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MEMORANDUM

ATTENTION Senate **DATE** January 17, 2012
FROM Jon Driver, Vice-President, Academic and Provost, and Chair, SCUP **PAGES** 1/1
RE: Faculty of Science: Full Program Proposal for a Joint Major and Honours in Earth Sciences and Chemistry, Departments of Earth Sciences and Chemistry (SCUP 11-62)

At its December 21, 2011 meeting SCUP reviewed and approved the Full Program Proposal for a Joint Major and Honours in Earth Sciences and Chemistry in the Departments of Earth Sciences and Chemistry within the Faculty of Science, effective September 2012.

Motion:

That Senate approve and recommend to the Board of Governors the Full Program Proposal for a Joint Major and Honours in Earth Sciences and Chemistry in the Departments of Earth Sciences and Chemistry within the Faculty of Science, effective September 2012.

encl.

c: G. Williams-Jones
D. Leznoff



OFFICE OF THE ASSOCIATE VICE-PRESIDENT, ACADEMIC AND
ASSOCIATE PROVOST

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MEMORANDUM

ATTENTION	Senate Committee on University Priorities	DATE	December 2, 2011
FROM	Bill Krane, Chair	PAGES	1/1
RE:	Senate Committee on Undergraduate Studies Faculty of Science (SCUS 11-55c)		

Action undertaken by the Senate Committee on Undergraduate Studies at its meeting of December 1, 2011, gives rise to the following recommendation:

Motion:

That SCUP approve and recommend to Senate the Full Program Proposal for the Joint Major and Honours in Earth Sciences and Chemistry.

The relevant documentation for review by SCUP is attached.



FACULTY OF SCIENCE
Departments of Chemistry and Earth Sciences

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MEMORANDUM

ATTENTION	George Agnes, Acting Chair, Faculty of Science Curriculum Committee	DATE	November 3, 2011
FROM	Daniel Leznoff, Glyn Williams-Jones Chairs, Chemistry Undergraduate Studies Committee & Earth Sciences Undergraduate Studies Committee	PAGES	1/1
RE:	Full Program Proposals for a new proposed Joint Major and Joint Honours in Earth Sciences and Chemistry		

Dear Prof. Agnes,

We are pleased to report that the Departments of Chemistry and Earth Sciences have enthusiastically completed the Full Program Proposal for a new "Joint Major in Earth Sciences and Chemistry", which is intended to bring together the expertise from Chemistry and Earth Sciences to foster interdisciplinary training of highly motivated students in the fields of geochemistry and environmental geoscience.

The NOI for this program was passed by SCUS on Sept. 14, 2011. At that meeting, it was suggested that the two Departments also develop a companion Joint Honours Program and accordingly the Full Program Proposal for a new "Joint Honours in Earth Sciences and Chemistry" is also attached for consideration by the Faculty of Science Curriculum Committee.

Both programs have been passed by both Departments and thus we request that it be considered at the next FacSci-Undergraduate Studies Committee meeting.

If you require any further information, just let us know.

Cheers,

Danny Leznoff
Chair, Chemistry Dept. Undergraduate Studies Committee

Glyn Williams-Jones
Chair, Earth Sciences Dept. Undergraduate Studies Committee.

PROPOSAL

Joint Major in Earth Sciences and Chemistry

Simon Fraser University

Executive Summary

A Joint Major in Earth Sciences and Chemistry has been developed and is proposed jointly by the two Departments in the Faculty of Science.

The intent of this proposal is to bring together the expertise from these two areas and to allow for a focused undergraduate education in geochemistry for geology and environmental geosciences. The program has been designed so that students completing it will be eligible for accreditation by the Association of Professional Engineers and Geoscientists in British Columbia (APEGBC), which is necessary for individuals to practice geoscience in B.C. Given the importance of the resource and environmental geosciences to the economy of B.C., since there is a significant shortage of trained geochemical professionals in B.C., this program will be attractive to students. No analogous program is currently offered at other B.C. universities.

Based upon existing courses, this program can be mounted immediately with no requirement for new resources.

Background

Simon Fraser University has committed to expand its programming in new and emerging areas. The Joint Major in Earth Sciences and Chemistry is one such area providing advanced interdisciplinary training in the fields of geochemistry, an area with a high demand in B.C. industry and across Canada. The subject areas have always been complimentary and this program will now capitalize on strengths in both departments to teach students about the chemical reactions and processes occurring within the natural environment, notably the atmosphere, biosphere, cryosphere, hydrosphere and geosphere.

Credential to be awarded:

Joint Major, Earth Sciences and Chemistry, B.Sc.

Location:

SFU, Burnaby Campus

Oct. 2011

Faculty/Department/School offering the new program:
Earth Sciences and Chemistry departments, Faculty of Science

Anticipated program start date:
September 2012

Description of proposed program:

a) Aims, goals, and/or objectives

The intent of this proposal is to bring together the expertise from Chemistry and Earth Sciences to capitalize on strengths in both departments to foster interdisciplinary training of highly motivated students in the fields of geochemistry, an area with a high demand in B.C. industry. This program can be run with no requirement for new resources.

b) Anticipated contribution to mandate and strategic plan of the Institution.

The enVision process focused on the concepts of SFU being a university that is student-centred, research-focused and community engaged. This proposed program is completely student-centred, in that it fully meets the needs and aspirations of highly motivated students that are interested in geochemistry. They will be trained for the needs of two important segments of B.C. industry, namely resource and environmental geosciences.

c) Target audience

The proposed curriculum will graduate Science majors with both an earth science and chemistry background. By combining these two areas of expertise these students will fill a niche that is usually occupied by people with post-graduate degrees. Students interested in working in the areas of resource geoscience (both exploration and analysis), environmental geoscience, government and academia should gain a significant competitive advantage with this specialized degree.

The program has been designed so that students completing it will be eligible for accreditation by the Association of Professional Engineers and Geoscientists in British Columbia (APEGBC), which is necessary for individuals to practice geoscience in BC. In addition to opportunities in geochemistry and environmental geoscience, graduates of this program will be well prepared for advanced degrees in both areas.

d) Content and summary of requirements for graduation

Content Lower Division (LD) Requirements

Lower Division Requirements: 68-69 Units

Breakdown: 22 CHEM, 26 EASC and 20-21 other.

Upper Division (UD) Requirements

Chemistry UD Requirements: 21 required credits plus 3 additional credits in NUSC or PHYS (total 24 credits). Earth Sciences UD Requirements: 18 required credits

Total Upper Division Requirements: 21 Chemistry + 18 Earth Sciences + 3 NUSC/PHYS = 42 credits. Electives = 2 credits (to bring the total UD to 44)

Total Requirements

Subtotal: 68-69 Lower Division + 44 Upper Division = 112-113 credits

LD or UD Electives: Students will supplement the specified courses to satisfy WQB graduation requirements

Total: 122-123 credits

University Breadth Requirement:

The B-Sci requirement is included in the required coursework. The 12 B-SocSci and B-Hum credits will be required to complete the total breadth requirements.

University Writing Intensive Requirement:

Both the lower and upper-division requirements will be included in the required coursework.

Co-Operative Education

Optional. Administered through the Science co-op coordinators. Many students in these fields obtain relevant summer jobs outside of the Co-op program.

e) Delivery Methods

Since the program is based upon existing courses, the standard delivery methods already in place on campus - Lecture/Lab/Tutorial - will be used. The Earth Sciences Dept. also runs regular field schools, which the students will participate in as part of the program.

f) Linkages between learning outcomes and curriculum design

The learning outcomes are to train professionals in geochemistry for geology and environmental geoscience and the curriculum has been developed with the goal of registration in APEGBC in mind. A work experience/work place term is NOT required for degree completion.

g) Distinctive characteristics

The partnership of Chemistry and Earth Science in a joint major degree is an obvious expression of the linkages between the two disciplines and will help bring students (and faculty) in the two departments closer together. The proposed new joint major will benefit both students and faculty who have otherwise been pursuing their interests through major/minor combinations. These interests are better accommodated by this focused program which delivers the content centred at the interface of these two areas.

A

h) Anticipated completion time

Four years.

i) Enrolment plan for the length of the program

The students will be admitted to the Joint major program directly from high-school, from other programs at SFU or via transfer from other post-secondary institutions. This will be attractive to high-school students who have a strong interest in chemistry and earth sciences and would like to work here in B.C. Admitted Science students can declare this Joint Major degree at any time.

We have informally surveyed current SFU Science students in Chemistry and Earth Sciences regarding their potential interest in this Joint Major program. From this exercise, it is clear that there is significant interest on both sides for such a program. We estimate the initial enrolment to be about 10 students.

The substantial interest of existing students indicates that this Joint Program will be a specific program offering that can target a new student audience resulting in increased enrolment into SFU programs.

j) Policies on student evaluation (degree requirements)

As per general regulations of the University and the Faculty of Science.

k) Policies on faculty appointment (minimum qualifications)

Nearly all continuing faculty have a Ph.D.; two Senior Lecturers in Earth Sciences have a M.Sc. degree.

l) Policies on program assessment

All academic units at SFU are subject to external review every six years.

m) Level of support and recognition from other post-secondary institutions (including plans for admission and transfer within B.C.) and relevant regulatory or professional bodies

As per SFU's transfer credit procedures, students may transfer from B.C. colleges or universities to enroll into this program. Graduates of this program will be eligible to register as Professional Geoscientists with APEGBC.

n) Evidence of student interest and labour market demand

We have informally surveyed current SFU Science students in Chemistry and Earth Sciences regarding their potential interest in this Joint Major program. From this exercise, it is clear that there is significant interest on both sides for such a program. A recent survey by the Mining Industry Human Resources Council indicated that with an aging workforce there will be a significant shortage of geoscientists, including geochemists, in the near future (MIHR, 2010). Looking at Canada as a whole, there will be a shortage of almost 700 by 2015, increasing to 1,250 by 2020. Projected shortfalls for British Columbia alone are 150 and 270

Oct. 2011

for 2015 and 2020, respectively. The mining industry is only one facet of potential jobs but data does not exist for government, academia, and environmental, so demand will be greater.

o) Summary of resources (faculty members, space, and equipment) required and available to implement the program

No additional resources are required. The program can be accommodated with present courses and faculty.

p) Brief description of any program and associated resources that will be reduced or eliminated when the new program is introduced

None.

q) List of faculty members teaching/supervising, what percentage of their teaching will be devoted to the program, and their areas of specialization

All faculty in both departments will contribute to this program as part of their normal teaching load, since all courses required for this Joint Major are already offered on a regular basis by the two Departments.

r) For a program where the intention is to charge a premium fee, a budget developed in collaboration with the dean of the faculty.

This is not a premium fee program.

s) Related programs at SFU and other British Columbia post-secondary institutions

The combination of these two programs is unique in the context of SFU and British Columbia. UVic has a Joint Major between Chemistry and Earth and Ocean Sciences, with a greater emphasis on the biosphere; because students are not required to take field school and structural geology it likely will not lead to registration with APEGBC. UBC does not offer a specific Joint Major between Chem/EASC; at best they have a general option for a Combined Honours program, which is much more intensive and not specific to these two disciplines.

Contact information for the faculty member responsible for program development

Daniel Leznoff, Professor, Department of Chemistry, 778-782-4887, dleznoff@sfu.ca. Glyn Williams-Jones, Associate Professor, Department of Earth Sciences, 778-782-4229, glynwj@sfu.ca.

Proposed Calendar Description - Faculty of Science

The following text is proposed to be placed in the Faculty of Science section,

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linked to both the Depts. of Chemistry and Earth Sciences.

Chemistry and Earth Sciences Joint Major Program

This Bachelor of Science (BSc) program is offered jointly by the Departments of Chemistry and Earth Sciences. Entry requires permission of both.

Minimum Grade Requirement

Students wishing to enroll in Chemistry, Physics and Earth Sciences courses must obtain a C- grade or better in prerequisite courses.

PROGRAM REQUIREMENTS

Students complete at least 122 units, as specified below.

Lower Division Requirements

Students will complete a minimum of 68 units including all of

CHEM 121-4 General Chemistry and Laboratory I
 CHEM 122-2 General Chemistry II
 CHEM 126-2 General Chemistry Laboratory II
 CHEM 215-4 Introduction to Analytical Chemistry
 CHEM 230-3 Inorganic Chemistry
 CHEM 236W-3 Inorganic Chemistry Laboratory
 CHEM 281-4 Organic Chemistry I
 EASC 101-3 Physical Geology
 EASC 201-3 Stratigraphy and Sedimentation
 EASC 202-3 Introduction to Mineralogy
 EASC 204-3 Structural Geology I
 EASC 205-3 Introduction to Petrology
 EASC 206-2 Field Geology I
 EASC 207-3 Introduction to Applied Geophysics
 EASC 208-3 Introduction to Geochemistry
 EASC 210-3 Historical Geology
 GEOG 213-3 Introduction to Geomorphology
 MATH 151-3 Calculus I or MATH 150-4 Calculus I with Review
 MATH 152-3 Calculus II
 STAT 270-3 Introduction to Probability and Statistics

and all of

PHYS 120-3 Mechanics and Modern Physics
 PHYS 121-3 Optics, Electricity and Magnetism
 PHYS 131-2 Physics Laboratory I

or all of

PHYS 125-3 Mechanics and Special Relativity
PHYS 126-3 Electricity, Magnetism and Light
PHYS 131-2 Physics Laboratory I

or both of

PHYS 140-4 Studio Physics-Mechanics and Modern Physics
PHYS 141-4 Studio Physics-Optics, Electricity and Magnetism

Upper Division Requirements

Students will complete a minimum of 42 units including all of

CHEM 316-4 Introductory Instrumental Analysis (Waive CHEM 260 pre-requisite)
CHEM 317-2 Analytical Environmental Chemistry
CHEM 332-3 The Chemistry of Transition Metals (Waive CHEM 260 pre-requisite)
CHEM 360-3 Thermodynamics and Chemical Kinetics
CHEM 371-3 Chemistry of the Aqueous Environment
CHEM 372-3 Chemistry of the Atmospheric Environment

and 3 units of 400-level CHEM not including CHEM 481-5 or CHEM 483-5

EASC 303W-3 Environmental Geosciences
EASC 306-3 Field Geology II

And all of

or all of

To Register in Environmental Stream	To Register in Geology Stream
EASC 304-3 Hydrogeology EASC 403-3 Quaternary Geology	EASC 301-3 Igneous and Metamorphic Petrology EASC 302-3 Sedimentary Petrology

And 6 additional units of upper division EASC courses

And one of

NUSC 341-3 Introduction to Radiochemistry
NUSC 344-3 Nucleosynthesis and Distribution of the Elements
PHYS 348-3 Energy and the Environment

Note: at least 3 units of upper division EASC courses must be 400-level

Upper-division electives

Upper-division units must total a minimum of 44 upper-division units (excluding EDUC 401-406)

Breadth Requirements

Writing 6 units (Included in the required coursework CHEM 236W-3 and EASC 303W-3)

Quantitative reasoning 6 units (Included in the required coursework)

Breadth 24 units**Designated**

Social sciences 6 units

Humanities 6 units

Sciences 6 units (Included in the required coursework)

Undesignated

Outside of the major 6 units (Included in the required coursework)

PROPOSAL

Joint Honours in Earth Sciences and Chemistry

Simon Fraser University

Executive Summary

As recommended by SCUS after reviewing the NOI, a Joint Honours in Earth Sciences and Chemistry has been developed and is proposed jointly by the two Departments in the Faculty of Science.

The intent of this proposal is to bring together the expertise from these two areas and to allow for a focused, intensive undergraduate education in geochemistry for geology and environmental geosciences, including a research component. The program has been designed so that students completing it will be eligible for accreditation by the Association of Professional Engineers and Geoscientists in British Columbia (APEGBC), which is necessary for individuals to practice geoscience in B.C. Given the importance of the resource and environmental geosciences to the economy of B.C., since there is a significant shortage of trained geochemical professionals in B.C., this program will be attractive to students. No analogous program is currently offered at other B.C. universities.

Based upon existing courses, this program can be mounted immediately with no requirement for new resources.

Background

Simon Fraser University has committed to expand its programming in new and emerging areas. The Joint Major in Earth Sciences and Chemistry is one such area providing advanced interdisciplinary training in the fields of geochemistry, an area with a high demand in B.C. industry and across Canada. The subject areas have always been complimentary and this program will now capitalize on strengths in both departments to teach students about the chemical reactions and processes occurring within the natural environment, notably the atmosphere, biosphere, cryosphere, hydrosphere and geosphere.

Credential to be awarded:

Joint Honours, Earth Sciences and Chemistry, B.Sc.

Location:

SFU, Burnaby Campus

Oct. 2011

Faculty/Department/School offering the new program:
Earth Sciences and Chemistry departments, Faculty of Science

Anticipated program start date:
September 2012

Description of proposed program:

a) Aims, goals, and/or objectives

The intent of this proposal is to bring together the expertise from Chemistry and Earth Sciences to capitalize on strengths in both departments to foster interdisciplinary training of highly motivated students in the fields of geochemistry, an area with a high demand in B.C. industry. This program can be run with no requirement for new resources.

b) Anticipated contribution to mandate and strategic plan of the Institution.

The enVision process focused on the concepts of SFU being a university that is student-centred, research-focused and community engaged. This proposed program is completely student-centred, in that it fully meets the needs and aspirations of highly motivated students that are interested in geochemistry. They will be trained for the needs of two important segments of B.C. industry, namely resource and environmental geosciences. All Joint Honours students will also complete a substantial research course.

c) Target audience

The proposed curriculum will graduate Science majors with both an earth science and chemistry background. By combining these two areas of expertise these students will fill a niche that is usually occupied by people with post-graduate degrees. Students interested in working in the areas of resource geoscience (both exploration and analysis), environmental geoscience, government and academia should gain a significant competitive advantage with this specialized degree.

The program has been designed so that students completing it will be eligible for accreditation by the Association of Professional Engineers and Geoscientists in British Columbia (APEGBC), which is necessary for individuals to practice geoscience in BC. In addition to opportunities in geochemistry and environmental geoscience, graduates of this program will be well prepared for advanced degrees in both areas. The research component that is included in the Honours degree (vs. the proposed Joint Majors program) in particular prepares students for either working in the field or moving to post-graduate degrees.

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d) Content and summary of requirements for graduation**Content Lower Division (LD) Requirements**

Lower Division Requirements: 68-69 Units

Breakdown: 22 CHEM, 26 EASC and 20-21 other.

Upper Division (UD) Requirements

Chemistry UD Requirements: 26 required credits plus 3 additional credits in NUSC or PHYS (total 29 credits). Earth Sciences UD Requirements: 15 required credits

Undergraduate research course: CHEM 481-5 or EASC 499-9

Total Upper Division Requirements: 26 Chemistry + 15 Earth Sciences + 3 NUSC/PHYS = 42 credits. Minimum 50 UD credits in CHEM/EASC. Minimum 60 UD credits overall.

Total Requirements

Subtotal: 68-69 Lower Division + 60 Upper Division = 128-129 credits

LD or UD Electives: Students will supplement the specified courses to satisfy WQB graduation requirements

Total: Minimum 132 credits

Minimum GPA of 3.0 to be awarded an Honours degree

University Breadth Requirement:

The B-Sci requirement is included in the required coursework. The 12 B-SocSci and B-Hum credits will be required to complete the total breadth requirements.

University Writing Intensive Requirement:

Both the lower and upper-division requirements will be included in the required coursework.

Co-Operative Education

Optional. Administered through the Science co-op coordinators. Many students in these fields obtain relevant summer jobs outside of the Co-op program.

e) Delivery Methods

Since the program is based upon existing courses, the standard delivery methods already in place on campus - Lecture/Lab/Tutorial - will be used. The Earth Sciences Dept. also runs regular field schools, which the students will participate in as part of the program.

f) Linkages between learning outcomes and curriculum design

The learning outcomes are to train professionals in geochemistry for geology and environmental geosciences and the curriculum has been developed with the goal of registration in APEGBC in mind. A work experience/work place term is NOT required for degree completion, however a research course is an integral part of this Joint Honours program.

g) Distinctive characteristics

The partnership of Chemistry and Earth Science in a joint honours degree is an obvious expression of the linkages between the two disciplines and will help bring students (and faculty) in the two departments closer together. The proposed new joint honours will benefit both students and faculty who have otherwise been pursuing their interests through major/minor combinations. These interests are better accommodated by this focused program which delivers the content centred at the interface of these two areas, as well as encouraging research interactions between the two Departments via undergraduate research experience.

h) Anticipated completion time

Four to five years.

i) Enrolment plan for the length of the program

The students will be admitted to the Joint Honours program directly from high-school, from other programs at SFU or via transfer from other post-secondary institutions. This will be attractive to high-school students who have a strong interest in chemistry and earth sciences and would like to work here in B.C. Admitted Science students can declare this Joint Honours degree at any time.

We have informally surveyed current SFU Science students in Chemistry and Earth Sciences regarding their potential interest in the Joint Major and Honours program. From this exercise, it is clear that there is significant interest on both sides for such a program. We estimate the initial enrolment to be about 10 students.

The substantial interest of existing students indicates that these Joint Programs will be a specific program offering that can target a new student audience resulting in increased enrolment into SFU programs.

j) Policies on student evaluation (degree requirements)

As per general regulations of the University and the Faculty of Science.

k) Policies on faculty appointment (minimum qualifications)

Nearly all continuing faculty have a Ph.D.; two Senior Lecturers in Earth Sciences have a M.Sc. degree.

l) Policies on program assessment

All academic units at SFU are subject to external review every six years.

m) Level of support and recognition from other post-secondary institutions (including plans for admission and transfer within B.C.) and relevant regulatory or professional bodies

As per SFU's transfer credit procedures, students may transfer from B.C.

colleges or universities to enroll into this program. Graduates of this program will be eligible to register as Professional Geoscientists with APEGBC.

n) Evidence of student interest and labour market demand

We have informally surveyed current SFU Science students in Chemistry and Earth Sciences regarding their potential interest in the Joint Major/Honours program. From this exercise, it is clear that there is significant interest on both sides for such a program. A recent survey by the Mining Industry Human Resources Council indicated that with an aging workforce there will be a significant shortage of geoscientists, including geochemists, in the near future (MIHR, 2010). Looking at Canada as a whole, there will be a shortage of almost 700 by 2015, increasing to 1,250 by 2020. Projected shortfalls for British Columbia alone are 150 and 270 for 2015 and 2020, respectively. The mining industry is only one facet of potential jobs but data does not exist for government, academia, and environmental, so demand will be greater.

o) Summary of resources (faculty members, space, and equipment) required and available to implement the program

No additional resources are required. The program can be accommodated with present courses and faculty.

p) Brief description of any program and associated resources that will be reduced or eliminated when the new program is introduced

None.

q) List of faculty members teaching/supervising, what percentage of their teaching will be devoted to the program, and their areas of specialization

All faculty in both departments will contribute to this program as part of their normal teaching load, since all courses required for this Joint Honours are already offered on a regular basis by the two Departments.

r) For a program where the intention is to charge a premium fee, a budget developed in collaboration with the dean of the faculty.

This is not a premium fee program.

s) Related programs at SFU and other British Columbia post-secondary institutions

The combination of these two programs is unique in the context of SFU and British Columbia. UVic has a Joint Honours between Chemistry and Earth and Ocean Sciences, with a greater emphasis on the biosphere; because students are not required to take field school and structural geology it likely will not lead to registration with APEGBC. UBC does not offer a specific Joint Major or honours between Chem/EASC; at best they have a general option for a Combined Honours program, which is much more intensive and not specific to these two

disciplines.

Contact Information for the faculty member responsible for program development

Daniel Leznoff, Professor, Department of Chemistry, 778-782-4887, dleznoff@sfu.ca. Glyn Williams-Jones, Associate Professor, Department of Earth Sciences, 778-782-4229, glynwj@sfu.ca.

Proposed Calendar Description - Faculty of Science

The following text is proposed to be placed in the Faculty of Science section, linked to both the Depts. of Chemistry and Earth Sciences.

Chemistry and Earth Sciences Joint Honours Program

This Bachelor of Science (BSc) honours program is offered jointly by the Departments of Chemistry and Earth Sciences. Entry requires permission of both.

Minimum Grade Requirement

Students wishing to enroll in Chemistry, Physics and Earth Sciences courses must obtain a C- grade or better in prerequisite courses.

PROGRAM REQUIREMENTS

Students complete at least 132 units, as specified below.

Lower Division Requirements

Students will complete a minimum of 68 units including all of

- CHEM 121-4 General Chemistry and Laboratory I
- CHEM 122-2 General Chemistry II
- CHEM 126-2 General Chemistry Laboratory II
- CHEM 215-4 Introduction to Analytical Chemistry
- CHEM 230-3 Inorganic Chemistry
- CHEM 236W-3 Inorganic Chemistry Laboratory
- CHEM 281-4 Organic Chemistry I
- EASC 101-3 Physical Geology
- EASC 201-3 Stratigraphy and Sedimentation
- EASC 202-3 Introduction to Mineralogy
- EASC 204-3 Structural Geology I
- EASC 205-3 Introduction to Petrology

EASC 207-3 Introduction to Applied Geophysics
EASC 208-3 Introduction to Geochemistry
EASC 206-2 Field Geology I
EASC 210-3 Historical Geology
GEOG 213-3 Introduction to Geomorphology
MATH 151-3 Calculus I or MATH 150-4 Calculus I with Review
MATH 152-3 Calculus II
STAT 270 Introduction to Probability and Statistics

and all of

PHYS 120-3 Mechanics and Modern Physics
PHYS 121-3 Optics, Electricity and Magnetism
PHYS 131-2 Physics Laboratory I

or all of

PHYS 125-3 Mechanics and Special Relativity
PHYS 126-3 Electricity, Magnetism and Light
PHYS 131-2 Physics Laboratory I

or both of

PHYS 140-4 Studio Physics-Mechanics and Modern Physics
PHYS 141-4 Studio Physics-Optics, Electricity and Magnetism

Upper Division Requirements

Upper-division units must total a minimum of 50 units in CHEM and EASC, including at least 26 units in upper-division CHEM, and all of

CHEM 316-4 Introductory Instrumental Analysis (Waive CHEM 260 pre-requisite)
CHEM 317-2 Analytical Environmental Chemistry
CHEM 332-3 The Chemistry of Transition Metals (Waive CHEM 260 pre-requisite)
CHEM 360-3 Thermodynamics and Chemical Kinetics
CHEM 371-3 Chemistry of the Aqueous Environment
CHEM 372-3 Chemistry of the Atmospheric Environment

and 6 units of 400-level CHEM (which can include CHEM 481-5)

EASC 303W-3 Environmental Geosciences
EASC 306-3 Field Geology II

And all of

or all of

To Register in Environmental Stream	To Register in Geology Stream
EASC 304-3 Hydrogeology EASC 403-3 Quaternary Geology	EASC 301-3 Igneous and Metamorphic Petrology EASC 302-3 Sedimentary Petrology

And 3 additional units of upper division EASC courses

And one of
EASC 499-9 Honours thesis
CHEM 481-5 Undergraduate research

And one of
NUSC 341-3 Introduction to Radiochemistry
NUSC 344-3 Nucleosynthesis and Distribution of the Elements
PHYS 346-3 Energy and the Environment

Upper-division electives

Upper-division units must total a minimum of 60 units overall (not including EDUC 401-406).

Breadth Requirements

Writing 6 units (included in the required coursework CHEM 236W-3 and EASC 303W-3)

Quantitative reasoning 6 units (included in the required coursework)

Breadth 24 units

Designated

Social sciences 6 units

Humanities 6 units

Sciences 6 units (included in the required coursework)

Undesignated

Outside of the major 6 units (included in the required coursework)

Free electives to bring the total to 132 units

Minimum GPA requirement is 3.00 to be awarded an Honours degree.