



Faculty of Science


Office of the Dean
St. John's, NL Canada A1B 3X7
Tel: 709 864 8154 Fax: 709 864 3316
deansci@mun.ca www.mun.ca/science

MEETING OF THE FACULTY COUNCIL OF THE FACULTY OF SCIENCE

A regular meeting of the Faculty Council of the Faculty of Science will be held on Wednesday, September 21, 2022, at 1:00 p.m. by Webex and in-person (Room: C- 2045)

AGENDA

1. **Regrets**
2. **Adoption of the Minutes of May 18, 2022**
3. **Business Arising from the Minutes**
4. **Correspondence: None**
5. **Reports of Standing Committees:**
 - A. **Undergraduate Studies Committee:**
 - a. Department of Computer Science- Calendar Changes, Amend Mathematics pre-requisite for Computer Science 2001 and 2022, Paper 5.A.a (pages 6-10)
 - b. Department of Computer Science – Calendar Changes, Amend course description for Computer Science 1001, Paper 5.A.b (pages 11-15)
 - c. Department of Computer Science – Calendar Changes, New Course – Computer Science 499A/B, Paper 5.A.c. (pages 16-23)
 - d. Department of Biology – Calendar Changes, Amend program Regulations, 11.2.3.1 Major in Biology, Paper 5.A.d. (pages 24-29)
 - e. Department of Biology – Calendar Changes, Crosslist Biology 4605 with Ocean Sciences 4605 and amend course title and update course description, Paper 5.A.e. (pages 30-33)
 - B. **Graduate Studies Committee:**
 - a. Department of Earth Science, Special Topics Graduate Course, EASC 6956, Applications of Petrochronology, approved by the committee and presented to Faculty Council for information only Paper 5.B.a. (pages 34-44)
 - b. Department of Earth Science, Request for Approval of a Graduate Course, EASC 6560, Applications of Petrochronology, Paper 5.B.a (pages 45-53)
 - C. **Library Committee: No business**
6. **Committee Matrix**
7. **Dr. C. Robert Lucas Graduate Fund**
8. **Motion for an Open Phase for the Provost Search**
9. **Reports of Delegates from Other Councils**
10. **Report of the Dean**
11. **Question Period**
12. **Adjournment**



Travis Fridgen, Ph.D.
Acting Dean of Science



Faculty of Science

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**FACULTY OF SCIENCE
FACULTY COUNCIL OF SCIENCE
Minutes of Meeting of May 18, 2022**

A meeting of the Faculty Council of the Faculty of Science was held on Wednesday, May 18, 2022, at 1:00 p.m. using Webex.

FSC 2949

Present

Biochemistry

M. Berry, V. Booth

Biology

T. Chapman, A. Chaulk, E. Edinger, Y. Wiersma

Chemistry

E. Merschrod, S. Pansare, D. Stirling

Computer Science

S. Anthony, S. Bungay, M. Emshey, A. Fiech, C. Hyde, V. Prado da Fonseca, A. Soares, T. Tricco

Earth Sciences

C. Farquharson, D. Guzzwell, A. Langille, G. Layne, A. Malcolm, M. Miskell

Economics

K. Chu

Mathematics & Statistics

R. Haynes, J.C. Loredano-Osti, S. Mantyka, M. Strong, T. Stuckless, S. Sullivan, H. Usefi, Y. Yilmaz-Cigsar

Ocean Sciences

I. Fleming, E. Ignatz, D. Nichols

Physics & Physical Oceanography

M. Geng, E. Hayden, M. Morrow, K. Poduska, L. Zedel

Psychology

A. Anand, C. Fitzpatrick, D. Hallett, C. Quinn-Nilas, A. Swift-Gallant, C. Thorpe

Dean of Science Office

J. Blundell, J. Bowering, S. Dufour, M. Fitzpatrick, K. Foss, T. Fridgen, L. Frizzell, G. Jackson, J. Kavanagh, G. Kenny, V. MacNab, J. Major, R. Newhook, R. Temple

Student Representatives:

W. Kinden

- FSC 2950 Regrets:**
G. Dunning, D. Dyer, V. MacNab, D. McIlroy, G. Miminis, C. Walsh
- FSC 2951 Adoption of Minutes**
Moved: Minutes of the meeting of April 20, 2022, be adopted. (Sullivan/Bungay)
Carried.
- FSC 2952 Business Arising:** None
- FSC 2953 Correspondence:** None
- FSC 2954 Faculty of Science Strategic Plan**
The updated draft of the Strategic Plan for the Faculty of Science was made available to all members of the Faculty of Science for review. This is a plan that the Faculty will work towards implementing. Funding may be an issue for some of the proposed initiatives, but there is hope that the University's budget will be less dire in the coming years.
Motion: Do you agree with the motion to adopt the most recent version of the Faculty of Science Strategic Plan? (Berry/Mantyka) **Carried.**
- FSC 2955 Reports of Standing Committees:**
- A. Undergraduate Studies Committee:** No business.
 - B. Graduate Studies Committee:**
Presented by Graham Layne, Chair, Graduate Studies Committee:
 - a.** Department of Computer Science, Request for Approval of a Graduate Course, COMP 6980, Algorithmic Techniques for Artificial Intelligence (Layne/Bungay) **Carried.**
 - b.** Department of Computer Science, proposed calendar changes (Layne/Bungay) **Carried.**
 - C. Library Committee:** No business.
- FSC 2956 Reports of Delegates from Other Councils:** No reports.
- FSC 2957 Report of the Dean:** No report.

FSC 2958 Question Period

It was suggested that a statement be included in the strategic plan requiring EDI credentials for those working to advance these principles in the Faculty. These credentials would be an understanding and knowledge of EDI principles that have been put into practice.

All departments should be notified immediately when water is shut off to a building, or portions of a building, as this interruption in water availability could be detrimental to expensive lab equipment.

FSC 2959 Adjournment

The meeting adjourned at 1:31 p.m.



Office of the Registrar

St. John's, NL Canada A1C 5S7
Tel: 709 864 8260 Fax: 709 864 2337
www.mun.ca

June 27, 2022

TO: All Members of Faculty Council, Faculty of Science

FROM: Tracey Edmunds, Secretary, Faculty of Science Committee on Undergraduate Studies

SUBJECT: **Proposals for Calendar Changes**

A virtual meeting held on June 2nd, 2022, the Faculty of Science Committee on Undergraduate Studies agreed that the following item should be forwarded to Faculty Council for approval:

- 1. Department of Computer Science - Calendar Changes**
 - a. Amend Mathematics pre-requisite for Computer Science 2001 and 2002
 - b. Amend course description for Computer Science 1001
 - c. New Course - Computer Science 499A/B

- 2. Department of Biology - Calendar Changes**
 - a. Amend Program Regulations, 11.2.3.1 Major in Biology
 - b. Crosslist Biology 4605 with Ocean Sciences 4605 and amend course title and update course description

Tracey Edmunds

Tracey Edmunds

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Cover Page

LIST OF CHANGES

Indicate the Calendar change(s) being proposed by checking and completing as appropriate:

- New course(s):
- X Amended or deleted course(s): COMP 2001 and 2002

- New program(s):
- Amended or deleted program(s):
- New, amended or deleted Glossary of Terms Used in the Calendar entries
- New, amended or deleted Admission/Readmission to the University (Undergraduate) regulations
- New, amended or deleted General Academic Regulations (Undergraduate)
- New, amended or deleted Faculty, School or Departmental regulations
- Other:

ADMINISTRATIVE AUTHORIZATION

By signing below, you are confirming that the attached Calendar changes have obtained all necessary Faculty/School approvals, and that the costs, if any, associated with these changes can be met from within the existing budget allocation or authorized new funding for the appropriate academic unit.

Signature of Dean/Vice-President: _____

Date: _____

Date of approval by Faculty/Academic Council: _____

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Senate Summary Page for Courses

COURSE NUMBER AND TITLE

2001 Object-Oriented Programming and Human-Computer Interaction
2002 Data Structures and Algorithms

ABBREVIATED COURSE TITLE

Obj-Orient Prgm Human Comp Int
Data Strctrs & Algorithms

RATIONALE

We would like to remove COMP 2001's prerequisite of Mathematics 1000 because the material covered in Mathematics 1000 is not required in order to successfully complete COMP 2001.

We would like to add a prerequisite of Mathematics 1000 for COMP 2002 because COMP 2002 builds on some of the concepts taught in Mathematics 1000.

CALENDAR CHANGES

2001 Object-Oriented Programming and Human-Computer Interaction

advances from Introduction to Programming and studies object-oriented programming. Additional topics include event-driven programming, program correctness and simple refactoring, as well as interfaces and human-computer interaction. A brief overview of programming languages is also provided.

CR: the former COMP 2710

LH: 3

PR: COMP 1001, and COMP 1003, ~~and Mathematics 1000~~

2002 Data Structures and Algorithms

covers fundamental data structures, algorithms and algorithm design techniques. A problem-driven course, it focuses on computational problem solving from designing an efficient algorithm to implementing it using appropriate data structures.

CR: the former COMP 2711

LH: 3

PR: COMP 1001, COMP 1002 or Mathematics 2320, ~~and~~ COMP 1003, and Mathematics 1000

CALENDAR ENTRY AFTER CHANGES

2001 Object-Oriented Programming and Human-Computer Interaction

advances from Introduction to Programming and studies object-oriented programming. Additional topics include event-driven programming, program correctness and simple refactoring, as well as interfaces and human-computer interaction. A brief overview of programming languages is also provided.

CR: the former COMP 2710

LH: 3

PR: COMP 1001 and COMP 1003

2002 Data Structures and Algorithms

covers fundamental data structures, algorithms and algorithm design techniques. A problem-driven course, it focuses on computational problem solving from designing an efficient algorithm to implementing it using appropriate data structures.

CR: the former COMP 2711

LH: 3

PR: COMP 1001, COMP 1002 or Mathematics 2320, COMP 1003, and Mathematics 1000

SECONDARY CALENDAR CHANGES

None

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Appendix Page

CONSULTATIONS SOUGHT

Academic Advising Centre
Humanities and Social Sciences
Business Administration
Education
Engineering and Applied Science
Grenfell Campus (Arts & Social Sciences)
Grenfell Campus (Science and the Environment)
Grenfell Campus (Fine Arts)
Human Kinetics and Recreation
Library
Marine Institute
Medicine
Music
Nursing
Pharmacy
Social Work
Science
<ul style="list-style-type: none"> • Biochemistry • Biology • Chemistry • Earth Sciences • Geography • Mathematics and Statistics

<ul style="list-style-type: none">• Ocean Sciences
<ul style="list-style-type: none">• Physics and Physical Oceanography

LIBRARY REPORT

No additional requirements.

RESOURCE IMPLICATIONS

There are no resource implications associated with this change.

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Cover Page

LIST OF CHANGES

Indicate the Calendar change(s) being proposed by checking and completing as appropriate:

- New course(s):
- New program(s):
- Amended or deleted course(s):
- New, amended or deleted Glossary of Terms Used in the Calendar entries
- New, amended or deleted Admission/Readmission to the University (Undergraduate) regulations
- New, amended or deleted General Academic Regulations (Undergraduate)
- New, amended or deleted Faculty, School or Departmental regulations
- X Other:

ADMINISTRATIVE AUTHORIZATION

By signing below, you are confirming that the attached Calendar changes have obtained all necessary Faculty/School approvals, and that the costs, if any, associated with these changes can be met from within the existing budget allocation or authorized new funding for the appropriate academic unit.

Signature of Dean/Vice-President: _____

Date: _____

Date of approval by Faculty/Academic Council: _____

Memorial University of Newfoundland

Undergraduate Calendar Change Proposal Form

Senate Summary Page for Courses

COURSE NUMBER AND TITLE

1001 Introduction to Programming

ABBREVIATED COURSE TITLE

Intro to Programming

RATIONALE

The COMP 1001 Calendar description has been updated to provide more detail regarding programming concepts covered in the course.

CALENDAR CHANGES**1001****Introduction to Programming**

~~is an introduction to fundamental programming techniques, primitive data types, and to simple algorithms and their design concepts.~~

covers fundamental programming concepts and introduces object-oriented programming. Students learn how to use primitive data types, and create and use fundamental data structures. They learn problem solving techniques, and apply them by designing and implementing algorithms, including search and sort, and simple recursive functions. They learn how to use control constructs and implement file and exception handling.

CR: the former COMP 1710

LH: 3

CALENDAR ENTRY AFTER CHANGES**1001****Introduction to Programming**

covers fundamental programming concepts and introduces object-oriented programming. Students learn how to use primitive data types, and create and use fundamental data structures. They learn problem solving techniques, and apply them by designing and implementing algorithms, including search and sort, and simple recursive functions. They learn how to use control constructs and implement file and exception handling.

CR: the former COMP 1710

LH: 3

SECONDARY CALENDAR CHANGES

None

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Appendix Page

CONSULTATIONS SOUGHT

Academic Advising Centre
Humanities and Social Sciences
Business Administration
Education
Engineering and Applied Science
Grenfell Campus (Arts & Social Sciences)
Grenfell Campus (Science and the Environment)
Grenfell Campus (Fine Arts)
Human Kinetics and Recreation
Library
Marine Institute
Medicine
Music
Nursing
Pharmacy
Social Work
Science
<ul style="list-style-type: none"> • Biochemistry • Biology • Chemistry • Earth Sciences • Geography • Mathematics and Statistics • Ocean Sciences • Physics and Physical Oceanography

LIBRARY REPORT

No additional requirements.

RESOURCE IMPLICATIONS

There are no resource implications associated with this change.

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Cover Page

LIST OF CHANGES

Indicate the Calendar change(s) being proposed by checking and completing as appropriate:

- New course(s):
- Amended or deleted course(s):
- New program(s):
- Amended or deleted program(s):
- New, amended or deleted Glossary of Terms Used in the Calendar entries
- New, amended or deleted Admission/Readmission to the University (Undergraduate) regulations
- New, amended or deleted General Academic Regulations (Undergraduate)
- New, amended or deleted Faculty, School or Departmental regulations
- Other:

ADMINISTRATIVE AUTHORIZATION

By signing below, you are confirming that the attached Calendar changes have obtained all necessary Faculty/School approvals, and that the costs, if any, associated with these changes can be met from within the existing budget allocation or authorized new funding for the appropriate academic unit.

Signature of Dean/Vice-President: _____

Date: _____

Date of approval by Faculty/Academic Council: _____

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Senate Summary Page for Courses

COURSE NUMBER AND TITLE

499A/B Honours Research in Computer Science

ABBREVIATED COURSE TITLE

Hons Resrch in Comp Sci

RATIONALE

Currently the computer science honours thesis course (COMP 4780) is three credit hours and takes place during one semester. It is difficult for a student to develop a project with their supervisor, perform research, analyse results, and complete a written dissertation in one semester. Changing to a two semester (six credit hour) honours research project will enable students and supervisors to perform more in-depth research, and it will give students a better overall research experience, including increased opportunity for publication.

CALENDAR CHANGES

499A and 499B Honours Research in Computer Science are consecutive linked courses, based on independent study of an approved topic in Computer Science. The topic is chosen in consultation with a Faculty Advisor. The research project and type of work required from the student will depend on the project and can involve literature review; developing methodologies; collecting, analyzing and presenting data; writing code; interpreting results and determining the significance of findings. Deliverables include a dissertation proposal, formal written report and a departmental presentation.

CH: 6

PR: admission to the Honours Program

CALENDAR ENTRY AFTER CHANGES

499A and 499B Honours Research in Computer Science are consecutive linked courses, based on independent study of an approved topic in Computer Science. The topic is chosen in consultation with a Faculty Advisor. The research project and type of work required from the student will depend on the project and can involve literature review; developing methodologies; collecting, analyzing and presenting data; writing code; interpreting results and determining the significance of findings. Deliverables include a dissertation proposal, formal written report and a departmental presentation.

CH: 6

PR: admission to the Honours Program

SECONDARY CALENDAR CHANGES

11.4.6 Honours in Computer Science

1. See **Bachelor of Arts (Honours) Degree Regulations** or **Degree Regulations** for the Honours Degree of Bachelor of Science (as appropriate).
2. Sixty-three credit hours in Computer Science courses are required for the Honours Degree in Computer Science, including:
 - a. Computer Science 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, and ~~4780~~ 499A/B.
 - b. ~~Fifteen~~ Twelve additional credit hours in Computer Science at the 4000 level.
 - c. Eighteen additional credit hours in Computer Science courses at the 3000 level or beyond.
3. Additional courses required are: Mathematics 1000, 1001, 2000, 2050, and Statistics 2500 or 2550.

10.2.14 Computer Science and Geography Joint Honours

As a component of the **Degree Regulations** for the Honours Degree of Bachelor of Science, the following courses are required:

1. Computer Science Requirements

Forty-eight credit hours in Computer Science courses are required for the Joint Honours:

- a. 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, the former 4751.
- b. Six additional credit hours in courses at the 4000 level not including ~~4780~~ 499A/B.
- c. Twelve additional credit hours in courses at the 3000 level or beyond.

2. Geography Requirements

Forty-eight credit hours in Geography courses are required for the Joint Honours:

- a. 1050, 2001, 2102, 2195, 2302, 2425, 3202, 3222, 3228 (or the former 2226 and the former 3226), 3250, 3260, 4202, 4250, 4261, the former 4291, 490A and 490B.
- b. Three additional credit hours in courses at the 3000 level.

3. Additional Requirements

- a. Mathematics 1000, 1001, 2000, and 2050.
- b. An Honours Dissertation (either Computer Science ~~4780~~ 499A/B or Geography 4999) with the topic chosen in consultation with both departments.

10.2.15 Computer Science and Physics Joint Honours (B.Sc. only)

The following courses are prescribed:

1. Chemistry 1050 and 1051 (or Chemistry 1010, the former 1011, and the former 1031) (or 1200 and 1001).
2.
 - a. Computer Science 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 3731.
 - b. Nine additional credit hours in Computer Science courses numbered 3000 or higher, including at least 3 credit hours in courses at the 4000 level.
3.
 - a. Physics 1050 (or 1020) and 1051.
 - b. Physics 2053, 2055, 2750, 2820, 3220, 3400, 3500, 3750, 3800, and 3820.
 - c. Three additional credit hours in Physics at the 4000 level.
4. ~~Physics 490A and Physics 490B~~ 490A/B or Computer Science ~~4780~~ 499A/B and ~~3 additional credit hours in Computer Science at the 4000 level.~~
- 5.

- a. Mathematics 1000 and 1001.
- b. Mathematics 2000, 2050, 2260, and 3202.
6. Six credit hours in **Critical Reading and Writing (CRW)** courses, including at least 3 credit hours in English courses.
7. Two electives to bring the total credit hours to 120. Computer Science 2500 and Statistics 2550 are recommended.

The topic for the honours project or thesis, Computer Science ~~4780~~ 499A/B or Physics 490A/B, must be chosen with the prior approval of both departments.

10.2.16 Computer Science and Pure Mathematics Joint Honours

As a component of the **Degree Regulations** for the Honours Degree of Bachelor of Science, the following courses are required:

At least 51 credit hours in Computer Science courses are required including the following:

1. Computer Science 1001, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008.
2. Excluding ~~4780~~ 499A/B, ~~24~~ twenty-one additional credit hours from courses numbered 3000 or higher, at least ~~9~~ six credit hours of which must be in courses at the 4000 level.

The following courses in Mathematics and Statistics are required:

1. Mathematics 1000, 1001, 2000, 2050, 2051, 2130, 2260, 2320, 3000, 3001, 3202, 3210, 3320, 3340, Statistics 2550.
2. Either Mathematics 4000 or 4001.
3. Excluding the former Mathematics 3330, the former 4399, and 439A/B, ~~fifteen~~ 15 additional credit hours in courses offered by the Department of Mathematics and Statistics numbered 3000 or higher including at least ~~nine~~ 9 credit hours from courses numbered 4000 or higher and at least ~~nine~~ 9 credit hours in Pure Mathematics courses.
4. An Honours Dissertation (either Computer Science ~~4780~~ 499A/B or Mathematics 439A/B) with the topic chosen in consultation with both departments.

10.2.17 Computer Science and Statistics Joint Honours

As a component of the **Degree Regulations** for the Honours Degree of Bachelor of Science, the following courses are required:

1. Mathematics 1000, 1001, 2000, 2050, 2051, 2320, 3340, Statistics 1510 or 2500 or 2550, 2410 or 3410, 2501 or 2560, 3411, 3520, 3521, 3540, 4530, 4590
2. Eighteen further credit hours in Statistics courses including at least 12 credit hours in courses numbered 4000 or higher, but not including Statistics 4581 and 459A/B.
3. Computer Science 1001, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 4734.
4. ~~Twenty-one~~ Eighteen additional credit hours in Computer Science courses at the 3000 level or higher, not including ~~4780~~ 499A/B.
5. An Honours Dissertation (either Computer Science ~~4780~~ 499A/B or Statistics 459A/B) with the topic chosen in consultation with both departments.

11.4.7 Honours in Computer Science (Software Engineering) (B.Sc. Only)

Completion of the Honours in Computer Science (Software Engineering) Program does not qualify persons to hold the designation "Professional Engineer" as defined by various Provincial Acts governing the Engineering Profession.

1. See **Degree Regulations** for the Honours Degree of Bachelor of Science.
2. Sixty-three credit hours in Computer Science courses are required for the Honours Degree in Computer Science (Software Engineering), including:

- a. Computer Science 1001, 1002, 1003, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 4770, ~~4780~~ 499A/B.
 - b. Nine additional credit hours in Computer Science chosen from 3100, 3301, 4718, 4721, 4723, ~~the former 4751~~ 4302, ~~the former 4753~~, ~~the former 4756~~, 4759, 4766, and 4768.
 - c. ~~Nine~~ Six additional credit hours in Computer Science at the 4000 level.
 - d. Twelve additional credit hours in Computer Science at the 3000 level or beyond.
3. Additional courses required are: Mathematics 1000, 1001, 2000, 2050, and Statistics 2500 or 2550.

Note:

The Honours project (~~4780~~ 499A/B) must be in the area of Software Engineering.

12.4.4 Fourth Year Courses

~~**4780 Honours Project** introduces computer science honours students to research activities, familiarizes them with a special problem in computer science, and provides independent study on an advanced topic under the direct supervision of a member of the computer science faculty. The topic is decided in consultation with the supervisor. The student is required to produce a written report on the project, to include the literature search on the topic, and to present this work at a departmental seminar prior to the last week of the semester.~~

~~PR: admission to the honours program and permission of the Head of Department~~

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Appendix Page

CONSULTATIONS SOUGHT

Academic Advising Centre
Humanities and Social Sciences
Business Administration
Education
Engineering and Applied Science
Grenfell Campus (Arts & Social Sciences)
Grenfell Campus (Science and the Environment)
Grenfell Campus (Fine Arts)
Human Kinetics and Recreation
Library
Marine Institute
Medicine
Music
Nursing
Pharmacy
Social Work
Science
<ul style="list-style-type: none"> • Biochemistry • Biology • Chemistry • Earth Sciences • Geography • Mathematics and Statistics

<ul style="list-style-type: none">• Ocean Sciences
<ul style="list-style-type: none">• Physics and Physical Oceanography

LIBRARY REPORT

No additional requirements.

RESOURCE IMPLICATIONS

The costs associated with new program/course(s) can be met from within the existing budget allocation for the Faculty of Science

ADDITIONAL INFORMATION REQUIRED FOR NEW COURSE PROPOSALS

All Honours candidates in the Department of Computer Science will need to complete the Honours Dissertation course (COMP 499A/B). Candidates are expected to complete the course over two successive semesters, normally the final two semesters of the student's program. The Honours Dissertation courses are different than a typical undergraduate course in that they do not involve classroom time, and the majority of coursework involves self-directed and supervised research. The time commitment for each of these courses is approximately equal to a typical 4000-level computer science course.

COMP 499A will be graded with PAS/FAL and is worth 0 credit hours. There are no classes as part of this course, rather, it consists mainly of self-directed and supervised research. Students and supervisors should meet on a regular basis while the student is enrolled in 499A, and the student should be progressing with their research and thesis writing.

As part of this course students will submit a Research Proposal. The Research Proposal is a short specification of the proposed thesis work and should be written in consultation with the thesis supervisor, it should provide a broad summary of the work proposed for the research project.

The Research Proposal should include, where appropriate:

1. A short Introduction providing a background outlining the rationale of the research
2. The Research Question and Hypothesis
3. Procedures: a summary of the proposed methods and procedures
4. Time-line: anticipated time to complete research and final thesis

COMP 499B will be given a numerical grade and is worth 6 credit hours. Deliverables for this course include:

- presentation (10 – 20 minute presentation that includes an overview of the student's research question, hypothesis, methods, results and discussion)
- final thesis

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Cover Page

LIST OF CHANGES

Indicate the Calendar change(s) being proposed by checking and completing as appropriate:

- New course(s):
- Amended or deleted course(s):
- New program(s):
- Amended or deleted program(s):
- New, amended or deleted Glossary of Terms Used in the Calendar entries
- New, amended or deleted Admission/Readmission to the University (Undergraduate) regulations
- New, amended or deleted General Academic Regulations (Undergraduate)
- New, amended or deleted Faculty, School or Departmental regulations
- Other:

ADMINISTRATIVE AUTHORIZATION

By signing below, you are confirming that the attached Calendar changes have obtained all necessary Faculty/School approvals, and that the costs, if any, associated with these changes can be met from within the existing budget allocation or authorized new funding for the appropriate academic unit.

Signature of Dean/Vice-President: _____

Date: _____

Date of approval by Faculty/Academic Council: _____

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Senate Summary Page for Programs

PROGRAM TITLE

11.2 Biology

RATIONALE

The Biology program has always included Organic Chemistry as part of the program requirements, but when the Department of Chemistry stopped offering CHEM 2440, we required Biology majors to take both Introductory Organic Chemistry I (CHEM 2400) and Introductory Organic Chemistry II (CHEM 2401). CHEM 2400 is a pre-requisite for Introduction to Biochemistry (BIOC 2201), which in turn is a pre-requisite to 2 of our courses (BIOL 2060, Principles of Cell Biology; BIOL 4200, Immunology) but CHEM 2401 is not a pre-requisite for any Biology courses. We have not observed any deficit in learning when students delay taking CHEM 2401 before taking any BIOL course. Thus, we propose to delete CHEM 2401 from the program requirements for Biology.

CALENDAR CHANGES

11.2.3.1 Major in Biology

All students majoring in Biology are required to complete a minimum of 45 credit hours in courses from the Department of Biology offering. Those 45 credit hours must include: Biology 1001 and 1002 or their equivalents; the 15 credit hours in core courses listed below; and 24 credit hours in Biology electives at the 2000, 3000 or 4000 level except Biology 2040, 2041, 2120, 3053, and 3820.

Biology Core (15 credit hours): Biology 2060, 2250, 2600, 2900, plus one of Biology 3401, 3402, 4245 or 4404.

A maximum of 9 credit hours can be in Biology courses with no associated laboratory/seminar.

All majors must also successfully complete the following courses or their equivalents:

1. Six credit hours in **Critical Reading and Writing (CRW)** courses, including at least 3 credit hours in English courses
2. Physics 1020 and 1021 (or equivalent)
3. Mathematics 1000
4. Chemistry 1050 and 1051 (or 1200 and 1001, or 1010 and the former 1011), Chemistry 2400 ~~and 2401~~

11.2.3.1 Honours in Biology

2. Core Course Requirements:

All honours students must also successfully complete the following courses or their equivalents:

- a. Six credit hours in **Critical Reading and Writing (CRW)** courses, including at least 3 credit hours in English courses.
- b. Physics 1020 and 1021 (or equivalent)
- c. Mathematics 1000
- d. Chemistry 1050 and 1051 (or 1200 and 1001, or 1010 and the former 1011), Chemistry 2400 ~~and 2401~~

CALENDAR ENTRY AFTER CHANGES

11.2.3.1 Major in Biology

All students majoring in Biology are required to complete a minimum of 45 credit hours in courses from the Department of Biology offering. Those 45 credit hours must include: Biology 1001 and 1002 or their equivalents; the 15 credit hours in core courses listed below; and 24 credit hours in Biology electives at the 2000, 3000 or 4000 level except Biology 2040, 2041, 2120, 3053, and 3820.

Biology Core (15 credit hours): Biology 2060, 2250, 2600, 2900, plus one of Biology 3401, 3402, 4245 or 4404.

A maximum of 9 credit hours can be in Biology courses with no associated laboratory/seminar.

All majors must also successfully complete the following courses or their equivalents:

1. Six credit hours in **Critical Reading and Writing (CRW)** courses, including at least 3 credit hours in English courses
2. Physics 1020 and 1021 (or equivalent)
3. Mathematics 1000
4. Chemistry 1050 and 1051 (or 1200 and 1001, or 1010 and the former 1011), Chemistry 2400

11.2.3.1 Honours in Biology

2. Core Course Requirements:

All honours students must also successfully complete the following courses or their equivalents:

- a. Six credit hours in **Critical Reading and Writing (CRW)** courses, including at least 3 credit hours in English courses.
- b. Physics 1020 and 1021 (or equivalent)
- c. Mathematics 1000
- d. Chemistry 1050 and 1051 (or 1200 and 1001, or 1010 and the former 1011), Chemistry 2400

SECONDARY CALENDAR CHANGES

10.1.13 Marine Biology Joint Major

10.1.13.2 Program of Study

6. Chemistry 1050 and 1051 (or 1200 and 1001), and 2400 ~~and 2401~~;

6. Chemistry 1050 and 1051 (or 1200 and 1001), and 2400;

10.2.8. Biology and Earth Sciences Joint Honours

3. Chemistry ~~2440~~2400, Biochemistry 2201 or the former 2101, Biochemistry 3206 or 3106, one of Statistics 2550 or 2560.

3. Chemistry 2400, Biochemistry 2201 or the former 2101, Biochemistry 3206 or 3106, one of Statistics 2550 or 2560.

10.2.9 Biology and Psychology Joint Honours

5. Mathematics 1000; Chemistry 1050 (or 1200), 1051 (or 1001), 2400~~and 2401~~; Physics 1020 (or 1050) and 1021 (or 1051); Biochemistry 2201 or the former 2101 and 3206 or 3106.

4. Mathematics 1000; Chemistry 1050 (or 1200), 1051 (or 1001), 2400; Physics 1020 (or 1050) and 1021 (or 1051); Biochemistry 2201 or the former 2101 and 3206 or 3106.

10.2.10 Biology and Psychology (Behavioural Neuroscience) Joint Honours

5. Mathematics 1000 and 1001; Physics 1020 (or 1050) and 1021 (or 1051); Chemistry 1050 (or 1200), 1051 (or 1001), 2400~~, and 2401~~.

6. Mathematics 1000 and 1001; Physics 1020 (or 1050) and 1021 (or 1051); Chemistry 1050 (or 1200), 1051 (or 1001), 2400~~, and 2401~~.

10.2.11 Biology and Statistics Joint Honours

5. Chemistry 2400~~and 2401~~, Biochemistry 2201 or the former 2101, and 3206 or 3106;

5. Chemistry 2400, Biochemistry 2201 or the former 2101, and 3206 or 3106;

10.2.21 Marine Biology Joint Honours

6. Chemistry 1050 and 1051 (or Chemistry 1200 and 1001), and Chemistry 2400~~and 2401~~;

6. Chemistry 1050 and 1051 (or Chemistry 1200 and 1001), and Chemistry 2400;

Memorial University of Newfoundland

Undergraduate Calendar Change Proposal Form

Appendix Page

CONSULTATIONS SOUGHT

From

Grenfell campus
 Faculty of Business Administration
 Faculty of Education
 Faculty of Engineering & Applied Science
 Faculty of Humanities & Social Sciences
 Faculty of Science
 Department of Biochemistry
 Department of Chemistry

Response Received

Yes – provided useful feedback which our APO will use in advising, some BIOL majors may still wish to take CHEM 2041, depending on upper level course interests.

Department of Computer Sciences
 Department of Earth Sciences
 Department of Economics
 Department of Geography
 Department of Mathematics and Statistics
 Department of Physics and Physical Oceanography
 Department of Psychology
 Marine Institute
 School of Human Kinetics and Recreation
 School of Medicine
 School of Nursing
 School of Pharmacy
 School of Social Work

Yes - approve

LIBRARY REPORT

Not applicable

RESOURCE IMPLICATIONS

Not applicable

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Cover Page

LIST OF CHANGES

Indicate the Calendar change(s) being proposed by checking and completing as appropriate:

- New course(s):
- Amended or deleted course(s): *Cross-list existing BIOL 4605 with Ocean Sciences (OCSC 4605) and amend course title and update course description*
- New program(s):
- Amended or deleted program(s):
- New, amended or deleted Glossary of Terms Used in the Calendar entries
- New, amended or deleted Admission/Readmission to the University (Undergraduate) regulations
- New, amended or deleted General Academic Regulations (Undergraduate)
- New, amended or deleted Faculty, School or Departmental regulations
- Other:

ADMINISTRATIVE AUTHORIZATION

By signing below, you are confirming that the attached Calendar changes have obtained all necessary Faculty/School approvals, and that the costs, if any, associated with these changes can be met from within the existing budget allocation or authorized new funding for the appropriate academic unit.

Signature of Dean/Vice-President: _____

Date: _____

Date of approval by Faculty/Academic Council: _____

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Senate Summary Page for Courses

COURSE NUMBER AND TITLE

BIOL 4605 Quantitative Methods in Biology

REVISED COURSE NUMBER AND TITLE

BIOL 4605 Statistics in the Biological and Environmental Sciences
OCSC 4605 Statistics in the Biological and Environmental Sciences

ABBREVIATED COURSE TITLE

Stat Sci Biol Env

RATIONALE

We would like to propose a calendar change to adjust this course title to better fit the current content, and cross list it with Ocean Sciences. The change better reflects the evolution of course content, to include the generalized linear model and its extensions, with some exposure to likelihood inference. Cross listing with OCSC 4605 reflects and facilitates collaborative teaching across the two departments (the course developer and instructor has historically been cross-appointed from Ocean Sciences).

CALENDAR CHANGES under 12.2 Biology

4605 ~~Quantitative Methods in Biology~~ Statistics in the Biological and Environmental Sciences (same as ~~Statistics 4581~~ Ocean Sciences 4605, and the former ~~Statistics 4605~~) is quantitative reasoning using verbal, graphical and statistical models of scaled quantities (units and dimensions). Exploratory and confirmatory analysis of field and laboratory data. Hypothesis testing, **including** randomization tests and likelihood ratios. Topics include the general linear model (t-tests, ancova etc), correlation, multivariate methods, mixed models, Poisson and logistic regression.

CR: ~~Statistics 4581 and the former Statistics 4605~~ OCSC 4605

LH: 3

PR: Statistics 2550 or any of the courses listed in the credit restrictions of Statistics 2550 or permission of the instructor.

CALENDAR ENTRY AFTER CHANGES under 12.2 Biology

4605 Statistics in the Biological and Environmental Sciences

(same as Ocean Sciences 4605) is quantitative reasoning using verbal, graphical and statistical models of scaled quantities (units and dimensions). Exploratory and confirmatory analysis of field and laboratory data. Hypothesis testing, randomization tests and likelihood ratios. Topics include the general linear model (t-tests, ancova etc), correlation, multivariate methods, mixed models, Poisson and logistic regression.

CR: OCSC 4605

LH: 3

PR: Statistics 2550 or any of the courses listed in the credit restrictions of Statistics 2550 or permission of the instructor.

SECONDARY CALENDAR CHANGES

Ocean Sciences 12.9

New entry

4605 Quantitative Methods in Statistics in the Biological and Environmental Sciences

(same as Statistics 4581 Ocean Sciences 4605, and the former Statistics 4605 is quantitative reasoning using verbal, graphical and statistical models of scaled quantities (units and dimensions). Exploratory and confirmatory analysis of field and laboratory data. Hypothesis testing, including randomization tests and likelihood ratios. Topics include the general linear model (t-tests, ancova etc), correlation, multivariate methods, mixed models, Poisson and logistic regression.

CR: OCSC 4605

LH: 3

PR: Statistics 2550 or any of the courses listed in the credit restrictions of Statistics 2550 or permission of the instructor.

Memorial University of Newfoundland Undergraduate Calendar Change Proposal Form Appendix Page

From	Response Received
Grenfell campus	
Faculty of Business Administration	
Faculty of Education	
Faculty of Engineering & Applied Science	
Faculty of Humanities & Social Sciences	
Faculty of Science	
Department of Biochemistry	
Department of Chemistry	
Department of Computer Sciences	
Department of Earth Sciences	
Department of Economics	
Department of Geography	
Department of Mathematics and Statistics	
Department of Ocean Sciences	YES – supportive
Department of Physics and Physical Oceanography	
Department of Psychology	
Marine Institute	
School of Human Kinetics and Recreation	
School of Medicine	
School of Nursing	
School of Pharmacy	
School of Social Work	

LIBRARY REPORT

Not applicable.

RESOURCE IMPLICATIONS

No change is expected with regards to instructional costs and Library holdings, arising from the attached Calendar changes



Faculty of Science

Office of the Dean
St. John's, NL Canada A1B 3X7
Tel: 709 864 8154 Fax: 7098643316
deansci@mun.ca www.mun.ca/science

September 13, 2022

TO: Registrar's Office

FROM: Secretary, Faculty of Science Faculty Council

SUBJECT: Special Topics Course – EASC 6560: Applications of Petrochronology

The special topics course EASC 6560: Applications of Petrochronology, has been approved by the Faculty of Science Faculty Council Graduate Studies Committee.

The Request for Approval of a Graduate Course forms are attached. If you require more information please let me know.

A handwritten signature in blue ink that reads "Gina Jackson".

Gina Jackson
Secretary, Faculty of Science Faculty Council

cc: A. Williams, School of Graduate Studies
A. Leitch, Earth Sciences



SCHOOL OF
GRADUATE STUDIES

Request for Approval of a Graduate Course

Adobe Reader, minimum version 8, is required to complete this form. Download the latest version: <http://get.adobe.com/reader>. (1) Save the form by clicking on the diskette icon on the upper left side of the screen; (2) Ensure that you are saving the file in PDF format; (3) Specify where you would like to save the file, e.g. Desktop; (4) Review the [How to create and insert a digital signature](#) webpage for step by step instructions; (5) Fill in the required data and save the file; (6) Send the completed form by email to: sgs@mun.ca.

To: Dean, School of Graduate Studies
From: Faculty/School/Department/Program
Subject: Regular Course Special/Selected Topics Course

Course No.: 6560

Course Title: Applications of Petrochronology

I. To be completed for all requests:

A. Course Type:

<input type="checkbox"/> Lecture course	<input checked="" type="checkbox"/> Lecture course with laboratory
<input type="checkbox"/> Laboratory course	<input type="checkbox"/> Undergraduate course ¹
<input type="checkbox"/> Directed readings	<input type="checkbox"/> Other (please specify)

B. Can this course be offered by existing faculty? Yes No

C. Will this course require new funding (including payment of instructor, labs, equipment, etc.)? Yes No
 If yes, please specify:

D. Will additional library resources be required (if yes, please contact munul@mun.ca for a resource consultation)? Yes No

E. Credit hours for this course: 3

F. Course description (please attach course outline and reading list):
 Attached in course outline.

G. Method of evaluation:

	Percentage	
	Written	Oral
Class tests	Final examination:	
Assignments		
Other (specify):		

0	60	0	20
20	0	0	0
Total		100	

II. To be completed for special/selected topics course requests only

For special/selected topics courses, there is no evidence of:

Instructor's initials

1. duplication of thesis work

ET _____

2. double credit

ET _____

3. work that is a faculty research product

ET _____

4. overlap with existing courses

ET _____

Recommended for offering in the Fall Winter Spring 20 22

Length of session if less than a semester:

III. This course proposal has been prepared in accordance with General Regulations governing the School of Graduate Studies

Dr. Eric Thiessen Digitally signed by Dr. Eric Thiessen
Date: 2022.04.01 13:14:20 -02'30'

Course instructor _____

_____ Date

Penny Morrill Digitally signed by Penny Morrill
Date: 2022.07.22 10:59:56 -02'30'

Approval of the head of the academic unit _____

_____ Date

IV. This course proposal was approved by the Faculty/School/Council



Secretary, Faculty/School/Council _____

Sept. 13, 2023 _____
Date

EASC 6560: Applications of Petrochronology

Course description

Petrochronology combines geochronologic and petrologic data to inform ages, rates, duration and thermal history of igneous, metamorphic and sedimentary rock forming processes. This seminar course will cover basic radiogenic isotope theory and techniques used for petrochronologic data acquisition. Petrochronologic mineral systematics and parageneses as well as concepts of diffusion and closure temperature will be explored. This course will also involve analytical data collection, processing, validation and interpretation.

Learning Outcomes

To gain a foundational understanding of petrochronologic systems and their application to geological processes.

To gain a practical, research-focused knowledge-base for evaluating and interpreting petrochronologic data.

Topics

- Basic radiogenic isotope theory
 - May include, but not limited to, U-Pb, Ar-Ar, Lu-Hf, Sm-Nd, Rb-Sr, Re-Os, U-series, Fission Track
- Techniques used for collection of petrochronologic data
 - EPMA, LA-ICPMS, SIMS, TIMS
- Closure temperature and diffusion
- Petrochronologic mineral systematics and parageneses
 - May include zircon, monazite, titanite, rutile, apatite, garnet, mica, sulfides, calcite
- Analytical data collection and data handling
- Interpretation of petrochronologic data

Instruction method

Students will perform assigned readings on specified topics each week and will present the material in seminar format (oral presentations). Each week, non-presenting students will also read required material and will engage in discussion with seminar presenters and course instructor. Lab work will include the study of prior and newly collected datasets; hands-on discussion of lab material will occur separately from seminars.

Resources

Students will be assigned historically relevant and current published literature for each topic discussed. Students will also use the freeware package *IsoplotR* by *P Vermeesch (2018)* or the original Excel® add-on '*Isoplot*' from *K Ludwig (2003)* for processing and presentation of data.

Recommended texts to complement weekly reading list

1) **Geochronology and Thermochronology**, Peter W. Reiners, Richard W. Carlson, Paul R. Renne, Kari M. Cooper, Darryl E. Granger, Noah M. McLean, Blair Schoene, Print ISBN:9781118455852 | Online ISBN:9781118455876 | DOI:10.1002/9781118455876. John Wiley & Sons Ltd., 2018.

2) **Zircon**, Hanchar, John M., (ed.); Hoskin, Paul W. O. (ed.), *Reviews in Mineralogy and Geochemistry*, 53, Mineralogical Society of America and Geochemical Society : Washington, DC, 2003.

3) **Petrochronology**, Kohn, Matthew J. (ed.) ; Engi, Martin (ed.); Lanari, Pierre (ed.), *Reviews in Mineralogy and Geochemistry*, 83, Mineralogical Society of America and Geochemical Society : Washington, DC, 2017.

Prerequisites

Students are expected to have a 3000 and 4000 undergraduate level geology and geochemistry background.

Seminar format

Readings from the published literature will be assigned weekly that will relate to a topic or theme. Each week, a student will present the assigned material as an interactive oral presentation to the class. Students will give four ~45min presentations each as part of a 2 to 3 hour long seminar that includes discussion

Lab work

Lab work will involve working with real datasets and will challenge students to tackle common issues in evaluating, interpreting and presenting petrochronological data. This course will utilize existing datasets for instructional purposes; however, students will also collect new datasets for each course offering using the available Earth Sciences and CREAT laboratories.

Assessment

20% Participation in Seminar and Lab-work Discussions

60% Seminar presentations

20% Lab assignments

Recommended reading list

- Anderson, J.L., and Smith, D.R., 1995. *American Mineralogist*, 80: 549-559.
- Baxter, E.F., Caddick, M.J. and Dragovic, B., 2017. Garnet: A rock-forming mineral petrochronometer. *Reviews in Mineralogy and Geochemistry*, 83(1), pp.469-533.
- Berman, R.G., Ryan, J.J., Gordey, S.P., Villeneuve, M., 2007. Permian to Cretaceous polymetamorphic evolution of the Stewart River region, Yukon-Tanana terrane, Yukon, Canada: P-T evolution linked with in situ SHRIMP monazite geochronology.
- Boehnke, P., Watson, E.B., Trail, D., Harrison, T.M. and Schmitt, A.K., 2013. Zircon saturation re-revisited. *Chemical Geology*, 351, pp.324-334.
- Braun, I., Montel, J.M., Nicollet, C., 1998. Electron microprobe dating of monazites from high-grade gneisses and pegmatites of the Kerala khondalite belt, southern India. *Chemical Geology*, 146(1-2): 65-85.
- Chang, Z., Vervoort, J.D., McClelland, W.C., Knaack, C., 2006. U-Pb dating of zircon by LA-ICP-MS. *Geochemistry, Geophysics, Geosystems G*, 7(5). *Chemical Geology*, 220(1-2): 47-66.
- Cherniak, D.J., 1993. Lead diffusion in titanite and preliminary results on the effects of radiation damage on Pb transport. *Chemical Geology*, 110(1-3): 177-194.
- Cherniak, D.J., Watson, E.B., 2000. Pb diffusion in zircon. *Chemical Geology*, 172(1-2): 5-24. Cherniak, D.J., Watson, E.B., Grove, M., Harrison, T.M., 2004. Pb diffusion in monazite; a combined RBS/SIMS study. *Geochimica et Cosmochimica Acta*, 68(4): 829-840.
- Cocherie, A., Legendre, O., Peucat, J.J., Kouamelan, A.N., 1998. Geochronology of polygenetic monazites constrained by in situ electron microprobe Th-U-total lead determination: Implications for lead behaviour in monazite. *Geochimica et Cosmochimica Acta*, 62(14): 2475-2497.
- Colpron, M., Price, R.A., Archibald, D.A., Carmichael, D.M., 1996. Middle Jurassic exhumation along the western flank of the Selkirk fan structure: thermobarometric and thermochronometric constraints from the Illecillewaet synclinorium, southeastern British Columbia. *Geological Society of America Bulletin*, 108(11): 1372-1392.
- Condon, D.J., Hodges, K.V., Alsop, G.I., White, A., 2006. Laser ablation (super 40) Ar/ (super 39) Ar dating of metamorphic fabrics in the Caledonides of North Ireland. *Journal of the Geological Society of London*, 163(2): 337-345.
- Corfu, F., Hancher, J.M., Hoskin, P.W.O., Kinny, P.D., 2003. Atlas of zircon textures. *Reviews in Mineralogy and Geochemistry*, 53: 469-500.
- Crowley, J.L., Brown, R.L., Gervais, F., Gibson, H.D., 2008. Assessing inheritance of zircon and monazite in granitic rocks from the Monashee Complex, Canadian Cordillera. *Journal of Petrology*, 49(11): 1915-1929.
- Crowley, J.L., Ghent, E.D., 1999. An electron microprobe study of the U-Th-Pb systematics of metamorphosed monazite: The role of Pb diffusion versus overgrowth and recrystallization. *Chemical Geology*, 157(3-4): 285-302.
- Dickin, A.P., 2005. *Radiogenic isotope geology*. Cambridge University Press, Cambridge.
- Faure, G., Mensing, T.M., 2005. *Isotopes; principles and applications*. John Wiley & Sons, Hoboken, 897 pp.
- Ferry, J.M. and Watson, E.B., 2007. New thermodynamic models and revised calibrations for the Ti-in-zircon and Zr-in-rutile thermometers. *Contributions to Mineralogy and Petrology*, 154(4),

pp.429-437.

- Ferry, J.M., 2000. Patterns of mineral occurrence in metamorphic rocks. *American Mineralogist*, 85(11-12): 1573-1588.
- Fitzsimons, C.W., Kinny, P.D., Wetherley, S., Hollingsworth, D.A., 2005. Bulk chemical control on metamorphic monazite growth in pelitic schists and implications for U–Pb age data. *Journal of Metamorphic Geology*, 23: 261-277.
- Foster, G. et al., 2002. Textural, chemical and isotopic insights into the nature and behaviour of metamorphic monazite. *Chemical Geology*, 191(1-3): 183-207.
- Gervais, F. and Crowley, J.L., 2017. Prograde and near-peak zircon growth in a migmatitic pelitic schist of the southeastern Canadian Cordillera. *Lithos*, 282, pp.65-81.
- Gibson, H.D., Carr, S.D., Hamilton, M.A., Brown, R.L., 2004. Correlations between chemical and agedomains in monazite, and metamorphic reactions involving major pelitic phases: an integration of ID-TIMS and SHRIMP geochronology with Y-Th-U X-ray mapping. *Chemical Geology*, 211: 237-260.
- Hanes, J.A., 1991. K-Ar and $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology: methods and applications. In: Heaman, L., Ludden, J.N. (Eds.), *Applications of radiogenic isotope systems to problems in geology*. Short Course Handbook. Mineralogical Association of Canada, pp. 27-57.
- Harrison, T.M., Grove, M., Lovera, O.M., Zeitler, P.K., 2005. Continuous thermal histories from inversion of closure profiles. In: Reiners, P.W., Ehlers, T.A. (Eds.), *Low-temperature thermochronology; techniques, interpretations, and applications*. Reviews in Mineralogy and Geochemistry. Mineralogical Society of America and Geochemical Society, Washington, pp.389-409.
- Heaman, L., and Parrish, R., 1991. U-Pb geochronology of accessory minerals. GAC Short Course chapter 3.
- Herwartz, D., Nagel, T.J., Münker, C., Scherer, E.E. and Froitzheim, N., 2011. Tracing two orogenic cycles in one eclogite sample by Lu–Hf garnet chronometry. *Nature Geoscience*, 4(3), pp.178-183.
- Hodges, K.V., 1998. $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology using the laser microprobe. *Reviews in Economic Geology*, 7: 53-72.
- Hofmann, A.E., Baker, M.B. and Eiler, J.M., 2014. Sub-micron-scale trace-element distributions in natural zircons of known provenance: implications for Ti-in-zircon thermometry. *Contributions to Mineralogy and Petrology*, 168(3), pp.1-21.
- Hoskin, P.W.O., Black, L.P., 2000. Metamorphic zircon formation by solid-state recrystallization of protolith igneous zircon. *Journal of Metamorphic Geology*, 18(4): 423-439.
- Ibañez-Mejía, M., Pullen, A., Pepper, M., Urbani, F., Ghoshal, G. and Ibañez-Mejía, J.C., 2018. Use and abuse of detrital zircon U-Pb geochronology—A case from the Río Orinoco delta, eastern Venezuela. *Geology*, 46(11), pp.1019-1022.
- J.N. (Eds.), *Applications of Radiogenic Isotope Systems to Problems in Geology*. Short Course Handbook. Mineralogical Association of Canada, pp. 59-100.
- Janots, E. et al., 2008. Prograde metamorphic sequence of REE minerals in pelitic rocks of the Central Alps: implications for allanite-monazite-xenotime phase relations from 250 to 610 degree C.
- Kelley, S., 2002. Excess argon in K-Ar and Ar-Ar geochronology. *Chemical Geology*, 188(1-2): 1-22.
- Kelly, E.D., Carlson, W.D. and Connelly, J.N., 2011. Implications of garnet resorption for the Lu–Hf garnet

- geochronometer: an example from the contact aureole of the Makhavinekh Lake Pluton, Labrador. *Journal of Metamorphic Geology*, 29(8), pp.901-916.
- Kingsbury, J.A., Miller, C.F., Wooden, J.L., Harrison, T.M., 1993. Monazite paragenesis and U-Pb systematics in rocks of the eastern Mojave Desert, California, USA: implications for thermochronometry. *Chemical Geology*, 110(1-3): 147-167.
- Longerich, H., 2008. Laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS); an introduction. In: Sylvester, P.J. (Ed.), Short Course Series - Mineralogical Association of Canada, vol. 40. Mineralogical Association of Canada, Quebec, pp. 1-18.
- Mattinson, J.M., 2005. Zircon U/Pb chemical abrasion (CA-TIMS) method; combined annealing and multi-step partial dissolution analysis for improved precision and accuracy of zircon ages.
- McDougall, I., Harrison, T.M., 1999. Geochronology and thermochronology by the (super 40) Ar/(super 39) Ar method. Oxford University Press, New York, 269 pp.
- Miller, C.F., McDowell, S.M. and Mapes, R.W., 2003. Hot and cold granites? Implications of zircon saturation temperatures and preservation of inheritance. *Geology*, 31(6), pp.529-532.
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- Parrish, R.R., 1990. U-Pb dating of monazite and its application to geological problems. *Canadian Journal of Earth Sciences*, 27(11): 1431-1450.
- Parrish, R.R., Noble, S.R., 2003. Zircon U-Th-Pb geochronology by isotope dilution; thermal ionization mass spectrometry (ID-TIMS). *Reviews in Mineralogy and Geochemistry*, 53: 183-213.
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- Pyle, J.M., Spear, F.S., Rudnick, R.L., McDonough, W.F., 2001. Monazite-xenotime-garnet equilibrium in metapelites and a new monazite-garnet thermometer. *Journal of Petrology*, 42(11): 2083-2107.
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- Rubatto, D., 2017. Zircon: the metamorphic mineral. *Reviews in mineralogy and geochemistry*, 83(1), pp.261-295.
- Rubatto, D., Williams, I.S., Buick, I.S., 2001. Zircon and monazite response to prograde metamorphism in the Reynolds Range, central Australia. *Contributions to Mineralogy and Petrology*, 140: 458-468.
- Schaltegger, U. et al., 1999. Growth, annealing and recrystallization of zircon and preservation of monazite in high-grade metamorphism: conventional and in-situ U-Pb isotope, cathodoluminescence and microchemical evidence. *Contributions to Mineralogy and Petrology*, 134: 186-201.
- Schärer, U., 1984. The effect of initial ²³⁰Th disequilibrium on young U-Pb ages: the Makalu case, Himalaya. *Earth and Planetary Science Letters*, 67: 191-204.
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- Schoene, B., 2014. 4.10-U–Th–Pb Geochronology. *Treatise on geochemistry*, 4, pp.341-378.
- Sherlock, S.C. et al., 2003. Precise dating of low-temperature deformation; strain-fringe analysis by ^{40}Ar - ^{39}Ar laser microprobe. *Geology*, 31(3): 219-222.
- Smit, M.A., Scherer, E.E. and Mezger, K., 2013. Lu–Hf and Sm–Nd garnet geochronology: chronometric closure and implications for dating petrological processes. *Earth and Planetary Science Letters*, 381, pp.222-233.
- Smith, H.A., Barreiro, B., 1990. Monazite U-Pb dating of staurolite grade metamorphism in pelitic schists. *Contributions to Mineralogy and Petrology*, 105: 602-615.
- Smith, H.A., Giletti, B.J., 1997. Lead diffusion in monazite. *Geochimica et Cosmochimica Acta*, 61(5):1047-1055.
- Stern, R.A., 1997. The GSC Sensitive High Resolution Ion Microprobe (SHRIMP): analytical techniques of zircon U-Th-Pb age determinations and performance evaluation. Current Research 1997-F, Geological Survey of Canada.
- Stern, R.A., Sanborn, N., 1998. Monazite U-Pb and Th-Pb geochronology by high-resolution secondary ion mass spectrometry. Current Research 1998-F, Geological Survey of Canada.
- Taylor, R.J., Kirkland, C.L. and Clark, C., 2016. Accessories after the facts: Constraining the timing, duration and conditions of high-temperature metamorphic processes. *Lithos*, 264, pp.239-257.
- Taylor, R.J.M., Clark, C., Harley, S.L., Kylander-Clark, A.R.C., Hacker, B.R. and Kinny, P.D., 2017. Interpreting granulite facies events through rare earth element partitioning arrays. *Journal of Metamorphic Geology*, 35(7), pp.759-775.
- Thiessen, E.J., Gibson, H.D., Regis, D., Pehrsson, S.J., Cutts, J.A. and Smit, M.A., 2019. High-grade metamorphism flying under the radar of accessory minerals. *Geology*, 47(6), pp.568-572.
- van der Pluijm, B.A., Hall, C.M., Vrolijk, P.J., Pevear, D.R., Covey, M.C., 2001. The dating of shallow faults in the Earth's crust. *Nature*, 412: 172-175.
- van der Pluijm, B.A., Vrolijk, P.J., Pevear, D.R., Hall, C.M., Solum, J., 2006. Fault dating in the Canadian Rocky Mountains: Evidence for late Cretaceous and early Eocene orogenic pulses. *Geology*, 34(10): 837-840.
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Request for Approval of a Graduate Course

Paper 5.B.a (pages 45-53)

SCHOOL OF GRADUATE STUDIES

Adobe Reader, minimum version 8, is required to complete this form. Download the latest version: <http://get.adobe.com/reader>. (1) Save the form by clicking on the diskette icon on the upper left side of the screen; (2) Ensure that you are saving the file in PDF format; (3) Specify where you would like to save the file, e.g. Desktop; (4) Review the [How to create and insert a digital signature](#) webpage for step by step instructions; (5) Fill in the required data and save the file; (6) Send the completed form by email to: sgs@mun.ca.

To: Dean, School of Graduate Studies
From: Faculty/School/Department/Program
Subject: Regular Course Special/Selected Topics Course

Course No.:

Course Title:

I. To be completed for all requests:

A. Course Type: Lecture course Lecture course with laboratory
Laboratory course Undergraduate course¹
Directed readings Other (please specify)

B. Can this course be offered by existing faculty? Yes No

C. Will this course require new funding (including payment of instructor, labs, equipment, etc.)? Yes No
If yes, please specify:

D. Will additional library resources be required (if yes, please contact munul@mun.ca for a resource consultation)? Yes No

E. Credit hours for this course:

F. Course description (please attach course outline and reading list):

G. Method of evaluation:	Percentage	
	Written	Oral
Class tests		
Assignments		
Other (specify):		
Final examination:		
Total		

¹ Must specify the additional work at the graduate level

II. To be completed for special/selected topics course requests only

For special/selected topics courses, there is no evidence of:

Instructor's initials

- 1. duplication of thesis work _____
- 2. double credit _____
- 3. work that is a faculty research product _____
- 4. overlap with existing courses _____

Recommended for offering in the Fall Winter Spring 20 ____

Length of session if less than a semester:

III. This course proposal has been prepared in accordance with General Regulations governing the School of Graduate Studies

Course instructor

Date

Approval of the head of the academic unit

Date

IV. This course proposal was approved by the Faculty/School/Council

Secretary, Faculty/School/Council

Date

EASC 6560: Applications of Petrochronology

Course description

Petrochronology combines geochronologic and petrologic data to inform ages, rates, duration and thermal history of igneous, metamorphic and sedimentary rock forming processes. This seminar course will cover basic radiogenic isotope theory and techniques used for petrochronologic data acquisition. Petrochronologic mineral systematics and parageneses as well as concepts of diffusion and closure temperature will be explored. This course will also involve analytical data collection, processing, validation and interpretation.

Learning Outcomes

To gain a foundational understanding of petrochronologic systems and their application to geological processes.

To gain a practical, research-focused knowledge-base for evaluating and interpreting petrochronologic data.

Topics

- Basic radiogenic isotope theory
 - May include, but not limited to, U-Pb, Ar-Ar, Lu-Hf, Sm-Nd, Rb-Sr, Re-Os, U-series, Fission Track
- Techniques used for collection of petrochronologic data
 - EPMA, LA-ICPMS, SIMS, TIMS
- Closure temperature and diffusion
- Petrochronologic mineral systematics and parageneses
 - May include zircon, monazite, titanite, rutile, apatite, garnet, mica, sulfides, calcite
- Analytical data collection and data handling
- Interpretation of petrochronologic data

Instruction method

Students will perform assigned readings on specified topics each week and will present the material in seminar format (oral presentations). Each week, non-presenting students will also read required material and will engage in discussion with seminar presenters and course instructor. Lab work will include the study of prior and newly collected datasets; hands-on discussion of lab material will occur separately from seminars.

Resources

Students will be assigned historically relevant and current published literature for each topic discussed. Students will also use the freeware package *IsoplotR* by *P Vermeesch (2018)* or the original Excel® add-on '*Isoplot*' from *K Ludwig (2003)* for processing and presentation of data.

Recommended texts to complement weekly reading list

1) **Geochronology and Thermochronology**, Peter W. Reiners, Richard W. Carlson, Paul R. Renne, Kari M. Cooper, Darryl E. Granger, Noah M. McLean, Blair Schoene, Print ISBN:9781118455852 | Online ISBN:9781118455876 | DOI:10.1002/9781118455876. John Wiley & Sons Ltd., 2018.

2) **Zircon**, Hanchar, John M., (ed.); Hoskin, Paul W. O. (ed.), *Reviews in Mineralogy and Geochemistry*, 53, Mineralogical Society of America and Geochemical Society : Washington, DC, 2003.

3) **Petrochronology**, Kohn, Matthew J. (ed.) ; Engi, Martin (ed.); Lanari, Pierre (ed.), *Reviews in Mineralogy and Geochemistry*, 83, Mineralogical Society of America and Geochemical Society : Washington, DC, 2017.

Prerequisites

Students are expected to have a 3000 and 4000 undergraduate level geology and geochemistry background.

Seminar format

Readings from the published literature will be assigned weekly that will relate to a topic or theme. Each week, a student will present the assigned material as an interactive oral presentation to the class. Students will give four ~45min presentations each as part of a 2 to 3 hour long seminar that includes discussion

Lab work

Lab work will involve working with real datasets and will challenge students to tackle common issues in evaluating, interpreting and presenting petrochronological data. This course will utilize existing datasets for instructional purposes; however, students will also collect new datasets for each course offering using the available Earth Sciences and CREAT laboratories.

Assessment

20% Participation in Seminar and Lab-work Discussions

60% Seminar presentations

20% Lab assignments

Recommended reading list

- Anderson, J.L., and Smith, D.R., 1995. *American Mineralogist*, 80: 549-559.
- Baxter, E.F., Caddick, M.J. and Dragovic, B., 2017. Garnet: A rock-forming mineral petrochronometer. *Reviews in Mineralogy and Geochemistry*, 83(1), pp.469-533.
- Berman, R.G., Ryan, J.J., Gordey, S.P., Villeneuve, M., 2007. Permian to Cretaceous polymetamorphic evolution of the Stewart River region, Yukon-Tanana terrane, Yukon, Canada: P-T evolution linked with in situ SHRIMP monazite geochronology.
- Boehnke, P., Watson, E.B., Trail, D., Harrison, T.M. and Schmitt, A.K., 2013. Zircon saturation re-revisited. *Chemical Geology*, 351, pp.324-334.
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- Cherniak, D.J., 1993. Lead diffusion in titanite and preliminary results on the effects of radiation damage on Pb transport. *Chemical Geology*, 110(1-3): 177-194.
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- Crowley, J.L., Brown, R.L., Gervais, F., Gibson, H.D., 2008. Assessing inheritance of zircon and monazite in granitic rocks from the Monashee Complex, Canadian Cordillera. *Journal of Petrology*, 49(11): 1915-1929.
- Crowley, J.L., Ghent, E.D., 1999. An electron microprobe study of the U-Th-Pb systematics of metamorphosed monazite: The role of Pb diffusion versus overgrowth and recrystallization. *Chemical Geology*, 157(3-4): 285-302.
- Dickin, A.P., 2005. *Radiogenic isotope geology*. Cambridge University Press, Cambridge.
- Faure, G., Mensing, T.M., 2005. *Isotopes; principles and applications*. John Wiley & Sons, Hoboken, 897 pp.
- Ferry, J.M. and Watson, E.B., 2007. New thermodynamic models and revised calibrations for the Ti-in-zircon and Zr-in-rutile thermometers. *Contributions to Mineralogy and Petrology*, 154(4),

pp.429-437.

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- Foster, G. et al., 2002. Textural, chemical and isotopic insights into the nature and behaviour of metamorphic monazite. *Chemical Geology*, 191(1-3): 183-207.
- Gervais, F. and Crowley, J.L., 2017. Prograde and near-peak zircon growth in a migmatitic pelitic schist of the southeastern Canadian Cordillera. *Lithos*, 282, pp.65-81.
- Gibson, H.D., Carr, S.D., Hamilton, M.A., Brown, R.L., 2004. Correlations between chemical and agedomains in monazite, and metamorphic reactions involving major pelitic phases: an integration of ID-TIMS and SHRIMP geochronology with Y-Th-U X-ray mapping. *Chemical Geology*, 211: 237-260.
- Hanes, J.A., 1991. K-Ar and $^{40}\text{Ar}/^{39}\text{Ar}$ geochronology: methods and applications. In: Heaman, L., Ludden, J.N. (Eds.), *Applications of radiogenic isotope systems to problems in geology*. Short Course Handbook. Mineralogical Association of Canada, pp. 27-57.
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- Ibañez-Mejía, M., Pullen, A., Pepper, M., Urbani, F., Ghoshal, G. and Ibañez-Mejía, J.C., 2018. Use and abuse of detrital zircon U-Pb geochronology—A case from the Rio Orinoco delta, eastern Venezuela. *Geology*, 46(11), pp.1019-1022.
- J.N. (Eds.), *Applications of Radiogenic Isotope Systems to Problems in Geology*. Short Course Handbook. Mineralogical Association of Canada, pp. 59-100.
- Janots, E. et al., 2008. Prograde metamorphic sequence of REE minerals in pelitic rocks of the Central Alps: implications for allanite-monazite-xenotime phase relations from 250 to 610 degree C.
- Kelley, S., 2002. Excess argon in K-Ar and Ar-Ar geochronology. *Chemical Geology*, 188(1-2): 1-22.
- Kelly, E.D., Carlson, W.D. and Connelly, J.N., 2011. Implications of garnet resorption for the Lu–Hf garnet

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- Kingsbury, J.A., Miller, C.F., Wooden, J.L., Harrison, T.M., 1993. Monazite paragenesis and U-Pb systematics in rocks of the eastern Mojave Desert, California, USA: implications for thermochronometry. *Chemical Geology*, 110(1-3): 147-167.
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- Mattinson, J.M., 2005. Zircon U/Pb chemical abrasion (CA-TIMS) method; combined annealing and multi-step partial dissolution analysis for improved precision and accuracy of zircon ages.
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Motion for Science Faculty Council

[Insert Date]

Moved by:

Seconded by:

Whereas,

The selection of academic administrators plays a critical role in Memorial University's ability to fulfill its public mission, including its special obligation to the people of Newfoundland and Labrador;

And whereas,

the process of selecting academic administrators must be conducted in accordance with the core principles of shared governance if our university is to fulfill its public responsibilities for scholarship and education;

And whereas,

Collegiality and openness are central to the effective governance of public universities;

And whereas,

Searches that are conducted in secrecy undermine both the principles of shared governance and trust in the search process;

And whereas,

Open searches - in which shortlisted candidates present themselves to the campus community - offer added insight into candidates' capabilities, knowledge of the institution, and approach to leadership; and allow candidates to better understand the institution they might lead;

Be it resolved that:

The Science Faculty Council calls on the Search Committee for Memorial's next Provost and Vice President (Academic) to provide for a search process with an open finalist phase, in which each shortlisted candidate makes public presentations that include an opportunity for questions from those present, and in which members of the campus community are given the opportunity to provide input to the Committee for consideration in its final deliberations.

Additional Resources:

“Opening Up the Search”:

<https://www.caut.ca/bulletin/2020/02/presidents-message-opening-search>

Preliminary Perspective on Laurentian University (Ontario Auditor General):

https://www.auditor.on.ca/en/content/specialreports/specialreports/Laurentian-U_Preliminary_Perspective_en.pdf

CAUT Policy Statement on Academic Administrative Searches:

<https://www.caut.ca/content/academic-administrative-searches>

“The Cost of Closed Searches”:

<https://www.aaup.org/article/costs-closed-searches#.YxeujCHMKqA>

OCUFA Report on Collegial Governance:

<https://ocufa.on.ca/assets/2019-02-09-Governance-Report.pdf>