivalent which includes fulfillment of the Faculty’s Distribution requirement ; must include at least four 300+-series courses, one of which must be at the 400-level)

### Environmental Geosciences Specialist

#### First Year:

| CHM151Y1/CHM135H1, CHM136H1 (CHM138H1, CHM139H1); (MAT135H1, MAT136H1) / MAT137Y1; PHY131H1, PHY132H1 |

#### First or Second Year:

| BIO120H1 |

#### Second to Fourth Years:

| ENV233H1, ESS221H1, ESS222H1, ESS241H1; GGR201H1; ENV234H1/ESS261H1/EEB214H1; CHM210H1; MAT235Y1/(MAT221H1/MAT223H1, ESS345H1); STA220H1/GGR270H1;ESS311H1, ESS312H1, ESS331H1; ESS425H1/ENV315H1; ESS461H1, ESS410H1 |

#### 2.0FCE from:

| JGA305H1, ESS381H1,E;ESS450H1, ESS441H1, ESS445H1, ESS481H1, ESS491H1 / ESS492Y1 |

## New Completion Requirements:
Jointly sponsored by the School for the Environment and the Department of Earth Sciences. Topics include earth materials, sedimentary geology, aqueous geochemistry, hydrogeology and biogeochemistry. For more information, please contact the Department of Earth Sciences, undergradchair@es.utoronto.ca. Students should note that under the Professional Geoscientists Act of 2000, individuals practicing Environmental Geoscience in Ontario require education that fulfills APGO knowledge requirements (see note below) or a P.Eng.

(12 full courses or their equivalent which includes fulfillment of the Faculty’s Distribution requirement, including at least 1.0 FCE from 400-series courses)

1st year required courses (2 FCE): CHM151Y1/(CHM135H1, CHM136H1), MAT135H1, PHY131H1/PHY151H1

1st year elective courses: 1 FCE from MAT136H1, PHY132H1/PHY152H1, BIO120H1, CSC108H1/ESS345H1, JEG100H1

2nd year required courses (2 FCE): ESS241H1, ENV233H1, ESS262H1, GGR201H1

2nd year elective courses: 1 FCE from ESS221H1, ESS222H1, ESS261H1, STA220H1/GGR270H1, CHM210H1, MAT221H1/MAT223H1; up to 0.5 FCE of this requirement can be satisfied by taking one of the following ethics courses: IMC200H1/PHL273H1/PHL275H1/ABS201Y1

3rd and 4th year required courses (2 FCE): ESS311H1, ESS312H1, ESS410H1, ESS461H1

3rd and 4th year elective courses: 4 FCE from JGA305H1, ESS330H1, ESS331H1, ESS361H1, ESS362H1, GGR337H1, GGR390H1, ENV333H1, ESS431H1, ESS441H1, ESS445H1, ESS450H1, ESS462H1, ESS463H1, ESS464H1, ESS490H1, ESS491H1/ESS492Y1

If you plan to become APGO certified, we suggest you consider the following courses to fulfill minimum qualifications. This list comprises courses which are required for the specialist as well as suggested courses; together they fulfill groups 1A, 1B, 2A and 2B of the APGO requirements and add up to 13.5 FCE:

Group 1A: CHM135H1, MAT135H1, PHY131H1

Group 1B: BIO120H1, MAT136H1, CHM136H1, PHY132H1, STA220H1/CSC108H1/ESS345H1

Group 2A: ESS221H1, ESS241H1, ESS330H1, ESS331H1

Group 2B: ENV233H1, ESS312H1, GGR201H1, GGR337H1, JGA305H1

Group 2C: 4.5 FCE of 200/300/400 level ESS or other allowable courses

All students, regardless of their career aspirations, are encouraged to talk to the undergraduate chair about their selection of electives.

Brief Description of the Proposal:

Reduction of overall FCE requirements from 14.5 to 12 FCE, reducing the number of required courses from 11.5 to 6 FCE, and increasing the number of electives from 2 to 6 FCE.

Rationale:

The rationale for this change can be seen from both the students’ and the faculty perspective:

Student perspective:

Not all students taking the Environmental Geoscience Specialist aim to become certified as professional geoscientists. In fact, the current requirement are restrictive and make it hard to complete the program in time. Changing the course designations from required to elective provides more flexibility, and reducing the total FCE requirements will enable students to complete an additional minor or major program in another discipline without compromising the program for those students who want to get APGO certified. All courses which are required to get APGO certification are listed in the...
calendar. This proposal gives students the choice whether they want to obtain this certification or not, depending on their career aspirations. Program learning outcomes are not diminished by reducing the number of required FCE from 11.5 to 6.0 FCE (see note below). The 6.0 FCE core courses provide depth of knowledge as well as an introduction and practice of competencies, and both required 400-level courses include an integrative, inquiry-based activity. Elective courses reinforce the learning of competencies. Increasing the number of elective courses from 2.0 to 6.0 FCE allows students to match courses to their interest. For example, by choosing programming, introductory geophysics, and a geophysics field course they will be able to link chemical aspects of groundwater to subsurface imaging and modeling methods. Or they may be interested in the biological aspects that would be covered by a combination of introductory biology, atmosphere-biosphere interactions, and global geochemical cycles. The list of electives is 15.0 FCE, large enough to offer choice but not too large to make it confusing.

Faculty perspective:

The external review in 2013 states: "The Environmental Geosciences specialist program is in need of revision, considering the recent addition of physical geographers to the Department (once their commitments to their former program have elapsed)." This proposal responds to the reviewers’ suggestion. The proposed revision, if approved, will offer a distinct environmental specialist degree that builds on the strength and expertise of our faculty. It includes new courses developed for the Earth and Environmental Systems Major POST, which reinforce the learning outcomes by providing a wider context. It builds a solid foundation for students who aspire to work in other professions (for example teaching, law, NGOs, and science reporting).

Program learning outcomes:

Graduates of the Environmental Geoscience Specialist program will continue to acquire essential knowledge and skills they need to assess environmental concerns related to geosciences and to contribute to the well-being of our society.

Specifically, graduates of the Environmental Geosciences Specialist program will be able to accomplish the following (relevant courses noted in brackets):

- explain biological [ESS262, ESS461], chemical [CHM151Y or CHM135+136, ENV233], and physical [PHY131] principles that form the basis for understanding environmental issues, including the actions of biological agents in geologic settings [ESS262],
- collect meaningful data both in the field and in a laboratory setting [ESS410, ESS461],
- integrate their own field observations into a meaningful map and coherent report [ESS241, ESS410, ESS461],
- infer from chemical, hydrologic, and geologic data possible solutions to issues of environmental concerns [ESS311, ESS312],
- interpret environmental data, and suggest possible and practical solutions [ESS312, ESS410],
- integrate geological knowledge with broader environmental issues [ESS262, ESS311, ESS410],
- discuss the availability of and threat to water resources [ESS311], and assess the fate of waste products [ESS312],
- evaluate the effects of natural processes and human actions on the environment [ESS262, ESS311], and
- appreciate the interconnectedness and quantify processes within the Earth system (biosphere, hydrosphere, atmosphere, and geosphere) [ESS262, ESS461].

In addition, our students will be able to

- organize their thoughts into coherent geological arguments [ESS241, ESS410, ESS461],
- communicate effectively to a variety of audiences in written work and oral presentations [WIT course ESS241, ESS461], and contribute as a competent member to the success of a team [ESS410 field course],
- locate and retrieve necessary information from a wide range of sources and evaluate its relevance and reliability [ESS241, ESS461],
- construct arguments based on statistics, calculus, algebra, geometry, and modelling as appropriate for a given problem [ESS262, ESS410], and
- reflect on the ethical implications of their actions [ESS312, ESS410].

Elective courses reinforce these learning outcomes and provide additional perspectives. We note that these learning outcomes are effectively unchanged from the previous specialist; while fewer courses are now explicitly required, those courses were always part of the program and in essence served as its invisible backbone; highlighting them as required, and not elective, really makes this explicit. Courses no longer required are listed as electives, these courses allow for additional hands-on experience in field work and data collection for example via a capstone field trip or a thesis project.
academic questions concerning the systems approach, which are actively being researched in the department (including chemical and biological processes in the oceans, determining and modeling past climate, human effects on the environment, and ways how we can monitor such processes), but are not required for registration by the professional societies in Canada. The current program automatically leads into such registration, our proposed revision will give students the choice. By offering more courses as electives, and advising students about prerequisite structures, we can better balance sufficient breadth of material of the overall field with depth of knowledge in those areas that match an individual student's interest.

**Impact that the proposal may have on students or other academic units/divisions:**

For those students aiming at APGO certification, there is no impact because we are not removing courses from our offerings. For other students in the program there is considerably more flexibility and a reduced course load without impact on overall learning outcomes. Currently the number of students in this program is very low, and we expect that more students will be attracted to the revised program. There is no expected impact on other units.

**Consultation:**

This proposal was developed by the department's Undergraduate Affairs Committee in fall 2016, and voted on at the department council on 27 January 2017. We shared it with Kimberly Strong (director) and Sarah Finkelstein (academic associate director) at the School of the Environment who see the change as positive, in particular as it will allow students to add a major or minor in Environmental Science or a minor in Environmental Studies. Seven students currently enrolled in the Environmental Geosciences Specialist program received an email outlining these changes and were given the opportunity to comment and/or come talk in person; they welcome the idea of getting more choice in the selection of courses.

**Resource Implications:**

There are no resource implications.