UNIVERSITY OF TORONTO SCARBOROUGH

OFFICE OF THE CAMPUS COUNCIL

FOR APPROVAL **PUBLIC** **OPEN SESSION**

TO: UTSC Academic Affairs Committee

SPONSOR: William Gough, Vice-Principal Academic and Dean
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PRESENTER: Mark Schmuckler, Vice-Dean Undergraduate
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DATE: February 4, 2019 for February 11, 2019

AGENDA ITEM: 3

ITEM IDENTIFICATION:

Undergraduate Minor Curricular Modifications (Sciences Academic Units)

JURISDICTIONAL INFORMATION:

University of Toronto Scarborough Academic Affairs Committee (AAC) "is concerned with matters affecting the teaching, learning and research functions of the Campus" (*AAC Terms of Reference, Section 4*). Under section 5.6 of its terms of reference, the Committee is responsible for approval of "Major and minor modifications to existing degree programs." The AAC has responsibility for the approval of Major and Minor modifications to existing programs as defined by the University of Toronto Quality Assurance Process (*UTQAP, Section 3.1*).

GOVERNANCE PATH:

1. **UTSC Academic Affairs Committee [For Approval] (February 11, 2019)**

PREVIOUS ACTION TAKEN:

No previous action in governance has been taken on this item.

HIGHLIGHTS:

This package includes minor modifications to undergraduate curriculum, submitted by the Sciences academic units identified below, which require governance approval. Minor

modifications to curriculum are understood as those that do not have a significant impact on program or course learning outcomes. They require governance approval when they modestly change the nature of a program or course.

- The Department of Physical and Environmental Sciences (Report: Physical & Environmental Sciences)
    - 5 program changes
        - Major (Co-operative) in Biochemistry
        - Specialist (Co-operative) in Biological Chemistry
        - Specialist Co-operative in Environmental Geoscience
        - Specialist in Biological Chemistry
        - Specialist in Environmental Geoscience
    - 2 new courses
        - CHMD11H3
        - EESB26H3

FINANCIAL IMPLICATIONS:

There are no net financial implications to the campus operating budget.

RECOMMENDATION:

Be It Resolved,

THAT the minor modifications to undergraduate programs, submitted by UTSC undergraduate Sciences academic units, as described in Undergraduate Minor Curriculum Modifications for Approval, Report: Department of Physical & Environmental Sciences, dated January 17, 2019, and recommended by the Vice-Principal Academic and Dean, William Gough, be approved effective as of Fall 2019 for the academic year 2019-20.

DOCUMENTATION PROVIDED:

1. 2019-20 Curriculum Cycle: Undergraduate Minor Curriculum Modifications for Approval Report: Department of Physical & Environmental Sciences, dated January 17, 2019.

UNIVERSITY OF TORONTO SCARBOROUGH

2019-20 Curriculum Cycle
Undergraduate Minor Curriculum Modifications for Approval
Report: Department of Physical & Environmental Sciences

January 17, 2019

Physical & Environmental Sciences (UTSC), Department of

5 Minor Program Modifications:

MAJOR (CO-OPERATIVE) PROGRAM IN BIOCHEMISTRY (SCIENCE)

Enrolment Requirements:

Enrolment Requirements

The minimum qualifications for entry are 4.0 credits, including BIOA01H3, BIOA02H3, CHMA10H3, CHMA11H3, [MATA29H3 or MATA30H3] and [MATA35H3 or MATA36H3], plus a cumulative GPA of at least 2.5.

Current Co-op Students:

Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits and must meet the minimum qualifications for entry as noted above.

Prospective Co-op Students:

In addition to requesting the program on ACORN, prospective Co-op students(i.e., those not yet admitted to a Co-op Degree POSt)must also submit a Co-op Supplementary Application Form, which is available from the Arts & Science Co-op Office (http://www.utsc.utoronto.ca/askcoop/future-co-op-students). Submission deadlines follow the Limited Enrolment Program Application Deadlines set by the Office of the Registrar each year. Failure to submit both the Supplementary Application Form and the program request on ACORN will result in that student's application not being considered.

Description of Proposed Changes:
Enrolment Requirements: MATA29H3 has been added as an optional course in the list of courses students must complete to apply to the program.

Rationale:
MATA29H3 has been added as an optional course to complete component 1 of the program requirements; the enrolment requirements have been revised to ensure they are aligned with the program requirements.

Impact:
None

Consultation:

DCC approval: Oct 9, 2018

Resource Implications:
None

SPECIALIST (CO-OPERATIVE) PROGRAM IN BIOLOGICAL CHEMISTRY (SCIENCE)

Enrolment Requirements:

Enrolment Requirements

The minimum qualifications for entry are 3.5 ~~4.0~~ credits, including BIOA01H3, BIOA02H3, CHMA10H3, CHMA11H3, MATA30H3,[MATA35H3 or MATA36H3], PHYA10H3 and ~~PHYA21H3~~, plus a cumulative GPA of at least 2.5.

Current Co-op Students:
Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits and must meet the minimum qualifications for entry as noted above.

Prospective Co-op Students:
In addition to requesting the program on ACORN, prospective Co-op students(i.e., those not yet admitted to a Co-op Degree POSt)must also submit a Co-op Supplementary Application Form, which is available from the Arts & Science Co-op Office. (http://www.utsc.utoronto.ca/askcoop/future-co-op-students). Submission deadlines follow the Limited Enrolment Program Application Deadlines set by the Office of the Registrar each year. Failure to submit both the Supplementary Application Form and the program request on ACORN will result in that student's application not being considered.

Completion Requirements:

Program Requirements

Students must complete the program requirements as described in the Specialist Program in Biological Chemistry.

Co-op Work Term Requirements

Students must satisfactorily complete three Co-op work terms, each of four-months duration. To be eligible for their first work term, students must be enrolled in the Specialist (Co-op) Program in Biological Chemistry and have completed at least 7.0 credits, including CHMB16H3. It is strongly recommended that BIOB12H3 be completed prior to the first work term.

In addition to their academic program requirements, Co-op students complete up to five Co-op specific courses. These courses are designed to prepare students for their job search and work term experience, and to maximize the benefits of their Co-op work terms. They cover a variety of topics intended to assist students in developing the skills and tools required to secure work terms that are appropriate to their program of study, and to perform professionally in the workplace. These courses must be completed in sequence, and are taken in addition to a full course load. They are recorded on transcripts as credit/no credit (CR/NCR) and are considered to be additive credit to the 20.0 required degree credits. No additional course fee is assessed as registration is included in the Co-op Program fee.

Co-op Preparation Course Requirements:

1. COPD01H3 – Foundations for Success in Arts & Science Co-op
- Students entering Co-op from outside of UTSC (high school or other postsecondary) will complete this course in fall of their first year at UTSC
- Current UTSC students entering Co-op in April/May will complete this course in the summer term
- Current UTSC students entering Co-op in July/August will complete this course in the fall term

2. COPD03H3 – Preparing to Compete for your Co-op Work Term
- Prerequisite: COPD01H3
- This course will be completed eight months in advance of the first scheduled work term

3. COPD11H3 – Managing your Work Term Search & Transition to Work
- Prerequisite: COPD03H3
- This course will be completed four months in advance of the first work scheduled work term

4. COPD12H3 – Integrating Your Work Term Experience Part I
- Prerequisite: COPD11H3 and one Co-op work term
- This course will be completed four months in advance of the second scheduled work term

5. COPD13H3 – Integrating Your Work Term Experience Part II
- Prerequisite: COPD12H3 and two Co-op work terms
- This course will be completed four months in advance of the third scheduled work term

Students must be available for work terms in each of the Fall, Winter and Summer sessions and must complete at least one of their required work terms in either a Fall or Winter session. This in turn requires that students take courses during at least one Summer session.

For information on fees, status in Co-op programs, and certification of completion of Co-op programs, see Section 6B.5 of the UTSC *Calendar*.

Description of Proposed Changes:
Enrolment Requirements: PHYA21H3 has been removed from the list of courses that students must complete to apply to the program.

Rationale:
These changes reflect changes to the program completion requirements for the non-Co-op analog Specialist program in Biological Chemistry; they are necessary to ensure the enrolment requirements for the Co-op program remain aligned with the non Co-op program requirements. Specifically:
1. PHYA21H3 has been deleted from the First Year component of the program completion requirements.
This program was recently accredited by the Chemical Institute of Canada (CIC). As part of this accreditation process, PHYA21H3 was identified as a potential barrier to entry for this program. In addition, PHYA21H3 is not required for any future courses in the program, therefore it's removal from the program will not impact the program learning outcomes. The reduction in the total credits to complete the program reflects the removal of PHYA21H3 as a required course.

Impact:
None

Consultation:

Approved by DCC: Oct 9, 2018

Resource Implications:
None

SPECIALIST (CO-OPERATIVE) PROGRAM IN ENVIRONMENTAL GEOSCIENCE (SCIENCE)

Enrolment Requirements:

Enrolment Requirements

The minimum qualifications for entry are 5.0 ~~4.5~~ credits, including BIOA01H3, BIOA02H3, CHMA10H3, CHMA11H3, EESA01H3, EESA06H3, MATA30H3,[~~MATA35H3~~ ~~or~~ MATA36H3 or MATA37H3], ~~and~~ PHYA10H3 and PHYA21H3, plus a cumulative GPA of at least 2.5.

Current Co-op Students:

Students admitted to a Co-op Degree POSt in their first year of study must request a Co-op Subject POSt on ACORN upon completion of 4.0 credits and must meet the minimum qualifications for entry as noted above.

Prospective Co-op Students:

In addition to requesting the program on ACORN, prospective Co-op students(i.e., those not yet admitted to a Co-op Degree POSt)must also submit a Co-op Supplementary Application Form, which is available from the Arts & Science Co-op Office (http://www.utsc.utoronto.ca/askcoop/future-co-op-students). Submission deadlines follow the Limited Enrolment Program Application Deadlines set by the Office of the Registrar each year. Failure to submit both the Supplementary Application Form and the program request on ACORN will result in that student's application not being considered.

Completion Requirements:

Program Requirements
Students must complete the program requirements as described in the Specialist Program in Environmental Geoscience.

Co-op Work Term Requirements

Students must satisfactorily complete three Co-op work terms, each of four-months duration. To be eligible for their first work term, students must be enrolled in the Specialist (Co-op) Program in Environmental Geoscience and have completed at least 7.0 credits.

In addition to their academic program requirements, Co-op students complete up to five Co-op specific courses. These courses are designed to prepare students for their job search and work term experience, and to maximize the benefits of their Co-op work terms. They cover a variety of topics intended to assist students in developing the skills and tools required to secure work terms that are appropriate to their program of study, and to perform professionally in the workplace. These courses must be completed in sequence, and are taken in addition to a full course load. They are recorded on transcripts as credit/no credit (CR/NCR) and are considered to be additive credit to the 20.0 required degree credits. No additional course fee is assessed as registration is included in the Co-op Program fee.

Co-op Preparation Course Requirements:

1. COPD01H3 – Foundations for Success in Arts & Science Co-op
- Students entering Co-op from outside of UTSC (high school or other postsecondary) will complete this course in fall of their first year at UTSC
- Current UTSC students entering Co-op in April/May will complete this course in the summer term
- Current UTSC students entering Co-op in July/August will complete this course in the fall term

2. COPD03H3 – Preparing to Compete for your Co-op Work Term
- Prerequisite: COPD01H3
- This course will be completed eight months in advance of the first scheduled work term

3. COPD11H3 – Managing your Work Term Search & Transition to Work
- Prerequisite: COPD03H3
- This course will be completed four months in advance of the first work scheduled work term

4. COPD12H3 – Integrating Your Work Term Experience Part I
- Prerequisite: COPD11H3 and one Co-op work term
- This course will be completed four months in advance of the second scheduled work term

5. COPD13H3 – Integrating Your Work Term Experience Part II
- Prerequisite: COPD12H3 and two Co-op work terms
- This course will be completed four months in advance of the third scheduled work term

Students must be available for work terms in each of the Fall, Winter and Summer sessions and must complete at least one of their required work terms in either a Fall or Winter session. This in turn requires that students take courses during at least one Summer session.

For information on fees, status in Co-op programs, and certification of completion of Co-op programs, see Section 6B.5 of the UTSC *Calendar*.

Description of Proposed Changes:
The enrolment requirements have been revised as follows: MATA35H3 has been removed from the list of courses that students must complete in order to enrol in the program; PHYA21H3 has been added to the list of courses that students must complete in order to enrol in the program.

Rationale:
These changes reflect changes to the program completion requirements for the non Co-op analog Specialist program in Environmental Science; they are necessary to ensure the enrolment requirements for the Co-op program remain aligned with the non Co-op program requirements. Specifically:
1. MATA35H3 is not an option to complete the First Year component of the program completion requirements;
2. PHYA21H3 has been added to the First Year component of the program completion requirements.

Impact:
1. New students will have to take either MATA36H3 or MATA37H3 to enrol in the program;
2. New students will have to take PHYA21H3 to enrol in the program.

Consultation:

Approved by DCC: October 09, 2018

Resource Implications:
None

SPECIALIST PROGRAM IN BIOLOGICAL CHEMISTRY (SCIENCE)

Completion Requirements:

Program Requirements
The program requires the completion of the following 14.5 ~~15.0~~ credits:

First Year:
BIOA01H3 Life On Earth: Unifying Principles
BIOA02H3 Life on Earth: Form, Function and Interactions
CHMA10H3 Introductory Chemistry I: Structure and Bonding
CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms
MATA30H3 Calculus I for Physical Sciences
[MATA35H3 Calculus II for Biological Sciences *or* MATA36H3 Calculus II for Physical Sciences]
PHYA10H3 Physics I for the Physical Sciences
~~PHYA21H3 Physics II for the Physical Sciences~~

Second Year:
BIOB10H3 Cell Biology
BIOB11H3 Molecular Aspect of Cellular and Genetic Processes
BIOB12H3 Laboratory for Cell and Molecular Biology
CHMB31H3 Introduction to Inorganic Chemistry
CHMB41H3 Organic Chemistry I
CHMB42H3 Organic Chemistry II

Second or Third Year:
CHMB16H3 Techniques in Analytical Chemistry
CHMB21H3 Chemical Structure and Spectroscopy
CHMB23H3 Introduction to Chemical Thermodynamics and Kinetics: Theory and Practice
STAB22H3 Statistics I

Third Year:
BIOC12H3 Biochemistry I: Proteins and Enzymes
BIOC13H3 Biochemistry II: Bioenergetics and Metabolism
BIOC23H3 Practical Approaches to Biochemistry
CHMC47H3 Bio-Organic Chemistry

Third or Fourth Year:
CHMC11H3 Principles of Analytical Instrumentation
CHMC31Y3 Intermediate Inorganic Chemistry
[CHMC41H3 Organic Reaction Mechanisms *or* CHMC42H3 Organic Synthesis]

Fourth Year:
CHMD79H3 Topics in Biological Chemistry
1.5 credits in D-level or 400-level CHM courses including one of the following courses:
- CHMD90Y3 Directed Research
- CHMD91H3 Directed Research
- CHMD92H3 Advanced Chemistry Laboratory Course
and
at least 0.5 credit from the following:
- CHMD69H3 Bioinorganic Chemistry
- CHMD71H3 Pharmaceutical Chemistry

Description of Proposed Changes:
1. The total credits to complete the program have been reduced from 15.0 credits to 14.5 credits.
2. PHYA21H3 has been deleted as a required course from the First Year components of the program requirements.

Rationale:
This program was recently accredited by the Chemical Institute of Canada (CIC). As part of this accreditation process, PHYA21H3 was identified as a potential barrier to entry for this program. In addition, PHYA21H3 is not required for any future courses in the program, therefore it's removal from the program will not impact the program learning outcomes. The reduction in the total credits to complete the program reflects the removal of PHYA21H3 as a required course.

Impact:
None

Consultation:
DCC Approval: October 9, 2018.

Resource Implications:
None

SPECIALIST PROGRAM IN ENVIRONMENTAL GEOSCIENCE (SCIENCE)

Completion Requirements:

Program Requirements
Total requirements: 16.0 ~~15.5~~ credits of which 1.0 credit must be at the D-level as follows:

First Year:
EESA01H3 Introduction to Environmental Science
EESA06H3 Introduction to Planet Earth
BIOA01H3 Life on Earth: Unifying Principles
BIOA02H3 Life on Earth: Form, Function and Interactions
CHMA10H3 Introductory Chemistry I: Structure and Bonding
CHMA11H3 Introductory Chemistry II: Reactions and Mechanisms
MATA30H3 Calculus I for Physical Sciences
[MATA36H3 Calculus II for Physical Sciences *or* MATA37H3 Calculus II for Mathematical Sciences]
~~[~~PHYA10H3 Physics I for the Physical Sciences ~~or PHYA11H3 Physics I for the Physical Sciences]~~
PHYA21H3 Physics II for the Physical Sciences

Second Year:
CHMB55H3 Environmental Chemistry
EESB02H3 Principles of Geomorphology
EESB03H3 Principles of Climatology
EESB04H3 Principles of Hydrology
EESB05H3 Principles of Soil Science
EESB15H3 Earth History
EESB18H3 Natural Hazards
EESB19H3 Mineralogy
[CSCA20H3 Introduction to Programming or PSCB57H3 Introduction to Scientific Computing]
STAB22H3 Statistics I

Third Year:
EESB20H3 Sedimentology and Stratigraphy
EESC03H3 Geographic Information Systems and Remote Sensing
EESC07H3 Groundwater
EESC13H3 Environmental Impact Assessment and Auditing
EESC20H3 Geochemistry
EESC31H3 Glacial Geology
EESC36H3 Petrology
and

0.5 credit from the following:
- BIOB50H3 Ecology
- EESB26H3 Introduction to Global Geophysics
- EESC18H3 Limnology
- EESC19H3 Oceanography

Fourth Year:
EESC37H3 Structural Geology
and
0.5 credit from the following:
- EESD02H3 Contaminant Hydrogeology
- EESD06H3 Climate Change Impact Assessment
- EESD09H3 Research Project in Environmental Science
- EESD10Y3 Research Project in Environmental Science
- EESD11H3 Advanced Watershed Hydrology
- EESD13H3 Environmental Law, Policy and Ethics
- EESD15H3 Fundamentals of Site Remediation
- EESD19H3 Professional Development Seminars in Geoscience
- EESD20H3 Geological Evolution and Environmental History of North America
and
- [1.0 credit at the C- or D-level in EES courses] or [0.5 credit at the C- or D-level in EES courses and PSCD11H3 Communicating Science: Film, Media, Journalism, and Society]

Strongly recommended : EESC16H3 Field Camp I or EESD07H3 Field Camp II or EESD33H3 Field Techniques

Description of Proposed Changes:
1. The total credits to complete the program have been increased from 15.5 to 16.0.
2. PHYA11H3 is being removed as an optional course from the First Year component of the program requirements; PHYA10H3 changes from an optional to a required course.
3. PHYA21H3 is being added as a required course to the First Year component of the program requirements.
4. CSCA20H3 is being added as an optional course to the Second Year component of the program requirements; PSCB57 changes from a required to an optional course.
5. EESB26H3 course is being added as a optional course to the Third Year component of the program requirements.

Rationale:
1. The total program credits are being increased from 15.5 to 16.0 credits because of the addition of PHYA21H3 to First Year courses. PHYA21H3 provides students with required knowledge to improve student success in a number of other courses in the program (e.g., EESC07H3; EESC37H3). This course is also one of the prerequisite for the new EESB26H3 course.
2. PHYA11H3 has been removed as an optional course to fulfill the First Year program requirement because it does not provide adequate background for the program.
3. PHYA21H3 has been added as a required course to the program to strengthen the physics component of the program.
4. Adding CSCA20H3 as an optional course will provide students with some flexibility for fulfilling the programming requirement of this program.
5. EESB26H3 is a new course that will add geophysics learning to the program, which is currently missing and will help satisfy a requirement towards the Association of Professional Geoscientists of Ontario.

Impact:
• New students will not be able to apply PHYA11H3 towards the program completion requirements; instead they must take PHYA10H3.
• New students must complete PHYA21H3 as part of the program requirements.
• Students will be able to choose between CSCA20H3 and PSCB57H3 to complete the program requirements.
• Students will be able to use EESB26H3 to complete the program requirements.

Consultation:
DCC Approval: October 09, 2018

Resource Implications:

None

2 New Courses:

CHMD11H3: Application of Spectroscopy in Chemical Structure Determination

Contact Hours:

Description:

In this course students will learn about the following analytical techniques used in organic structure determination: mass spectrometry, IR spectroscopy, NMR spectroscopy, and ultraviolet-visible spectroscopy. There will be focus on a systematic approach in structure determination through various spectroscopy. Students will receive hands-on training in spectral interpretation, processing and analysis as well as training on the use of different computer software for the purpose of analysis.

Prerequisites:
CHMB16H3 and CHMC11H3

Corequisites:

Exclusions:
CHM442H5

Recommended Preparation:

Enrolment Limits:
16; additional students will be admitted as space permits.

Note:
Priority will be given to students enrolled in the Specialist/Specialist Co-op programs in Environmental Chemistry.

Learning Outcomes:
Students who complete this course will gain:
1) an in-depth understanding of chemical structural determination,
2) hands-on experience with spectral analysis,
3) experience with problem solving and development of literature research skills,
4) development of oral and written communication skills through preparation of assignments and projects.
This course will expose students to at least 2 scientists who are working in the industry. The instructor of this course will also provide students with information about career opportunities after graduation as well as graduate school options.

Topics Covered:
- Week 1: Analytical Chemistry Refresher (LOD, LOQ, Statistics, Standard Curves, Internal vs external standards, etc).
- Week 2: UV-Vis & Chromatography – method of purification
- Week 3: Mass spectrometry & IR spectroscopy
Guest speaker (ACDLab – NMR spectral processing)
- Week 4: Basic NMR Spectroscopy (1D NMR spectroscopy & NMR theory).
- Week 5: Advance NMR Spectroscopy (Advance NMR spectroscopy – 2D NMR)
Guest speaker (Center for Forensic Science – Identification of Unknown)
- Week 6: Students present research project (oral presentation with submitted report).
- Week 7: Application of NMR spectroscopy in structure determination
- Week 8: Class Activity – Case Studies (Using Spectra from Literature)
- Week 9: Class Activity – Case Studies (Role of computer simulation in spectral analysis)
Laboratory Portion (2 weeks - 16 hours - Student will be working in Groups of 4):
Week 10 – 11: Final Project – Determination of an unknown organic compound (TRACES)
- The student will receive hands-on training on various instrumentation, including MS, NMR, UV and FTIR
- The student will be responsible for running their own unknown samples on the instruments. They will learn to prepare their sample as well as selecting the appropriate
experiments for structure determination.

- The student will process and analyze their data and propose a structure based on their findings.

- Week 12: Presentation of their findings from week 10-11 and a reflection of their approach.

Methods of Assessment:
- In-class Quizzes (2): two quizzes will ensure that students learn the theory presented within the lecture component of the course. It is imperative that students gain this knowledge prior to moving onto the PBL component. (20%)
- Assignments (In class activity): the in class PBL assignments will provide an opportunity for students to examine the various approaches one can take for structure determination. This will give them an chance to reflect and learn from their methodology. The students will discuss and reflect on the reason behind their methodology and approach (20%).
- Research Presentation: this will give student an opportunity to review the current available method/instrumentation used for structure determination for either organic and biological molecules (10%).
- Final Project: the PBL assignments will prepare students for their final project in which they are required to solve for a structure of an unknown compound. The final project will consist of a written report and presentation (10%).
- Final Project Presentation: this presentation will give students an opportunity to have an open dialogue with their peers about their finding and shortcoming of their methods. Data interpretation skills will be developed through preparation of final project reports and discussion (10%)
- Final Exam: this will be use to evaluate their overall understanding of the course materials and concepts presented in the assignments, projects and presentations (30%)

Mode of Delivery:
In Class

Breadth Requirements:
Natural Sciences

Rationale:
This course will fill a gap in the current curriculum and will focus on teaching students the application of spectroscopy in chemical structure determination. Other courses in chemistry cover certain aspects of chemical structure elucidation, however a full systematic treatment of this topic is missing. This course will be beneficial to students enrolled in both Chemistry and Environmental Chemistry. In particular, skills acquired from this course will be useful for students in both research and industry settings. In addition, the collaborative learning will be a key component in this course as students piece together the structural "clues" from different spectroscopy in order to determine the chemical structure.

Consultation:
DCC Approval: March 15, 2018.
RO Course Code Approval: December 11, 2018

Resources:
The course will be taught by existing faculty as part of their regular teaching loads. No TA support will be required for this course.
TRACES currently houses the necessary instrumentation for the laboratory portion of this course. Consumables ($1000-$2500/year) will likely be required for laboratory experiments proposed through this course. These consumables include: 1) Deuterated solvents 2) disposable NMR tubes 3) commercially available compounds served as unknown for their class project (Note: compounds can be reused for subsequent year) 4) organic solvents require for sample preparation for other analytical instrumentation 5) Other disposable laboratory items such as pipettes tips, vials, etc.
Cost for the consumables will be covered by department existing budget.
No additional instrumentation is required for this course.

EESB26H3: Introduction to Global Geophysics

Impact on Programs: This proposal triggers modifications in the unit's program(s)

Contact Hours:

Description:

This course describes the processes and energy sources shaping the solid Earth's physical evolution and the means by which the properties of the planet’s interior can be inferred. Topics include detection of the Earth's core, Earth's magnetic field, manifestations of Earth's secular cooling (e.g., mantle convection) and Earth's gravity field.

Prerequisites:

MATA36H3 and PHYA21H3

Corequisites:
EESB15H3

Exclusions:
JPE395H1

Recommended Preparation:

Enrolment Limits:

Note:

Learning Outcomes:
- Understanding that Earth's physical geography, magnetic field and biotic evolution are driven by the physics governing energy transfer in its deep interior.
- To clarify the time frames associated with different physical processes occurring in the deep Earth and their surface manifestations.
- To use mathematics to understand observations of the Earth's seafloor geography.
- To clarify how understanding wave motion through the Earth has revealed what we know of the Earth's deep interior.

Topics Covered:
- Seismic-wave types, detection of the Earth's core, seismic tomography
- Earth's heat budget, the processes driving plate tectonics, heat flow and physical topography of the ocean floor
- Earth's gravity field, the geoid, gravity measurements
- The source of Earth's magnetic field, properties of the Earth's core and mantle

Methods of Assessment:
- Four Assignments – mathematically based to reinforce understanding of the physical processes governing Earth's evolution and emphasize mathematics as a tool to understand global geography, seismological observations and physical fields.
- A midterm – to ensure students are absorbing the main concepts delivered early in the course.
- A final exam – both mathematically based and concept question based

Mode of Delivery:
In Class

Breadth Requirements:
Natural Sciences

Rationale:
This course fits into DPES's Geosciences offerings. The Department offers no similar course and features current glaring weaknesses in its preparation of students wishing to pursue a career in geophysics. The Departmental external review also identified geophysics as an area well suited for growth at UTSC given other areas of strength in DPES. The proposed course will probe deeper into the Earth's interior, include a greater degree of physics and mathematics in its content and will satisfy a requirement of the Association of Professional Geoscientists of Ontario (Geophysics specialty) for students following the specified electives in the newly proposed Program Modification for Environmental Physics.

Consultation:
DCC approval: October 09, 2018
RO course code approval: November 12, 2018

Resources:
The course will be taught by an existing faculty member as part of his regular teaching load.
The course will require TA support which will be funded by the department's existing budget. No special infrastructure is required for the course.